SEA TURTLES - GUAM FILE

G.H. BALAZS

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1-16-88

Guam man arrested in B-52 case

Associated Press

FBI agents on Guam have arrested a territorial conservation officer suspected of crippling a U.S. Air Force B-52 with gunfire while the Strategic Air Command bomber was making touch-and-go landings at Andersen Air Force Base.

Leonard Z. Irriarte, who works for the Department of Agriculture's aquatics and wildlife division, was charged with attempted murder, obstruction of justice and destruction of government property, Eugene F. Glenn, the special agent in charge of the FBI office in Honolulu, said yesterday.

Gunfire from a large-caliber weapon hit the B-52 at least 10 times on Oct. 6, puncturing the plane's main hydraulic line and knocking out the plane's brakes and steering, Glenn said.

The disabled aircraft skidded off the base runway when its front landing gear collapsed while making an emergency landing, he said.

No injuries were reported.

Irriarte was scheduled to be arraigned Tuesday in U.S. District Court on Guam.

Guam officer arrested on charges

A Guam wildlife conservation officer accused of shooting at an Air Force B-52 bomber and forcing it to make an emergency landing last October was arrested by FBI agents on Guam yesterday.

Leonard Z. Irriarte was charged with attempted murder, obstruction of justice and destruction of U.S. property, Eugene Glenn, Honolulu special agent in charge, said.

The giant strategic bomber was struck at least 10 times, forcing it to skid off a runway as it practiced touch-and-go landings Oct. 6 at Guam's Andersen Air Force Base, Glenn said.

Irriarte will be arraigned

of 'shooting down' B-52

Tuesday in Guam's U.S. District Court.

The FBI gave no motive for the shooting, but residents near Andersen have complained about noise from touch-and-go landings by the eight-engine bombers.

The FBI said the slugs that hit the B-52 came from a high-caliber weapon, and at least one shot punctured a main hydraulic line, causing a loss of control and an emergency landing.

1-16-88

"No one was injured as the plane skidded off a runway when it lost brakes and steering and its front landing gear collapsed when hydraulic power failed, the FBI reported.

Immediately after the shooting, the Air Force reported the plane suffered only minor damage when hit by "by several small-caliber" bullets.

Glenn said Irriarte's arrested followed an investigation by the FBI and the Air Force's Office of Special Investigations.

Interior's Guam Snafu Gets Golden Fleece

Honolulu Star-Bulletin Wednesday, June 20, 1984

WASHINGTON (AP) — U.S. funds for Guam went to pave parking lots for a nightclub and an apartment building, while more taxpayer money went to a pre-election hiring binge due to lax management by the Interior Department, Sen. William Proxmire charged today.

The Wisconsin Democrat presented his monthly "Golden Fleece of the Month" for June to the Interior Department for "gross mismanagement" of millions of dollars the department funneled to Guam.

Not only did the territorial government embark on an ambitious and virtually uncontrolled paving program, Proxmire said, it also began a program to put thousands of island residents on the government payroll, with the senator saying the hiring increased significantly two months before the island's 1982 primary election.

"The government of Guam spent over $16 million on these paving and hiring programs," Proxmire said. "About 50 percent of this money came from the federal government, although in this instance mismanagement was so extensive that the Department of the Interior auditors were unable to determine exactly how much federal money was wasted."

Sunday Travel

The Sunday Star-Bulletin & Advertiser

History has made Gua

By Robert W. Bone
Advertiser Staff Writer

AGANA — The first things you notice about the island of Guam are things that it is not.

It is not a foreign country (some appearances to the contrary). It is not a universally comfortable climate. It is not a land of architectural treasures. And it is not exactly a cultural center, either.

So what is it? Well, it is America's farthest western or farthest eastern territory (depending on your view of the international date line). It's a fortified Pacific outpost which has grown up in rather a dishevelled fashion since World War II. And it is an interesting study in unbridled American commercialism, with a heavy military accent.

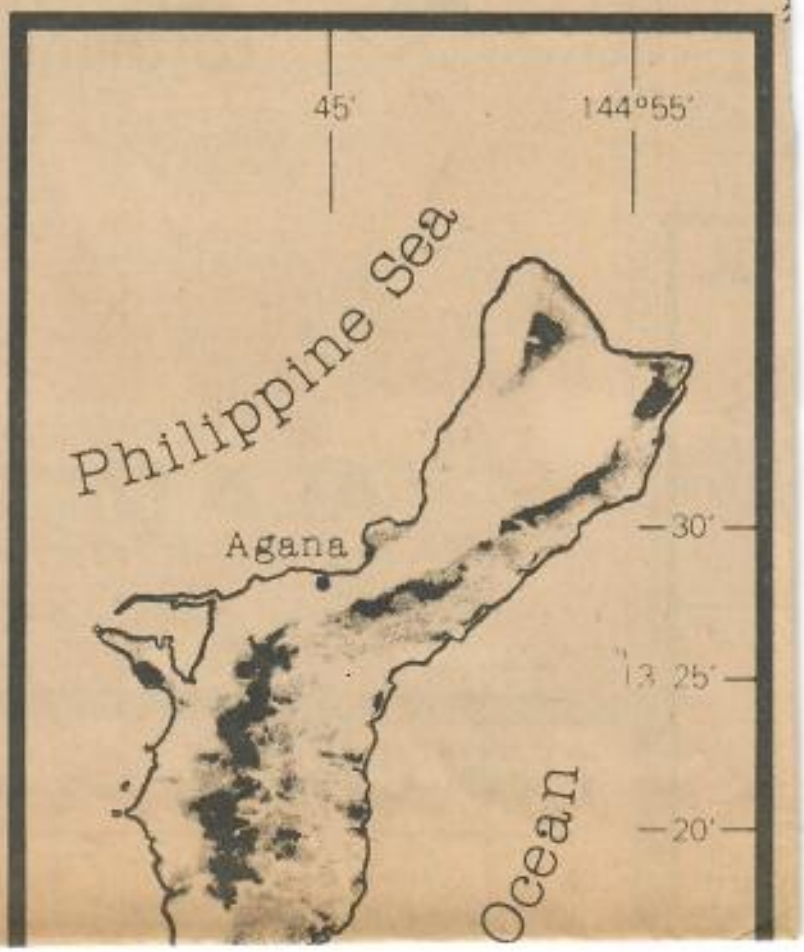
Guam (pop. 110,000) may be in high profile soon, now that Pan American World Airways has pulled out of its longtime Honolulu-Agana non-stop route. Three other airlines have jumped in to pick up the market, and all plan to promote their new destination, perhaps concentrating on Guam's position as the gateway to all of Micronesia.

The most experienced in the immediate area is Continental/Air Micronesia, which has run an island-hopping narrow-body aircraft route in the neighborhood for years. Now it has put one of Continental's DC-10 jumbos on the new non-stop run. Guam is eight jet hours out of Honolulu, and you can spend just about all that time drinking in Continental's flying pub, if you want. (One-way coach fare is currently $295.)

South Pacific Island Airways (SPIA) has increased its service on the route with Boeing 707s, and Aloha Airlines, which heretofore limited its activities only to Hawaii, is also scheduled to inaugurate

A Chamoritta and her bodyboard.

Tumon Bay is home for the i



Prepared by the staff of the Honolulu Advertiser ★ April 22, 1984

n a cultural patchwork

land's top hotels, restaurants and nightclubs.

lar. Of equal interest is a nearby iron gate at a doorway in the side of a hill. It was part of an underground network of tunnels built in Agana during the Japanese rule. Guam was the only U.S. territory occupied by the Japanese during the Second World War.

Latte Park is near downtown Agana — which is usually pronounced something like "again-ya," by the way. In Spanish it was spelled with that squiggly tilde over the "n." Again, because of war and storm there is very little left of the Spanish colonial period of Guam, which lasted from the late 1600s until 1898, when it became a U.S. prize in the Spanish-American War. Nearly all the population is Roman Catholic, a heritage from the Spanish which was not destroyed.

Guam residents are now referred to as Guamanians, but the descendants of the original residents of the island prefer to call themselves Chamorros, a term once reserved for the nobility in Guam's prehistoric society.

knows what Quipuha looked like, of course. And he is shown wearing a sort of loincloth — a modern form of modesty, as archaeologist Calkins pointed out.

"The early Chamorros wore nothing at all," she said. "Except an occasional hat."

The second statue, near Plaza Espana, is that of Pope John Paul II, who visited the territory in 1981. If you think the statue looks a little different every time you see it, you may be right. An unusual feature is the clock mechanism hidden in the statue's base, which slowly rotates His Holiness completely around approximately every 12 hours.

Other statues on the island are stranger. Typical is the heroic, twice life-size painted alabaster representation of John Wayne on a bucking bronco in front of a place called the Western Frontier Village. This is just one of a breed of Guam establishments catering to the cowboy craze among Japanese tourists.

There they can dress up like Jesse James, sit on a stage

lessness on an island which felt so much misery during the occupation, it is lost on all concerned today.

The Japanese often take guided tours around the island, but there are few available in English. Most Americans rent a car (about $25 a day and $1.50 per gallon for gas). To find a tour, however, ask at the Guam Visitors Bureau (phone 646-8516). If you're lucky, you may get one conducted by free-lance writer Carol Ibanez Diaz, a native Guamanian, who is just as at home at the front of a bus as she is behind a typewriter.

If anybody can make you appreciate Guam, it would be Diaz, who is fascinated by her own history and culture. She'll take you to Two Lovers Point, a sheer, thousand-foot cliff where a Chamorro maiden, upon hearing that she had been betrothed to a Spanish soldier, tied her hair with that of her true love, a Chamorro warrior. Together they jumped to their death — or so the story goes.

World War II veterans occasionally come to Guam to relive their experiences here. At the War in the Pacific National Historical Park are displays and artifacts, including some American and Japanese guns, still in place after 40 years. Scuba divers enjoy exploring wrecks as well as coral just under the surface of many lagoons surrounding the island.

Guam is a free port, which means that there are a lot of bargains — for the Japanese, anyway. Stay away from most of that stuff if you don't already know your prices. Liquor, however, is cheap and you can bring a gallon back to the United States.

While you don't need a passport to go to Guam, you should have some sort of proof of citizenship to return to the United States. The passport is

non-stop service (marketed under the Aloha Pacific logo) from Honolulu to Guam in May in a long-range DC-10-30 it has leased from Philippine Airlines. The Aloha plane will then fly on to Taiwan, and Guam would make an interesting stopover on such a trip.

A few days on Guam today may remind a seasoned traveler of an observation made in a London coffee house a couple of centuries and a hemisphere removed from here. It was attributed to Dr. Samuel Johnson after his friend James Boswell asked him about a well-known tourist attraction on a remote coast of Northern Ireland.

"Is not the Giant's Causeway worth seeing, Dr. Johnson?" asked Boswell.

"Worth seeing, perhaps," replied the great lexicographer. "But not worth going to see."

Well, Guam, too, is at least worth seeing, and today approximately 300,000 tourists peek in each year, in contrast to fewer than 7,000 in 1967. Some 80 percent of these visitors are Japanese, many of them honeymooners who have come to spend a tropical week or two in one of the hotels catering to them at Ypao Beach on Tumon Bay, just out of Agana.

Check in to one of these establishments and you may find the staff more comfortable in Japanese than in English. And the only magazine you can buy in the hotel will probably be Penthouse, whose pages of skin tones are considered forbidden flesh in Japan. It's sold in the hotel's duty-free shop along with toiletries, leather goods and other specialty items which are so expensive in Japan.

The Japanese are used to paying a lot for everything, apparently. If you sit down at the teppan table restaurant in the Guam Hilton, tell the waiter you live on Guam. He may bring you a separate menu which lists a teppan steak for $9.75 — the same dish the tourist menu offers for $22.

The territorial government is also far from rich. When it fell behind on its electric bill last year, the power company pulled the plug on all the island's street lights for a time.

Americans who stop off in Guam generally do so while hopping from point to point across the Pacific, or because they are military personnel stationed for a spell at Anderson Air Force Base or one of the Naval stations which take up huge hunks of this 6- by 30-mile island. If you have no military credentials, about a third of Guam is unavailable to you and the Guamanians, including some of the island's best beaches.

From a tourism standpoint Guam has always had an image problem, not the least of which is its very name.

"The first thing they've got to do something about is what they call this place," said one businessman with a good sense of public relations.

"Let's face it — Goo-wam — it sounds like some messy, warm and sticky stuff that you accidentally got on your shoe."

Warm and sticky it can be, especially from June to December, when the temperatures are in the upper 80s and 90s and the humidity is also high — if it's not actually raining. Things seemed hot and muggy to this reporter even on an April Fool's Day arrival, but it was called unusual weather locally. If you hate air conditioning in other parts of the world, you just may love it on Guam.

The real problem with Guam, or at least its capital of Agana, is simply that the place has so often had the hell beaten out of it, especially in the 20th century. War and typhoons have taken a heavy toll here and all thatched roofs have gone with the wind. Residents have determinedly built thousands of massive and unattractive cement and steel utility poles and no-nonsense concrete block houses designed to withstand big blows of well over 200 mph which rake the island every decade or so.

The island's only modern building which would ever win an architectural prize is the airport terminal, a strong, yet colorful and well-designed structure which incorporates some historical Micronesian themes in its makeup, including columns inspired by the storied latte (pronounced "laddie") stones.

You can see real 1,500-year-old latte stones that were brought down from the hills and re-installed in what is now called Latte Park in central Agana. A latte stone looks vaguely like a large cereal bowl sitting atop a tapered pil-

The outside kitchen is still a very popular extension of even the most modern homes on Guam.

The Chamorro language is still in daily use on Guam and other Micronesian islands, although it includes many Spanish words. And on Guam, at least, English terms are also part of it. By the time the Japanese invaded Guam, within hours after the attack on Pearl Harbor, most Chamorros considered themselves loyal Americans. Many did not survive the repressive and severe 2½-year occupation, especially the men of the island. Ironically, it was the men who were killed by the Spanish, too, and the Chamorros of today are descended from the marriage of Chamorro women to Spanish men. Nearly all have Spanish surnames.

Near Latte Park, look for the Plaza de Espana (marked incorrectly on the Official Highway Map of Guam). There, in an uncharacteristically shady section of the city, are some of the old Spanish walls. Also you'll find at least the large stone porch of the governor's palace. The building itself was smashed to smithereens by American bombs and gunfire just prior to the Marines' recapture of Guam in July 1944.

The floor of the palace is just below the neatly trimmed grass, however, and currently it is under archaeological excavation preparatory to an application for a federal grant to rebuild the old structure.

At work there recently was sun-bronzed, New Mexico-born archaeologist Fabiola R. Calkins, who said she would prefer that the building be reconstructed in the original Spanish design.

Much is made locally of a nearby tiny, cylindrical structure called "The Chocolate House." The refurbished gazebo remains from the Spanish period and was reportedly where chocolate was made to serve the Spanish governor's dinner guests. If you buy a box of Guam chocolates, there may be a picture of The Chocolate House on the cover, but there is no real connection between the two.

There are two well-known statues in downtown Agana. One is the controversial representation of Chief Quipuha, who welcomed the first Spanish Jesuit missionaries. The early Spanish turned out to be harsh masters, and some people now place some of the blame on Quipuha. No one coach, have their pictures taken in Old West costumes, and most important, fire revolvers, automatics, rifles, etc., in special shooting galleries. Apparently because such weapons are strictly prohibited in Japan, the Japanese seem to hanker for the feel of a cold-steel six-gun once they get outside the country. If there is any irony in this play-like law- the easiest, although a birth certificate or a voter registration card will do the job. If you don't have these, be prepared to do a lot of fast talking. Otherwise you just could be sent back to Guam.

Robert W. Bone is the editor of the "Maverick" guides to Hawaii, Australia and New Zealand.

The Chocolate House in Agana's Plaza de Espana, is one reminder of Guam's Spanish colonial era dating from the 1600s to the late 1800s.

These latte stones, located in Agana's Latte Park, were built around 500 A.D. and used as house pillars.

Fear of Terrorism at Spells Doom for Rare

AGANA, Guam (AP) — The last nesting place for a species of nearly extinct, flightless bird is to fall prey to machetes and chainsaws on Monday because the U.S. Air Force fears the tall, bushy weeds could be a hiding place for terrorists.

Just a few dozen wild Guam rails are left, the rest having fallen victim to disease, house pets and a predatory snake recently introduced on this central Pacific island.

But the newest threat to the quail-sized birds known locally as "kokos" are the huge B-52 bombers at nearby Andersen Air Force Base, which the military considers the "priority resource" in need of protection.

Base officials say the area must be cleared because it poses a security threat at the 20,000-acre Strategic Air Command facility; the weeds could provide cover for would-be terrorists.

Last week, sympathizers managed to round up three of the swift gray and white birds, but they fear four or five are still in the vegetation scheduled to be mowed down.

THE SCRUBBY, bushy vegetation known as tangantangan "is a viable breeding habitat area," Robert D. Anderson, assistant chief of the Guam Department of Agriculture's Aquatic and Wildlife Resources division, said in a telephone interview with Associated Press in Honolulu.

The ground is the last wild breeding habitat for the rails, whose numbers have dropped from an estimated 80,000 in 1968 to fewer than 100 in 1983, conservationists say.

Any rails displaced by defoliation would probably fall prey to the snakes and likely would be devoured within a year, according to Eugene Morton, curator of

Guam Base Rail Bird

birds at the National Zoo in Washington, D.C.

"The birds are found nowhere else in the world, so just to move them off the area where they're safe would just subject them to snake predation," Morton said. "We know they won't survive at all moving from there."

Morton returned from Guam this week with two pairs of rails he hopes can be bred in captivity. "There are probably less than 50 birds left in the whole world," he lamented. Sixteen are in captivity.

The rail was placed on Guam's endangered species list in 1973. Five years later, the U.S. government was asked to place it under federal protection. However, no action has been taken, Anderson said.

Guam Rail
Only about 50 left

Guam Prepares for Move

By Matt Mygatt

ALBUQUERQUE, N.M. (AP) — The Central Pacific island of Guam by Feb. 1 is to give Congress a first draft of proposed legislation to grant commonwealth status for the island.

The move will be "evolutionary, not revolutionary," Rep. Manuel Lujan Jr., R-N.M., said during a meeting yesterday of the Insular Affairs Subcommittee of the House Interior Committee to discuss the proposal.

Proposed changes in the draft legislation are to be returned to territorial Gov. Ricardo J. Bordallo by March 15. A final draft then is to be hammered out and submitted to Congress May 1, 1984.

GUAMANIANS ARE to vote whether to ratify the final draft by May 31 and then the legislation is slated to be introduced in Congress in June.

Lujan, ranking minority member of the House Interior Committee, said he was concerned about making promises of commonwealth status to Guamanians — promises Congress might change.

"I am concerned about their expectations," he said.

Lujan, who visited Guam earlier this year, also said he was concerned about the crowded schedule in Congress next year.

Jim Beirne, a staff member of the Senate Energy Committee, said 1984 is an election year when it would be "difficult to get legislation through."

"The thing to do is get a list of concerns, start the process and see what we can do," he said.

A.B. Won Pat, Guam's delegate to the House of Representatives, said the legislation must be initiated by the people of Guam.

"I prefer the people ratify this through Congress," said Won Pat, who can vote in committee but not on the House floor.

BORDALLO SAID, "We'll just give it our best shot to give early submission to Congress. . ."

Lujan, who supported the proposal, said it might be easier to get Congress to pass the legislation in 1985 but promised "we'll do the best we can" in 1984.

Bordallo said he did not expect unanimous backing of the proposal in Guam.

"This is a democracy in action — you can't expect 100 percent endorsement," he said. "There are people that have different views."

Toward Commonwealth

Commonwealth status would give Guam's people a step toward self-government while simultaneously protecting U.S. interests in the Pacific, Bordallo said.

Commonwealth status would be "somewhere between a territory and a state. Statehood is not quite obtainable at this stage," Bordallo said before the meeting.

The subcommittee was meeting in Albuquerque because Lujan is ranking minority member of the Interior Committee and because Bordallo was attending a meeting of Western governors here.

ALSO ATTENDING the meeting were several members of Guam's Legislature; Paul J. Abbate, presiding judge of the Superior Court of Guam; and representatives of the U.S. Department of the Interior.

Guam is under the jurisdiction of the Interior Department. It is administered under the Organic Act of 1950, which provides for an elected governor and 21-member Legislature. Guam residents are American citizens but don't vote for president.

"The meeting is a very informal discussion on the first phase of Guam's political aspirations of self-government," Bordallo said. "It is most fundamentally an upward move from what it is today."

Guamanians voted in January 1982 to seek commonwealth status.

Larry L. Morgan, director of legislative affairs for the Interior Department, said commonwealth status doesn't necessarily mean more federal money for the island — Congress decides that.

Won Pat said there is no subject that could be "dearer to my heart than the political development of Guam."

"In my nearly half a century of public service, I have been preoccupied with obtaining for our people full rights of self-government within the American framework," he said.

Guam Girds

By Russ Lynch
Star-Bulletin Writer

Hawaii has its share of sensitivity about being out in the middle of the ocean but Guam, further out and a lot smaller with only 100,000 in population, is a lot more sensitive.

That's one reason for all the excited discussion emanating from Guam these days about the decision of Pan American World Airways to pull out of the Honolulu-Guam route at the end of this month.

The Guam Legislature, deciding that none of the alternative services being offered by Hawaiian Airlines, Continental Air Micronesia and South Pacific Island Airways will do the job properly, has asked the Civil Aeronautics Board to tell Pan Am to stay where it is.

The CAB has been asked to subsidize Pan Am if necessary.

And the Guamanians have said Hawaiian Air, which said it will use a narrow-bodied DC-8 on the run, can't provide adequate service. Two prominent Guam legislators have asked the CAB to discourage Hawaiian Air from entering the market.

IN THE BACKGROUND Aloha Airlines is being noncommittal.

The airline industry, one of those businesses that has a high gossip level, is circulating rumors that Aloha wants into the Guam business as well and the airline says it would make sense that if it is going to expand into other routes, that's one direction that would be logical.

Aloha has no definite plans, however, and Hawaiian's still hinge on making a deal with Pan Am to take over one of Pan Am's big jets.

South Pacific Island Airways has said it will step up the number of flights it runs between Honolulu and Guam from two flights a week to six a week as soon as Pan Am is gone and step up to daily service later.

Continental Air Micronesia will launch its new Honolulu-Guam service with three wide-body DC-10 flights a week, with an inaugural flight out of Honolulu March 31, the day Pan Am quits. Continental Air Micronesia has been running one flight a week on the service.

The new services will connect with flights to Asia and the South Pacific, and a Honolulu-San Francisco link will be added in mid-April, Continental Air Micronesia says.

MEANWHILE, THE people on Guam — their legislators at least — feel that all this is getting out of their hands.

What they really want is daily direct wide-body service between the West Coast and Guam and some level of say in who flies what type of aircraft between Guam and Honolulu.

Part of their problem is the deregulation of the U.S. airline industry. The fact is that any American carrier with a certificate to fly in the United States can enter or leave any service more or less when it wishes and for that purpose Guam is considered part of the United States.

Hawaiian Air doesn't need a special certificate to go to Guam. Neither would Aloha.

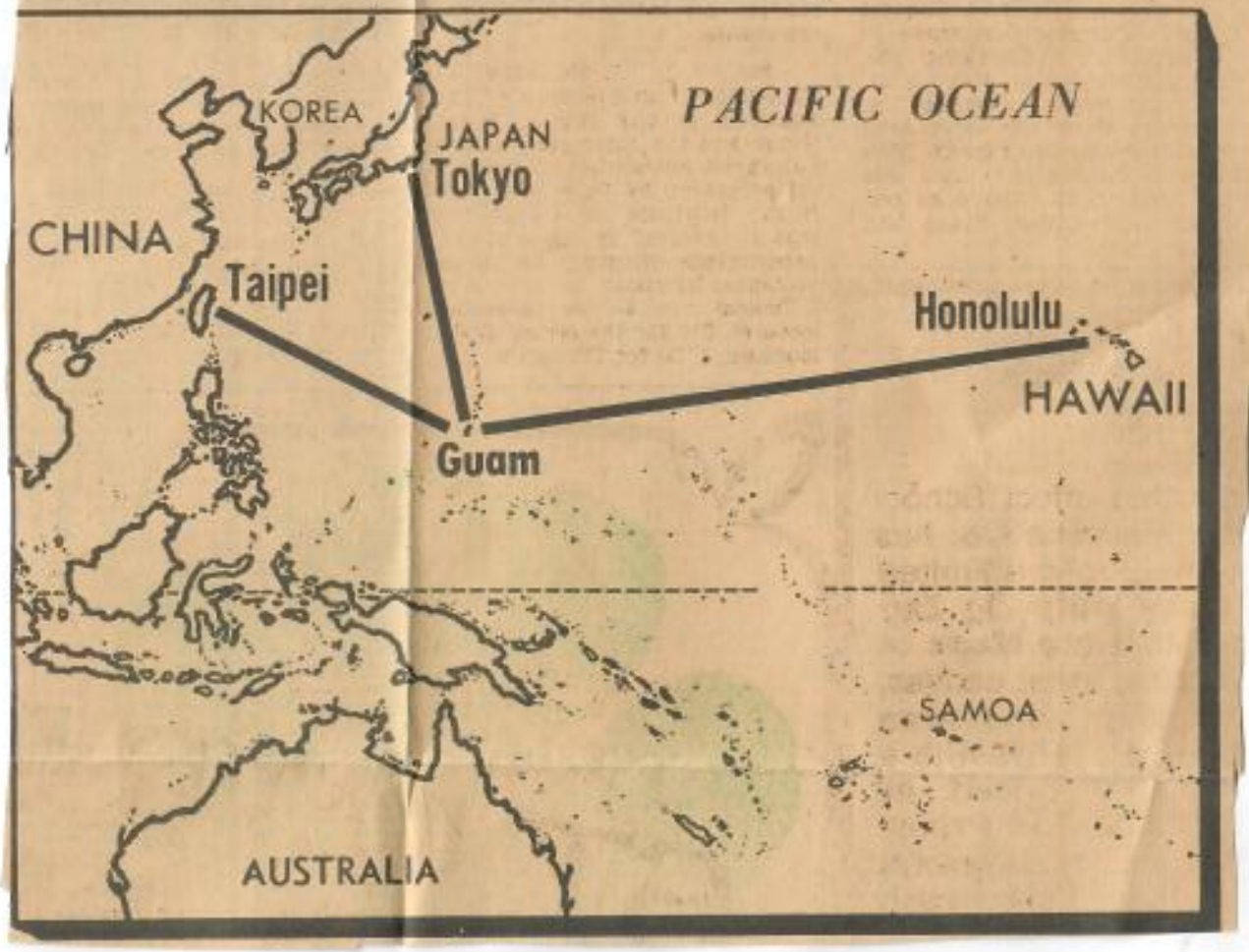
By the same token, Pan Am is free to pull out and has decided to do so.

to Battle Pan Am's Pullout

CONTINENTAL
AIR MICRONESIA

PAN AM

HAWAIIAN AIR



nnounced its decision to drop its hree flights a week between Honolulu and Guam's population enter, Agana.

Reacting to Hawaiian Air's announcement that it had reached an agreement with Pan Am in which Hawaiian will provide the Honolulu-Guam link and connect with Pan Am flights, the chairmen of two Guam legislative committees told the CAB that Hawaiian "cannot be a viable substitute for Pan American."

First, Hawaiian Air officially is talking about using a DC-8, said the letter from Frank Santos, chairman of the Committee on Federal, Foreign and Legal Affairs, and Franklin Gutierrez, chairman of the Committee on Tourism, Transportation and Communication.

That "is not a substitute for a 747, DC-10 or L-1011," the letter said. "It is our feeling that Hawaiian Airlines could not provide for the needs of this American territory. It could only serve to provide competition to the incumbent carrier, South Pacific Island Airways."

THE LEGISLATORS said any more seats would only damage SPIA's profitability. Hawaiian Air should be discouraged because "there is presently no need to be filled," the Jan. 25 letter said.

"The need is with wide-bodied aircraft on a daily schedule to the U.S. West Coast."

Five days later, the same committee chairmen wrote again to CAB Chairman Dan McKinnon, saying Hawaiian's plan of three flights a week along with SPIA's increase in service "does not resolve Guam's air transportation problems."

That letter talked of the "disastrous impact" of the loss of flights from the West Coast.

Passenger flights can only be subsidized to satisfy a community's essential passenger seat needs and there are no cargo subsidies, the letter said.

But Guam's "100,000 residents are totally dependent upon the importation of certain types of goods . . . on an urgent or direct daily basis from the West Coast."

"Experience has shown that goods get backlogged, and even lost, at the Honolulu Airport, so that either they arrive on Guam in poor condition or they arrive too late to be of service," the politicians wrote.

THEY ALSO HAD some criticism for Continental and indicated they look at Continental Air Micronesia's announced new Honolulu-Guam service with more than a little cynicism.

In 1977 Pan Am — which actually started serving Honolulu-Guam way back in 1935, with a flying boat — started a jumbo 747 freight-only flight from the West Coast.

In six months more space was needed and Continental entered the picture.

"Unable to compete with Continental," Pan American withdrew the freight service.

One month later, "to our shock and dismay," Coninental quit the freight business, the legislators wrote.

Guam is "totally at the mercy of the initiatives and self-interest of American airlines whose policies are dictated by profit motives, not by Guam's essential needs," the letter said.

There are sections of the law that allow the CAB to specify the type of aircraft and the number of stops allowed on a service if it is declared "essential air transportation," they said, asking the CAB to do just that.

The two Guam legislators, representatives from Palau, the Guam Employers Council and representatives of the Marianas joined in a formal petition to that effect.

They said the CAB has authority to prohibit Pan Am from getting out of the service and to subsidize it to stay on the route.

THERE IS ALSO a second petition, this time coming from Guam Gov. Ricardo Bordallo and the Guam Airport Authority as well as the other parties, asking the CAB to determine just what are Guam's air service needs.

Pan Am responded this month.

PAN AM SAID the subsidy needed for it to stay on the run would be $3 million a year and that cannot be justified.

Continental also filed an answer, opposing both the request to hold Pan Am in the market and the proposed subsidy for Pan Am.

Under deregulation, Continental said, the CAB must place "maximum reliance on competitive market forces and on actual and potential competition."

"Subsidizing the operations of one carrier in a competitive market where other carriers are also operating is contrary to this policy and to principles of fundamental fairness."

Hawaiian Air President Paul Finazzo said the "bottom line" is that the Guam people want wide bodies not narrow bodies such as the DC-8 or 707 and they are also concerned about cargo.

Hawaiian hasn't changed its announcement that it will enter the service April 1 with DC-8-62 aircraft.

Sandy Allen, speaking for Aloha Airlines, said the airline is "not averse to making a profit" and is looking for any opportunity to do that. It "stands to reason," she said, that a route expansion for Aloha would have to be outside Hawaii, and Guam would be a logical servcie to look at.

However, she said, Aloha has no plans for Guam as yet.

Star-Bulletin
The Thursday Report
Section B
Honolulu
Thursday, March 15, 1984

What could change that is a CAB decision that traffic to Guam is an "essential air service," in which case the CAB can order the carrier on the run to use certain types of aircraft and make only certain stops and that's what the Guam legislators are seeking.

Can the CAB force Pan Am to provide the service? No way, says Pan Am.

NEVERTHELESS, the CAB under deregulation is being phased out, and the big question, anyway, is whether any government agency these days can force a business to keep on providing a service it wants to drop because it is not making money out of it.

All of this is before the CAB in the form of letters, petitions and answers from the Guamanians, Pan Am and Continental.

First, the group recognized by the CAB as the "Guam parties" wrote to the CAB in January, a couple of weeks after Pan Am

First, it said, it wasn't even required to give any notice of its termination of the Guam service but did so anyway.

Second, Pan Am said, the CAB cannot forbid Pan Am from dropping out but even if it could, keeping the airline there could only hurt other carriers and in the end reduce Guam services.

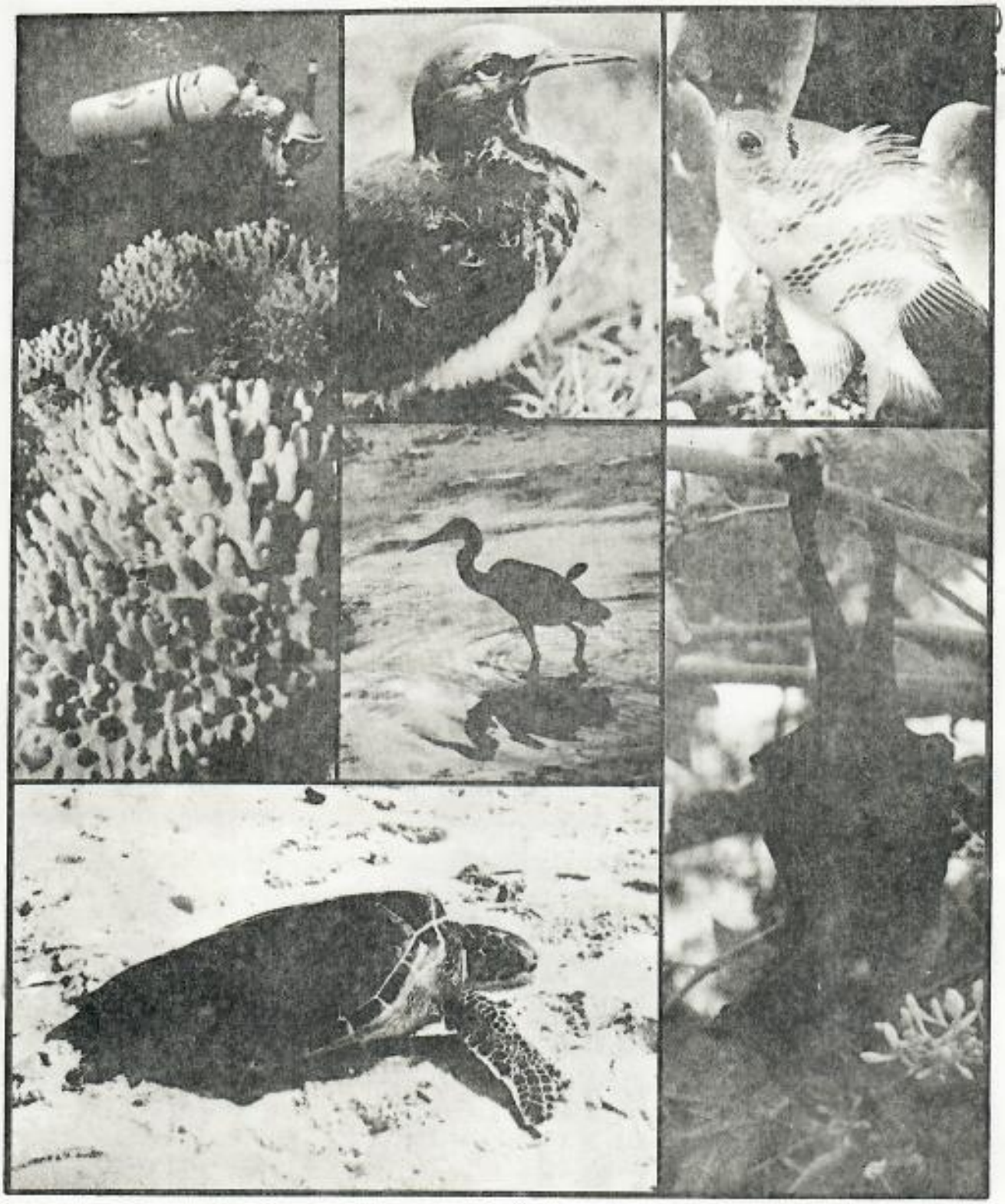
With Continental Air Micronesia (with DC-10s) and SPIA (with 707s) both announcing stepped-up service, "Guam will have more U.S. carrier service after Pan Am's suspension than it has now," Pan Am said, quite aside from Hawaiian's plans.

Because Pan Am has told everybody it won't be running, it will have an empty 747 jumbo, if it is forced to stay in, "at the exact time that SPIA is doubling its capacity" and Continental is coming in with three weekly DC-10 round trips, Pan Am said.

"It is a formula for disaster."

FY 1979

AQUATIC AND WILDLIFE RESOURCES



DEPARTMENT OF AGRICULTURE

JULY 1978 – JUNE 1979

FY 1979

F-1E Aerial Fishery Surveys - Guam by Michael E. Molina

Twenty-four aerial surveys were scheduled between July 1978 and June 1979, but due to bad weather only 21 of these flights were completed. These included 11 weekday and 10 weekend surveys. Each flight began at approximately 1030 hours, and circled the island once just beyond the reef margin. The flights usually took about 1.5 hours to complete at an average altitude near 800 feet. The primary objective of this program was to obtain a more or less "instantaneous" evaluation of inshore fishing activity for the whole island. The surveys yielded data on fishermen participation, fishing methods employed, and locations used for fishing. Additional data was taken on offshore fishing activity, the numbers of porpoises, sharks and turtles observed in the near-shore surface waters just beyond the reef, and on coastal non-fishing activities. This data is presented in Table 1. The same 12 census regions employed in previous aerial survey programs were again used during FY 79. These regions are shown in Figure 1. Due to military restrictions on low flying aircraft, Region 5 (Apra Harbor) was not censused during this program.

A total of 858 persons were observed performing one or another of the inshore fishing methods. As last year, gill and surround netting was found to be the most popular method, attracting 44% of the observed inshore fishermen. Next in popularity were cast netting (25%) and hook and line fishing (22%). Comparisons were made between the aerial and inshore creel census participation data for the five major inshore methods. Inshore gill and surround net data were lumped to make the comparison valid. Our inshore surveys indicated the greatest participation (42%) in hook and line fishing. The reason for such widely separated estimates probably lies in the fact that our aerial surveys do not include Apra Harbor and are less accurate at the Agana Boat Basin during the atulai season. During this season hook and line participation increases at both locations, especially at the Agana Boat Basin. Also, the high degree of relief at the boat basin due to the presence of many tall trees, boat masts, light poles, large boulders, ect. results in aerial counts much less accurate than those made on the ground, particularly during the atulai season. However, overall, this year's inshore fishing activity appeared to have increased somewhat over that of FY 78. That is, the mean number of participants sighted per flight went up by about 10 individuals.

As usual, offshore near-island fishing activity was dominated by the method of multiple line surface trolling. Based on the aerial survey data, participation (number of boats) in this method appears to have changed very little since FY 78. This is misleading, however, since more accurate data derived from our offshore creel census program indicated a substantial increase in trolling participation this year. The method of bottom fishing seemed to drop in popularity during FY 79 and this is in agreement with the results of our offshore creel census analysis.

This year's total sightings of marine turtles, sharks and porpoises was fairly close in number to those of FY 78. However, the total number of porpoises observed near the island during FY 79 was down nearly 22%. There was a notable reduction in the number of sightings in Regions 1 and 2, with a significant increase in the number of Region 7 sightings. As usual, more porpoises were sighted in Region 11 than in any other (60%). Taken together, approximately 84% of the porpoises were counted in the latter two regions alone.

Total sightings of marine turtles increased about 57% over those of FY 78. Based on 82 aerial surveys conducted from FY 75, through FY 79, far more turtles have been sighted within Region 12 (Pati Pt. - Ritidian Pt.) than in any other (Fig. 2). A total of 285 turtle sightings were made within this area during that time (Table 2). This represents 36% of the five-year total of 783 individuals, and is almost as many turtles as were observed within Regions 8, 9, 10, and 11 (Cocos Lagoon - Pati Pt.) combined; that is 294 turtles or 37.5% of the five-year total. Taken together, approximately 74% of the observed turtles were seen within these five regions alone. The most probable explanations for this distribution are the relatively low levels of development and fishing pressure found in these areas.

Marine turtle abundance appears to peak twice during the year (Fig. 3). In general, these peaks occur during the winter/spring (December - June) months. This loosely correlates with Guam's "dry" tradewind season which usually persists throughout that time of year. It is unclear at the present time whether or not the turtles are mating during this entire period. The time of nesting is also unclear, however, reports from local fishermen indicate that nesting occurs around June.

Reports have been made of larger than usual numbers of turtles visiting Guam about every three years. The last of these visits occurred in 1976, and is reflected in our aerial survey data (Table 3). Another visit was expected this year, and again, our data shows the winter increase in numbers. However, this year's influx of turtles did not appear to be as strong as the one which occurred in 1976.

Since it is difficult to make positive species identifications on turtles from a moving airplane, we have no reliable estimate of the species composition of Guam's marine turtle community. However, it is generally regarded that the green turtle, Chelonia mydas, is by far the major component. This species has a known breeding cycle of about three years which would explain the tri-annual increase in numbers of turtles observed on the aerial surveys. This also supports information offered by a resident of Tarague Beach (west end) that turtle nesting at that site is heavier every third year or so. It may be that mating (and possibly nesting) occurs every year among the "resident" portion of Guam's turtle community, and that the tri-annual increase in numbers is due to the return of the "migrating" portion for mating and nesting, a behavior known to occur among C. mydas populations.

Report prepared by: Michael E. Molina

Table 2. Summary Of Turtle Sightings By Aerial Survey Region For Fiscal Years 1975 Through 1979

	REGION													
	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	NUMBER MONTHS
FY'79	4	1	1	1		1	6	2	43	31	18	77	185	12
FY'78	6	3	1	9		6	14	3	10	1	15	15	83	12
FY'77	0	3	1	1		4	1	5	10	0	8	8	41	2
FY'76	7	5	6	6		35	8	14	44	10	12	42	189	9
FY'75	14	5	18	3		23	11	9	37	16	6	143	285	6
TOTAL	31	17	27	20		69	40	33	144	58	59	285	783	41
$\bar{X}$/REGION	6	4	6	4		15	8	8	31	12	13	59		

Table 3. Summary Of Turtle Sightings By Month For Fiscal Years 1975 Through 1979

	MONTH													
	J	A	S	O	N	D	J	F	M	A	M	J	TOTAL	NUMBER FLIGHTS
FY'79	12	3		6	7	12	18	52	24	14	20	11	185	24
FY'78	7	6	10	4	16	17	7	5	0	3	4	4	83	24
FY'77	23			18									41	4
FY'76		20	28	24	20	42	16	10	7	22			189	18
FY'75							45	44	32	46	54	64	285	12
TOTAL	42	29	44	52	43	71	86	111	63	85	78	79	783	82
$\bar{X}$/MONTH	14	12	15	13	14	24	22	28	16	21	26	26		

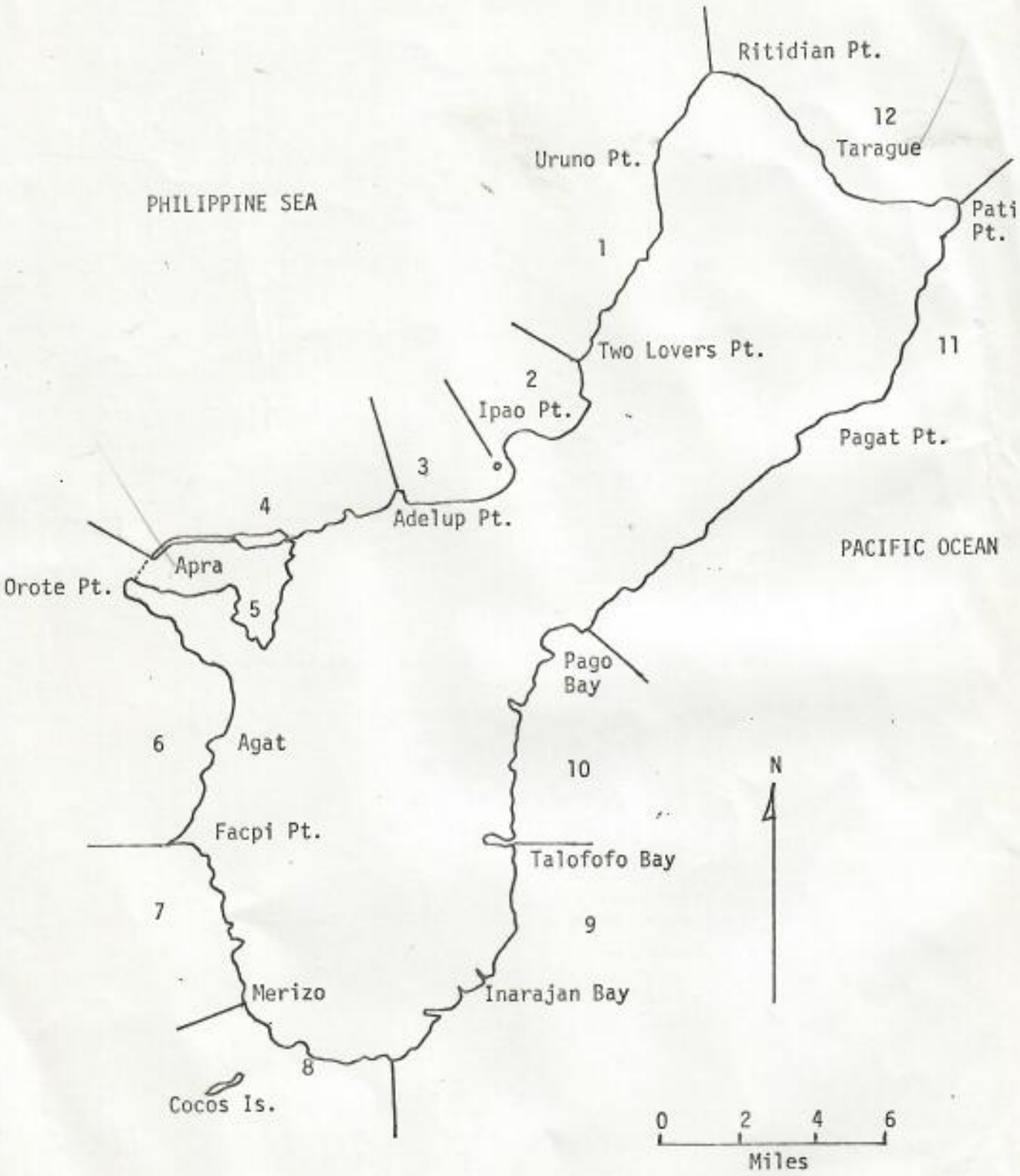


Figure 1. The island of Guam with its twelve aerial survey regions.

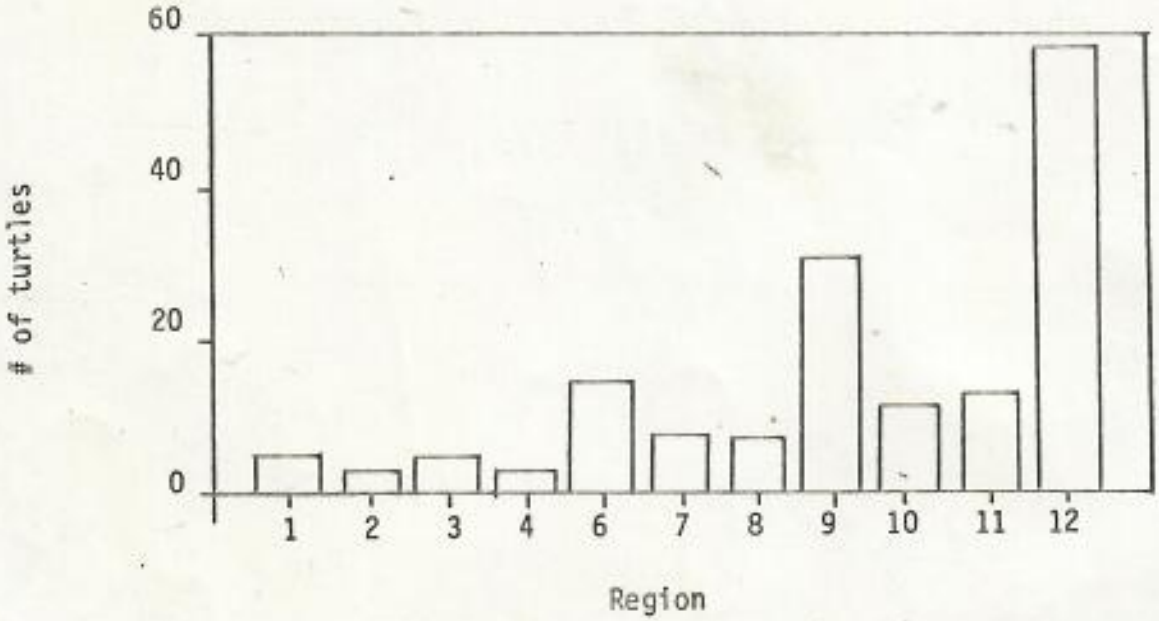


Figure 2. Mean number of turtles observed annually in the survey regions during Fiscal Years '75 -'79.

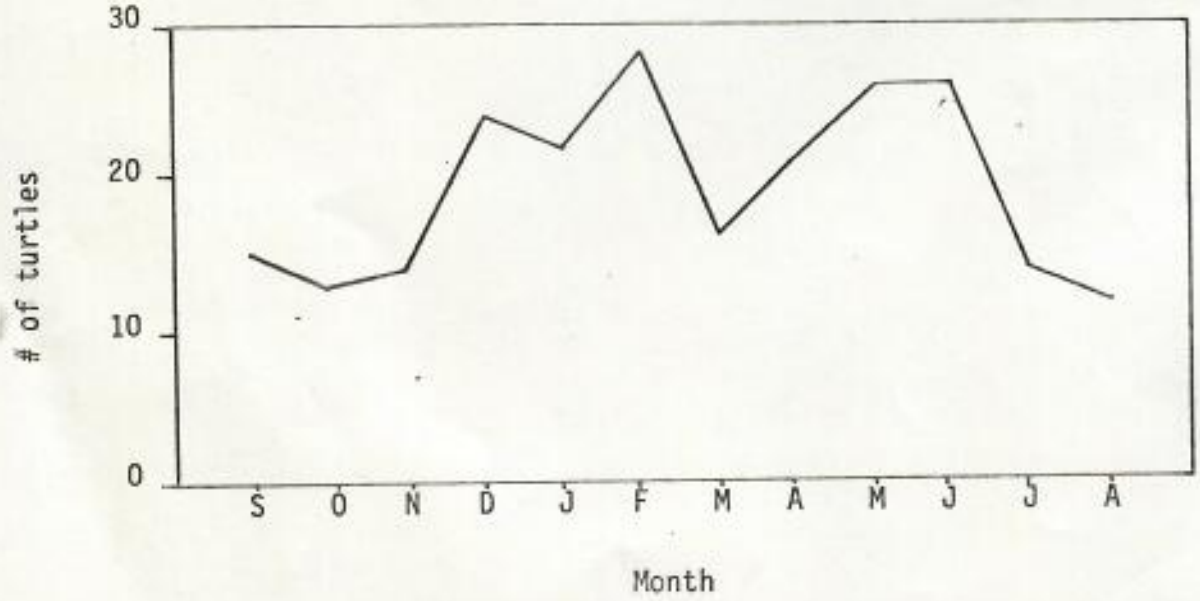


Figure 3. Mean number of turtles observed per month during Fiscal Years '75 -'79.

Guam Finds Itself Up to Its Bird Nests in Imported Snakes

Los Angeles Times June 10, 1982

By DICK WILLIAMS, *United Press International*

AGANA, Guam—Snakes wanted—frozen or alive.

Biologists with the Guam Department of Wildlife and Aquatic Resources know little about the *Boiga irregularis* and they are asking the public to help by providing the snakes, either alive, or if dead, brought in frozen.

Government experts insist there are no snakes native to Guam.

In the early 1950 snakes were discovered in the jungles of southern Guam. Since then they have spread throughout the island.

The reptiles, which grow 6 to 8 feet long, have been identified as a tree-climbing rat snake native to the Philippines.

Because they first showed up in areas adjacent to the harbor, the theory is that the nocturnal reptiles were introduced to Guam aboard ships from the Philippines.

There is speculation that the snake population is increasing while Guam's bird population is decreasing, and that is causing a great deal of consternation. The question of snakes and birds was even the subject of a two-hour debate on the floor of the Legislature.

Evidence against the rat snake has been mounting since 1980 when scientists first started studying the habits and diet of the reptile. Of 24 items found in dissected rat snakes, only one was a rat. The rest were birds and bird eggs.

If biologists confirm the rat snake is the culprit, the next step will be to determine how to reduce the snake population. There have been suggestions for a snake roundup with a bounty.

But the scientists had a warning for prospective snake hunters. The rat snake is poisonous, although there is no case on record in Guam of a person dying or even becoming ill from the snake's bite.

Unlike a rattlesnake, the rat snake's fangs are more like teeth, short and grooved, and they are in the back of the jaw. The poison runs along the grooves and into the wound opened by the fangs.

Whether the rat snake is guilty of decreasing the bird population or not, there is another reason to reduce the number of snakes. They sometimes cause power outages.

The snakes climb power poles and come in contact with high-voltage lines, creating a short. Because of Guam's antiquated power transmission system, the short does not trip isolation switches.

When the source of the short is located, employees almost always find the culprit at the foot of the pole, in two pieces, severed by the electrical burn.

Advertiser file photo

Guam's jungle swallows the rusted remains of a World War II Japanese light tank.

Celebrating a 'new' Guam

robert trumbull

A new Japanese invasion of Guam, this time by free-spending tourists, seems finally to have counteracted the bitter memories of the brutal, 31-month enemy occupation of that American Island in the western Pacific during World War II.

The Japanese captured Guam on Dec. 8, 1941, the same day as the attack on Pearl Harbor on that side of the international date line. They took 400 American prisoners and used the Chamorro-speaking native islanders, who then numbered about 25,000, as slave labor.

UNITED STATES soldiers and Marines came back, 55,000 strong, on July 21, 1944, killed nearly the entire Japanese garrison of 11,000 men in a fierce two-week battle that also cost about 1,300 American lives, and delivered the Guamanians from a long, painful bondage.

The Guamanians had been moved en masse by the Japanese to a far part of the island, separated from the battle zone by a mountain range. Their joy as they came out to meet an advance party of G.I.'s remains one of the most affecting memories of the war.

Many were the harrowing stories they had to tell.

Father Calvo, the senior Roman Catholic priest, related how his colleague, Father Duenas, had been executed by the Japanese for allegedly trying to signal American planes.

Two teenagers, a boy and a girl, had been slashed in the neck with swords and left for dead in a shallow grave, but they survived to tell the story at an impromptu press conference.

Several days later, in a sequestered jungle clearing, several of us counted 52 headless bodies in a group. These were young Guamanian men who had been pressed into service as porters for the retreating Japanese soldiers, and decapitated when their usefulness was ended.

EVERY YEAR since, the Guamanians have celebrated the anniversary of the American landing on July 21, 1944, as Liberation Day, an official holiday marked by singing, dancing, feasting and games commemorating deliverance from the Japanese. Until now.

Liberation Day, as such, has vanished from the Guamanian calendar. Beginning this year, the anniversary loses its name but continues to be observed as the terminal date of a marathon 17-day festival beginning July 4, and known as the "Spirit of America Celebration."

Guamanian authorities feared that their Japanese visitors, who account for about 75 percent of the entire tourist traffic, might be offended if they found out that the local people regarded the American recapture of the island as a liberation (July 4 is still called Independence Day, though, since the British don't seem to mind and very few of them come to Guam anyway.)

Japanese honeymooners and others began coming to Guam in the 1960s, when there was only one Pan Am plane a week from Tokyo, and there were only two or three modest hotels. Now Pan Am and JAL widebodied jets land several times a day, decanting some 300,000 Japanese a year.

Tumon Bay, lined with hotels belonging to big Japanese chains, has become Waikiki West, though the beach isn't nearly so good. Some of the shops in the hotels don't bother with signs in English, since the customers are virtually all Japanese.

INCORPORATING Liberation Day into the new Spirit of America Celebration seems appropriate, to be sure, since part of the spirit of America is to keep the customers happy. Those Japanese tourist dollars support a lot of Guamanians.

The spirit of America also includes forgiveness for injuries suffered at the hands of a former enemy. That process began on Guam a long time ago, as painful memories began to recede into history.

Many years ago, Guamanians and Japanese together raised money for a joint war memorial honoring the victims of both sides. Now a tourist attraction itself, it shows a pair of giant hands placed together as if in prayer.

The nobler aspect of the spirit of America is best personified, perhaps, by the principal Guamanian fundraiser for the memorial project. He was Father Calvo, by then a monsignor, who had seen the worst of the wartime occupation.

1

HA TURTLE SIGHTING REPORT

(Please return to: George H.Balazs;
Hawaii Institute of Marine Biology;
P. O. Box 1346; Kaneohe, HI 96744;
Tel. 247-6631)

Observation made by: E.O.D.

Address & Tel. No. (optional): GUAM

Date: 20 Aug 77 Time: 1030 Location (~~indicate on chart~~):

IF AVAILABLE, PLEASE SEND A TURTLE I.D. CHART/POSTER.

Ralph Darling

Observation made from: ___ shore;

✓ boat; or while ___ skin ✓ SCUBA diving.

Estimated size (shell length): _____

Turtle seen on: ___ surface; or at depth of approx. 85 ft. Distinguishing characteristics (species I.D. if known, long tail, shell color, tags, injuries, etc.): → NUMEROUS POINTS (SHARP) ON END OF SHELL

~~GREEN~~

Other comments: LOCATED NEAR BUOY #1, COMMERCIAL PORT, APRA HARBOR, GUAM

THANK YOU FOR YOUR COOPERATION

LT. R. DARLING
EODGRUONE DET 64
US NAVAL MAGAZINE
FPO S.F., CA. 96630

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

AGANA, GUAM 96910

Agricultural Development Services 734-3947
Aquatic & Wildlife Resources 734-3945
Forestry & Soil Resources 734-3948
Animal Industry 734-3940
Plant Industry 734-3949

Sales & Permit Info 734-3943
Administrative Ser. 734-3941/2

October 13, 1982

Dr. George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

The Department of Agriculture's Division of Aquatic and Wildlife Resources and Division of Forestry and Soil Resources are pleased to present you with their recently printed poster "Man, Land and Sea, Living in Harmony". These will be utilized mainly in the schools as a part of our conservation education program.

Funds for this poster were made available by the U.S. Department of Commerce, office of Coastal Zone Management Program and the U.S. Forest Service.

We hope that you will display this poster in your office.

Sincerely,

JUDY E. BEAVER
Public Information Officer
Aquatic & Wildlife Resources

Enclosure

27 SEP 1976

GOVERNMENT OF GUAM

AGANA, GUAM

September 23, 1976

Mr. Eugene Kridler
Endangered Species Coordinator
Fish and Wildlife Service
Pacific Islands Field Station
Room 606, 1311 Kapiolani Blvd.
Honolulu, Hawaii 96814

Dear Gene:

The Government of Guam Customs Officers have been intercepting stuffed hawksbill turtle at a rather high frequency at the airport. Most of these turtles have been confiscated from Japanese tourists returning from the Trust Territories and a few people returning from the Philippines.

The U.S. Military Customs Officer is also concerned because many of the military dependents buy these turtles as souvenirs only to have them confiscated by the military customs people when they have their household effects inspected prior to departure from Guam. The military customs people conducted a survey of the local shops to determine which shops are selling turtle products. A copy is enclosed. As you can see, this turtle sells for a considerable amount and represent a financial loss to the buyers when their turtles are confiscated.

Last week a meeting was held at ComNavMar among the Government of Guam Customs Inspectors, Navy Customs Officers and myself from Fish and Wildlife to discuss ways to reduce or eliminate the entry of hawksbill turtle into Guam.

We are of the opinion that since this is a Federal law, it is really the responsibility of the U.S. Attorney and the U.S. Marshall's office to enforce this law. Lieutenant Commander C.L. Nissler, who is in-charge of the Military Customs office here, agreed to present the situation to the U.S. Attorney and to urge him to instruct the U.S. Marshalls here to inspect the various shops and confiscate any hawksbill turtle on sale.

We feel that even if the U.S. Attorney does not prosecute the violators, the mere confiscation of these turtles from the shops would discourage the shop owners from continuing the sale of these turtles.

Would you also bring this matter to the attention of the U.S. Attorney here in Guam and urge him to have the U.S. Marshalls make routine inspections of the various shops and confiscate any hawksbill turtle on sale. I am aware that the U.S. Endangered Species Act has no bearing on the Trust Territories, but if you should bring this matter to the attention of the High Commissioner of the Trust Territory, he may be able to cooperate and implement some sort of control on the taking as well as selling of hawksbill turtle to the tourists.

Our Division has prepared a press release informing the public that the hawksbill turtle is an endangered species and possession of this turtle is illegal.

Sincerely yours,

HARRY T. KAMI
Acting Chief, Division of
Fish and Wildlife

Enclosure

PETER R. NELSON
Director
ELIZABETH P. TORRES
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

Administrative Services
Agric. Development Services
Animal & Plant Industries
Aquatic & Wildlife Resources
Forestry & Soil Resources
Animal Quarantine Services

AGANA, GUAM 96910

PHONE: 734-3941/2/3

March 24, 1983

Dr. George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

I'm enclosing a copy of an article that recently appeared in the Guam Tribune on the turtle release. You might want it for your files.

Keep in touch.

Sincerely,

JUDY E. BEAVER
Public Information Officer
Aquatic & Wildlife Resources

Enclosure

BUREAU OF PLANNING
GOVERNMENT OF GUAM
AGANA, GUAM 96910

Box 2950

NOV 0 9 1983

George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Thank you for your letter and for the brochures. The monk seal brochure is especially beautifully done and appealing. Both brochures will do a great deal to alert people to the plight of these animals.

I talked to Mike Molina at Aquatic & Wildlife about the Cocos Island sea turtle hatch. Mike is compiling all of the data as Gene Nita had also requested this information. This should be arriving shortly.

I'm glad you liked the poster. Please keep in touch.

Sincerely,

Judy

JUDY BEAVER

University of Guam

MARINE LABORATORY
UOG Station, Mangilao, Guam 96913
Cable: "UnivGuam" Telex: 721 6275

May 23, 1983

Dr. George H. Balazs
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, Hawaii 96744

Dear George:

Thank you for the notice and background information for the public hearing on Guam. I wasn't aware of this meeting previously, but now I will attend. I have no new information to contribute and I think you and Pritchard have stated things well. I will see what I can do.

Meanwhile, I will circulate your materials around the Marine Laboratory faculty and to the Division of Aquatic and Wildlife Resources and encourage others to attend the hearing.

Sincerely yours,

CHARLES BIRKELAND
Associate Professor

CB:lcl

SURF RESORTS
HAWAII

U.S FWS SPECIAL AGENT
JAMES MICUDA
011-671-342-1168 Home
477-8528 office
P.O. BOX 3238
AGANA GUAM 96910

KAUAI SURF MAUI SURF KONA SURF NANILOA SURF

Pacific Islands Finances

Editorial in the Pacific Daily News, Guam

THE GUAM Penitentiary project may be the straw that could break the camel's back.

For years we've been advocating more local control, and less of the heavy-handedness of the bureaucrats in distant Washington.

Now we're not so sure. After federal auditors' claims that $4.7 million is missing from the prison construction fund, presumably merged in with the general fund, our reaction is being reversed.

What the federal government needs, not only in Guam, but in the Virgin Islands, American Samoa, the Northern Marianas, and in the emerging island nations of Micronesia is a solid federal office.

The whole system needs changing. If the federal government is going to give hundreds of millions of dollars a year in capital improvements, grants, food stamps, agriculture, and economic development aid to the islanders, then it has to exercise more control on how that money is spent.

BY A FEDERAL OFFICE, we mean an office that can monitor federal grants, that has certifying power and auditing power. We need a watchdog agency that can keep close tabs on the spending of federal monies in the islands, an agency that can issue yearly reports to Congress, to Interior, and other concerned departments.

The taxpayers of the nation should demand such an office. There has been far too much waste and inefficiency in the spending of federal funds in the islands.

It has happened time and again in the Virgin Islands. It has become rampant in Samoa. The Northern Marianas is letting money slip through their fingers like it is going out of style. The waste in Micronesia is appalling.

And so it is with Guam.

We would like to be able to report to the U.S. taxpayers that their money is being used wisely in the islands.

It's time for the U.S. government to set up a federal office in each island group to carefully oversee such spending. The taxpayers deserve that.

Honolulu Star-Bulletin 5-9-83

TUGUA
...or

VICTOR T. ARTERO
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

AGANA, GUAM 96910

Agricultural Development Services 734-3947
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Plant Industry 734-3949

Sales & Permit Info 734-3943
Administrative Ser. 734-3941/2

5/10

WPPO	
DEG	✓
JJN	✓
ETN	
PAM	
HEW	✓
WCS	
SLA	
MCS	
GKH	

May 3, 1982

Dr. Dolye E. Gates
Administrator
National Marine Fisheries Service
Western Pacific Program Office
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Gates:

I am pleased to enclose the Guam Legislature's Resolution adopting the Territory of Guam Fisheries Development and Management Plan as official policy of the Government of Guam. A copy of the Plan itself was transmitted to your office in November 1981.

Future fisheries development and management programs for the Territory of Guam will be conducted in accordance with this Plan.

Sincerely,

ANTONIO S. QUITUGUA
Director
Department of Agriculture

Enclosure

BUREAU OF PLANNING
GOVERNMENT OF GUAM
AGANA, GUAM 96910

OCT 0 5 1983

Dr. George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

The Department of Agriculture's Division of Aquatic & Wildlife Resources is pleased to present you with a copy of its latest poster, "Guam's Vanishing Wildlife." The poster was developed as a part of Guam Coastal Management Program's conservation education effort. Designed by local artist Jeff Skvaril, the poster was funded by the U.S. Department of Commerce, Office of Coastal Zone Management, Bureau of Planning, Government of Guam.

If you would like additional copies of the poster, please contact Judy Beaver, the Bureau of Planning's Public Information Officer, at 477-9502, 477-9639, or 472-2264; or at P.O. Box 2950, Agana, Guam 96910.

Sincerely,

Paul B. Souder
PAUL B. SOUDER

Enclosure

Hope everything is going well there. We had about 200 turtles to hatch on Cocos. Keep in touch. Judy

OM BUREAU OF PLANNING
P.O. BOX 2950
AGANA, GUAM 96910

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Robert F. Myers & Robert D. Anderson

Type of turtle: Chelonia mydas

Tag numbers: location A (left flipper) 8981 location B (right flipper) _____

Previous tag numbers (if present): _____

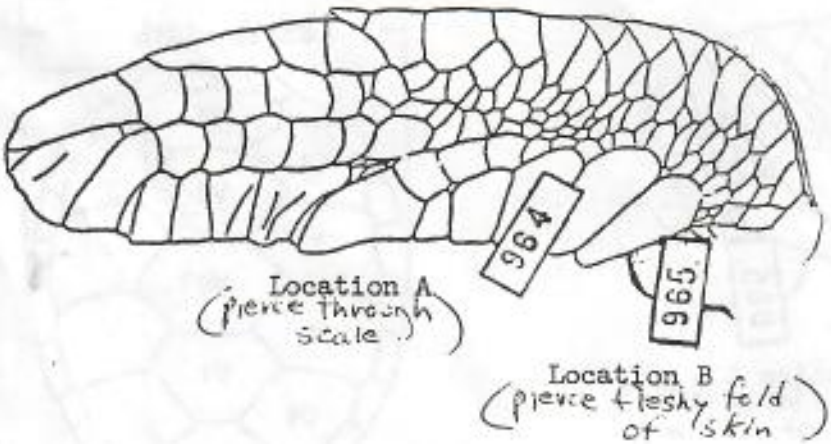
Curved (or straight) upper shell measurements: length 46 cm width _____

Length of tail past end of upper shell: _____

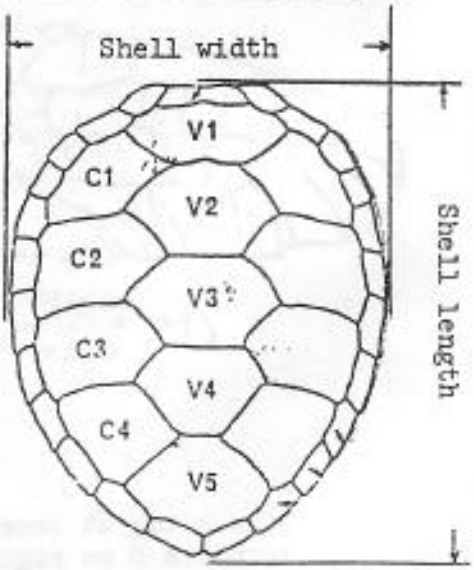
Location and date of capture and release: Cetti Bay, Guam Dec 14, 1990
Apra Harbor, Guam, Dec 19, 1990 Release

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

puncture wound, right forward plastron
(likely penetration of lung)



Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Robert F. Myers & Robert D. Anderson

Type of turtle: Chelonia mydas

Tag numbers: location A (left flipper) 8980 location B (right flipper) _____

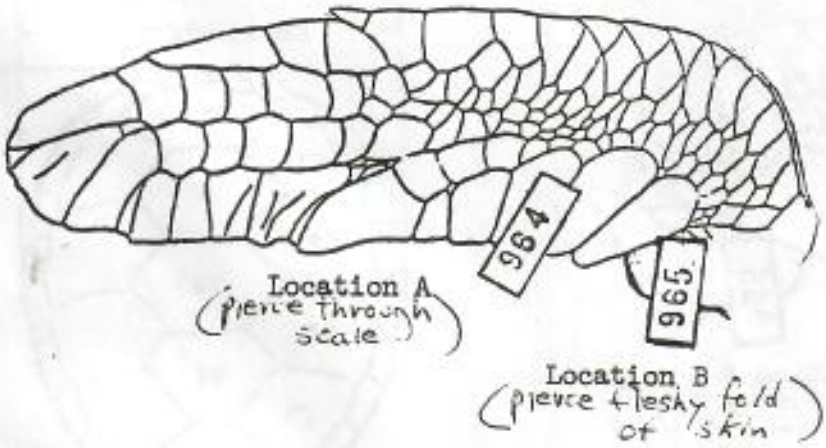
Previous tag numbers (if present): _____

Curved (or straight) upper shell measurements: length 36.5 cm width _____

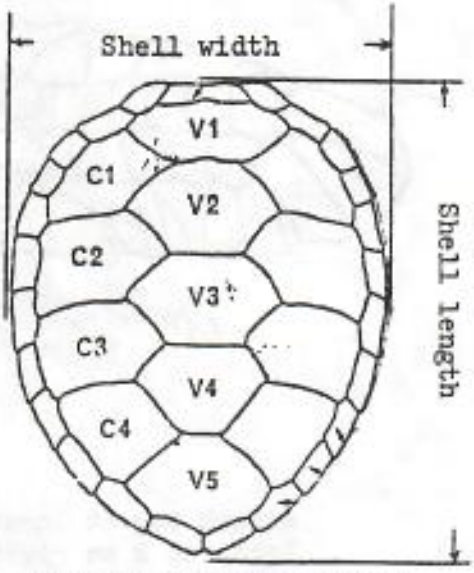
Length of tail past end of upper shell: _____

Location and date of capture and release: Cetti Bay, Guam Dec 14, 1990
Apra Harbor, Guam, Dec. 19, 1990 (release)

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.) puncture wound on neck, difficult to detect



Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Robert F. Myers & Robert D. Anderson

Type of turtle: Chelonia mydas

Tag numbers: location A (left flipper) 8982 location B (right flipper) _____

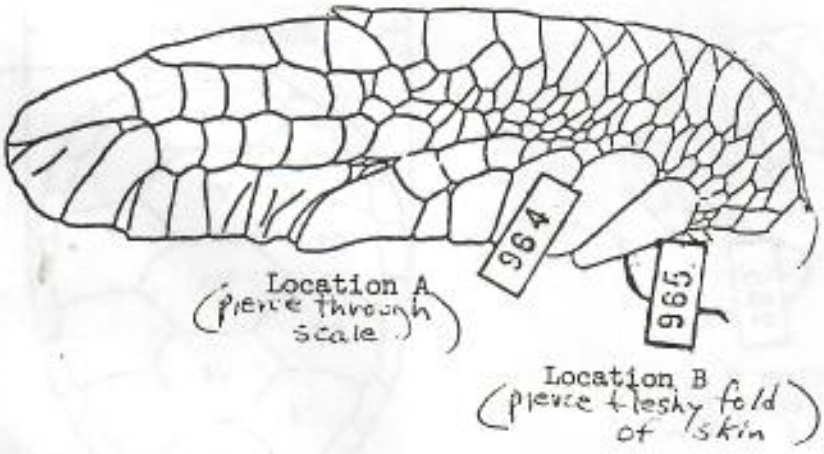
Previous tag numbers (if present): _____

Curved (or straight) upper shell measurements: length 44.5 cm width _____

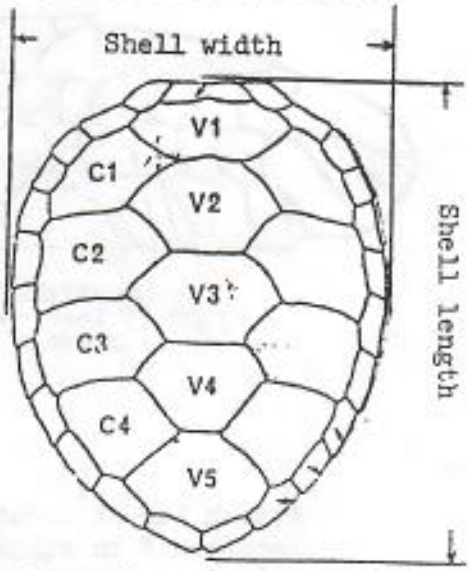
Length of tail past end of upper shell: _____

Location and date of capture and release: Cetti Bay, Guam, Dec 14 1990
Apra Harbor, Guam, Dec 19, 1990 Release

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.) puncture wound on neck; difficult to detect



Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2184

Tagged by: Robert F. Myers & Robert D. Anderson

Type of turtle: Chelonia mydas

Tag numbers: location A (left flipper) 8983 location B (right flipper) _____

Previous tag numbers (if present): _____

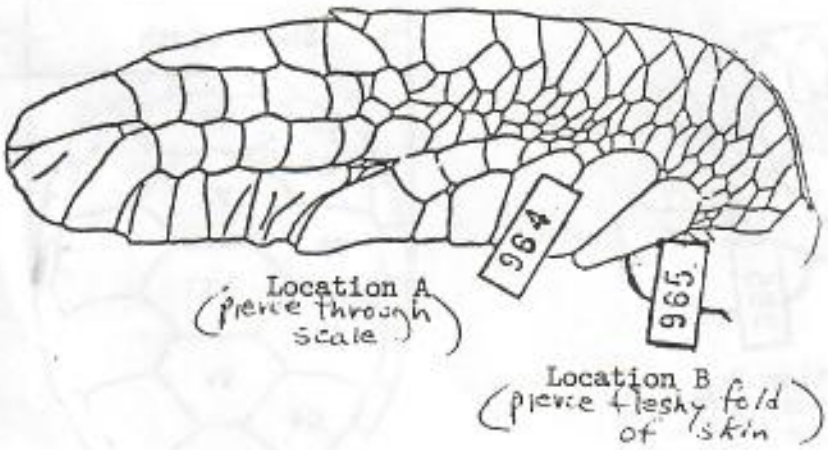
Curved (or straight) upper shell measurements: length 42 cm width _____

Length of tail past end of upper shell: _____

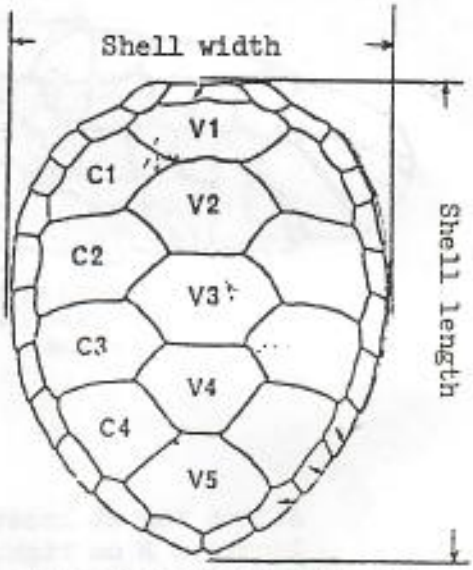
Location and date of capture and release: Cetti Bay, Guam, Dec 19, 1990
Apra Harbor, Guam, Dec 19, 1990 Release

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

puncture wound, forward center of carapace



Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2184

Tagged by: Robert F. Myers & Robert D. Anderson

Type of turtle: Chelonia mydas

Tag numbers: location A (left flipper) 8940 location B (right flipper) _____

Previous tag numbers (if present): _____

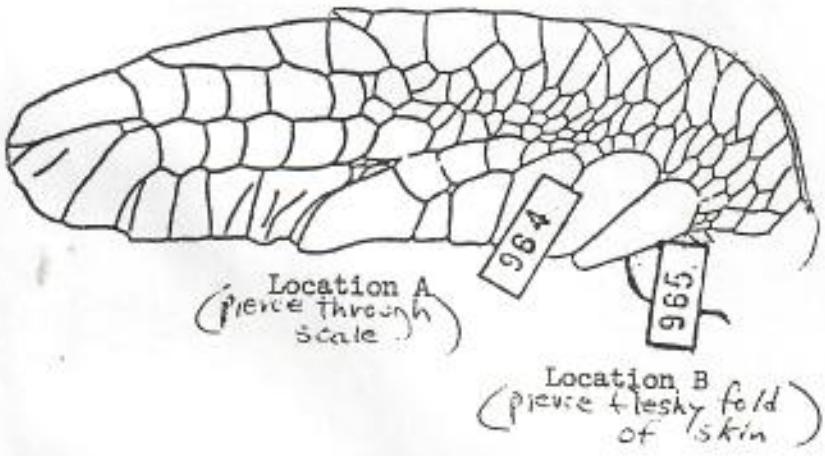
Curved upper shell measurements (or straight): length 45 cm width _____

Length of tail past end of upper shell: _____

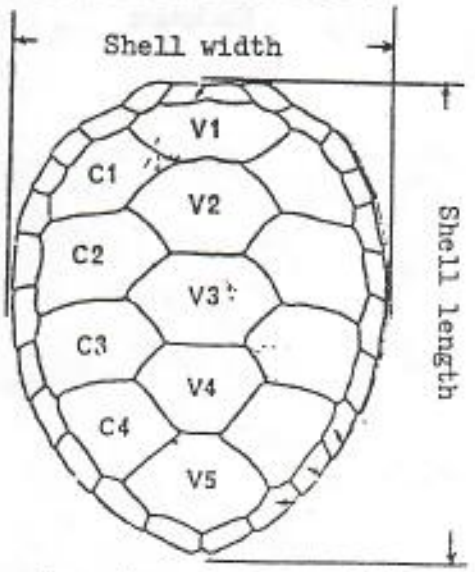
Location and date of capture and release: Cetti Bay, Guam Dec 14, 1990
Apra Harbor, Guam, Dec 19, 1990. Release

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

puncture wound on forward center of plastron



Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Department of Agriculture
Division of Aquatic and Wildlife Resources
P.O. Box 2950
Agana, Guam 96910
Telephone Numbers (671)734-3493/3944/3945/5283
Fax Number (671)734-6570
E-mail:SUNIPORTALICUP.PORTAL.COMIGUAM-DAWR

January 9, 1991

George Balazs
Honolulu Laboratory
Southwest Fisheries Center
National Marine Fisheries Service, NOAA
Honolulu, HI 96822-2396

Dear Mr. Balazs:

Enclosed is some sea turtle information of interest to you. Happy New Year!

Sincerely,

ROBERT F. MYERS
Fisheries Biologist
Aquatic & Wildlife Resources

Enclosure

The Sport Fish and Wildlife Restoration and Endangered Species Conservation Programs under the Department of Agriculture, Division of Aquatic and Wildlife Resources are funded in their entirety with federal money under the Sport Fish Restoration Act of 1950, as amended, the Wildlife Restoration Act of 1937, as amended , and the Endangered Species Act of 1973, as amended.

CARAPACE lgt.

Turtle #1 ♀ 36.5 cm No wounds visible
Tag # 8980

Turtle #2 ♀ 46 cm Puncture wound right forward plastron
Tag # 8981

Turtle #3 ♀ 44.5 cm No visible wounds
Tag # 8982

Turtle #4 ♀ 42 cm Puncture wound toward center of carapace
Tag # 8983

Turtle #5 ♀ 45 cm Puncture wound forward center of plastron
Tag # 8984

CASE # 90-26315

COI Domingo C. Paragilinan
"WATCH MAN"

COI David C. TORRES
Jimmie B. Camacho

Dec. 18, 1990

Affidavit: Illegal taking of green sea turtles, Dec. 14, 1990, case no. 90-26315

At about 1800 hr., Dec. 14, I participated in the examination of five green sea turtles (*Chelonia mydas*) in the presence of conservation officers Domingo C. Pangilinan, Jimmie B. Camacho, and David C. Torres as well as division Chief Rufo Lujan, Assistant Chief Bob Anderson, Public Information Officer Lilian Mariano, and biologist Michael McCoid.

I arrived on the scene just as the vehicle and boat confiscated from the suspects arrived at the Dept. of Agiculture. The five turtles were piled onto the bottom of the boat and appeared listless. Each turtle was removed from the boat, set on the sidewalk right-side up, and photographed while its carapace length (CL) was measured. Most of the turtles struggled during this procedure. All turtles were sexed, and their wounds, if any were noted. Afterwards, each turtle was turned upside-down and placed on the grass adjacent to the sidwalk. This calmed the animals. Each turtle was then tagged with a standard numbered metal tag on the left front flipper.

All five turtles were females as listed below:

1. 36.5 cm CL, tag # 8980, no visible wounds

2. 46 cm CL, tag # 8981, puncture wound on right foward plastron

3. 44,5 cm CL, tag # 8982, no visible wounds

4. 42 cm CL, tag # 8983, puncture wound on foward center of carapace

5. 45 cm CL, tag # 8940, puncture wound on foward center of plastron

At approximately 7:30 pm, I proceeded to the Marine Laboratory where I met Reseach Assistant Suzanne Wilkins. At approximately 8:15 pm, Conservation Officers David C. Torres and Jimmy B. Camacho arrived with the turtles. We then placed them in a large holding tank on the west lanai of the Marine Lab. Each turtle swam vigorously as soon as it was placed in the tank. Suzanne Wilkins then signed a custody receipt and the conservation officers departed. A part of the inflow pipe was knocked loose shortly thereafter, and Suzanne and I had to wait for Lab. Technician Richard Sakamoto to arrive and fix the problem. This was done at about 9 pm, and I left at that time.

Robert F. Myers
Fisheries Biologist

AFFIDAVIT BY:
FISHERIES BIOLOGIST III
ROBERT F. MYERS

TESTIMONY REQUESTING PROMPT COURT ACTION TO FACILITATE THE RELEASE OF GREEN SEA TURTLES CASE NO. 90-26315 OF DECEMBER 14, 1990

Five green sea turtles (*Chelonia mydas*) are currently being held at the University of Guam Marine Laboratory as evidence in an illegal fishing case (Case No. 90-26315; all five had been speared, the two alleged unwounded animals in the previous affidavit for this case were subsequently been found to have well-hidden neck wounds).

Past experience has indicated that green sea turtles held at facilities on Guam have deteriorated in health and that non-mortally wounded turtles stand a much better chance of survival in the wild. There are no facilities on Guam that are capable of properly holding and caring for green sea turtles. Their natural diet is difficult to duplicate and even healthy turtles in captivity frequently succumb to a Vitamin A deficiency that has led to blindness in at least one case on Guam. It is not uncommmon for wounded turtles to recover on their own in the wild. Turtles are frequent victims of large sharks and have been known to survive and recover from loss of limbs and severe puncture wounds.

The five animals now in captivity are being held in entirely inadequate tanks that do not have the space required for active swimming. In addition there is no way to provide the proper diet and no security. In the past, turtles and other animals have been stolen from the Marine Laboratory. I have already been told by one of the graduate students at the Laboratory that suspicous looking people have been observed looking at the turtles, so the "word is out" that there are turtles there. Furthermore, with the impending storm, it is highly likely that the seawater system at the Laboratory will be down for up to several days, and many animals may die. This as well as the turtles' own waste products would foul the water and greatly increase the chance that those with recoverable wounds will succumb to infection as well as the above mentioned dietary deficiencies. If the turtles are released immediately in a safe environment such as Apra Harbor, even the worst of storm conditions would have a negligible impact on them and at least four of the five would have an excellent chance of recovery, and the remaining most seriously wounded one would stand a much better chance than if left in captivity.

As a fishery biologist with over 10 years experience, it is my opinion that it is imperative that these turtles be released immediately to ensure their recovery and survival.

ROBERT F. MYERS
Date: _____

United States Department of the Interior
FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

TAKE PRIDE IN AMERICA

August 16, 1990

Dr. Ralph Frew
President, Marianas Audubon Society
P. O. Box 4425
Agana, Guam 96910

Dear Dr. Frew:

In anticipation of the Air Force's initiation of formal Section 7 (Endangered Species Act) consultation regarding the granting of increased access to the Artero property at Urunao Point, we are gathering available information on the possible impact of development there on listed species. In your comments presented at the Scoping Meeting for the Environmental Impact Statement on August 6th, you stated that the beach at Urunao Basin is one of only four remaining areas on Guam where endangered sea turtles are still known to nest. We assume that you are referring to the green sea turtle, a threatened species. Further, you referenced that the area represents 40% of the total known sea turtle nesting still taking place on Guam.

Any information available on sea turtles at Urunao could be extremely important in our analysis. It would be very helpful if you could provide us with the references used in drafting your comments. What figures were used to determine 40%; does it refer to green sea turtles?

Your comments also stated that some illegal taking of sea turtle eggs occurs at Urunao. We would also appreciate any details on such activities. Has the taking been reported to the conservation law enforcement staff on Guam?

Thank you for your consideration of these requests. We want to ensure that we do as thorough a job as possible in evaluating the potential adverse impacts of any development at Urunao, and your assistance is greatly appreciated.

Sincerely yours,

William R. Kramer

William R. Kramer
Deputy Field Office Supervisor
Fish and Wildlife Enhancement

cc: George Balazs, National Marine Fisheries Service, Honolulu, Hawaii

GUAM FILE

ENHALUS

ACOROIDES

- A SEAGRASS FOUND OFF COCOS, GUAM

GUAM FILE

UNITED STATES GOVERNMENT

memorandum

10/84

George Balazs.

News from Guam says that at least four turtle nests have hatched this year so far.

I'm sorry to have taken so long to send this to replace Xerox provided earlier.

Best wishes.

Tom

rly on the Payroll Savings Plan

OPTIONAL FORM NO. 10
(REV. 7-76)
GSA FPMR (41 CFR) 101-11.6
5010-111

PHOTO BY CHRIS WILLE

GREEN SEA TURTLE Endangered Species

There are two types of sea turtle that may be found in the waters around Guam: the green and the hawksbill sea turtle. Sea turtles spend most of their lives in the water. They feed in shallow reef areas. The green turtle eats plants, such as turtle grass and algae. Some sea turtles weigh over 1,000 pounds and may be over one hundred years old.

Sea turtles may migrate hundreds of miles across the ocean from where they were born. Every few years the adults swim back to the beach of their birth to nest. The female crawls up on the sand, digs a hole with her flippers, and lays about 100 eggs. She covers the eggs with warm sand and returns to the sea. When the baby turtles hatch, they run for the water, but predators eat many of them.

Sea turtles live in warm waters around the world. Turtle eggs and turtle stew are highly prized foods on many islands. Their shells can be used to make cooking utensils, jewelry and many other things. Turtles were often kept aboard ships and voyaging canoes as a source of fresh meat.

Because sea turtles have been over-hunted and their nesting beaches destroyed, there are few of them left today. Sea turtles are endangered species and are protected on Guam.

FUNDED BY GUAM COASTAL MANAGEMENT PROGRAM
BUREAU OF PLANNING
GOVERNMENT OF GUAM

DIVISION OF AQUATIC & WILDLIFE RESOURCES
DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

PETER R. NELSON
DIRECTOR

ELIZABETH P. TORRES
Deputy Director

Please make a copy for George B.

George pls your request - gm

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

AGANA, GUAM 96910

Agricultural Development Services 734-3947
Aquatic & Wildlife Resources 734-3945
Forestry & Soil Resources 734-3948
Animal Industry 734-3940
Plant Industry 734-3949

Sales & Permit Info 734-3943
Administrative Ser. 734-3941/2

November 7, 1983

Gene Nita
National Marine Fisheries Service
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Gene:

It was good to hear from you. I trust all is well. Sorry for the slight delay in writing but I've been waiting for photos of the turtle hatchlings to be developed. I intended to include them with this letter, but just found out that they won't be available for another week or so. I'll forward copies to you as soon as they are available. In the meantime, here is the information you requested.

Very early in the morning on Sunday, August 7, 1983, a Cocos Island Resort Hotel guest named Anthony Godwin observed a large turtle constructing a nest near the hotel beach. The approximate location of the nest is indicated in the attached figures. Although Mr. Godwin could not identify which species of turtle he had observed, he estimated its weight to be between 135 and 225 kilograms. Because of this we feel it was probably Chelonia mydas. The nest was finished sometime between 0100 and 0200 hours, at which time Mr. Godwin ceased observation.

The next day our office was notified of the nesting by Mr. Conwell, Chief of Security at the hotel. We responded by arranging a visit to the site by two of our staff (Fishery Biologist Rob Myers and Conservation Officer Wayne Bigler) and Jim Micuda, the U.S. Fish & Wildlife Service Special Enforcement Agent currently stationed on Guam. Transportation was offered and provided by the hotel. After being informed of the law protecting marine turtles and their nests, the hotel security staff agreed to put up a fence and warning signs around the nest, and to check the nest site every 20 minutes while on their routine patrols. They cooperated further by clearly informing other hotel employees that anyone seen tampering with the nest might be fired.

Several weeks later between 0300 and 0600 hrs. security personnel on routine patrol observed numerous hatchlings disbursing in all directions near the site. However, the source of the hatchlings was identified to be a nest approximately 15m inland from the original fenced-off site. The security officers collected over 200 hatchlings into tubs and released all of them into

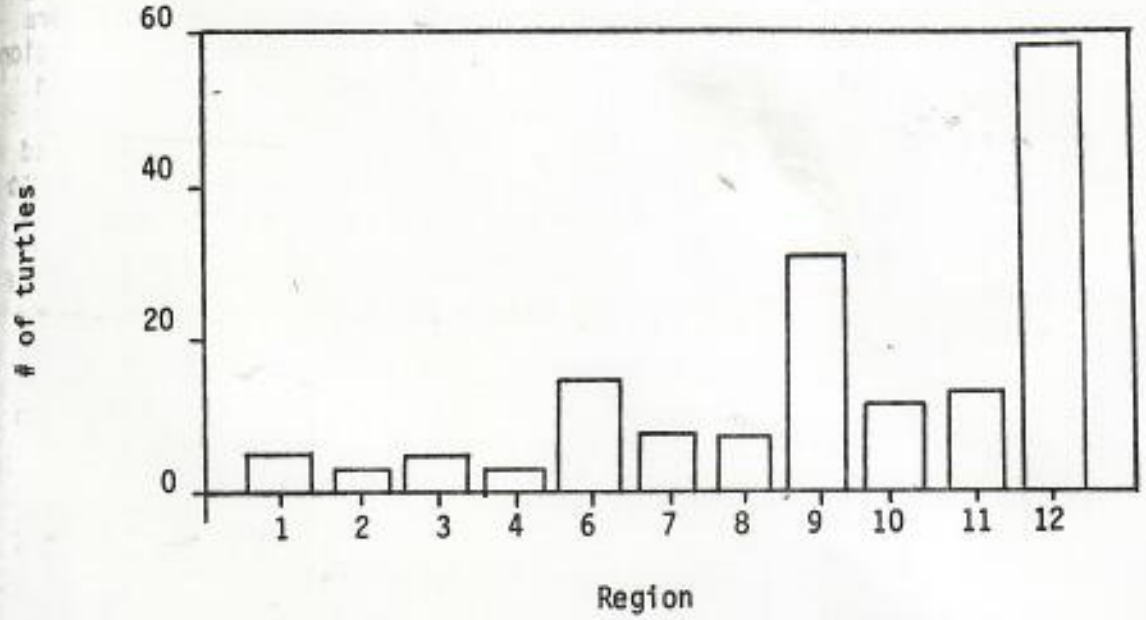


Figure 2. Mean number of turtles observed annually in the survey regions during Fiscal Years '75 -'79.

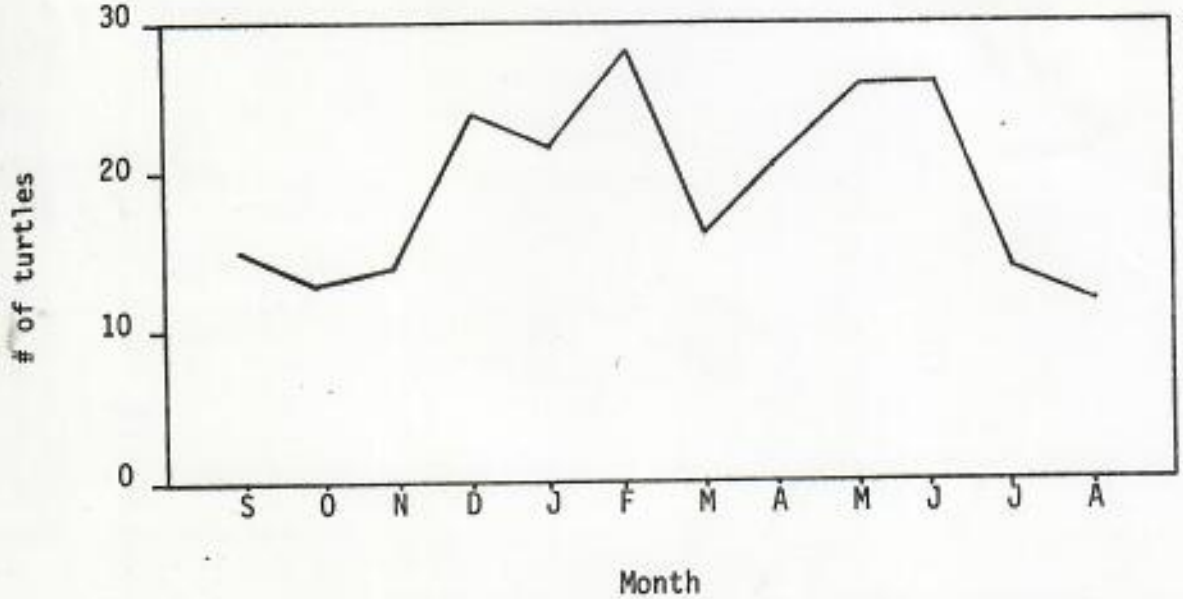


Figure 3. Mean number of turtles observed per month during Fiscal Years '75 -'79.

PETER R. NELSON
DIRECTOR

ELIZABETH P. TORRES
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

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Aquatic & Wildlife Resources 734-3945
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Animal Industry 734-3940
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Sales & Permit Info 734-3943
Administrative Ser. 734-3941/2

AGANA, GUAM 96910

July 6, 1983

Mr. George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Today, I responded to a call regarding a live captured green sea turtle. I took measurements and the weight of the turtle and attached an "old" HIMB tag (#570) to its right flipper. The turtle will be released at the site of capture (Tarague Beach) tonight.

Unfortunately, we are now out of tags and our sealer has disappeared. In going through our turtle file I found a letter from you to Harry dated 6 January 1981 which evidently accompanied a small shipment of tags to our office. It is now time to take you up on your offer to send us more tags when they are needed. If you can spare a sealer as well we would be most appreciative.

So far, we have tagged five hawksbills and one green sea turtle. I know it's a slow start, but hopefully, someday we'll find out if our turtles are migrating up and down the Mariana Chain as yours apparently do in the Hawaiians. I look forward to hearing from you soon; and thanks for sending us all the great turtle info.

Sincerely,

Mike

MICHAEL E. MOLINA
Acting Fishery Supervisor
Aquatic & Wildlife Resources

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

Administrative Services
Agric. Development Services
Animal & Plant Industries
Aquatic & Wildlife Resources
Forestry & Soil Resources
Animal Quarantine Services

AGANA, GUAM 96910

PHONE:

March 1, 1983

Mr. George Balazs
Fishery Biologist
NMFS
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

I just wanted to give you the results of the turtle releasing, and thank you for your assistance. All the turtles arrived alive, however 3 were very stressed/fatigued. All but one hawksbill recovered quickly when placed in a shallow tank and were released within 2 hrs., about 2 miles north of Ritidian Pt., Guam. The fifth hawksbill was retained at the Cushing Zoo tank because of its poor state. Apparently this turtle had ingested a large quantify of black, plastic netting material. This material was not in the crate so it must have eaten it earlier. We are treating it now and hopefully it will recover and be released soon.

I should mention that improvements could be made in shipping. Most of the turtles from Marine World had shifted in the crates and were in very awkward positions, which I believe hindered respiration. Restricted mobility is recommended. Also most of the turtles had "chewed" the styrofoam packing and ingested small quantities of it. Perhaps with decreased mobility, packing material would be out of reach for them. All in all, the release was a success and I hope they all survive to an old age. I just regret that we'll not know the final outcome.

Enclosed are copies of our field data, and your tagging pliers.

Sincerely,

Alan J. Hosmer

ALAN J. HOSMER
Fishery Supervisor
Aquatic & Wildlife Resources

Dear George -

Excuse this informal note but did want to add to Alan's comments. I went along on the release as did the media. The coverage was excellent and a short TV segment will be appearing on TV - Dolan Group shortly.

I am enclosing a copy of a front page photo and some close shots of the statue. Please keep us posted on your work.

Sincerely,

Judy Beaver

6500 not put ON

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Alan T. Hosmer USAOR - Guam

Type of turtle: Green

Tag numbers: location A (left flipper) — location B (right flipper) —

Previous tag numbers (if present): none

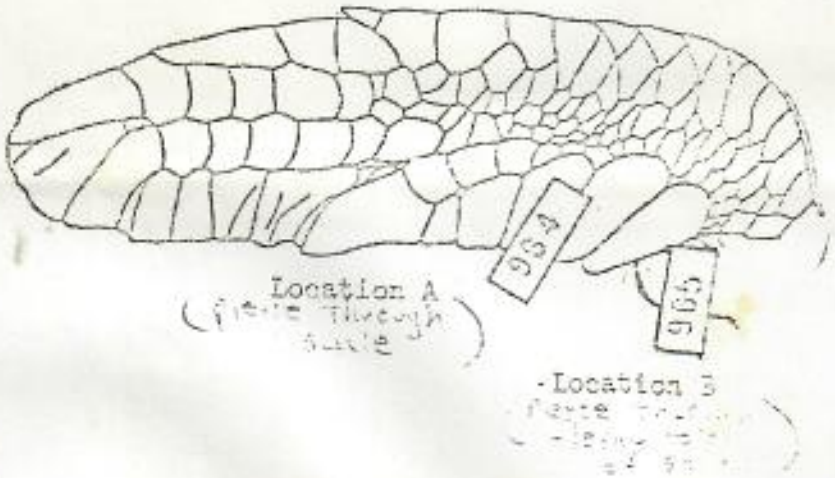
Curved (or straight) upper shell measurements: length 20.5 cm width 17.5 cm

Length of tail past end of upper shell: —

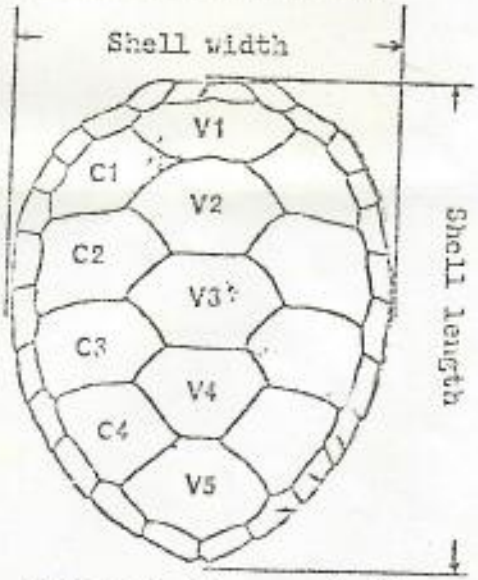
Location and date of capture and release: 8/24/83, 2 miles north of Ritidian Pt., Guam

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

Immature Hg. Turtle



Attach tag at location A on left flipper, location B on right flipper. Tag should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 808-7-6631 or 808-2121

Tagged by: Alan F. Hosmer, DAWR-Guam

Type of turtle: Hawksbill

Tag numbers: location A (left flipper) ——— location B (right flipper) 6502

Previous tag numbers (if present): none

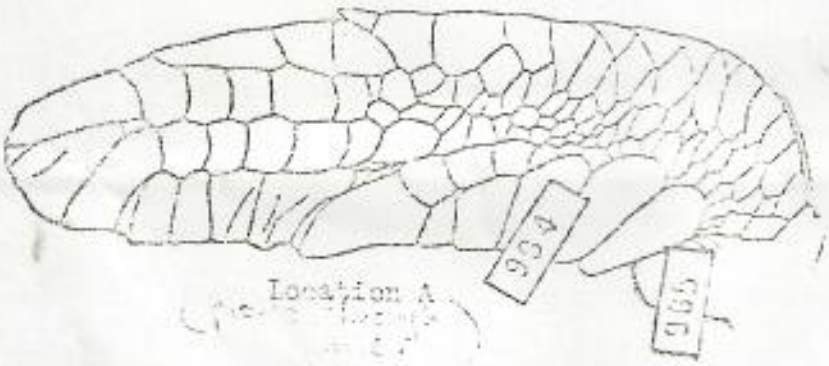
Curved upper shell measurements: length 48 cm width 34 cm
(straight)

Length of tail past end of upper shell:

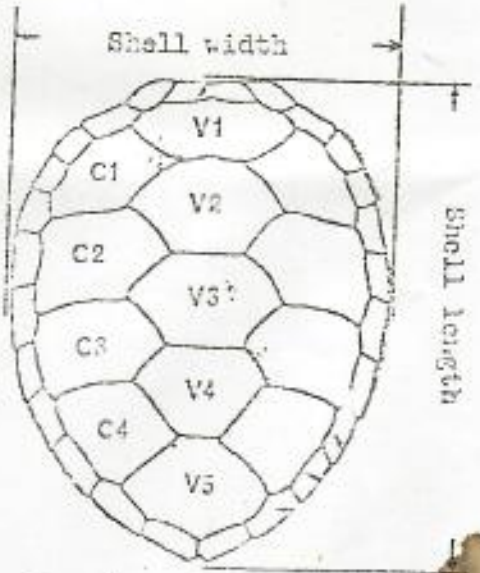
Location and date of capture and release: 2/24/83, 2 miles
N of Ritidian Pt. Guam

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

Straight SL. Turtle



Attach tag at location A on left flipper, location B on right flipper. Tag should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Alan J. Hosmer, Navy - Guam

Type of turtle: Hawksbill

Tag numbers: location A (left flipper) ____ location B (right flipper) 6501

Previous tag numbers (if present): none

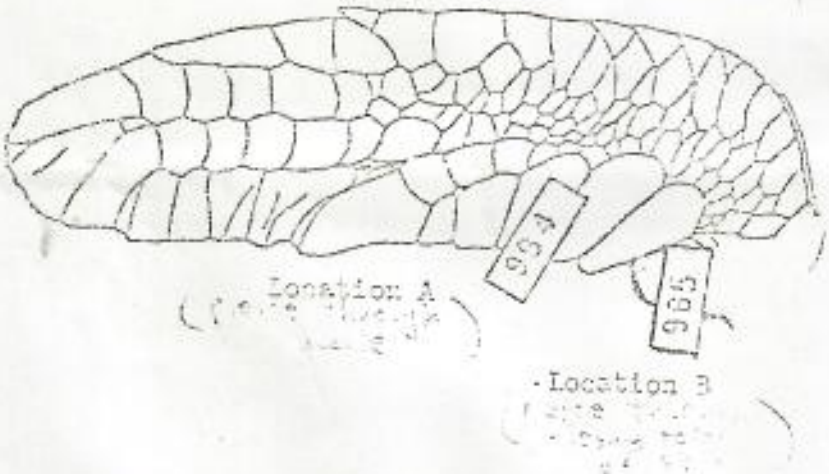
Curved (or straight) upper shell measurements: length 54 cm width 38 cm

Length of tail past end of upper shell: ____

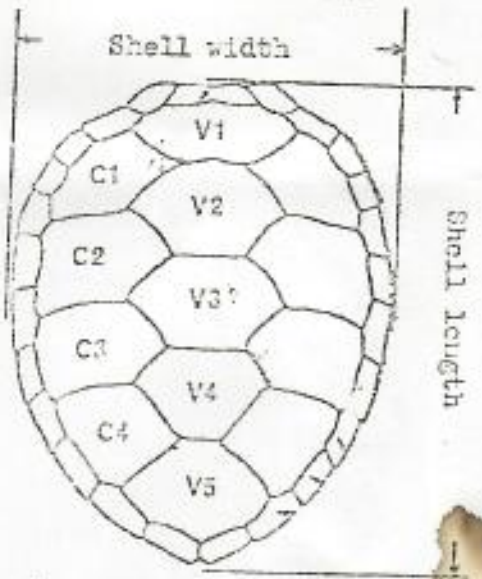
Location and date of capture and release: 8/24/83

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

Captive Turtle held at "Marine World" CA, held from hatchling - to date; confiscated upon entry to CA from P.I.



Attach tag at location A on left flipper, location B on right flipper. Tag should extend approximately 3/4 of the way on flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 236-2151

Tagged by: Alan J. Hofmann Dawn Gulko

Type of turtle: Hawksbill

Tag numbers: location A (left flipper) — location B (right flipper) 6506

Previous tag numbers (if present): none

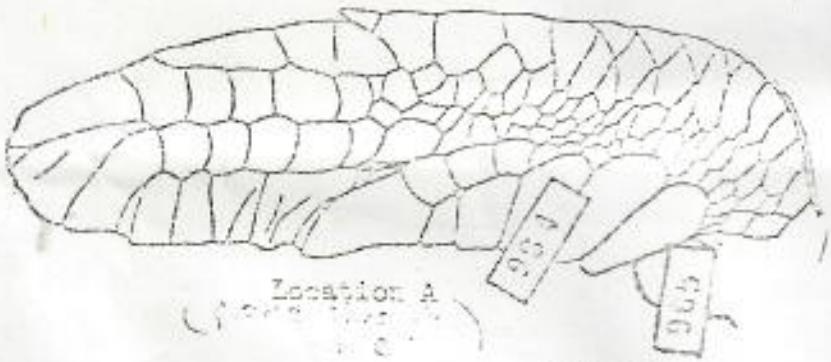
(Straight)
Curved upper shell measurements: length 50 cm width 42 cm

Length of tail past end of upper shell:

Location and date of capture and release: 3/24/83

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

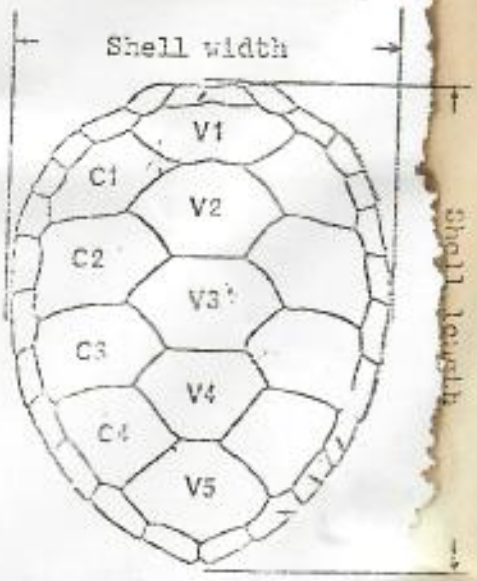
"Marine World", CA turtle; very weak state after shipping, to die 8/28 left at Coshing Zoo.



Location A

Location B

Attach tag at location A on left flipper, location B on right flipper. Tag should extend approximately ½" of the edge of flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 235-2181

Tagged by: Mark J. Hosmer DAWR-Guam

Type of turtle: Hawksbill

Tag numbers: location A (left flipper) — location B (right flipper) 6703

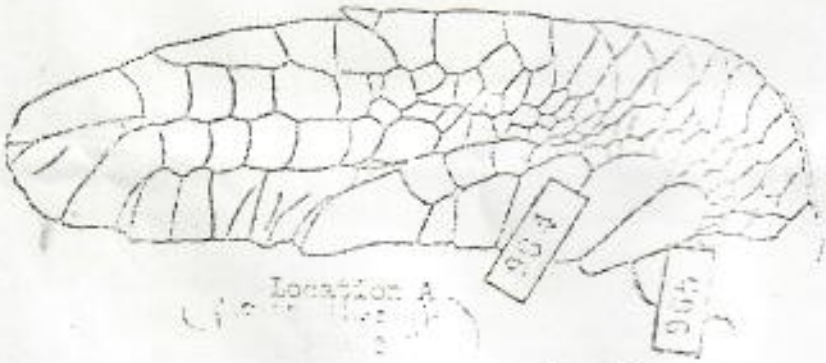
Previous tag numbers (if present): none

Curved (skeletal) upper shell measurements: length 54.5 cm width 41.0 cm

Length of tail past end of upper shell: —

Location and date of capture and release: 8/23/83

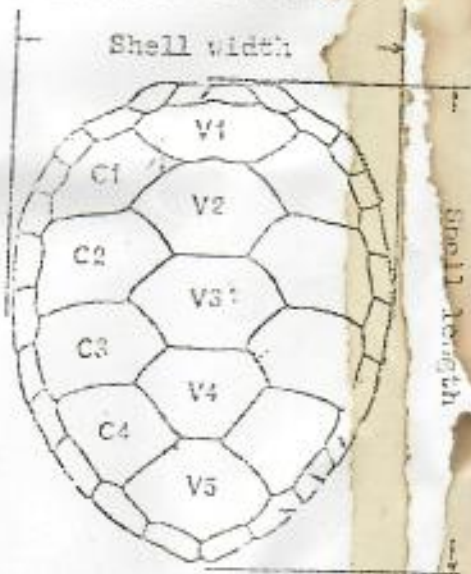
General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.) Normal "Hawksbill" Turtle



Location A

Location B

Attach tag at location A on left flipper, location B on right flipper. Tags should extend approximately 1/3 of the way in flipper, as illustrated.



Top view of upper shell (green and hawksbill)

Marine Turtle Tagging Data - George H. Balazs
Hawaii Institute of Marine Biology
P. O. Box 1346, Kaneohe, 96744
Tel. 247-6631 or 946-2181

Tagged by: Alans J. Hosmer, DAWR-Guam

Type of turtle: Hawksbill.

Tag numbers: location A (left flipper)_______ location B (right flipper) 6504

Previous tag numbers (if present): None

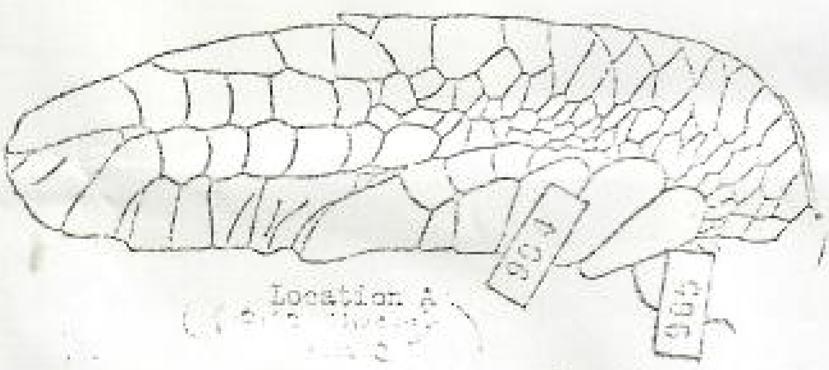
Curved ~~upper~~ (or straight) shell measurements: length 57.5 width 47.5

Length of tail past end of upper shell: _______

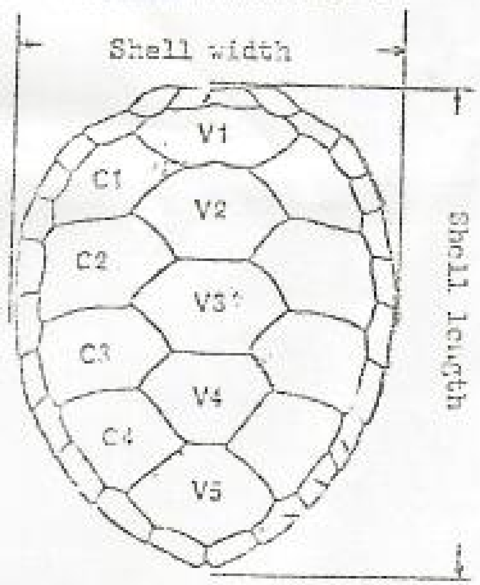
Location and date of capture and release: 8/24/83

General description of turtle (upper and lower shell colors, injuries, tumors, barnacles, abnormal plate counts, etc.)

MARINE WORLD. Turtle



Attach tag at location A on left flipper, location B on right flipper. Tag should extend approximately 1/4 of the way on flipper, as illustrated.



Top view of upper shell
(green and hawksbill)

MARIANAS VARIETY NEWS & VIEWS - January 29, 1982

NMI To Scrap Fishing Zone

By Francisco T. Uludong

The new Republican administration plans to eliminate the Northern Marianas' 200-mile fishery zone which it says is "unrealistic."

Lt. Governor Pete A. Tenorio announced the plan at a session of the Western Pacific Regional Fishery Management Council earlier this week.

Tenorio claimed that the enactment of the 200-mile zone by the 2nd Legislature with strong support from the Camacho Administration, was "another example of poor planning and unrealistic goals."

Instead of having its own fishery zone, Tenorio said the Northern Marianas will accept the full application of the U.S. Fishery Conservation and Management Act, which creates a 200-mile zone for the United States and its territories and regulates all types of fishing except tuna.

Tuna, which is abundant around the Northern Marianas, is a migratory fish and therefore not regulated by the federal law. Anyone is free to catch tuna around the Northern Marianas.

By reversing the Northern Marianas position, the Republican Administration hopes to win Washington support on a number of concerns facing the islands.

Tenorio submitted a list of requests for financial, technical and enforcement assistances for consideration by various federal agencies.

Among the major concerns are:

– Voting membership by NMI in the Western Pacific Regional Fisheries Management Council;

– Use of foreign-hull fishing vessels by Northern Marianas citizens;

– Establishment of a special 200-mile zone for tuna specifically to benefit the Northern Marianas; and

– Extension of foreign technical assistance to the Northern Marianas by foreign countries fishing in Northern Marianas waters.

However, federal officials at the session said the Reagan administration will oppose efforts to regulate tuna and that it was unlikely that Congress would return to the Northern Marianas license fees paid by foreign boats fishing in local waters.

Local fishermen were behind the enactment of the NMI 200-mile fishery zone and may oppose full application of federal fishery laws and regulations.

Herman Palacios, who attended the meeting, told the council that local fishermen prefer the Northern Marianas Legislature to enact fishery laws and regulations.

Jack Villagomez, chief of NMI Fish and Wildlife Division, said the council will work closely with the local government to protect the interests of local fishermen.

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

AGANA, GUAM 96910

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Administrative Ser. 734-3941/2

February 5, 1982

Dr. G.H. Balazs
U.S. Dept. of Commerce
National Oceanic and Atmospheric
Administration
National Marine Fisheries Service (142)
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs:

Thank you so much for the slide of the monk seal and green sea turtle. It is an excellent addition to our slide program on endangered species.

I also want to thank you for the article on the sea turtles. I am enclosing several articles from our local newspaper. I went through the sea turtle file at the Micronesian Area Research Center yesterday and found a number of sea turtle articles. I will send copies to you shortly.

I would greatly appreciate receiving any other information you have which might help me in our conservation program.

Sincerely,

JUDY BEAVER
Public Information Officer
Aquatic & Wildlife Resources

Enclosures

Monday, February 1, 1982 Honolulu Star-Bulletin A-5

Guam Voters Endorse Closer Ties with States

By the Associated Press

Residents of the U.S. territory of Guam have voted overwhelmingly to seek closer political ties with the United States.

In a non-binding vote Saturday, residents of the unincorporated territory indicated the island should become a U.S. commonwealth. Statehood was a distant second in the voting.

Of 9,992 ballots cast, 4,815 residents, or 48.5 percent, voted to urge the government to seek a commonwealth status, under which Guam would remain under the United States but have self-government.

Statehood received 2,547 votes, or 25.7 percent.

Options to move the territory away from its U.S. ties received little support.

There were only 379 votes for independence and 393 votes for an option known as free association.

Obviously there is very, very little sentiment on the island to cut political ties with the U.S.," said Jack Rosenzweig, an attorney for the Guam Election Commission and a member of the Commission on Self Determination, which conducted the vote.

Slightly more than 1,000 residents voted to maintain the island's current status, while 535 voted to seek a status of incorporated territory.

The voting came after an extensive campaign to educate residents about what each option would mean.

Honolulu S-B 18 MARCH 1981

With Statehood as a Goal

Guam—Island in a State of Limbo

By Peter O'Loughlin

AGANA, Guam (AP) — After almost 300 years of the Spanish sword, 80 years of U.S. Navy commissaries, three years of Japanese control and 10 years of running their own affairs, Guamanians are trying to figure out where they go from here.

"We're in limbo," Gov. Paul Calvo said in referring to the 200-square-mile island's present status as an unincorporated territory of the United States.

Guam, located 6,007 miles west of Los Angeles and 1,593 miles east of Manila, is next door to Asia but is very much America.

The 35-mile-long island, which is the peak of a 40,000-foot undersea mountain, boasts it has the world's biggest McDonald's restaurant. Burger King is here, too, along with Kentucky Fried Chicken, Taco Bell, used-car lots and six-lane highways.

Eight-cylinder American limousines which guzzle $1.60-a-gallon gasoline at the rate of 12 miles to the gallon are used as taxis; there is no public transportation. Guam also has cable television which features week-old tapes of Los Angeles programs complete with commercials.

And the islanders, a mixture of Chamorro-speaking natives, Filipinos, Koreans, Japanese and Hawaiians, and some 25,000 U.S. military personnel and their dependents, constantly remind the rest of the world they live in America's westernmost outpost. The sign at Guam Airport welcomes visitors to "Guam U.S.A. The place where America's day begins."

"GUAM IS AMERICA," said the 47-year-old Calvo, who was born in Agana, the capital, and educated at Peacock Military Academy in San Antonio, Texas. He graduated from Santa Clara (Calif.) University in 1958.

But the main hotels on Tumon Bay are Japanese, and so are their customers. More than 75 percent of the 300,000 tourists to Guam last year were Japanese. Japan is only three hours' flying time away, compared with 10 to the Mainland U.S.A.. And it is this distance from Mainland that is part of Guam's problem, according to Calvo.

"We are 9,000 miles from Washington. No matter how smart they are, their sensitivity to Guam will be lacking," he said.

Although Guam has been part of the United States since it was bought from Spain in 1898 in a $20 million package deal that included the Philippines and Puerto Rico, the island is sensitive about how neighboring U.S.-administered islands are treated.

Guam is part of the Marianas group, but the Northern Marianas — Saipan, Rota and Tinian — have negotiated commonwealth status with the United States, giving them some advantages over Guam in negotiations with other countries.

OTHER ISLANDS, Palau, Yap, Truk, Ponape and Majuro in the Caroline and Marshall groups, have been part of the U.S. Trust Territory of the Pacific since the end of World War II. Upon termination of the trusteeship, the islands will be able to negotiate independently in foreign affairs. This means money for fishing rights, airline landing rights and foreign investment.

Guam has none of these rights and feels frustrated — and dependent.

The island has its own governor, lieutenant governor and 21-seat legislature, collects its own taxes and sends a representative to Congress, although he or she may not participate in House votes. The 110,000 Guamanians are U.S. citizens but may not vote in U.S. elections.

The federal government provides 20 percent of the employment on the island; tourism and the local government supply most of the rest.

There is virtually no significant agriculture or industry. So much of the island was destroyed or damaged in World War II that the government is still struggling to install a workable telephone and power system.

The island's unemployment rate is between 6.5 percent and 7 percent. The average annual per-capita income is $4,198.

Opportunities for the islanders are limited. Some 2,000 young people graduate from college or high school each year, but many cannot find work and leave for the Mainland.

DURING A 58-day strike by 700 of the island's 1,600 teachers, which ended March 10, many parents sent their high-school-age students to Hawaii or the Mainland so they would be able to qualify for college this fall.

Guam also depends on federal government grants for a big chunk of its revenue — $47.8 million in 1979 — and on local U.S. military purchases, which totaled $306 million in 1979.

The military owns one-third of the Singapore-sized island. The Strategic Air Command has B-52s based on Guam and the Navy has long-range reconnaissance aircraft.

Calvo believes Guam should achieve eventual statehood.

"That is the goal," he said. "Meantime, we want more autonomy. We are at the mercy of congressmen. We have no say."

Plane Spots SOS on Isle Near Guam

BELLEVILLE, Ill. (AP) — Up to 25 persons have been spotted stranded on a small island in the Western Pacific, U.S. Air Force officials said today.

A spokesman for the Air Rescue Center at Scott Air Force Base near Belleville said a patrol plane first reported that about 25 persons had been seen near an SOS signal scratched into a sandy beach on an island about 300 miles south of Guam.

Authorities said a weather reconnaissance plane later confirmed the report but messaged that only 13 persons were seen in an area around two camp fires. Two canoes also were seen.

Food packages were dropped and a supply ship from the Truk Islands was dispatched to the island. It was expected to reach the scene Sunday, the spokesman said.

A-4 Honolulu Star-Bulletin Thursday, January 10, 1980

Group Probes Plan to Move Navy Unit from Guam to Isles

By David Shapiro
Gannett News Service

WASHINGTON — The Investigations Subcommittee of the House Armed Services Committee has launched a probe of U.S. military activities on Guam, particularly the Navy's decision to transfer an air reconnaissance squadron from Guam to Hawaii.

Rep. Samuel Stratton, D-N.Y., said he ordered the investigation at the request of Guam Delegate A.B. Won Pat, who serves on the subcommittee.

The Navy recently announced plans to move Fleet Air Reconnaissance Squadron Three from Guam to Barbers Point in Hawaii between April and September of 1981.

The move, which has been protested by Guam officials, will mean the transfer of 48 officers and 322 enlisted men from Guam to Hawaii. The transfers will cost the Guam economy an estimated $4.8 million a year.

Stratton sharply criticized the Navy for announcing the transfers at a time when the defense officials knew his subcommittee planned to examine military operations on Guam.

"SINCE THE Navy knew that our subcommittee examination was in progress, the least it could have done was to let us know before making the announcement," Stratton said.

Stratton said his committee "will carefully examine the justification for the transfer of Fleet Air Reconnaissance Squadron Three and the disestablishment of Submarine Squadron 15.

"We want to determine the impact of those actions on the ability of our armed forces to react in the Western Pacific area."

Saturday, August 30, 1980 Honolulu Star-Bulletin A-7

Island Rescue

AGANA, Guam (AP)—The U.S. Trust Territory vessel Micro Dawn was scheduled to reach tiny West Fayu Atoll 300 miles southeast of here today to rescue two dozen stranded islanders.

The identity of the native group is not known, although it is thought they might be Truk islanders, who are known to make long canoe voyages throughout the Caroline Island chain.

The crew of a Navy antisubmarine warfare plane on patrol out of Guam spotted an SOS on the beach Tuesday and upon closer inspection saw a group of natives waving near two wrecked canoes, military officials said. The Navy plane dropped an emergency kit of food, water and medicine.

It was not known how long the natives were stranded on the atoll, which is less than a mile long.

A-16 Honolulu Star-Bulletin Monday, January 14, 1980

Natives Repair Canoes

Thirteen natives stranded on a tiny Pacific atoll apparently have repaired their canoes and are leaving the atoll, according to information received here Tuesday.

The natives were sailing to Satawal Island, about 65 miles south of West Fayu Atoll, where they were sighted last Tuesday, the Coast Guard said.

Four others earlier were picked up by the Micro Spirit, a vessel operated by the U.S. Trust Territory of the Pacific. They are being taken to Truk Island, about 100 miles away, the Coast Guard spokesman said.

THE 13 REMAINING had been scheduled to be picked up by another Trust Territory vessel, but apparently were able to make necesssary repairs to their canoes to allow them to leave on their own, the spokesman said.

It earlier was reported that about two dozen people had been stranded on the tiny atoll, located 300 miles southeast of Guam.

The islanders, who were reported in good condition, were discovered after a Navy patrol plane spotted an SOS on the beach. The Navy later dropped a kit contaning food, water and medicine.

It is not known how long the natives were stranded on the atoll, which is less than a mile long.

A-4 Honolulu Star-Bulletin Tuesday, January 15, 1980

Guam, Marianas — will they be 51st U.S. state?

By CHARLES HILLINGER
Los Angeles Times Service

AGANA, Guam — Will a U.S. commonwealth and a U.S. territory someday merge as a historic first?

That's the consensus here.

It was on Jan. 9 that the United States added its first new territory — the commonwealth of the Northern Marianas — since the acquisition of the Virgin Islands in 1917.

The new commonwealth has a population of 15,000. It consists of 16 islands with the southernmost, Rota, located 45 miles north of Guam.

"I predict the new commonwealth and the Territory of Guam will join together and become America's 51st state — the state of the Marianas," Guam's Gov. Ricky Bordallo told the Los Angeles Times.

"It won't happen overnight. But I see it happening within the next 10 to 20 years, perhaps sooner.

"The people of Guam, the southern Marians island, and the people of the Northern Marianas are the same people — Chamorros. We share the same heritage, the same culture, the same native language, the same Catholic religion.

"We are all Chamorro cousins. We are of the same families. Reintegration of the islands will be a natural political development."

Bordallo's opinion is echoed by political and civic leaders and by people from all walks of life on Guam and on Saipan, Tinian, Rota and the other islands of the new commonwealth.

Guam has been in U.S. hands since it was acquired from Spain in 1898 except during World War II when it was occupied by Japanese troops from Dec. 7, 1941, to the summer of 1944.

Guam and the 16 islands to the north were called the Marianas in honor of queen Maria Anna, wife of King Philip IV of Spain. The islands were a Spanish possession from 1521 to 1898. The islanders are a mixture of the native Chamorro and Spanish.

The Northern Marianas became a German possession the year Guam became a U.S. territory. In 1914, Japan occupied the Northern Marianas and held the islands until American troops captured them in 1944.

Guam is 28 miles long, 4 to 8½ miles wide and lies 6,000 miles west of Los Angeles, 1,500 miles east of Manila and 1,500 miles south of Tokyo.

It has a population of 110,000, including the 22,000 military personnel and their dependents stationed here.

Residents of Guam are American citizens but cannot vote for president. They have a delegate to the U.S. House of Representatives.

The military presence is more in evidence here than anywhere else in the United States or its territories.

One-third of all land on Guam is held by the military. One of every five persons on the island is either a member of the armed forces or a dependent of one.

Military expenditures are the lifeblood of the island's economy. Manufacturing is virtually nonexistent. Agriculture is minimal. Nearly everything has to be imported.

Six of every 10 persons working on Guam are employed by the federal or local governments.

Guam is caught in a boom-or-bust economic cycle. Since the end of the Vietnam War (the entire island served as an advance military base during the conflict), Guam has been in the economic doldrums. The cutback in military activity caused a direct loss of 7,500 jobs.

Then along in May 1976, Typhoon Pamela caused widespread damage and destruction.

Congress has approved large appropriations to rebuld island installations. Guam is now moving into a boom phase with a planned construction program estimated at $400 million.

From 1898 to 1951, Guam was as much a Navy base as it was a U.S. territory. The Navy ran the show. Navy governors ruled the island until 1951.

Guam is home port for America's 7th fleet; home port for eight nuclear submarines. The island has a large ship repair installation, a supply depot, fuel docks and ammunition facilities.

Andersen Air Force Base is a major advanced Strategic Air Command base with a squadron of B52s.

The Navy owns the runways and all the land at Guam International Airport. The Navy owns 5,800 acres fronting Guam's Apra Harbor, with only 33 acres set aside for commercial docks.

Until 1962, the Navy decided who could visit Guam and who could leave.

To this day, the Navy plays a key role in island affairs. A Navy officer is a member of the Territorial Board of Education.

Bishop Felixberto C. Flores, Adm. David Cruden, Commander Naval Forces Marianas, and Bordallo are the three prime movers on the island.

A priest for 28 years, Flores, 57, in 1970 was ordained the first Chamorro bishop in the 300-year history of the Roman Catholic Church in the Marianas.

"There is no denying the church exerts a strong influence," the bishop said in an interview. "One would expect it with 97 percent of the 70,000 native Guamanians members of the Catholic Church.

"Our people look to the church for guidance. It is up to me to provide good leadership."

Meanwhile, Guam is so far from the Mainland that few Americans come here. But it is visited each year by 250,000 Japanese who crowd several three-hour daily flights from Tokyo.

The Japanese lost the war and with it the island but have won it back again as a vacation spot. More than 90 percent of the tourists visiting Guam are from Japan.

Japanese interests own nine posh hotels, an 18-hole golf course, restaurants, a dozen duty-free shops and two dozen jewelry stores in Guam.

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

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AGANA, GUAM 96910

December 15, 1981

Dr. George Balazs
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear Dr. Balazs,

Our Division Chief Harry Kami showed me your excellent post cards of sea turtles and monk seals. I would very much like to purchase duplicates of the slide you used in the post card depicting a green sea turtle and a monk seal asleep on one of the uninhabited islands at French Frigate shoals. In the card the monk seal has a flipper on the turtle's back. These would only be used in our slide presentations which we give for Guam schools and clubs. I would be glad to pay for duplication and a small fee for using the slide in our slide programs.

I look forward to hearing from you.

Sincerely,

Judy Beaver

JUDY BEAVER
Public Information Officer
Aquatic & Wildlife Resources

Sent 1-22-82

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Fisheries Center
Honolulu Laboratory
P. O. Box 3830
Honolulu, Hawaii 96812

April 27, 1981 F/SWC2:RNU

TO: Staff

FROM: Richard N. Uchida, Leader, Insular Ecosystem Study Task

SUBJECT: Seminar and slide show on the northern islands of the Mariana Archipelago

Dr. Lu Eldredge of the University of Guam Marine Laboratory, who is visiting the Honolulu Laboratory for about a week for discussions to participate in producing a background document of Guam and the Northern Mariana Islands, has consented to present an informal slide show and talk on the natural history of the northern islands (north of Saipan) on Thursday, April 30, 1981 at 10 a.m. in the seminar room.

All interested staff members are invited. I urge all Insular Ecosystem Study Task members to attend in view of our ongoing RAIOMA program.

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

Agricultural Development Services
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AGANA, GUAM 96910

March 23, 1981

Dr. George Balz
U.S. Dept. of Commerce
NOAA
National Marine Fisheries Service
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Sorry for not acknowledging the receipt of the turtle tags and plier. We did receive them, but so far has not had the need to use them.

We will keep you informed every time we tag and release turtles in our part of the Pacific.

Much thanks for the tags and plier.

Aloha,

Harry

HARRY T. KAMI
Chief, Aquatic & Wildlife Resources

7 January 1981
1 pair pliers
+ tag nos. 5110 - 5125

son cautions, "because so few hunters have returned their report cards."

Andersen Air Force Base, Northwest Field and Naval Magazine are the areas where most of Guam's wildlife can be found. However, most of the hunting is not done by military personnel.

PACIFIC DAILY NEWS
January 19, 1980

UOG turtle goes home

By LESTER CHANG
Daily News Staff

A hawksbill turtle which has been living at the University of Guam Marine Lab for the past year went back home to the sea this week.

The turtle, of the kind whose shell is used for jewelry in the Pacific, lived in a pool at the lab after Department of Agriculture wildlife officials confiscated it from a local pet store.

She was well-fed and pampered during her stay at the university.

"She ate real well. We fed her fish and seaweed," said Richard Sakamoto, marine technician at the lab.

The 20-pound turtle shared living quarters with a few multi-colored striped ban reef fish and pink-colored sea-urchins in a 1,000 gallon pool.

But she had to fight for her food when the lab introduced an eel into the community six months ago, according to Sakamoto.

"I never thought to name her," said Sakamoto, looking paternalistic as he stroked the turtle's head and then the length of shell.

"We had to let her go because the students didn't have time to study her."

A week earlier, a 45-pound green sea turtle was released into Cetti Bay by the agency, he said.

Hawksbill, green, olive ridley and loggerhead sea turtles have all recently been added to the lists of threatened and endangered species in the United States.

All the turtles are protected under federal laws and may not be captured, harmed or killed, according to Anderson.

"The turtle's main concern is evading the predators — the sharks and man," Anderson said.

Hawksbill turtles were abundant in the Pacific, but hunters of their shells, used for jewelry, have decimated their ranks, according to Chris Wille, a wildlife agency public information officer.

Anderson tagged and weighed the turtle before releasing it at Pago Bay.

"And you know, she looked back," Sakamoto said.

Summary of Marine Turtle Sightings Made on Aerial Fishery Surveys During Fiscal Years '75 through '79

By
Michael E. Molina

Division of Aquatic and Wildlife Resources
Department of Agriculture
Government of Guam
Agana, Guam

Study Site

Island of Guam divided into 12 survey regions (Figure 1).

Turtle Sightings

Marine turtles have been sighted within every survey region (Table 1) and during all months of the year (Table 2). Region 5 has not been censused due to military restriction. Two flights were made each month in all cases. A Total of 783 marine turtles have been sighted around Guam on 41 aerial surveys made during the past five years.

Distribution

Far more turtles were sighted within region 12 (Pati Pt. - Ritidian Pt.) than in any other (Figure 2). The 285 sightings made within this region represent 36.4% of the five-year total. This is almost as many turtles as were observed within regions 8,9,10, and 11 (Cocos Lagoon - Pati Pt.) combined; that is, 294 turtles or 37.5% of the five-year total. Taken together, approximately 74% of the observed turtles were seen within these five regions alone. The most probable explanations for this distribution are the low levels of development and fishing pressure found in these areas.

Seasonality

Marine turtle abundance appears to peak twice during the year (Figure 3). In general, these peaks coincide with the winter (December - February) and late spring (May - June) months.

This also loosely correlates with Guam's "dry"/tradewind season which usually lasts from December to June. It is unclear at the present time whether or not the turtles are mating during this entire period, yet it seems likely. The time of nesting is also unclear. However, reports from local fishermen indicate that nesting occurs around June.

Multi-Annual Cycle

Reports have been made of larger than usual numbers of turtles visiting Guam about every three years. The last of these visits happened in 1976, and is reflected in our aerial survey data (Table 2). Another visit was expected this year. Again, our data shows the winter increase in numbers. However, this year's influx of turtles doesn't appear to be as strong as the one which occurred in 1976.

Remarks

Since it is difficult to make positive species identifications on turtles from a moving airplane, we have no reliable estimate of the species composition of Guam's marine turtle community. However, it is generally regarded that Chelonia mydas is by far the major component. This species has a known gestation period of about three years which would explain the tri-annual increase in numbers of turtles observed on the aerial surveys. This also supports information offered by Manuel Castro, property-owner and resident at Tarague Beach (west end), that turtle nesting at that site is heavier every third year or so.

It may be that mating (and possibly nesting) occurs every year among the "resident" portion of Guam's turtle community, and that the tri-annual increase in numbers is due to the return of the "migrating" portion for mating and nesting. Extra effort, by whatever means available, should be expended to insure the greatest possible survial of at least the tri-annual adults and hatchlings. This would help keep the largest possible number of turtles returning to Guam.

Mr. Castro has also stated that human interference with nesting turtles is a serious problem at Tarague Beach. According to him, the majority of the problem lies with the friends and relatives of the Tarague landowners who use the beach for "4-wheeling" and who actively hunt for turtle eggs. Since Tarague Beach is privately owned and enjoys military isolation, there may be a good chance of controlling this problem, especially if the area could be designated as a marine turtle sanctuary. If it is not already too late, Tarague Beach may be Guam's only hope for such a valuable natural resource. Mr. Castro appears to be pro-turtle conservation and has offered to do what he can in cooperation with our office to help protect these animals.

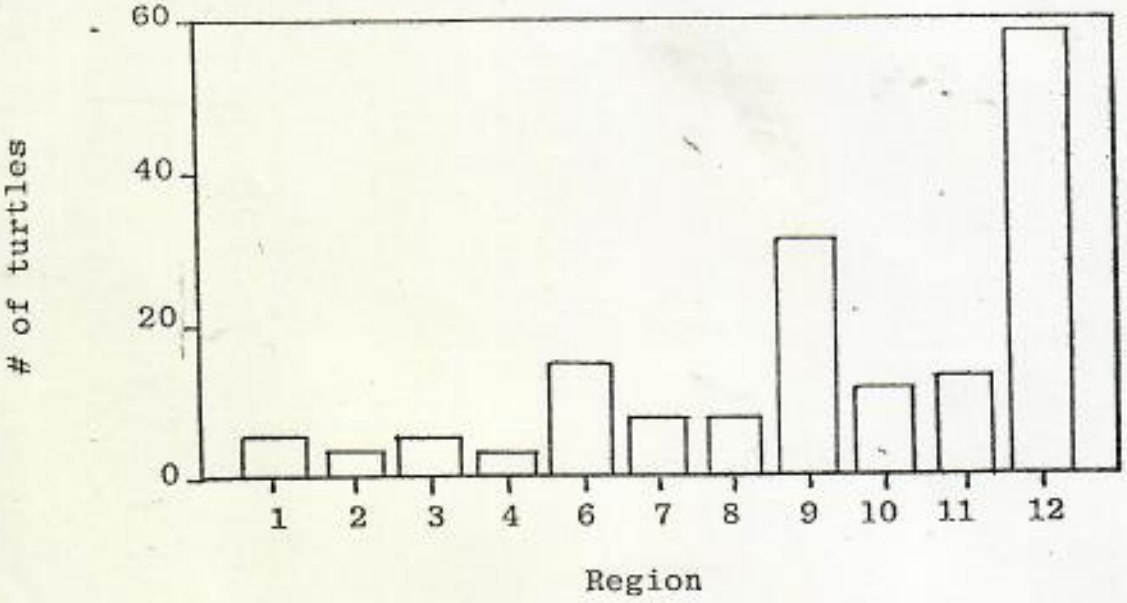

Figure 2. Mean number of turtles observed in the survey regions during Fiscal Years '75-'79.

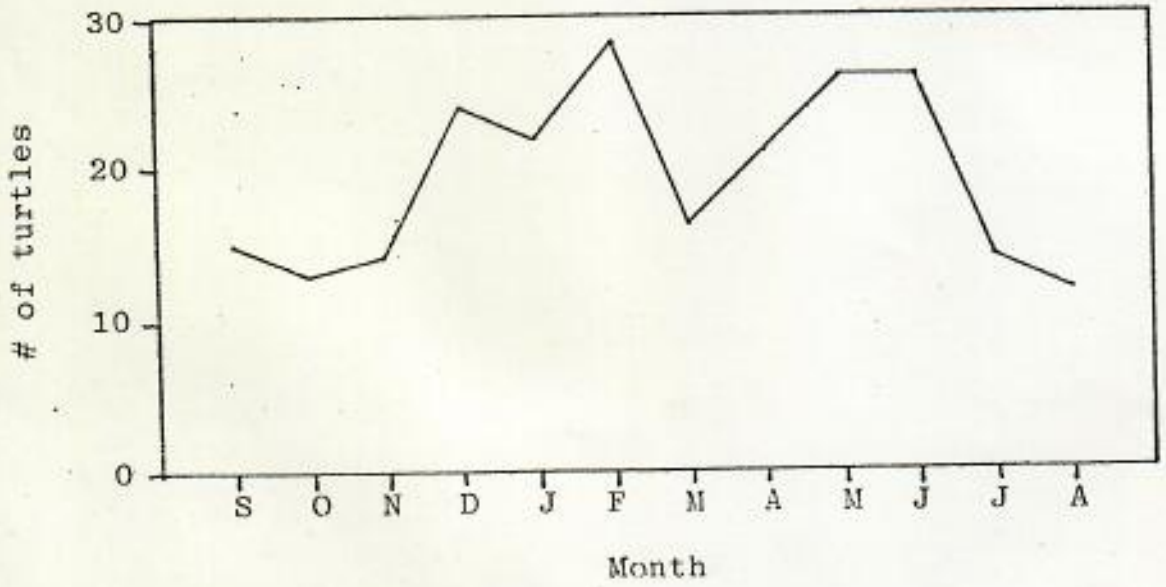

Figure 3. Mean number of turtles observed per month during Fiscal Years '75-'79.

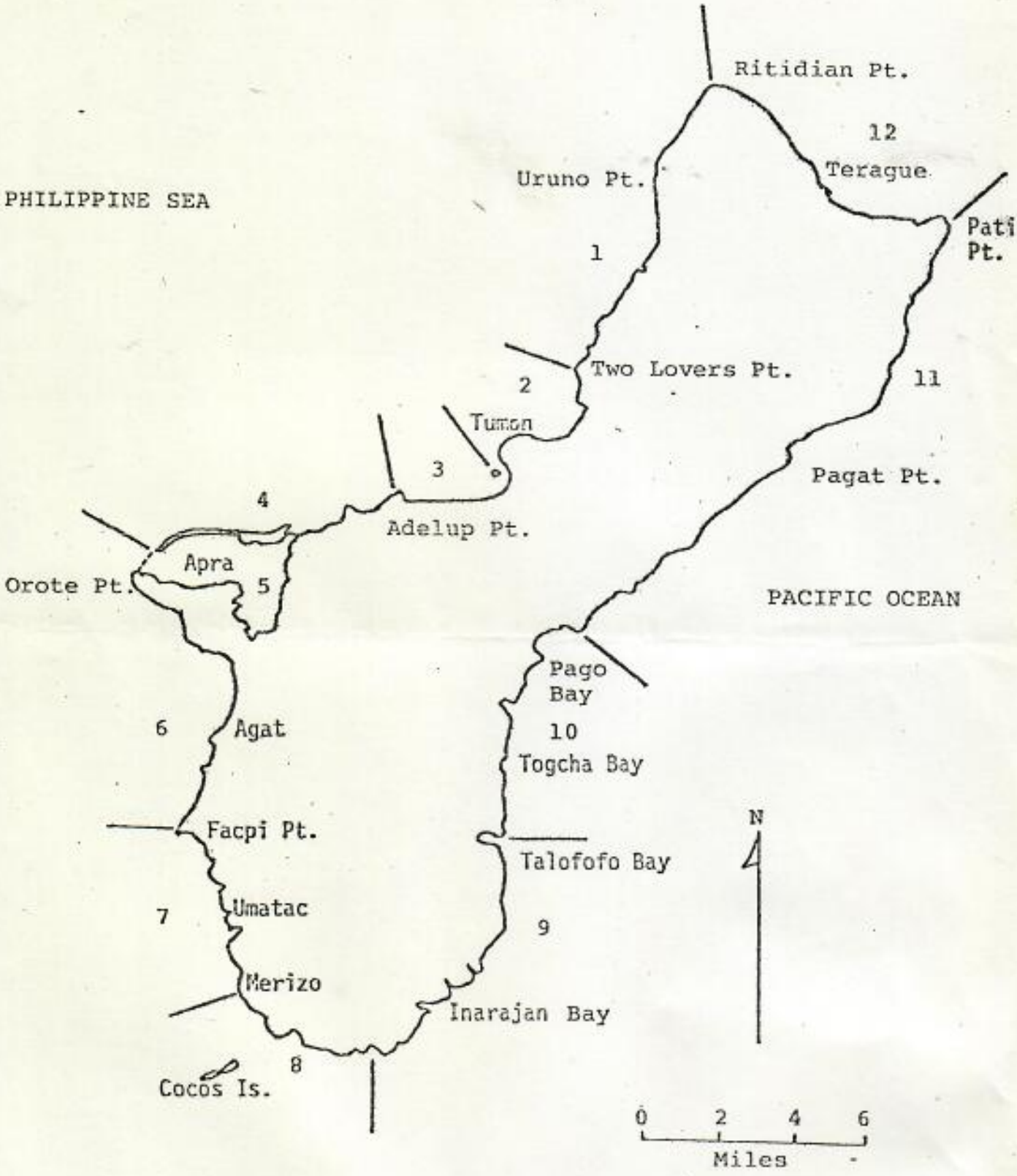

Figure 1. The island of Guam with its twelve aerial survey regions.

TABLE 1. Summary Of Turtle Sightings By Aerial Survey Region For Fiscal Years 1975 Through 1979.

	REGION													
	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL	# MONTHS
FY'79	4	1	1	1		1	6	2	43	31	18	77	185	12
FY'78	6	3	1	9		6	14	3	10	1	15	15	83	12
FY'77	0	3	1	1		4	1	5	10	0	8	8	41	2
FY'76	7	5	6	6		35	8	14	44	10	12	42	189	9
FY'75	14	5	18	3		23	11	9	37	16	6	143	285	6
TOTAL	31	17	27	20		69	40	33	144	58	59	285	783	41
$\bar{X}$/REGION	6	4	6	4		15	8	8	31	12	13	59		

TABLE 2. Summary Of Turtle Sightings By Month For Fiscal Years 1975 Through 1979.

	MONTH													
	J	A	S	O	N	D	J	F	M	A	M	J	TOTAL	# FLIGHTS
FY'79	12	3	6	6	7	12	18	52	24	14	20	11	185	24
FY'78	7	6	10	4	16	17	7	5	0	3	4	4	83	24
FY'77	23			18									41	4
FY'76		20	28	24	20	42	16	10	7	22			189	18
FY'75							45	44	32	46	54	64	285	12
TOTAL	42	29	44	52	43	71	86	111	63	85	78	79	783	82
$\bar{X}$/MONTH	14	12	15	13	14	24	22	28	16	21	26	26		

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

AGANA, GUAM 96910

Agricultural Development Services
Aquatic & Wildlife Resources
Forestry & Soil Resources
Animal Industry
Plant Industry

Sales & Permit Info 734-3943
Administrative Ser. 734-3941 / 2

April 15, 1981

Dr. George Balaz
National Marine Fisheries Service
Honolulu Laboratory
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George:

Thanks for the tags.

We went to the Marine lab the day after we received the tags to tag and release the turtle. The turtle was in the tank that morning, but in the afternoon it was gone. Some one swiped it.

I'll bring the plier back with me to Honolulu in June and pass it to Richard Shomura at the Council meeting.

Aloha,

HARRY T. KAMI
Chief, Aquatic & Wildlife Resources

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

Administrative Services
Agric. Development Services
Animal & Plant Industries
Aquatic & Wildlife Resources
Forestry & Soil Resources
Animal Quarantine Services

AGANA, GUAM 96910

PHONE: 734-9966 /67 /68

January 10, 1980

Dr. George H. Balazs
Assistant Marine Biologist
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, Hawaii 96744

Dear George:

A Happy New Year.

Thank you for your letter of December 24. I appreciate the fact that you took time from your busy schedule to write me that letter.

I have a little turtle story that may interest you.

On October 27, 1979, a Guamanian fisherman while fishing at the Agana Boat Basin snagged a green turtle. He brought this turtle to the University of Guam's Marine Laboratory. The lab held the turtle in its tank until yesterday. Yesterday the lab technician came to my office inquiring if we had any turtle tag. They had decided to release the turtle. We do not have any turtle tag but do have tags which we use on deer. These tags are very similar in construction to your turtle tags. Ours are of stainless steel.

Our staff tagged both fore flippers with these tags. The right flipper with tag #178, the left with tag #179. The inscriptions on the tag read: ADVISE DIV. FISH & WILDLIFE GUAM, 96910.

The weight and measurements are as follows:

Weight:	40 lbs.
Carapace length:	60 cm
Carapace width:	60 cm
Plastron length:	47 cm
Plastron width:	47 cm
Fore flipper:	38 cm
Hind flipper:	25 cm

sex thought to be a female because it has a short tail.

Division of Aquatic & Wildlife Resources
Department of Agriculture
P. O. Box 23337, GMF
Guam M.I. 96921

This turtle will be released today at Cetti Bay. This Bay is on the south western coast of the island.

I know it is not likely for this turtle to show up in Hawaiian waters, but just in the event that this turtle decides to take a vacation in Hawaii, I feel that you should be made aware of this tagged turtle.

I hope some kind of a regional turtle program will be initiated soon.

Aloha,

HARRY T. KAMI
Chief, Aquatic & Wildlife Resources

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

AGANA, GUAM 96910

Agricultural Development Services	*734-3947*
Aquatic & Wildlife Resources	*734-3945*
Forestry & Soil Resources	*734-3948*
Animal Industry	*734-3940*
Plant Industry	*734-3949*
Sales & Permit Info	*734-3943*
Administrative Ser.	*734-3941/2*

June 3, 1982

Dr. George Balazs
U.S. Dept. of Commerce
National Oceanic and
Atmospheric Administration
P.O. Box 3830
Honolulu, Hawaii 96812

Dear George,

Thank you so much for the gorgeous turtle posters. They arrived just in time for this weekend's Environmental Fair and one is on my wall at work.

Neither of our posters deal with sea turtles. However, I am sending you copies of our wildlife flyers. One of the flyers is on the green sea turtle. Please contact me if you need more information on our program.

Again thank you for the turtle posters.

Sincerely,

JUDY E. BEAVER
Public Information Officer
Aquatic & Wildlife Resources

Enclosure

ANTONIO S. QUITUGUA
Director

VICTOR T. ARTERO
Deputy Director

Agricultural Development Services
Aquatic & Wildlife Resources
Forestry & Soil Resources
Animal Industry
Plant Industry

Sales & Permit Info 734-3943
Administrative Ser. 734-3941 / 2

AGANA, GUAM 96910

Dear Teachers:

In a continuing effort to provide materials and assistance to the teachers of Guam, the Division of Aquatic and Wildlife Resources has developed a series of brochures intended to spark student interest in the wildlife of Guam. The wildlife brochures contain the English and Chamorro name for each animal, a concise description of the animals' habitat, life history and habits, and its current status on Guam. Throughout this initial set, we have introduced key ecological concepts such as predator-prey relationships, causes for endangerment, and metamorphosis.

Intended as reading material for the third grade and up, we have tried to keep difficult new words to a minimum of five per animal. While mainly science-oriented, we feel these brochures will be suitable for a number of subject areas. As additional high-quality photographs become available, we hope to enlarge the selection to include most common or endangered animals on Guam. This project was funded by the Guam Coastal Zone Management Program.

Teachers will undoubtedly devise many creative uses for these brochures. A few suggestions are indicated below:

1. Laminate on matboard, with a series of comprehension questions and related activities on the reverse side, appropriate for your grade level.

2. Display individually or in related groups (i.e. "lizards") at a science center with appropriate task cards. Use terrariums containing brochure species as a focus.

3. Use to stimulate dioramas, papier-mache sculptures, or murals depicting typical habitats on Guam and their appropriate wildlife species.

4. Use to spark library research (MARC has some excellent information) and class reports.

5. Display in a loose-leaf binder, with attendant questions and activities, to be added to as new brochures become available.

6. Use to re-enact old Chamorro legends in rhythm or theater activities. Pantomime the way an animal might move, feed, hide, or hunt.

7. Prepare students for a trip to the zoo or a field trip in the limestone forest habitat.

8. Use to illustrate, with local examples, divisions in the animal kingdom: mammals, birds, reptiles, amphibians, crustaceans, insects.

9. Duplicate the photos and use in cut-and-paste exercises, with original stories below.

In addition to the enclosed brochures, the Division has recently developed a filmstrip entitled "Guam's Coral Reef", suitable for elementary through jr. high school students. The 81 frame filmstrip details the development of Guam's reefs and highlights many of its inhabitants. A cassette tape, in both Chamorro and English, complements the filmstrip. A teacher's guide including the complete script will be provided. A set will be sent to each elementary school library and the Learning Resources Center in the near future. A 92 frame enlarged version of the filmstrip is presently being developed for high school use.

The Learning Resource Center has recently been provided with a selection of books dealing with wildlife and the environment. These books are immediately available for teachers' use, along with many free brochures and posters displayed at the Center's Environmental Awareness rack. A single copy of the Dr. Suess film "The Lorax" has also been donated. This popular animated film deals with common pollutants that effect our environment and what happens when we let things get out of hand.

We sincerely hope these materials will become frequently-used tools in your classroom. Ultimately, they may become a factor in instilling a conservation ethic in Guam's bright hope -- our children.

ANTONIO S. QUITUGUA
Director of Agriculture

Enclosures

COMMENTS
for
SCOPING HEARING
concerning
ENVIRONMENTAL IMPACT STATEMENT
for
FEDERAL ACTION GRANTING ACCESS TO ARTERO FAMILY LAND
at
URUNAO BASIN.

August 6, 1990

Ralph Frew, President
Marianas Audubon Society
P.O. Box
Agana, Guam 96910

Good afternoon, I am Ralph Frew, President of the Marianas Audubon Society, a local conservation organization with more than 100 members on Guam and in the Commonwealth of the Northern Islands. We are dedicated to the conservation of both the natural and cultural history heritages of the Mariana Islands. I will today be presenting preliminary comments at this scoping hearing on concerns we have with the granting of an unrestricted easement or right of way by the Air Force to the Artero family property located at Urunao Basin and adjacent cliffline areas. We will submit more detailed written comments at a later date.

Let me make it clear at the outset that we are not necessarily opposed to granting of the easement under any circumstance. In fact, we are sensitive and supportive of the Artero Family's long time desire and attempts to gain a more reasonable access to their land-locked property which has been blocked by adjacent security controlled Federal property since World War II.

We are also extremely appreciative of the Artero family's opposition to the Navy's Relocatable-Over-The-Horizon Radar Project proposed for the adjacent Northwest Field area that would destroy up to 600 acres of mostly high quality native forest habitat that is essential for the preservation and recovery of Guam's critically endangered native forest bird and fruit bat species.

However, it is our concern for these same endangered species and in general for Guam's natural and cultural history heritage that brings me here today presenting our membership's concern over the proposed access and the planned massive tourist development that will follow. The Mariana Audubon Society strongly believes that the Air Force's granting an easement for access to the Artero family property would be a major Federal action as defined under the National Environmental Policy Act that will require a full Environmental Impact Statement. In addition, due to the endangered species found on the site, we believe that a consultation with the U.S. Fish and Wildlife Service as required by Section 7 of the Federal Endangered Species Act is also required. This is because both the easement and the consequences of the opening of the Artero property to potential mega-development may likely have major as yet undetermined impacts on both the natural and cultural history resources of the area. Therefore, we feel that the scope of the Environmental Impact Statement must include all impacts that may result from the granting of the easement. These impacts would include but not be limited to the cumulative impacts of the easement on the area it traverses, the expected development of the lands opened by

the easement and the construction of the Navy's radar sites on the adjacent Northwest Field areas.

The area in question at Northwest Field and Urunao Basin is one of the last locations on Guam where several federally listed endangered bird and fruit bat species are found. Recent wildlife surveys conducted by the Division of Aquatic and Wildlife Resources, Department of Agriculture, Government of Guam biologists and by Bechtel consultant biologists have found federally listed Mariana Crows and Mariana Fruit Bats on the site. It contains some of the most pristine, high quality native forest found anywhere on Guam. This forest has been identified as high priority habitat essential for the preservation and recovery of Guam's native forest birds and fruit bats in the U.S. Fish and Wildlife Service's final draft (and soon to be published) Recovery Plans. In recognition of the importance of this area, most of the native forest in the northwestern part of Guam is presently being considered for Critical Habitat designation as defined in the Endangered Species Act by the U.S. Fish and Wildlife Service. How will the increased vehicular activity and infrastructure development on the access route itself affect these critically endangered species and their habitat?

Federally listed endangered sea turtles also use the beaches bordering the Urunao Basin. This area is one of only four remaining areas on Guam where sea turtles are still known to nest and represents approximately 40% of the total known sea turtle nesting still taking place on Guam. Some illegal taking of their eggs already takes place at these relatively inaccessible beaches. What will be the impact of increased access and development on these animals?

The Urunao Basin is major cultural resource that is extremely rich in both prehistoric and historic sites that are presently virtually untouched. The area contains some of the last big prehistoric coastal habitation sites left in all of the Mariana Islands. There are several ancient prehistoric Chamorro villages in the area. The area is historically important as well. There is likely an early Spanish mission on the site that dates back to 1670-90. What will be the impact of increased access and development on these priceless windows to the islands past?

The position of the Marianas Audubon Society on development in habitat where endangered species and cultural resources are found is and has been for the past four years, that no massive land intensive high impact projects should take place in such areas. We opposed the Navy's ROTHR radar project based on this policy. The Air Forces granting of increased access to the Urunao Basin with concomitant increased vehicular traffic and infrastructure development along that access route, coupled with the Artero Family's publicly stated intention to develop up to 400 acres of their land, into a golf course-hotel-condominium mega-resort, raises similar concerns to those which we have expressed over the Navy project. We believe that a thorough Environmental Impact Statement and Section 7 Consultation will demonstrate that such access as is being requested will jeopardize the preservation and recovery of Guam's endangered bird and fruit bat resources, seriously disturb endangered sea turtle nesting sites, and disturb and destroy valuable cultural records of our islands still relatively unknown past.

In conclusion, we urge the Air Force to conduct a thorough environmental review as required by the National Environmental Policy Act and the Endangered Species Act. Secondly, we urge the Artero family to reorient the development they are planning for the Urunao Basin to be less in conflict with the preservation of the natural history and cultural resources found on the site. Further, the Marianas Audubon Society is ready to assist in any way we can to define a development plan for this area that maximizes the conservation of the natural and cultural history heritage of Guam.

THE CHAMORRO

A History And Ethnography of the Marianas

oOo

Georg Fritz

DISTRICT CAPTAIN IN SAIPAN

Translated By ELFRIEDE CRADDOCK

Edited By SCOTT RUSSELL

(Original 1904)

1986 Division of Historical Preservation

boar takes place right after birth through cutting. The wound is covered with warm wood ash. The castration of pigs and cattle is done by certain persons who know how to do it. There are no superstitions connected with this job, however.

Goats are not kept much. The meat is not liked. On Tinian, a few hundred live in a wild state. There are no sheep on the German islands and no horses. On Guam, on the other hand, there are a great number in the possession of the natives. Geese, ducks and turkeys are not kept by the Chamorros. However, chickens are raised in great numbers as are domestic pigeons. On all islands are large numbers of feral chickens, especially on Tinian.

The large number of useless domestic dogs was limited by taxing the bitches. They are not tied up and are only useful during the pig hunt. A pack of wild dogs causes a good deal of damage to the wild cattle on Tinian at this time. Domestic cats are also present in small numbers. They easily become wild.

Hunting and Fishing

The Chamorros are eager hunters. This exciting but safe sport replaces the excitement of war. In ancient battles, the outwitting of the enemy was preferred to open attack. Likewise, in today's hunting, the trap plays the main role. Scheidnagel jokes with his tale of the conspicuously painted Chamorro, who attacks the shark in his own element with a dagger. The [modern] Chamorro is neither a good swimmer nor diver, especially not one to get too close to a shark. I observed something analagous near some bathing Carolinian boys when I called their attention to a shark. Instead of bringing themselves to safety, they pursued the fleeing beast in the water and threw sticks and stones at it. The local shark, by the way, is not very dangerous. During my three and one half year stay [on Saipan] it happened only once that a native was bitten in the thigh by a shark while fishing.

A companion piece in the area of fable to the conspicuously painted shark hunter is the Chamorro as an "outstanding rifleman whose shot seldom misses the mark" (Blumentritt 1883:138). The shooting book of the police troop in Saipan shows how long it takes until these outstanding shots fulfill the condition "no mistake at 100 meters". Presumably, the fame of a master marksman previously was easier to obtain. Invented also is the unbelievable numbers of deer on Guam, the many herds of deer on Saipan and their tremendous numbers on the Northern Islands. On Guam, only very seldom is a deer shot. Perhaps formerly there were more. On Rota, a small herd populates the Taipingot peninsula, from where I brought six to Saipan in 1900 and gave them their freedom there. On the other islands, not one head can be found. For conservation, the hunting of wild deer is completely prohibited until further notice. Also, the wild cattle on Saipan and Tinian, and the wild pigs, chickens and goats on Saipan only can be hunted by those empowered by the district administration. Otherwise, hunting is permitted and, as mentioned previously, eagerly indulged in. *Halum tano* is the Chamorro word for forest (literally the interior of the island). By insertion of the veral syllable "um" *humanlum tano* to forest, to hunt results. In the same way, from *babui* the word *bumaubi*, to hunt pigs originates.

For the pig hunt, four to six men assemble with as many dogs as possible. If they find a pig, the hunters rush as quickly as the thicket will allow and kill the pig with a machete. It is immediately eviscerated and cut into pieces which are transported on a pole by two men.

Where many trails lead to the watering place, traps are set. The construction

and operation of these traps are shown in Figure 4j. Pigs are not hunted with guns. The most popular game is the fruit bat called *fanihe*. They occur in great numbers on all islands. During the day, the bat is shot from the trees. In the evening, especially in the light of the moon, it is caught in flight with the *laguan fanihe* [fruit bat net]. This is a net made of rope or thorny twigs *pakau* attached to a pole approximately four meters long (See Figure 5a). Wild roosters are caught in snares, made of weaker ropes but otherwise placed the same way as the pig snare. One erects, at the proper place in a forest, about thirty traps. In the center of the area a tame rooster is positioned in order to attract his wild friends by his singing. Or the hunter imitates the cackling of a hen and thereby leads the amorous rooster into the snare. They are also shot with buck-shot.

The jungle fowl *sasnget* and the wild duck *nganga* are caught in snares also but without the use of a lure. Other game birds include four species of pigeons, *toddot*, the turtle doves, *paloman kunan, paloman halumtano, paloman apaka,* a blackbird *sali*, two snipes, *dolile* and *kalalang*, one water hen *pulatat*, the white heron *tchutchugo apaka* and the black heron *tchutchugo atilong*.

Different gulls include *luan, hahang* and *tchungi*. The latter are caught at night by shining a torch into the bushes. This causes the birds to fall to the ground where they are caught by hand.

The coconut crab *ayuyu*, furnishes a very tasty and popular meal. It stays in the holes of limestone rock. One places bait made of a decayed copra [near these holes] and returns around eight o'clock in the evening. The animals are caught by hand near the bait.

There are many species of marine and beach crayfish. [These include] *panglan maanite, panglan tunas, mahongang* (lobster) and *uhang*, a small river crayfish. With the exception of the lobster, these are caught by hand, sometimes at night by torchlight on the reef. The lobster is speared with the two-pronged *fiska* (See Figure 5c). Pocket crayfish are also caught with a trap *okudo* without bait.

Women and children dig for clams and snails in the sand with their hands or collect them on the reef during low tide. The most common are *taro* (pterocera lambist), *tapon* (Venus puerpera L. var), (Strombus gibberatus L), *palos* (Spondylus zonalis Lam), *ahling* (Turbo setosus Gm), *hima* (Tridacna elongata Lam) and *amson* (Mesedesma straitum Chemnitz).

Naturally, fishing provides the main source of food for the island inhabitants. However, fishing takes place only inside the reef. Only the Carolinians sometimes go on the high seas to visit Aguigan 25 sea miles from Saipan and dive for trepang *balete* which they sell to the Japanese. They also catch turtle *hagan* and utilize weir traps inside the reef, a fishing technique not practiced by the Chamorros.

The Chamorros use mainly nets. The *talaja* is a round net four meters in diameter. Its perimeter is weighted with lead pieces. To use it, the fisherman takes the handle placed at the midpoint of the net between his thumb and forefinger of the right hand, hangs about half of the net over the right forearm and grasps with the left forearm under the net, so that upon throwing, it surrounds completely the school of fish seen from the beach. It is then pulled slowly to the shore. The pieces of lead scrape the bottom and let no fish out. If a big one is trapped, the fisherman jumps into the water and kills it by biting it. Commonly, small fish are caught in this narrow-meshed net; for larger fish, a wider mesh net is used. The fisherman walks along the beach, accompanied by a boy, who carries the basket for him, and recognizes by the movement of the water the proximity of a school of fish. From the shore, he can throw the net a maximum distance of about eight meters. *Kitcho, gulli, laiguan* and *tiao* are usually caught with this net.

The *lagua* net is five meters long and 1.7 meters wide. On the lower, long

side are lead weights. On the upper portion are floats *boya* made of light wood such as hibiscus or breadfruit. The short sides are fastened to a pole.

For fishing, twelve to fifteen women and young men assemble. One person stands at each pole which are held slanted from the ocean bottom to the water surface. One person remains in place and another pulls the tightly stretched net in the direction of the school of fish. At the same time, the remaining participants rush toward the net shouting and splashing in order to drive the fish toward the net. Finally, they grasp the net's weights and raise them up high with the catch.

The net is sometimes made of locally spun cotton but more commonly from imported net twine. The fishing with the *lagua* during the day is called *lalago* and at night *gumade*.

The *tchentchulo* net is up to 200 meters long and three meters wide and made of imported hemp. [Attached] below are lead pieces and above floats. The participants, up to 40 in number, go with the net in two boats to a suitable location, the best is where a spit of land forms a small bay. When positioned at the middle of the bay, each boat takes half of the net and goes in opposite directions, gradually letting the net slide into the water. On the outer side of the net people distribute themselves at equal distances. They lift the floats out of the water to prevent the fish from jumping over the top of the net. After the entire *tchentchulo* is in the water, both boats row with the greatest haste toward land and the crews pull the net with the catch on the beach. The meshes are wide and usually bigger fish are caught such as *gulli, tataga, tarakito, mafute, hamotan, godau, lililuk* and *managang*.

Sometimes at low tide, a closed-in area of rocks is built near the reef. At high tide, the *tchentchulo* is pulled around this wall and the fish caught in this trap. They are grasped by hand or speared with the two pronged *fiska* (with barbed hook). *Tchentchulo-painge* is fishing by night and *tchentchulo haane* is fishing by day. Fishing with a hook *haguet*, which is made of imported iron, is called *lumulai*. One hangs the *haguet* baited (with small fish, crabs, etc.) into the holes of the reef. One fishes in this fashion during full moon periods. Only children using smaller hooks fish in this fashion during the day.

At night, during low tide, fishing and crabbing are also done with torches (*haef*, the dry sheath of the coconut flower). The fish or crabs are grasped by hand or speared *kumatoktscha*. This type of fishing is called *sumulo*.

On Rota, two ancient types of fishing have been preserved. *Atchuman* is a fish which is caught with a stone *atcho puco;* this has the shape of a half sphere. On its flat side, a half coconut shell *haiguas* is fastened with gum from the sap of the breadfruit. Placed inside the shell is ground coconut meat (*mahan*), which gradually exits out through a hole at the top of the shell. This lures the fish in great numbers. The flat side of the stone is pierced at two opposite places and tied with a rope *hadak*. The fisherman sitting in a boat above, catches the fish with a hook and line or with a *lagua* net which is fastened to a round wooden hoop and is drawn up with a rope.

[A second ancient fishing method is as follows] *Lagua*. A lure fish tied with a long thread which is fastened to its pierced jaw. The thread is slowly pulled in and the lure fish returns frequently with companions. These are caught with the *lagua* net or with the *fiska*. After completing service, the *lagua* [parrot fish] is tied to a stone or confined to a stone enclosure in the water [to be retained for future use]. These two methods were already used by the ancient Chamorros; in the ruins are found pierced and circled stones.

Fish poison is also commonly employed. It is made from the fruit of a mangrove, the bark of which is broken in a stone mortar and sprinkled on the water.

Figure depicts the construction of a fish "garden" *gigua*. [These are constructed in the following manner] first one drives *estahas* or stakes into the ocean bottom. Tied to these are bamboo poles plaited with the root, cut lengthwise, of a pandanus variety *pahon*. In these gardens, one catches all types of fish, especially *laiguan* and *tarikito*. Sometimes a large shark strays in. The back of the shark is eaten.

Turtles *hagan* are grasped by hand, as previously mentioned. When the fisherman sees a turtle near the reef, he hastens with his boat there, plunges into the water and grasps it with his arms to protect himself from the strong jaws of the animal. A captured female is sometimes pierced at the back end of the belly shell and a strong wire inserted. The turtle is tied in a suitable place to lure other turtles. The animal is killed by stabbing after which the blood is drunk directly from the wound. The turtle is then put on its back in a ditch before it is completely dead and a fire is lit over it until the meat is cooked. It tastes like the best beef. The broth accumulates in the shell and is drunk. The turtle shell of the type found here is thin and worthless and is also destroyed by fire. The genuine turtle *carai* occurs here only seldomly.

Boats

When Magellan arrived in the islands, his flotilla was greeted by innumerable outrigger sailing canoes. They flew across the ocean like arrows. Legaspi called the islands "The Islands of the Latin Sails" after their triangular sails made of leaf plaitings. With these craft, they travelled from island to island. Father Sanvitores and other missionaries also used these canoes to visit the other islands in the Marianas group. [Le Gobien noted that] "the boats were of amazing lightness and of pleasing form, caulked with resin and lime, slaked in coconut oil".

With the demise of the brave [Chamorro] nation, these ocean craft disappeared. Only the Carolinians who migrated to the Marianas in the 19th century, whose canoes and sails had the same form and construction as the canoes from the Marianas, resumed the traffic between Guam, Rota, Tinian and Saipan. [These voyages were stopped as a result of Spanish] government policy because of a few accidents. The last *sagman* is supposed to have arrived in Guam from Saipan in 1892.

The Chamorros now use - solely for fishing within the reef - outrigger canoes made of *dugdug* or *lemai*. They are from three to six meters in length and are called *galaide*. They are shaped from the fresh wood with the *sose*, a hollow hatchet. For benches, a number of cross boards are nailed down. Two 1.5 to 2.5 meter long poles *gahet* hold the outrigger *lutcha*. This is a massive wooden piece shaped in the form of a smaller canoe and lashed parallel to the axis of the craft.

Rowing and steering are accomplished with the *pagasi*, a short paddle which is placed perpendicularly into the water without a fixed turning point on the boat rim. Usually, one uses a long pole *tulus* which the ferryman places on the bottom of the ocean and pushes the canoe along.

According to de la Corte, a number of artificially made canals exist on Guam which cut through the reef and allow a convenient entry for boats.

SOFT-SHELL TURTLES

The soft-shelled turtle (Trionyx sinensis) is a high-priced item that is considered a delicacy in Taiwan and Japan. The culture of this animal on Guam was initiated by a private entrepreneur, with facilities that include three concrete tanks (20 x 7 x 0.7 meters), an egg incubation house, and a well. Chinese Carp (Aristichthys nobilis, Hypophthalmichthys molitrix, Ctenopharyngodon idellus) and tilapia serve as secondary species in the culture system.

The original stock of turtles came from Taiwan. The stocking density varies according to the size of the turtles, and size segregation is necessary to prevent cannibalism. The turtles mature in 9-10 months on Guam and have a clutch of 10 to 15 eggs. The incubation time ranges from 40 to 50 days at 30°C.

The growth rate of the turtles on Guam is substantially faster than those cultured in Taiwan (Chen, 1976). Feed consists of trash fish, which yields a conversion ratio of 10:1. Turtles reach market size in 8-10 months. Areas of high oriental population are expected to be the most favorable for market development. An export market to Hawaii has been established, and exporting to Hawaii continues on a limited basis. Local marketing of the turtles has been mainly to restaurants; they are always marketed alive.

Due to the expense in feeding and the difficulties in marketing small quantities off-island, however, the turtle culture is being phased out. The facilities would have to be greatly increased to supply the quantities required to compete in foreign markets (Taiwan, Japan), or to cover shipping costs to markets in the States (Hawaii, Mainland U.S.). The main emphasis currently is on the production of the red hybrid tilapia, and on the short-term culture of eels for shipment to Taiwan. The Turtle Farm has already expanded its facilities for the culture of the red hybrid tilapia with the construction of three concrete ponds (28 x 30 x 4 feet).

TILAPIA

A. Monosex Tilapia

Monosex experimentation with sexually indeterminate tilapia fry using the hormone methyltestosterone in their feed for two weeks (Table 3) was initiated in April 1977. After one year of growth in a tank at the Department of Agriculture, these tilapia were sexed and found to have a 93% occurrence of males. During the year some breeding did occur in the tank; however, the reduction in the percentage of females greatly decreased reproduction and the resulting problems of overpopulation and stunted growth. These results are similar to those obtained with methyltestosterone by the staff of the Freshwater Aquaculture Center, Nueva Ecija, Philippines (FAO 1975, 1976).

Development Agency. Funds orginally intended for a fumigation plant, and which could have been reappropriated in June 1979 for the construction of a prawn hatchery, were not obtained because negotiations with the U.S. Navy for an ideal site in Apra Harbor at Sasa Bay remained unsettled. A report prepared by Aquatic Farms Inc. of Hawaii (1978) evaluated and summarized the economic aspects of developing a prawn industry on Guam. This economic study, funded through the Government of Guam, Department of Commerce, will be helpful in securing funding from the Federal EDA for the proposed prawn hatchery. A tentative time schedule calls for construction on the hatchery to start around February 1980, and for it to be in operation about a year later. From here on the Department of Commerce will spearhead all efforts and preparations for the construction and operation of the permanent hatchery. In the interim, the Department of Commerce is subsidizing the purchase of 200,000 post-larvae from Aquatic Farms Inc. so that the prawn farms will not be affected too adversely by the delay in building the hatchery.

FRESHWATER EELS

Guam presently has one entrepreneur engaged in freshwater eel culture. The eels are cultured in concrete-walled ponds with a total area of five (5) hectares. The eel farm reports a monthly harvest of 2.0 metric tons of eels. The majority of the product is shipped to Japan for sale at $10 to $40/kg; however, larger eels are sold locally at $5.50/lb. ($12.10/kg).

Elvers of Anguilla japonica have been obtained mainly through suppliers in Hong Kong, who in turn obtain the elvers from mainland China. The majority of the elvers are grown to market size on Guam; however, some of them are transshipped to Taiwan for a rapid return on the initial capital investment. The importation of products to Taiwan from mainland China is illegal, but after holding elvers on Guam for a short growing period (approximately one month), they have been exported as a product of Guam. The price received for elvers in Taiwan this year ($430/kg) is approximately one third the price in 1978.

At one time the ponds were stocked with approximately 40,000 elvers of A. rostrata imported from South Carolina. The difficulty in obtaining a sufficient supply of A. japonica elvers (at $1,000/kg) necessitated the substitution. However, A. rostrata grow at a substantially slower rate than A. japonica, and they are also more susceptible to disease. The upper temperature tolerated by A. rostrata is less than that for A. japonica, and they are often thermally stressed on Guam. In addition, the market acceptance of A. rostrata in Japan is not very good due to the toughness of the skin and overall shortness of the body, which makes them less suitable for Kabayaki (barbequed eel) than A. japonica.

All the ponds are in operation, except for two ponds that have structural damage. One pond is being used to culture the red hybrid tilapia in brackish water because the freshwater supply has been inadequate during the past dry season. Water quality in all the ponds has been marginal at times. An attempt was made to reuse the water by cycling it through a swimming pool filter. This proved to be impractical, however, since the filter would frequently clog and require back flushing.

Guide to the Coastal Resources of Guam: Vol. 3

FISHING ON GUAM

DEDICATION

To Guam's fishermen, past, present, and future, and particularly to Greg Johnroe, a good fisherman and friend.

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GUIDE TO THE COASTAL RESOURCES OF GUAM

VOLUME 3. FISHING ON GUAM

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INTRODUCTION

The sea has been the major source of food, particularly protein food, for Pacific island people for as long as they have inhabited their islands. Because of their relatively small size and their distance from mainland sources of animal life, oceanic islands such as Guam have few species of native land animals of significant food value. Those terrestrial animals which are native to Guam are species of birds and bats which can fly across large expanses of water (or get blown across in storms) and land crabs, such as the ayuyu or coconut crab, which are capable of being carried from island to island by ocean currents during their pelagic larval stages.

The early inhabitants of Guam apparently brought few land animals with them when they colonized the island. Monitor lizards may have been brought by the early Chamorros, although it is possible that these lizards managed to reach the island on their own prior to human contact. But so far there is no unequivocal evidence that the first inhabitants of Guam brought any other animals. Archaeological excavations in various parts of the island have not yielded remains of pigs, chickens, or dogs in layers deposited prior to the coming of Magellan in 1521. These animals were presumably brought to Guam by the Spanish ships which stopped on Guam on their way between Mexico and the Philippines. Over a period of years, the Spanish also brought in carabao, cattle, goats, horses, deer, sheep, cats, and rats.

The early inhabitants of Guam were thus dependent upon the sea for their survival. Fortunately the reefs, lagoons, and offshore waters of Guam provide habitats for a wide variety of edible marine life including sea turtles, several hundred different kinds of fishes, octopus and many kinds of shelled molluscs, and a variety of crabs, lobsters, and other invertebrates. To harvest this wide variety of marine life, the early fishermen on Guam developed a diversity of fishing methods appropriate to the habits and behaviors of the animals they sought.

Even today, with the availability of imported foods of all sorts (including imported seafood), fishing is still important on Guam. Many types of marine animals are harvested to provide food for home consumption, to be shared with friends and family, to be sold, and just for the fun of it. And many fishing methods, some similar to methods used in the past and some only recently attempted on Guam, are used.

The purpose of this book is to describe the fishing methods used on Guam, both methods used in the past and those being used today. We hope that this information will be of value in several ways:

1) In describing past fishing practices on Guam, we hope to preserve some of the cultural knowledge of the people of Guam before it is irretrievably lost.

2) In describing present fishing practices on Guam, we are attempting to make this knowledge more widely available to fishermen and potential fishermen who may wish to diversify their marine harvesting capabilities and also to provide information to marine resource planners and managers who need

to be aware of the kinds of fishery resources available on Guam and the methods by which they are harvested.

Photographs and additional scientific information on most of the fish species mentioned in this book can be found in The Coastal Resources of Guam Volume I: The Fishes (University of Guam Press, 1982). A similar book on the molluscs of Guam is in preparation and will contain photographs and information on locally harvested molluscs. Armed with these books, the enterprising fisherman should be able to catch something, identify what it is, and understand something of its biological and ecological role in the marine ecosystem. We'll leave the best part, the eating of it, to you!

ANCIENT FISHING PRACTICES

Radiocarbon dates indicate that Guam has been inhabited since at least 1500 BC. The ancestors of the Chamorros came originally from the Philippines-Indonesia-Malaysia region, the source of the original settlers of virtually all the islands of Micronesia, Melanesia, and Polynesia. As seafaring people, familiar with the marine environment, the original settlers of Guam no doubt brought considerable fishing knowledge with them from their homeland. Bengt Anell, who has studied the distribution of various types of fishing implements in the Pacific, has documented many similarities in fishing methods throughout this region. However, there are differences in fishing implements within this broad area, and some methods common in, for instance, Melanesia are not found in the Marianas.

Our understanding of the fishing practices of Guam during the long period of time before European contact with the island depends upon the excavation and analysis of archaeological materials. Although archaeological research has been carried out on Guam since the 1920's, there is a tremendous amount of work still to be done. The summary of the archaeological information on fishing presented here can only be considered preliminary.

The range of prehistoric fishing practices on Guam will probably never be completely known from archaeological investigations because many types of fishing equipment are perishable. In particular, nets and fishing lines made from plant fibers deteriorate rapidly and would probably not be recovered in excavations. What have been uncovered are various durable implements of stone and shell as well as the bones and shells of various fishes and molluscs harvested by the ancient Chamorros.

Fish hooks are among the most commonly found artifacts of fishing. Most are rather small and J-shaped and are made from the shell of the oyster Isognomon. Some have notches at the upper end of the shank for the attachment of the fishing line (PLATES 1 and 2).

Fish gorges made of Isognomon shell are also found reasonably frequently. These are L-shaped objects with a notch at the apex, to which a line was attached (PLATE 2). A gorge is designed to be swallowed by the fish. When the fishing line is pulled taught, the gorge becomes lodged in the fish's throat, and the fish can be pulled in.

Very few compound fish hooks have been found on Guam (Figure 1). These large hooks are made from two pieces of clam shell, one piece forming the shank and the other forming the upward-pointing tip of the hook. This type of hook is quite common in the Caroline Islands and Melanesia where it was used for offshore trolling for pelagic fish. Presumably it had the same function on Guam.

Various kinds of weights and sinkers make up most of the rest of the archaeological fishing implements so far discovered. These are made of stone and come in various shapes, including hemispherical (the stone weights used in polo fishing for opelu described later in this book), conical, cylindrical, and globular (more-or-less spherical). Many of these have holes or grooves for the attachment of fishing lines (PLATE 3).

Of the identifiable fish remains recovered from archaeological sites on Guam, parrotfish beaks and grinding plates are the most common. One reason for their frequency is that these beaks and grinding plates are large and extremely hard and probably persist in archaeological deposits for a much longer time than do the more fragile bones of other fish species. Nonetheless, they are so common that they must reflect the importance of parrotfish in ancient Chamorro diets. The jaws of a number of other reef fish species have also been recovered from excavations around the island.

Barry Smith, who is studying archaeological remains of shellfish from the Tarague site has found a change in mollusc shell debris over time: in the earlier layers, marine snail shells such as conchs, turbans, and limpets predominate; in more recent layers, bivalves, including the giant clams (Tridacna) as well as other types of clams, are most abundant. The significance of these changes in fishery species is not entirely understood at present.

FISHING DURING SPANISH TIMES

Magellan's Visit

The earliest written description of the customs of the Chamorro inhabitants of Guam was provided by Antonio Pigafetta, an officer on one of Magellan's ships, who wrote a chronicle of the first circumnavigation of the globe, including a brief account of the landing at Guam on March 6, 1521. The only fishing practice mentioned by Pigafetta was the catching of flyingfish, which was done from canoes by fishermen using hooks made of fishbone. Considering the unfortunate circumstances surrounding Magellan's stop on Guam and its brevity (at most, a few days), it is understandable why little fishing information was acquired. However, other early Spanish visitors were able to obtain more details of Chamorro fishing practices including the methods used for catching flying fish.

Juan Pobre de Zamora's Report

Early Spanish reports on the Marianas describe the Chamorros as "the most skilled fishermen ever to have been discovered." One of the earliest descriptions of Chamorro fishing

Figure 1. A compound fishhook made of two pieces of clam shell.

methods is contained in a report written by the Franciscan friar Juan Pobre de Zamora who spent some seven months on Rota in 1602. In this report he quotes an account of Chamorro customs related to him by a Spaniard named Sancho, a survivor of a shipwreck a year earlier, who had been living on Guam. Sancho described methods of fishing from canoes to catch flyingfish, mahimahi, and marlin.

To catch flyingfish, a floating dropline was used. The float was a gourd to which was attached a very thin cord having at its other end a two-pronged shell hook. One prong was baited with "carne de cos" (possibly coconut meat), and the other prong was baited with shrimp or small fish.

Several canoes, each carrying ten to twelve fishermen (each with his own gourd rig), would go out. The gourd and dropline were placed in the water near the canoe, and when the gourd float wiggled, the fisherman would know that he had hooked a flyingfish. The flyingfish caught were generally about 8 inches long, although some were twice that size. The first flyingfish caught was eaten and the second one was used as bait for mahimahi, marlin, and other large fish. The rest of the flyingfish catch, which was often quite substantial, was taken back to the village for food.

The flyingfish saved for bait was attached to a large hook (hooks were originally made from shell and wood, but, within a short time after the arrival of the Spanish, iron nails were used to make hooks) and dropped over the stern of the canoe. Mahimahi, marlin, and other pelagic fish were taken in this way, although sharks, when caught, were not eaten.

Sharks, in fact, were considered enemies of the fishermen, and Sancho goes on to describe an incident in which his master (Sancho was apparently held as a slave on Guam) hooked a large marlin that was attacked by a shark before he could get it into his canoe. Sancho's master tied his fishing line to his canoe, capsized the canoe, and swam down the line to drive the shark away from the marlin. He then brought the marlin back to his canoe, righted the vessel, and sailed home, "...flying a woven mat as a banner from the masthead." Like modern-day sports-fishermen, the Chamorro fishermen of the 1600's flew flags of different designs to proclaim their catch.

When the catch was brought to the village, the fisherman would cut it up, giving the entrails to the children who helped carry the fish to the village and slices of the meat to his neighbors. The rest was salted to be eaten later.

The Chamorro names for these fish, according to Sancho, were "gaga" for flyingfish (a name still known today), "botague" for mahimahi, and "batto" for marlin. These latter two names are apparently no longer in use on Guam.

Sancho's account of the Chamorro fishing methods on Guam during the early Spanish contact period is the most detailed description available but says nothing about reef harvesting. Nonetheless, we must be appreciative of what information he did provide as Sancho was speared to death on the day after he related his account to friar Juan Pobre.

The Freycinet Expedition

In 1819, the Freycinet Expedition, a French scientific exploration of the Pacific, stopped on Guam. The report of this expedition noted that fishing provided the most essential part of the meat diet of the inhabitants, although by this time several domestic animals had been introduced to the island.

The report described the local method for catching flying fish, essentially the same method that Sancho described over 200 years earlier. In addition, several other fishing methods were discussed.

Hachuman Fishing

One method was the use of a device called a "poio" to attract a kind of fish called "atchoman." From the description of its habits, the atchoman was apparently the fish known today as hachuman or opelu (Decapterus).

The poio was made from a piece of limestone, smoothed and rounded into the shape of an egg with one end flattened, slightly larger than a husked coconut (Figure 2). Holes were made in the limestone so that it could be suspended by a pair of fiber ropes, with the flattened end of the stone uppermost. Attached to the top of the flat surface of the stone was half of a coconut shell, situated like a cap. A small hole was drilled through the uppermost end of the coconut shell. Chewed coconut meat was placed inside the coconut shell on top of the stone, and the whole device was lowered into the water to a depth of approximately 40 to 50 feet in an area known to contain hachuman, in water a mile or more from shore.

The purpose of the poio was to act as a chum bag, to attract and feed the hachuman and to gradually bring these fish to the surface. Using this method required a great deal of patience. For best results, the fisherman would start chumming with his poio in August and would not attempt to catch the fish until October.

Each day the poio would be lowered and shaken to release the ground coconut. This would be done several times each day. On each successive day the same spot was visited and the same routine was followed, but the poio would be dropped one to two feet shallower than on the previous day. The fish, coming to feed on the coconut chum, would slowly be brought closer and closer to the surface, until after about two months of this, large groups of hachuman would aggregate at a depth of about 6 feet. Finally the time arrived to catch them.

On the day in October when the fish were to be caught, the fishermen would bring a conical net about 9 feet in diameter mounted on a circular frame. Four lines attached around the circumference of the frame formed a bridle which was attached to a single dropline. This hachuman net was lowered carefully into the water under the poio and the mass of fish that had accumulated around it. The net was then pulled slowly to the surface to catch the fish. Those fish not caught would continue to mill around the poio and the net could be used repeatedly until the desired number of fish were caught. The hachuman were then taken to shore where the women salted and dried them.

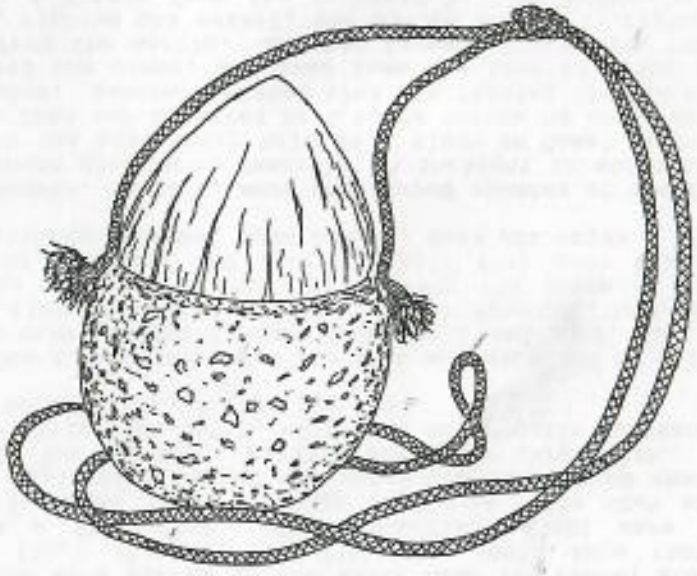


Figure 2. The poio, a chum container used on Guam in the harvest of hachuman (opelu). The base is made from a piece of limestone and the cap is a half coconut shell.

Because of the great amount of time and effort invested in the daily attraction and feeding of the hachuman, there was, understandably, considerable concern over poaching of the fish. To control this, each hachuman fisherman had an assigned fishing area whose boundaries were determined by lining up landmarks on the shore. However, from time to time, a poacher would trespass into another fisherman's area, cast his poio into the water and paddle off, with the fish following behind. Once he lured the hachuman into his own fishing ground, he would be able to harvest them himself. However, if the poacher was caught doing this, he was taken before a judicial council composed of the chiefs and principal women of the village. If found guilty, the poacher was condemned to death.

It is extremely interesting to find great numbers of opelu (hachuman) documented on Guam during these times. Many old-time fishermen on Guam have stated that opelu used to be abundant around the island; today they are quite scarce, although they are caught from time to time at Galvez Bank and Double Reef. What has caused this decline in opelu around Guam is a mystery.

Fishing for Parrotfish

According to Freycinet, parrotfish (laggua) were caught by two different methods on Guam. At night, during the time of the new moon from August to December, at low tide, fishermen would go out in their canoes in shallow areas near the edge of the reef. One man in the bow of the boat would carry a torch which illuminated sleeping parrotfish on the reef. Another man would spear the fish from the canoe with a multipronged spear.

During the daytime, a more unusual method was used. To begin this method it was necessary to have a live parrotfish. (If a live one could not be obtained, a freshly salted parrotfish could be used, but it would be necessary to put a rock inside its stomach, or a sinker beneath it, to keep the fish from floating.) A cord would be attached through the lower jaw of the parrotfish.

The fisherman then took his tethered fish out to a likely part of the reef. The fish would be put into the water and would swim around as far as the cord would permit. Other parrotfish would be attracted to this live decoy and would try to bite it in the jaw where the cord was tied. The fisherman would then pull the tethered fish to his canoe, bring it into the boat, and attach a noose to the line. The decoy was quickly return to the water, the other parrotfish would attack it again, and the fisherman would manage to catch one of the attacking parrotfish with the noose. Only a few fish could be caught in a day with this method, but the decoy parrotfish could be used over and over for an entire week if it were kept in a pen in the water each night.

Nets and Weirs

Freycinet described three types of nets in use on Guam. The simplest of these was the lagoa popo (sometime called lagoa omo-soho), a long-handled dip net. The frame of the net was oval, 1 1/2 feet by 2 feet, and the handle was 5 to 6 feet long. These nets were used to catch fish in rocky areas or to remove fish caught in fish weirs. The second type of net was the lagoa atchoman, used in the poio fishing method for opelu described above.

The third type of net was a kind of bag seine called lagoa pola. This net was made of three sections of netting: two end pieces 6 feet high and 3 feet long, and a center section 12 feet high and 20 to 30 feet long. The ends of the center section were gathered so that 12-foot-high net could be attached to the 6-foot-high end pieces. This formed a large pocket in the center section. Floats of pago wood were attached along the top of the net and weights (traditionally stones, but by the early 1900's lead obtained from Europeans was also used) were attached along bottom of the net. Poles at boths ends of the net were used to pull the net across the sand.

The mesh of these nets was made from the resistant fibers of the seagrass. (This material has also been used for nets on Yap within memory of some of the older people there.)

A fourth type of net, the conical lagoa djoti, was also mentioned by Freycinet, but he gave neither a description of it nor an explanation of its use.

Fish weirs (gigao) were also used on Guam. They were made from bamboo and located in areas where fish commonly passed. Two designs of fish weirs were constructed (Figure 3).

Freycinet was told that stone fish traps had been used on Guam in the past, but they no longer existed by the time he visited the island.

Freycinet described fishing for manahak (young rabbitfish). The lagoa pola (bag net) was used to catch these fish. As is the case today, the manahak entered the reef during the last quarter moon in the months of April, May, and June. Occasionally, manahak would also run in September or October. These late arrivals were known as manahak ababa (crazy manahak).

Other Fishing Methods

Eels were caught with iron barbed spears. Freycinet was informed that only the lower classes (manachang) fished for eels in past times; by the time of Freycinet's arrival on Guam, however, all classes of society harvested eels.

Crabs were caught with multipronged spears. During the daytime only male crabs could be caught. The females, larger and tastier, could only be caught at night by torch light.

Sea turtles were captured by flipping them onto their backs. No implements were used.

Various types of molluscs were collected for food or for their shells which were used for fishhooks. Sea cucumbers (balate'), although abundant, were harvested in insignificant amounts. The Chamorros would not eat them, although the Spanish colonists occasionally did.

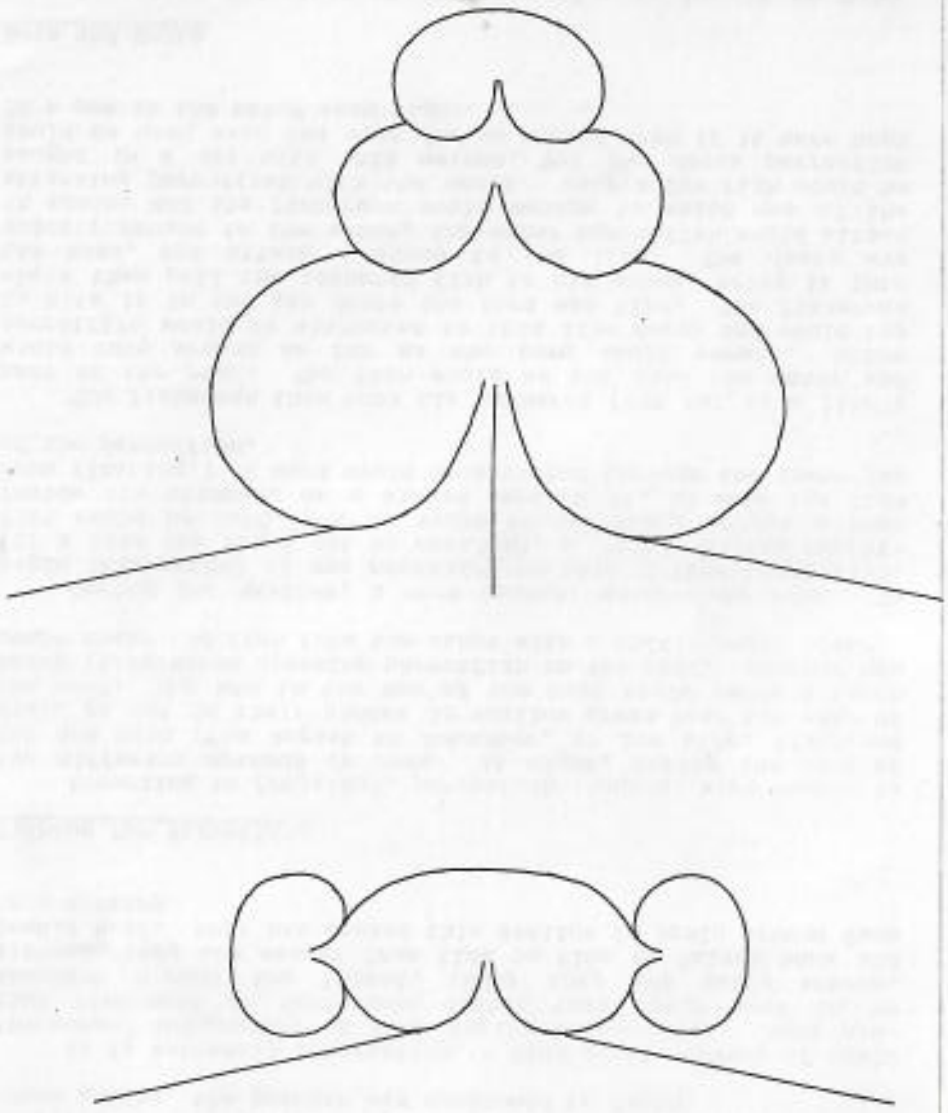


Figure 3. Designs of fish weirs used on Guam in the early 1800's.

Don Felipe de la Corte's Report

Don Felipe de la Corte y Ruano Calderon, the Spanish governor of the Marianas from 1855 to 1866, wrote a long and detailed account of the status of the Marianas, which included a discussion of the fishing practices of the time. By the 1860's fishing outside the reef had ceased. There were only 24 outrigger canoes on Guam, and these were all used inside the reef.

Don Felipe described the poio method of catching opelu, but noted that the method was no longer in use, and only a few of the older men knew of the technique.

The fish catch consisted of reef fish species that were available all year round and three seasonal fish, atanaja (manahak, young rabbitfish), ti'ao (young goatfish), and atislai (atulai, young bigeye scad). The atanaja came in through the reef during May, June, and July; the ti'ao ran during April through August, and the atislai came in during June, July, and August. The methods for catching these fish were not described.

Two to three tons of sea cucumber (balate') were collected, but the use to which there were put was not indicated. Sperm and humpback whales were hunted in nearshore waters by European whalers.

Don Felipe also noted that sharks were very abundant around Guam as was another fish he called "rompe candados" (Spanish for "lock breaker"). This fish was reputed to be more voracious than the shark.

THE PREWAR AMERICAN PERIOD

The United States acquired Guam from Spain in 1898; in the following year, the Northern Marianas and the rest of Micronesia were ceded to Germany. Within a few years, two reports were issued, one by Georg Fritz, German District Administrator of the Northern Mariana Islands, and one by William E. Safford, first American Lieutenant Governor of Guam (as well as botanist, linguist, and ethnologist). Fritz described the customs and ways of life of the Chamorros of the Northern Marianas (and also included information on Guam which he visited). Safford's report dealt extensively with the useful plants of Guam, but also described many other aspects of life on Guam. Both reports described contemporary fishing practices.

Fritz's Report

Nets, according to Fritz, were the major kind of fishing gear used by the Chamorros. Throw nets (talaya) were conical, about 12 feet in diameter, and were weighted with pieces of lead. Different mesh sizes were used for different sizes of fish. The fisherman would walk along the beach searching for schools of fish, whose presence could be recognized by a disturbance of the surface of the water. The net would be cast

out to a distance of up to 25 feet, and kichu (convict surgeonfish), guili (rudderfish), laiguan (mullet), and ti'ao (juvenile goatfish) were caught.

A second type of net, the lagua', was used to catch various reef fishes that were driven into it. The lagua' was about 15 feet long and 5 feet high with vertical poles at each end. Floats of pago (Hibiscus) or breadfruit wood were attached to a line running across the top of the net, and lead weights were attached to the bottom. Two people would hold the net on the reef while ten or more others would fan out over the reef and then drive the fish toward the net by running and splashing through the water. When everyone converged on the net, the lead line would be lifted, trapping the fish in the net.

A large seine, called a chenchulu, was the third type of net described by Fritz. The chenchulu was 10 feet high and up to 200 yards long, with a floatline along the top and a leadline along the bottom. It was used principally in bays and was operated by a large group of fishermen. Two small boats would take the net out to the middle of the bay. The boat crews would paddle in opposite directions paying out the net as they went. When all the net was out, the boats would bring the towlines into shore and the crews would begin pulling the net toward the beach. Other people in the water would swim behind the net, holding the floatline above the water's surface to prevent fish from jumping over the net. The meshes of the chenchulu were rather wide and only large fishes such as guili (rudderfish), tataga' (unicornfish), laggua (parrotfish), tarakitu (jacks), mafute' (emperors), hamoktan (surgeonfish), and gadao (groupers) were caught.

A variation to this procedure involved making an enclosure of rocks near the reef at low tide. At high tide, the chenchulu would be pulled toward this enclosure and the fish trapped within would be grabbed by hand or speared with a barbed, two-pronged spear called a fiska. When used during the day, this method was known as chenchulun ha'ane; at night, chenchulun puenge.

Other fishing techniques were used as well. Lumulai was a method of hook and line fishing used at night to catch fish in holes in the reef. During the day children would fish with hook and line for small fish.

Torches made of coconut spathes were used on the reef at night in a method called sumulo'. Fishes and crabs seen were taken by hand or speared.

The poio method of catching opelu (described by Freycinet) had apparently disappeared everywhere but on Rota. The method survived on Rota until at least the 1920's, as it was described by Hans Hornsbostel, an anthropologist then living on the island. Also surviving on Rota during Fritz's time (and in Hornsbostel's) was the live decoy method of catching parrotfish described earlier.

Fish weirs similar to those described by Freycinet were used to harvest a variety of fish, including laiguan (mullet), tarakitu (jacks), and even sharks. Stakes were driven into the reef to support the fencing of the weir which was made from bamboo poles tied together with strips of pandanus root.

Turtles were collected by hand. Sometimes a captured female turtle would be fastened to a rope and used to attract other turtles which were then captured.

Safford's Report

Safford's description of fishing methods on Guam in 1905 is less detailed than Fritz's. He mentions the use of throw nets, traps, and seines, as well as the poisoning of fish with puting, the fruit of the Barringtonia asiatica tree. The poison was prepared by crushing the fruit into a paste and keeping it in a bag overnight. Then, on low tide, the bag was taken to the reef and put into reef holes. Dead and dying fish soon appeared and were collected with nets, spears, and by hand. A great variety of reef fishes could be collected by this method. Safford reported that fishing from canoes for flying fish and bonito (skipjack tuna) had nearly died out by his time.

FISHING DURING THE 1930's AND 1940's

Several of the older fishermen on Guam who fished or helped in fishing as boys during the 1930's and 1940's have described the fishing practices of those times to us. This period was the beginning of the transition from the traditional fishing methods of Guam to more modern methods used today. Some imported fishing supplies, such as manufactured hooks, cotton line, and swimming goggles, were available from Butler's store, Dejima's store, and others, but money was rather scarce, and most fishing equipment was homemade. In fact, some harvesting methods used no fishing gear at all.

Fishing with Little or No Gear

Lachon

Lachon (Leptoscarus vaigiensis) is a species of parrotfish that lives in seagrass beds. Because of the scarcity of refuges (such as holes or coral patches) in seagrass beds, the lachon depends upon its mottled green color pattern to camouflage itself in the seagrass, and it will lie motionless to avoid detection. At low tide, a fisherman would wade through the seagrass bed until he disturbed a lachon which would dart from its hiding place. The fisherman would chase the fish until it again stopped to hide. Now knowing its location, the fisherman could carefully approach the lachon and grab the fish with his hands. On a good day, a fisherman could catch ten to 15 lachon in this way.

Manocho

In sandy areas, manocho (fishing by hand) was used to catch wrasses (tatanum, Novaculichthys taeniourus) which buried themselves in the sand. The location of these fish could be determined by finding a loose pile of coral rocks on the sand, which the fish apparently piled there. Larger rocks indicated

the presence of larger fish. The harvester, in this case usually an older woman, would dig in the sand and grab the fish.

Women also used manocho in reef areas. The harvester would wrap a rag around her hand to protect herself from eels, porcupinefish, stonefish, and other hazardous organisms, and reach into reef holes to grab fish hiding inside.

Puting

Poison was used to catch various reef species. Puting (Barringtonia) nuts and bark were ground up and put into bags. These bags were placed in tide pools, and would kill or stun fish, although reportedly it did not affect invertebrates. A toxic secretion is produced when the skin of certain species of reef sea cucumbers (balate') is rubbed. This material was used to extract octopus and large fishes from their hiding places on the reef.

Umefohmo'

Various small fishes from shallow reef areas, including damselfishes (fohmo'), cardinal fishes (lanse) and small wrasses (pegge'), were caught by the umefohmo' method. This method used a coconut leaf basket about 2 feet in diameter and 1 1/2 feet deep which was filled with pieces of coral and placed on its side in an area of rich staghorn coral. Three or four harvesters, usually women, would then begin driving the fish toward the basket, often by breaking up nearby corals with a stick. As their natural coral hiding places were destroyed, the small fish would ultimately take refuge among the corals in the basket. The basket would then be righted and the coral chunks removed one by one, leaving the fish trapped within the basket.

Hook-and-Line Fishing

Forms of hook-and-line fishing have been carried out on Guam since its earliest inhabitation by the Chamorros. In the 1930's and 1940's, several forms of hook-and-line fishing were practiced. During this period, imported hooks were available on Guam, although some homemade hooks, fashioned from nails, pins, or umbrella ribs, were also used. Imported fishing line was also replacing line made locally from pineapple fiber or pago bark.

Kamura

Before transparent monofilament fishing line was available on Guam, Chamorro fishermen used a method called kamura to catch fish in shallow, sandy reef areas. For kamura fishing, a line of up to 20 feet in length was buried in the sand with about a foot or so of line and leader exposed at one end bearing a baited hook. Pieces of fish, octopus, or crab were used for bait. The fisherman waited quietly at the other end of the line, wearing goggles so that he could watch the hook under water. To attract fish to the baited hook, the fisherman

into the water above the hook. When a fish too[illegible] fisherman would jerk the line to catch it. [illegible] mafute' (emperors) were the main catch, but g[illegible] and tarakitu (jacks) were also caught. On a goo[illegible] fish could be caught within two or three hours.

[illegible]ed out in people [illegible]inging, two [illegible]mall [illegible]ut

Sumulo - used

Pisao and Lulai

Pisao and lulai were two types of hook-[illegible] which used bamboo fishing poles. Pisao was done [illegible] or nighttime. The fishermen would wade out into waist-deep water with a 20-foot bamboo pole with about 15 feet of line attached to it. The hook was baited with fish, octopus, or hermit crab. Various reef predators such as snappers (kaka'ka'), groupers (gadao), emperors (mafute'), and jacks (tarakitu) were caught. Lulai fishing was done from the edge of the reef at night during full moon on the low tide. The types of fish caught were similar to those caught by pisao.

Smaller hooks baited with pieces of freshwater shrimps or marine snail meat were used for hook-and-line fishing for i'e' (juvenile jacks). The i'e' were caught close to shore.

Batangga

Hook-and-line trolling from canoes and small boats was also practiced. This method was called batangga. The line was 60- to 80-pound test and approximately 50 to 75 feet long. To the line was attached a lure made of chicken feathers or strands of pago bark and a hook. The canoe was paddled by two or three men who would troll in locations known to be good fishing grounds or who would seek groups of seabirds feeding at the surface. Jacks, skipjack tuna, barracuda, and other pelagic species were caught. Some trolling was also done on the reef at night for squirrelfishes.

Spears

Several types of spears were used in the 1930's and 1940's. The simplest was a sharpened steel rod which was used to spear fish hiding on holes on the reef. In deeper water (down to about 15 feet) outside the reef, divers wearing goggles would spear fish with a pole spear, a sharpened steel rod mounted on a 10- to 15-foot wooden pole.

A more elaborate spear was the fiska, a double-pronged, barbed spear, which was used during nighttime torch fishing.

Umegamsom

Octopus were collected by a method called umegamsom in which two steel spears each about 3 feet long, were used, one straight and the other hooked at the end. Octopus hiding places could be recognized by the piles of shellfish remains accumulated around them. When an octopus lair was found, the straight spear was inserted to "tickle" the octopus. After a short time, the octopus would begin to emerge, clinging to the spear. The hooked spear would then be inserted behind the octopus, and the octopus would be extracted from the hole. The

Sumulo'

Sumulo' or sulo' was a method of nighttime spearfishing used before lanterns or flashlights were generally available. A torch was made from a bundle of dry coconut leaves or spathes, from swordgrass, or from lengths of bamboo stuffed with kerosene-soaked rags. At low tide on the dark moon, two fishermen, one carrying the burning torch and one with a spear or machete, would wade along the reef flat. Sleeping parrotfish (laggua), mullet (laiguan), surgeonfish (kichu), and rabbitfish (sesyon) which were seen were speared, struck with the machete, or just grabbed with the bare hands. Torch fishing was also done at night from canoes in areas where the water was shallow enough for the sleeping fish to be seen and speared. A barbed, two-pronged spear was used.

Torches were also used for fishing at night in the rivers. River shrimp were caught with the hands, while eels were killed with a machete.

Net Fishing

Most nets used during the 1930's and 1940's were homemade. The traditional material for nets was pineapple fiber. To obtain this fiber, a pineapple leaf was scraped with the edge of a half coconut shell (PLATES 4 to 9). The scraping removed the softer, pulpy leaf material, leaving the tough fibers which were then formed into cords by rolling them between the hand and the leg. As the cord formed, additional fibers were lapped in to lengthen it. This coconut fiber cord was strong and durable. Imported cotton line eventually replaced the homemade pineapple fiber cords.

Lagua'

Perhaps the simplest type of net used was the lagua', a pocket net with vertical poles at each side, a floatline across the top, and a weighted leadline along the bottom. Floats for this and other nets were made from lightweight pago wood or breadfruit wood, and weights were made from rocks or from lead. The lagua' was used on relatively shallow reef areas, and fish were driven into the net by a group of people positioned in various places on the reef who would move toward the net, splashing the water with their feet and hands or with wooden poles. A somewhat more elaborate variation of this technique, involving a long "rope" of coconut leaves, was called gade'.

Gade'

Small i'e' (juvenile jacks) and ti'ao (juvenile goatfish) were caught at night by gade'. A dozen or more people from the community participated, and it was an occasion for singing and having a good time as well as for catching fish.

The first step in gade' was the construction of two long (15 to 30 feet) lines of coconut leaves. Many coconut leaves were split down the midrib and were tied together to form a sort of rope with the individual leaflets sticking out in all

the reef. The two coconut leaf ropes were stretched out in front of and to the sides of the net, with several people positioned along each rope. Accompanied by laughter, singing, and general high spirits, the participants moved the two coconut ropes across the reef toward the pocket net. Small fish, presumably terrified by the activity and by the coconut leaves moving across the reef, would retreat before the converging fishermen and be driven into the pocket net where they were caught. From 15 to 50 pounds of fish could be caught with this method.

These coconut ropes were also used to block off the edge of reef channel as the tide was going out. Fish would be frightened by the gade' and would remain in shallow water on the reef where they could be speared or otherwise caught.

Chenchulu

The surround net or chenchulu was a long net used to entrap fishes in shallow areas. The net could be up to 400 feet long and about 20 feet high. The fishermen would set it in a semicircle on the reef and then drive fish toward the open side. As the fish were driven toward the center of the net, the ends would be brought around and joined to completely encircle the fish. The trapped fish were caught by hand or with spears. Sometimes a large pile of coral boulders was built on the reef and the surround net would be set around it. As the surround net was closed, the fish would take refuge in the pile of boulders. The boulders were then removed, one by one, to capture the fish. Guili (rudderfish), tataga' (unicornfish), mafute' (emperors), tarakitu (jacks), and many other reef fishes could be caught by this method.

For netting methods which involved several people and caught many fish, the catch was usually distributed by thirds: one third went to the owner of the net, one third was divided among the people participating in the catch, and one third was distributed to the village.

Talaya

The throw net or talaya was a more individual method of net fishing, usually involving only two people: the fisherman throwing the net and a helper, usually a young boy who was learning how to fish, who carried the catch. Several different mesh sizes of talaya were used, depending upon the type of fish sought. Talaya fishing is still quite common on Guam and is described in more detail later in this book.

Tekken

The gill net, or tekken, is a more recent style of net fishing. Because gill nets must be difficult for fish to see in the water, the modern monofilament gill nets are the most effective ones. However, in the 1930's and 1940's, gill nets made of less transparent materials were used at night. Prior to low tide, a large mound of rocks was built near the edge of the reef. Fish were attracted to this mound and would take refuge among the rocks. As the tide dropped, a gill net would be placed around the mound, and at low tide fish attempting to

leave the mound to escape to deeper water would be trapped by the gill net. A variety of reef fish species, as well as lobsters, could be caught by gill netting at night.

Opelu Fishing

The poio method of fishing for hachuman (opelu) described by Freycinet in the early 1800's survived in a modified form into the prewar period on Guam. At this later date, the poio (chum container) was made from two coconut shell halves wedged together. A line ran down through both coconut halves and was fastened in such a way that a sharp tug on the line would cause the two half-coconuts to separate, releasing the chum (rice and ground coconut) packed inside. A talaya (throw net) mounted on a hoop was suspended below the poio to serve as a lift net for catching the opelu.

The time-consuming daily chumming of an area to attract and concentrate the opelu was no longer done. Instead, two men would go out on an outrigger canoe, during the month of October, to search for schools of opelu. Since these fish were often concentrated at depths around 100 feet, clear water was essential. Once a school was sighted, the lift net was lowered to an appropriate depth, and the poio was positioned above the mouth of the net and jerked to release the chum. One fisherman would watch the opelu as they accumulated around the poio, and when enough fish had gathered he would signal the other fisherman who would rapidly pull the lift net up.

Subsequent to World War II, this method of opelu fishing has disappeared, as have large schools of opelu around Guam. There may be some cause-and-effect relationship here, but whether the decline in opelu was a result of overharvesting or of other causes in unknown.

THE JAPANESE OCCUPATION

During the period of the Japanese occupation, from December 8, 1941, to July 21, 1944, traditional fishing practices on Guam were sharply curtailed. Most of the island's manpower was mobilized for agriculture work and other landbased occupations, and fishing by island residents was generally forbidden. However, some local men were assigned to fish, usually under Japanese supervision, to provide food for Japanese soldiers quartered on the island.

As American military forces advanced through the Pacific, it became increasingly difficult for the Japanese to provision their troops on Guam. Increased pressure was placed on local food production, and the practice of using explosives to harvest fish on the reef was intensified. Most of the fish harvested were taken by the Japanese, although some of the smaller fish might be returned to the fishermen who caught them.

Despite the prohibition of unauthorized fishing by the local population of the island, some still managed fish surreptitiously at night. In isolated areas where Japanese observers could not patrol the reefs, coconut torches were used to illuminate sleeping parrotfish which were killed with a blow with a machete. In areas where torches would be conspicuous, fishermen went out in the dark and felt around for fishes and lobsters in holes and crevices, capturing these animals by hand or with spears.

POSTWAR YEARS

In 1946, shortly after the end of the Second World War, an American team of fishery biologists surveyed the status of fisheries in Guam and in the areas of Micronesia formerly mandated to Japan but which by 1946 were under U.S. jurisdiction (the Marshall Islands, Caroline Islands, and Northern Marianas Islands). Robert O. Smith, the leader of this team, noted that local fisheries on Guam were at a very low level of productivity. He attributed this to several factors, among which were the greater profitability of working for the American military rather than fishing, the lack of local capital for acquiring boats and fishing gear, the limited availability of experienced fishermen, the lack of shoreside facilities for handling and refrigerating the catch, and the low abundance of fish in nearshore water.

Smith mentioned a number of fishing methods which were in use on Guam at the time of his visit. The most commonly used gear was the throw net, which was made of cotton twine. Two mesh sizes were used, 1-inch and 1/2-inch stretch mesh. Small beach seines were also employed. These were of 1-inch stretch mesh and were 3 feet high and 30 feet long. Several 30-foot sections were tied together to make longer seines. These seines could be used only in a few areas because of the rough bottoms which dominated most of the shallows around Guam. Fish traps were being used in Merizo, but catch rates were quite low. Torches were used at night to locate spiny lobsters on the reef. Octopus were also caught, as were small black-tipped reef sharks. Diving and spearing were negligible.

Smith was impressed by the fishermen of Umatac who made large catches of mackerel (atulai) with gill nets. He felt that fishing in this area could be enhanced by developing refrigeration and transportation facilities.

MODERN FISHING PRACTICES

Fishing practices on Guam today involve a wide gamut of methods, some of considerable antiquity and some more recently developed or introduced. The most important influence on current fishing techniques has been the availablity of modern power boats and sophisticated fishing gear imported from the Orient and from U.S. mainland manufacturers. Even with reef fishing methods, where the techniques have remained quite similar to those of past times, the use of imported gear (nylon nets, monofilament line, factory-made hooks, underwater flashlights, spinning reels and fiberglass rods, chicken wire for fish weirs, factory-made spearguns, etc.) has enhanced fishing efficiency and productivity to the point of overfishing of some species.

The social importance of fishing on Guam has also undergone changes as marketing opportunities have developed, and much fish is now caught for sale rather than for family consumption and village distribution. Because of the wider variety of career and recreational opportunities available to the young people of Guam, many have not been particularly interested in fishing and have not learned the techniques used by their fathers or other, more recently introduced, methods. Nonetheless, fishing is still widely practiced on Guam, and much of its social role still remains.

Fishing today is concentrated in three marine habitats: the coral reef and adjacent shallow areas, the deep island slopes to depths exceeding 100 fathoms, and the surface waters of the ocean beyond the reef.

REEF FISH HARVESTING

Net Fishing

Talaya

The throw net or talaya is an important reef fishing method on Guam. Its original introduction to the island is not known with certainty. Freycinet, in the early 1800's, mentioned a conical net called "lagoa djoti," which may be the talaya, although no description of the net or of its use was given. By 1900, the talaya was in common use, and in the years immediately after World War II, it was one of the most widely used fishing gears on Guam. Some authorities have suggested that the Japanese introduced the throw net to Guam, but Bengt Anell has pointed out that linguistic evidence indicates that this type of gear was brought to Guam by the Spanish: the Chamorro name for the net, talaya, is obviously similar to "tarraya," the name for the throw net in the southern Catalan dialect of Spanish, and is quite unlike the Japanese name for this gear, "uchi ami."

The talaya is a conical net, 8 to 12 feet high with an opening 10 to 16 feet in diameter. The opening has weights attached around its edge, and the edge is tucked under to form a series of pockets around the opening of the net where fish can become trapped. These pockets are formed by folding the weighted edge of the net inward and upward and tying it to the net about 6 or 8 inches up (this distance can be varied to form larger or smaller pockets). These folds and ties are made every 8 inches or so around the entire edge of the talaya.

The cord for these nets was originally made from pineapple fibers. Pineapple fibers were subsequently replaced by cotton twine (soaked in coconut oil to preserve the net). Cotton twine is still used for the smaller mesh manahak net, but the larger mesh talaya are made of monofilament or, more commonly, nylon. Monofilament is heavier than nylon and sinks faster, an advantage in catching fast-moving fish, but it tends to deteriorate more rapidly than does nylon. Some talaya are still made locally, but most are purchased ready-made.

The weights have also changed over the years, beginning with basalt stones, which were replaced by lead weights, which are now largely being replaced by lead chain. The lead chain has the advantage of being continuous around the margin of the net and conforming to reef irregularities when it sinks, preventing fish from escaping under the edge of the net.

There are several mesh sizes of talaya which are used for different kinds and sizes of fish. Mesh size here is given as "stretched mesh," the distance between knots on opposite sides of the eye or opening in the net when these knots are stretched as far apart as possible (which equals twice the distance between two adjacent knots). The smallest mesh ordinarily used is 1/4-inch, which is the mesh size of the talayan manahak, a throw net used for seasonal juvenile rabbitfish. The next larger size is the talayan ti'ao, of 1/2-inch mesh, used for juvenile goatfish (ti'ao) and juvenile jacks (i'e'). The talayan aguas, 1-inch mesh, is used for young mullet. Several species of moderate-sized reef fishes, including some of the surgeonfishes, are caught with the 1 1/2- to 2-inch mesh talayan kichu. The largest throw nets in common use are the talayan laggua or talayan guili, with 3- to 4-inch mesh, used for guili (rudderfish), laggua (parrotfish), tataga' (unicornfish), and even turtles and sharks. This classification of throw nets is somewhat flexible, and other categories are recognized by some fishermen.

Because of the predictability of the manahak (juvenile rabbitfish) run, the talaya fisherman can usually position himself in a reef location where the fish are known to run on the day they are expected to arrive. On the first few days of the manahak run, a larger, 12-foot-long talayan manahak is used because the fish are in large, cohesive schools and are less wary of the fisherman who can approach the schools more closely. Smaller, 8-foot-long nets are used on later days as the schools break up into smaller aggregations and the fish become more wary; the smaller nets can be thrown farther and retrieved more quickly, giving the fisherman more opportunities to catch the manahak.

Ti'ao (juvenile goatfish) typically come in close to shore, and a fisherman seeking this fish will walk along the beach looking for schools. The talayan ti'ao is cast out from the beach to catch the fish (PLATES 10 to 17).

I'e' (juvenile jacks) are also netted from shore. To lure the fish into talaya range, a line with a clump of seagrass or piece of plastic bag is cast out into an i'e' school and pulled toward shore. The flapping of plastic or seagrass attracts the fish which follow it to the beach. A hook and line can also be used to catch an i'e' and bring it into shore, and again the school will follow and can be taken with the talaya.

The talayan kichu is used near the edge of the reef for a variety of herbivorous fishes, principally surgeonfishes and rabbitfishes. When the tide is going out or just coming in and the water is shallow, the fish begin to feed actively on reef algae and often their tails can be seen sticking out of the water. Each time a wave breaks over the reef and covers the fish with foamy water, the talaya fisherman takes a few steps toward the feeding fish. When the fisherman gets within throwing range, he waits until the fish are again covered by a wave, takes a few steps forward, and throws his net onto the spot where he last saw the fish. He then immediately grabs the apex (center) of the net and holds it up so that the fish will go into the pockets. If some fish have not entered the

pockets, their heads can be pinched or bitten to kill them. The talaya is then bunched together and the whole thing lifted up to capture the fish. A coconut-leaf basket or guagua' is traditionally used to hold the catch, although plastic bags and other containers are now also used.

Surround Net

Chenchulu or surround net is consistently the most effective inshore fishing method on Guam in terms of kilograms of catch per gear-hour or per man-hour of effort. These large nets (3 to 5 feet high and 300 to 600 feet long) are used to surround and trap fish in a large reef area.

Surround nets are made of nylon mesh and have floats along the top and lead along the bottom.

Two automobile inner tubes with wooden bottoms are used in setting the chenchulu. Each end of the net is laid inside one of the inner tube floats and the rest of the net is stacked on top until half of the net is in each inner tube. Two men take the inner tubes out on the reef at high tide and begin setting the net in a horseshoe shape, curving toward the shore at each end. Other fishermen, shoreward of the net, begin driving the fish toward the net. When the fishermen driving the fish reach the net, the men with the inner tubes set the rest of the net, forming a complete circle around the fish, overlapping the ends to prevent the fish from escaping. Once the net has been closed, the fishermen swim around the base of the net to make sure that the lead line is secure along the bottom and that no gaps are open to allow fish to escape. Then everyone jumps inside the net to spear the trapped fish. A wide variety of reef fish are caught with chenchulu.

Gill Net

The gill nets (tekken) now used on Guam are all imported monofilament nets. Nets of various dimensions and mesh sizes are readily available from many stores on the island, and hand-made nets are no longer constructed.

The imported nets come with plastic floats along the top and lead weights along the bottom; however, fishermen often add additional floats and leads if the nets are to be used in areas of relatively strong current.

Gill nets work by trapping the fish in the meshes when the fish tries to swim through the net. A fish is "gilled" when the highest part of its body is too large to fit through the eye of the net (the opening between the meshes) and its gill covers get caught on the meshes when it tries to withdraw itself. Thus, the size of fish caught in a gill net is closely related to the mesh size of the net, and fishermen use nets of a variety of mesh sizes to catch different kinds of fish. The finer the monoflament, the more effective the net, because fish have greater difficulty seeing it. However, nets of very fine monofilament do not last as long as heavier nets. Fishermen usually mend their nets if they become damaged, but it is becoming increasingly common to find badly tangled and torn gill nets abandoned on the reef. Unfortunately, these abandoned nets are still capable of entangling occasional fishes

Gill nets are usually set near the edge of the reef or along the sides of channels. The nets are set after high tide when many fish are on the reef flat and the water level is beginning to drop. Fish escaping to deeper water as the tide goes out become trapped in the tekken, It is often effective to curl the ends of the net around to form pockets. Fish that attempt to go around the end of the net become trapped in the pockets and may become gilled when they try to escape.

The tekken should be patrolled periodically as the tide is dropping to remove gilled fish. This prevents the fish from escaping or from spinning around and tangling the net. It also prevents loss of fish and damage to the nets by predators which may attack the gilled fish.

Gill nets are used both day and night when the tide is right. At night, laiguan (mullet) and guili (rudderfish) are the main catch. During the day a variety of species are caught (PLATE 18). Tekken are also used to catch atulai (bigeye scad) during their seasonal inshore runs (PLATE 19).

Atulai Gill Net

John Taitano uses specially made monofilament gill nets for catching atulai. The nets are 40 feet deep and 400 feet long. Two mesh sizes, 1 1/2-inch and 2-inch, are used depending upon the size of the fish: the smaller mesh is used during the first three weeks of the season; after this time, the atulai have grown and the 2-inch mesh net is used. The net is well weighted with 1-pound leads every 10 feet and has sufficient floats to prevent large schools of fish from collapsing the net.

The atulai gill net is used in deeper channels and harbors around Guam where atulai characteristically run.

The gill net is set from a small boat by one or two fishermen. Most often this is done early in the morning when the atulai first move into the channel for the day and are tightly aggregated; later in the day, the fish are in less cohesive schools and big catches are more difficult to make.

From the surface of the water, the atulai school appears as a dark mass below the surface. It is sometimes possible to "herd" the fish into a tighter group by running the boat around them a time or two. Then the fishermen in the boat set the net around the school and the fish become gilled as they attempt to escape through the net.

The net is hauled back into the boat and brought to shore. When large catches are made, removing the gilled fish from the net is very time consuming. To prevent the fish from spoiling while the net is being cleaned, the net and fish are covered with a tarp and packed with ice. Then section by section, the net is pulled out and the atulai are removed. Bystanders who help remove fish from the net receive a share of the catch.

Sometimes a large throwing gill net is used to harvest atulai. This net is about 14 feet in length and has a mesh size of 1 1/2 or 2 inches. Unlike the normal talaya, this net has no pockets around the bottom. Fish attempting to escape through the net are gilled in the meshes. A line tied to the

top of the throwing gill net is used to pull the net and the gilled fish into the boat.

Fish Weirs

Fish weirs (gigao) have a long history on Guam which appears to be coming to a close. At one time, fish weirs were rather widely distributed around the island; at present only six fish weirs are in operation, all in Cocos Lagoon. The existing licencing law for fish weir sites mandates the permanent "retirement" of a weir site if fish weir operators do not apply for a permit for that site in any given year. Thus the remaining six site may be retired if interest in operating them wanes.

A typical fish weir consists of a large trap (4 feet square and 8 feet high) from which extend two to four fence-like leaders (6 feet high) which direct the fish into the mouth of the trap. The mouth is a funnel-shaped opening which allows the fish to enter the trap but which makes it difficult for the fish to escape. In front of the mouth is an additional, partially enclosed, area (the "bedroom") which accumulates fish and enhances the likelihood that the fish will enter the trap (PLATES 20 to 22).

The trap, leaders, and other fencing are made of chicken wire supported by rebar. Strips of pandanus bark are used to lash the chicken wire to the rebar. The top of the trap can be opened so that the fish can be removed with a scoop net.

The weirs are placed in relatively shallow reef areas and oriented so that the trap is upstream relative to the prevailing current direction and the leaders extend out in the downstream direction. Fish swimming upstream encounter the leaders and are guided into the "bedroom" area. From here, the fish enter the funnel mouth of the trap and are caught. The trap is emptied daily at low tide or at dusk (to prevent poachers from stealing the fish at night).

A wide variety of species are caught including jacks, goatfish, emperors, rabbitfish, mullets, snappers, slipmouths, and parrotfish. Most of the catch is sold to markets.

Hook-and-Line Fishing

The kinds of inshore hook-and-line gear used on Guam range from simple handlines with baited hooks to graphite rods and spinning reels with various types of lures. (Fishing methods which involve the use of hook and line in offshore water, such as trolling, bottomfishing, and mackerel jigging, are described in a later section on offshore fishing methods).

Although hook-and-line fishing is one of the most popular inshore fishing methods on Guam (in terms of man-hours devoted to it), it is one of the least efficient (in terms of weight of fish caught per man-hour); hook-and-line fishermen are apparently motivated more by recreational rewards than they are by monetary ones.

An important part of the inshore hook-and-line catch is the seasonal atulai and i'e'. When the atulai (bigeye scad) are running, hook-and-line fishermen are lined up elbow to elbow in the Agana Marina channel trying to catch them (PLATES 23 to 25). The lure used is a small Japanese-made fly with an aluminum head, a waxed paper skirt, and a tuft of nylon floss surrounding the hook.

Seasonal i'e' (juvenile jacks) are caught with a variety of baits, including bits of fish flesh, triangular pieces of surgical glove, small pieces of surgical tubing, and small Japanese-made waxed paper flies. In the past, a section of i'e' stomach was also used for bait. Wooden floats (bobbers) are attached to the line a pole's length up from the hook; some fishermen attach the float upside-down (blunt end uppermost); when the line is pulled, the blunt end of the float splashes the surface of the water which attracts the i'e'.

Cut fish is used as bait for other carnivorous fishes, such as emperors (mafute'), snappers (kaka'ka', funai, and bu'a), jacks (tarakitu), and needlefish (pulos). Mafute' can also be caught by using hermit crabs for bait. Live atulai, mullet, or i'e' can be used as bait for daytime hook-and-line fishing for tarakitu; at night, glowing lures resembling squids or flies and glow beads are used for these fish. (The glowing lures and beads are impregnated with a phosphorescent substance which glows for several minutes after being exposed to a light; nighttime fishermen often wear battery-powered head lamps to activate their glowing lures). Saksak (menpachi or squirrelfish) are also caught with these glowing lures at night.

Although hook-and-line fishing is most often used to catch carnivorous fish, herbivorous species can also be caught with the right kind of bait. Clumps of seaweed are used as bait for tataga' and hangon (unicornfishes) and sesyon (rabbitfish). At least one hook-and-line fisherman uses octopus ink to catch hiyok (the blue-lined surgeonfish). The octopus ink is allowed to congeal into a jelly-like mass which is placed on the hook. This bait is apparently quite successful for catching this particular fish species. The soft, white meat of the young coconut is used as a bait for guili (rudderfish).

Spearfishing

Fish are speared on Guam's reefs with pole spears and with a variety of spear guns (PLATE 26). Pole spears are usually multipronged and have a loop of surgical tubing connected to the rear end of the spear shaft. This elastic loop is placed over the hand between the thumb and first finger and the spear is grasped about half-way up the shaft, stretching the loop of tubing. When the spear is released, the elastic loop causes the pole spear to shoot forward. Because of their relatively short range, pole spears are most effectively used at night (with the aid of an underwater flashlight) to harvest sleeping parrotfish and other species which are less mobile at night.

Factory-made spearguns, known as arbolets, are also most effectively used at night. Most arbolets have two "rubbers" which are each made from two pieces of surgical tubing connected with a V-shaped piece of stainless steel wire for engaging the spear. The fisherman loads the gun by bracing the

stock against his body and pulling the rubbers back with both hands until the wire slips into a notch in the spear. The two rubbers give the spear substantial power for spearing large fish.

Palauan spearguns have a wooden stock and are made with a variety of trigger mechanisms, some fashioned from spoons or parts of pliers. Palauan guns have less power than arbolets because each rubber is a single piece of surgical tubing with a wire loop at one end, but they have more range because the guns are longer and the spears are smaller in diameter. Large Palauan guns (approximately 5 feet in length) are effective during the daytime. At night a smaller (3-foot) gun is easier to use because the fisherman can usually get much closer to the fish at this time.

During the day, speared fish are put on a stringer and towed behind the fisherman. At night, a container suspended in an inner tube or an "M-boat" (a small, boat-shaped, floating container) is used to prevent sharks from taking the fish (PLATE 27).

Most spearfishing is done with snorkeling gear. Although scuba gear permits the fisherman to stay under water longer, the bubbles produced by scuba often scare fish away.

During the day, the best spearfishing areas are along the reef margin, just beyond the breaking waves. The fisherman swims parallel to the reef watching for fish ahead. When the desired fish are seen, the fisherman holds his breath and dives down below them. Usually fish will come down to investigate a fisherman. When a fish is close enough and turns sideways, the fisherman shoots, trying to hit the fish in the head or backbone. The main catch is guili (rudderfish), tataga' (unicornfish), and laggua (parrotfish), although a variety of other species may also be taken.

At night, using a flashlight, the spear fisherman swims over the reef looking for sleeping parrotfish and other species that are quiescent during the dark. If the moon is up, many of these nocturnally inactive fish will become active, so it is best to fish when the moon is down.

A curious but widely attested observation is that fish in areas commonly fished with spears appear to recognize spearguns and will maintain a greater distance from divers carrying them. It is known that many fish secrete chemical "alarm substances" when they are injured, and it is possible that other fish learn to associate these alarm substances with spear fishermen and so become more wary. It is also possible that the common experience of having a desirable fish pass close by when a spear is not being carried his led to this belief.

General Life History Patterns of Reef Fishes

Most of the reef fishes which are important fishery species spawn in groups, usually in waters beyond the reef margin. Robert Johannes has documented some of these spawning aggregations among Palauan reef fishes and has shown that the location and timing of these reproductive gatherings are predictable and often well known to local fishermen. The eggs which are released and fertilized during these spawning events float in offshore waters for various periods of time (depending upon the species involved and possibly influenced by environmental conditions) after which the developed embryo inside hatches, initiating the larval stage of the fish's life history. The larvae feed and grow and reach a stage of development at which they are ready to return to the reef, a process referred to as recruitment. Whether a particular larva succeeds in recruiting to the reef depends on three factors:

1) its survival during the larval stage, during which starvation and predation no doubt take a heavy toll;

2) its likelihood of encountering a reef during the period in which the larvae has reached the proper stage of development for recruitment; and

3) its ability to find an appropriate reef habitat with sufficient food and the right combination of other ecological requirements to permit survival on the reef.

The first of these factors, larval survival, depends upon the availability of food for the larvae and upon the abundance of their predators, which are principally larger zooplankton and fishes. Planktonic food is probably available year round, and most reef fish species spawn throughout the year. Predators are probably also present year around, and there is little a fish can do to protect its larvae from predation other than producing as many eggs as possible so that at least some of the larvae may survive. Many reef fish spawn on a lunar cycle, usually on the full moon or new moon. During these two moon phases, tidal ranges are greatest, and seawater flow off the reef as the tide drops probably helps to carry eggs away from the reef where predation is most intense.

Some reef species, notably damselfishes, cardinalfishes, blennies, and gobies, protect their eggs on the reef until they hatch. This protection no doubt enhances the survival of the eggs and leads to a greater proportion of the eggs successfully releasing larvae. In these fishes, the eggs hatch at times of high tidal flow, again presumably to ensure that the larvae are carried off the reef. Reef fishes which protect their eggs are generally small fish and so produce fewer eggs per female than larger species. Egg protection may be necessary to guarantee sufficient numbers of larvae to provide a reasonable likelihood that some will survive the offshore phase.

The second factor, encountering a reef at the proper time, is controlled primarily by oceanic current patterns and, to a lesser extent, by the swimming ability of the larvae (which is not great in most fish larvae). Johannes and others have obtained evidence that spawning reef fish tend to aggregate near points of land where the water moves in circular eddies. If the eggs and larvae stay in these eddies, they will remain close to shore and not be carried out into deep waters away from the reef. Fish larvae are also capable of extending their larval life if no appropriate reef area is encountered. There is however a limit to the length of time the larval life can be extended, beyond which larvae will no longer survive if they fail to find places to settle.

The third factor, encountering an ecologically favorable habitat, depends upon a variety of conditions including reef predator abundance, food availablity, physical environmental features, and the presence of already established resident fishes. The particular conditions required vary from species to species, and the absence of some species from certain areas may be the result of the absence of certain conditions or resources required by their recruiting young.

Once recruited, young reef fish feed and grow and may move into new habitats as their maturity places new ecological demands on them. Most species of reef fishes eventually settle down to a more or less limited home range or to a defended territory, living there for the rest of their lives, leaving periodically to participate in spawing activities.

Reef Resource Groups

Tropical fisheries differ from most of the world's other fisheries in the great variety of fish species caught but the rather low abundance of any particular species. Tropical reef fisheries are perhaps the extreme example of resource diversity in which a single fishing method, such as gill netting or spearfishing, might result in the harvest of a dozen or more of species in a single fishing operation, with no one species being overwhelmingly abundant.

Despite their diversity, reef fish can be categorized into groups which share various biological and ecological characteristics.

Herbivores

The major plant-eating reef fish families include the surgeonfishes (Acanthuridae), rabbitfishes (Siganidae), rudderfishes (Kyphosidae), parrotfishes (Scaridae), and mullets (Mugilidae). Each of these families is represented by several species on Guam's reefs.

Among the important surgeonfish species on Guam are the kichu (Acanthurus triostegus), hiyok (Acanthurus lineatus), hugupao (various species of Acanthurus and Ctenochaetus), hangon (Naso lituratus), and tataga' (N. unicornis). All feed on filamentous and fleshy seaweeds, with the exception of species of Ctenochaetus which have specialized teeth for scraping detritus and microscopic algae from various reef surfaces. Kichu often occur in relatively large schools. The other surgeonfish species do not typically school, although large aggregations may be found in certain areas.

Two species of rabbitfish, sesyon (Siganus spinus) and hiteng (S. argenteus), are important in Guam's reef fisheries. The young of these species (known as manahak) are subject to an intense fishery during their first few days on the reef. These fish are again harvested when they become adults. Rabbitfish feed on filamentous and fleshy seaweeds. They are usually found in schools, sometime together with other species of reef fishes.

The rudderfishes or guili (Kyphosidae) also feed on filamentous and fleshy algae. They tend to be found in groups, often swimming together off the bottom, feeding on bits of floating seaweed that has torn loose or diving down to browse algae from rocks. Three species occur on Guam of which Kyphosus cinerascens is the most common.

Parrotfishes (Scaridae) are also herbivorous, but they feed primarily on calcareous algae and filamentous algal "scuzz" which they scrape up with their heavy beaks. The calcareous material is ground up by a pharyngeal mill, a specialized grinding structure in the fish's throat. As this ground up material passes through the parrotfish's gut, the edible plant material is broken down and digested, while the unassimilated calcareous powder is passed out of the gut, often in large, white clouds that settle to the reef surface. It has been suggested that parrotfish play an important role in coral reef development by their redistribution of calcium carbonate from one part of the reef to another.

During the daytime, schools of parrotfish cruise the reef, descending from time to time to scrape algae from exposed surfaces (and, in the process, leaving characteristic beak scrape marks where they have fed). At night they sleep on the reef, sometimes enveloped in a mucus cocoon. Their sleeping habits make them particularly vulnerable to nighttime spear fishermen who locate the fish with flashlights. More than 17 species of parrotfish are found on Guam, and they all are harvested for food.

The mullets (Mugilidae) occur in sandy or muddy areas near river mouths or along the edges of beaches and mangrove swamps. They feed by ingesting loose material from the substrate and digesting the microscopic algae and organic detritus found in these sediments. Mullets often occur in schools, and their tendency to leap out of the water when alarmed makes it difficult to catch these fish with nets.

The five families above are the major herbivorous fishes harvested for food on Guam's reefs. There are other important reef-dwelling herbivores, especially members of the damselfish family Pomacentridae, but these are not commonly harvested.

Planktivores

The microscopic plants and animals that float in the water are called plankton. The plant part of the plankton (the phytoplankton) is so small and usually so dispersed that it is not fed upon directly by fishes. It is eaten by the animal plankton or zooplankton which, in turn, provides food for numerous marine fishes. The zooplankton is a heterogeneous assemblage of many animal groups, including the eggs and larval stages of most of the fish and invertebrate species that live on the coral reef. In addition are organisms that spend their whole lives as plankton, some of which are found exclusively associated with the reef and some of which are washed in from the open ocean.

Although several reef fish group are primarily planktivorous, many of these, such as the damselfishes (Pomacentridae) and cardinalfishes (Apogonidae) are small fishes not usually harvested for food. Among the planktivorous fishes

that are harvested, the most important are the squirrelfishes (Holocentridae), flyingfishes (Exocoetidae), halfbeaks (Hemiramphidae), and fusiliers (Caesionidae).

Squirrelfishes are nocturnally active, spending the daytime hours holed up in caves and under overhangs in the reef. At night they forage for various zooplankton that emerge from the reef after dark. The most sought after squirrelfish are the saksak (Myripristis) and the sisi'ok (Sargocentron).

Halfbeaks are long, slender, silvery fishes with a very elongate beak projecting from their lower jaw. By comparison, the upper jaw is quite short. These fish swim at the surface of the water and feed on zooplankton found there.

Flyingfishes also occur principally at the water's surface, usually in waters beyond the reef, where they feed on zooplankton. When alarmed, the flyingfish propels itself out of the water by rapidly beating its tail fin, using its large, wing-like pectoral fins to glide through the air.

Fusiliers are slender, forktailed fishes that aggregate in the waters at the reef front where they feed on the zooplanktonic floating by. These fishes are not ordinarily very numerous on Guam, but occasionally large runs of juveniles occur in inshore waters. These young fusiliers resemble, and have been mistaken for, small rainbow runner.

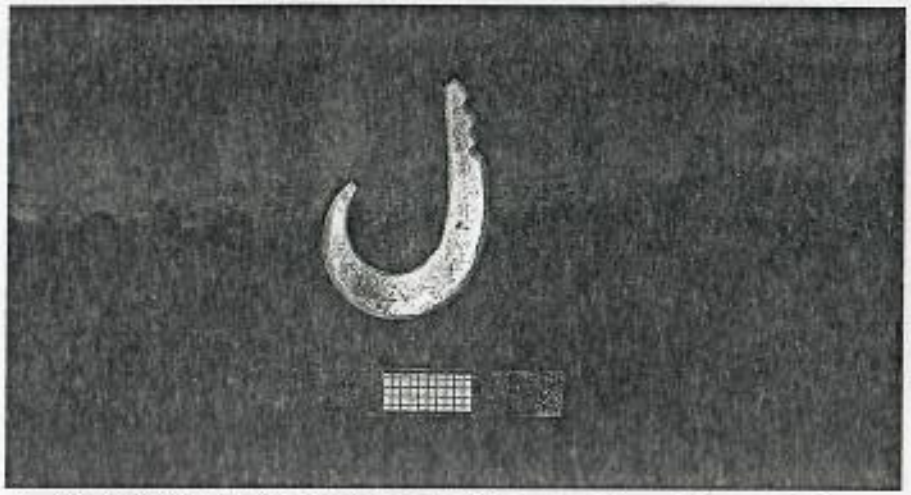
Invertebrate Feeders

An enormous variety of invertebrates inhabit the coral reef, from various kinds of worms, sponges, seastars, sea urchins, and sea cucumbers to octopus, snails, shrimps, and crabs. The coral animals which provide the basic structure of the coral reef itself are also invertebrates, as are their relatives the sea anemones and jellyfishes. Several groups of fishes which eat reef invertebrates are important food fishes on Guam, including emperors (Lethrinidae), sweetlips (Haemulidae), goatfish (Mullidae), wrasses (Labridae), triggerfish (Balistidae), and squirrelfish (Holocentridae).

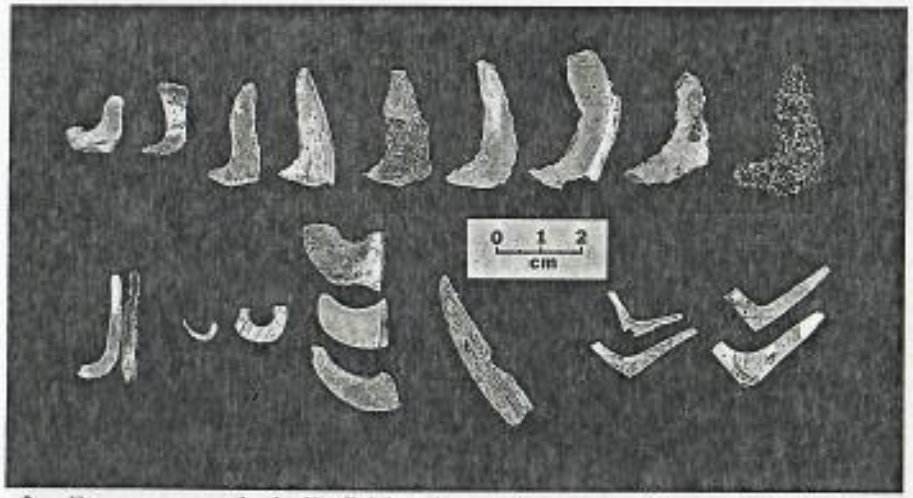
The family Lethrinidae includes the mafute' and lililok (genus Lethrinus) as well as other primarily invertebrateeating species such as saligai (Gnathodentex aureolineatus) and matan hagon (Monotaxis grandoculis). Mafute' and lililok are caught by handlines in waters off the reef margin, but other species are caught on the reef itself. They have rounded molar-like teeth for crushing hard-shelled invertebrates. Saligai often occur in schools, but most of the other lethrinids tend to be solitary or in loose aggregations.

Several species of sweetlips (hamala) occur on Guam's reefs. Because they are less wary of spear fishermen than most other edible species, their numbers quickly become reduced in well fished locations. Their teeth, like those of the lethrinids, are adapted for crushing molluscs and invertebrates.

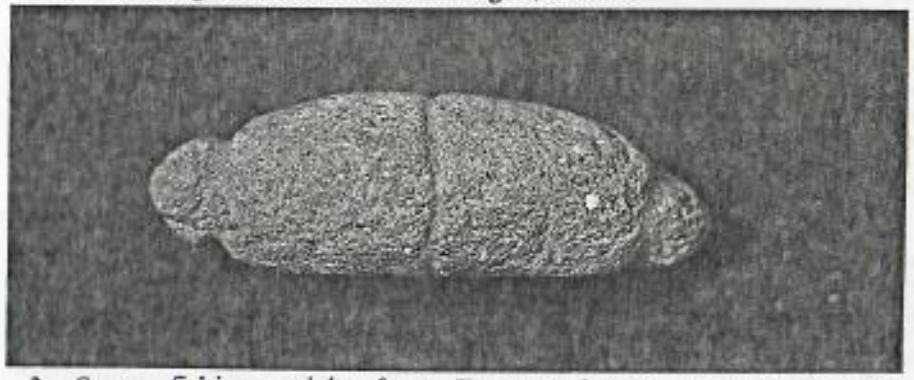
The wrasses (a'aga) are a diverse group. Most species are rather small and of little fishery importance, but several reach "frying pan" size, and the giant humphead tangison (Cheilinus undulatus) can grow to nearly 400 pounds. Wrasses



1. Shell fishhook from archaeological excavation at Tumon, Guam. Notches on shank are for attachment of line.



2. Fragments of shell fishhooks and gorges (lower right) from archaeological excavation at Tarague, Guam.



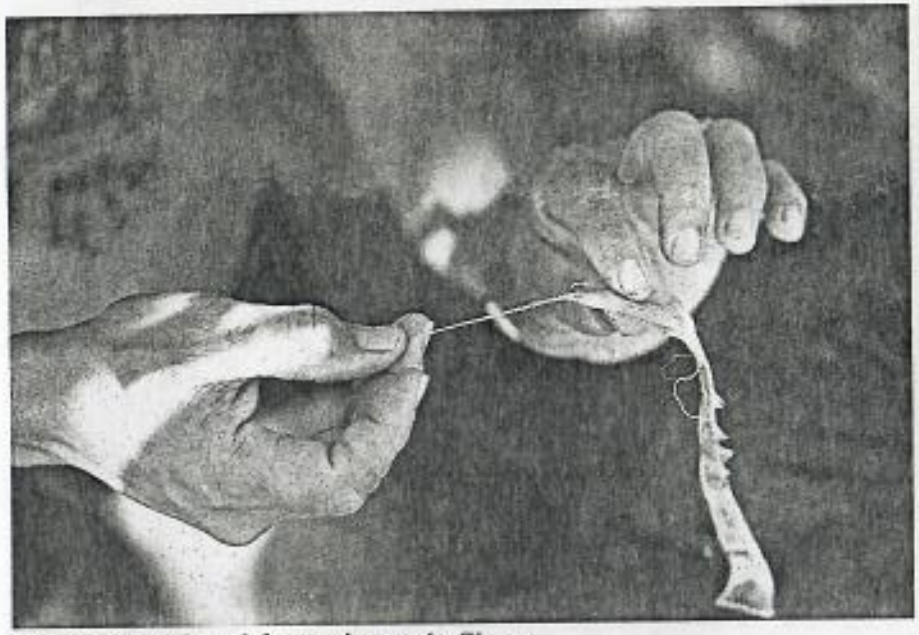
3. Stone fishing weight from Tumon, Guam. Grooves permit secure attachment of line.

4. Juan R. Chaco preparing net cord from pineapple fiber. The pineapple leaf is scraped with a half coconut shell to remove pulp.

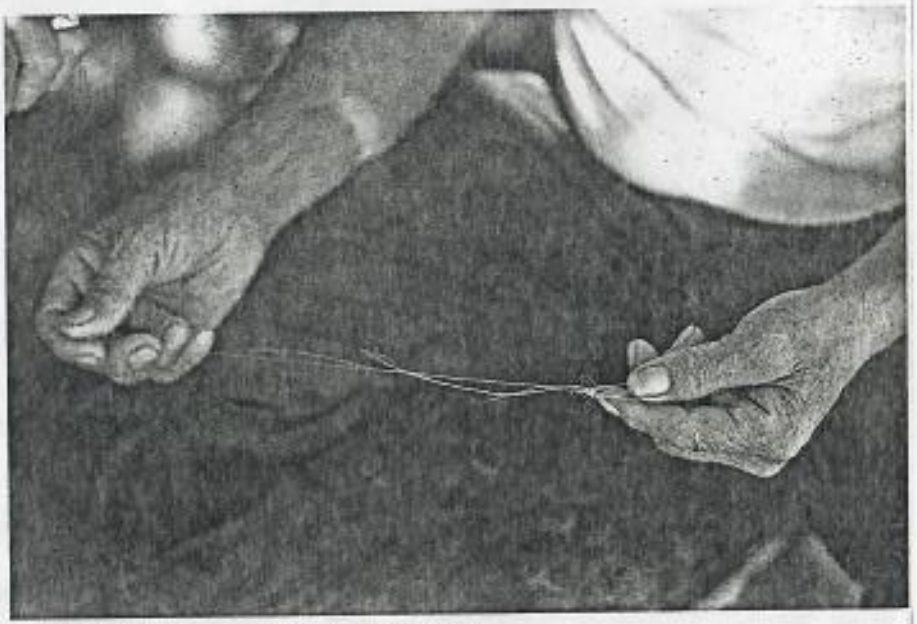
5. Pineapple leaf fibers.

6. Extracting the fibers from the pineapple leaf.

7. Rolling the pineapple fibers to produce a cord.



8. Cord produced from pineapple fibers.



9. Lengthening pineapple fiber cord.

10. John Viloria using talaya. His helper is carrying a guagua to hold the catch.

11. First step in preparing talaya for the throw: Net is held with right hand about 2 feet from the leadline.

12. Upper part of net is grasped in the middle with left hand.

13. Upper part of net is transferred to right hand and lower part is spread.

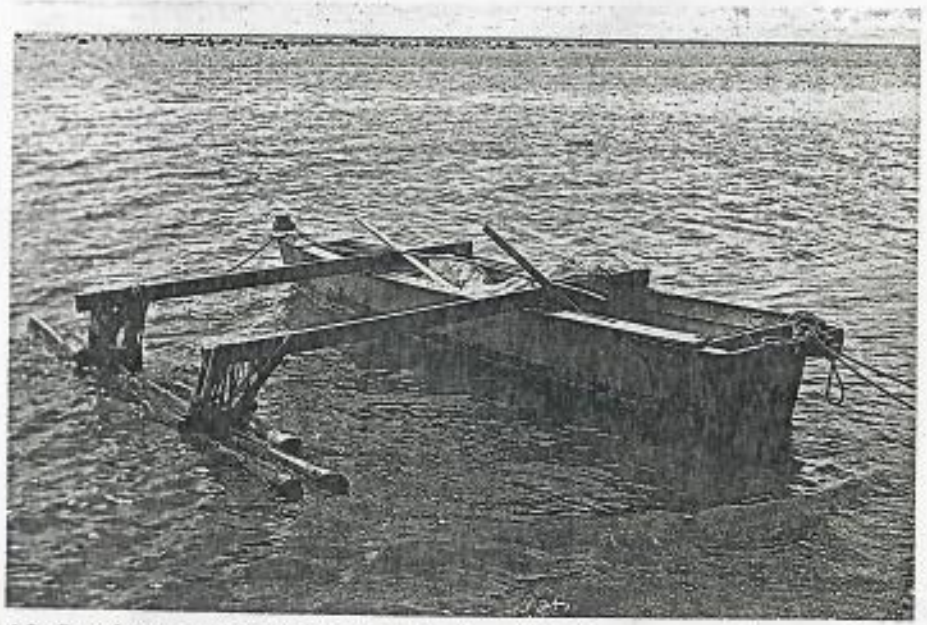
14. Spread section of net is supported by right arm and elbow.

15. Additional section of net is spread prior to throw.

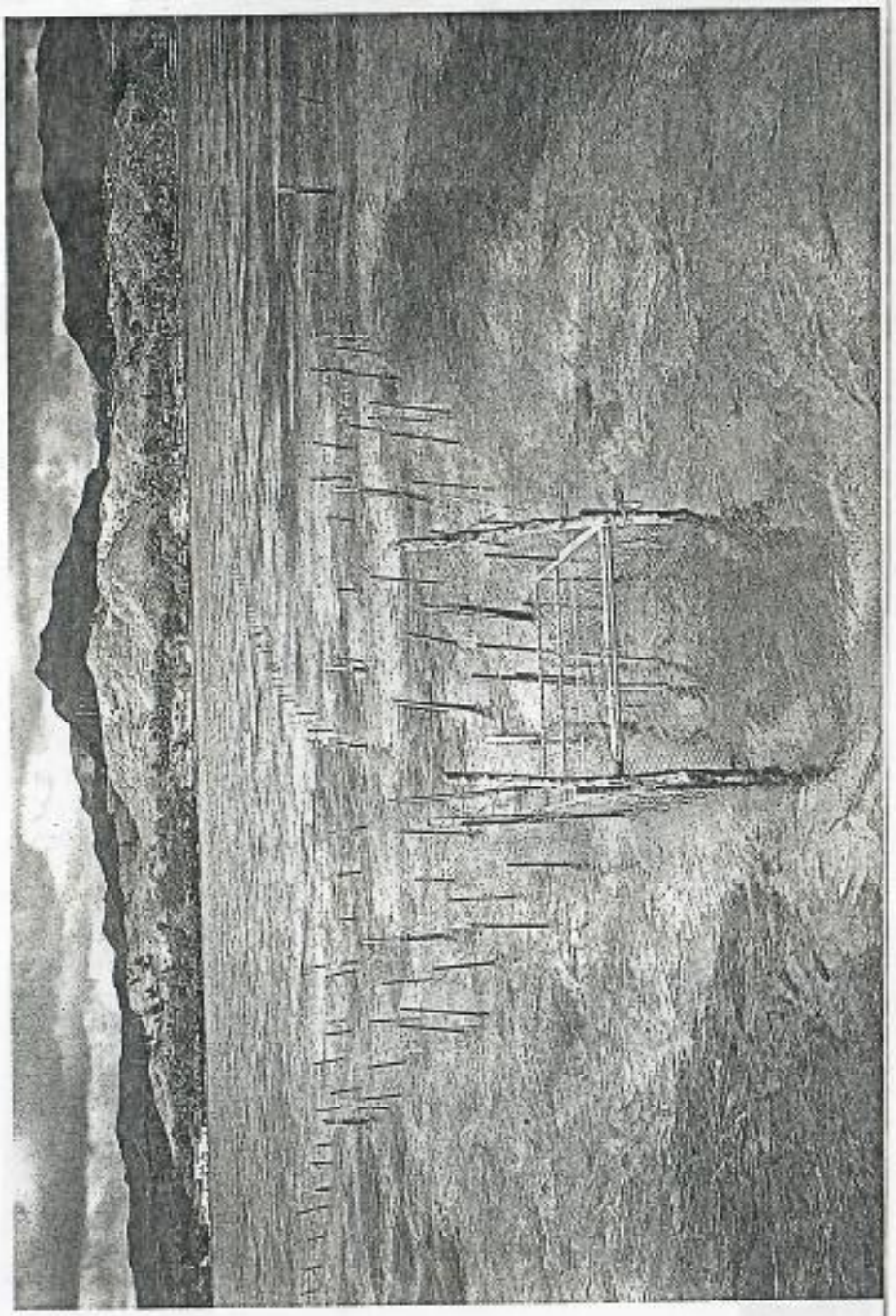
16. The left hand spreads the talaya as it is released.

17. Talaya opening to encircle fish.

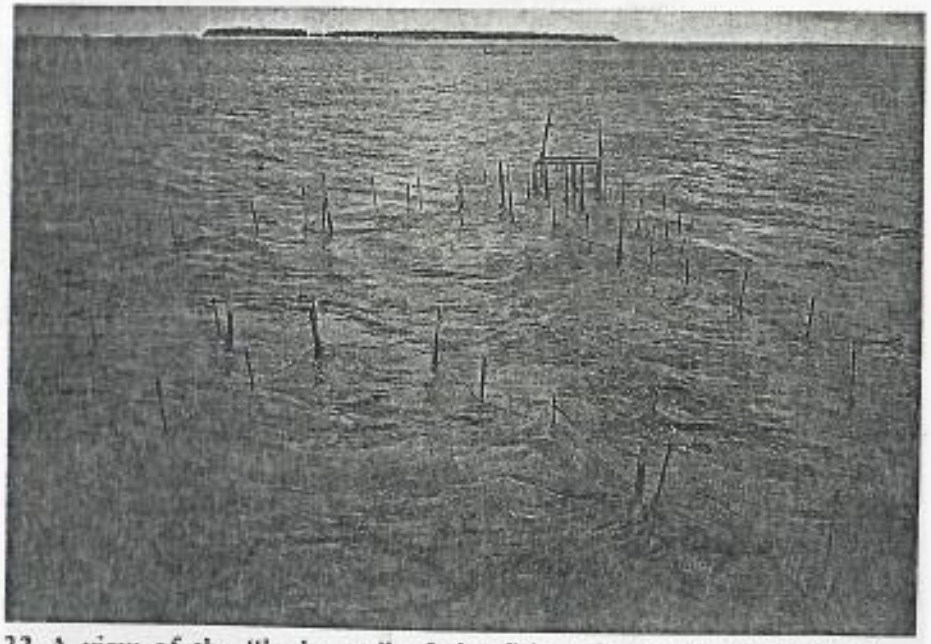
18. Gill net catch of tataga (unicornfish), laiguan (mullet), kichu (convict surgeonfish), hangun (orange-spot unicornfish), and lagua (parrotfish).



19. Outrigger canoe belonging to Juan R. Chaco, used for setting atulai gill net.



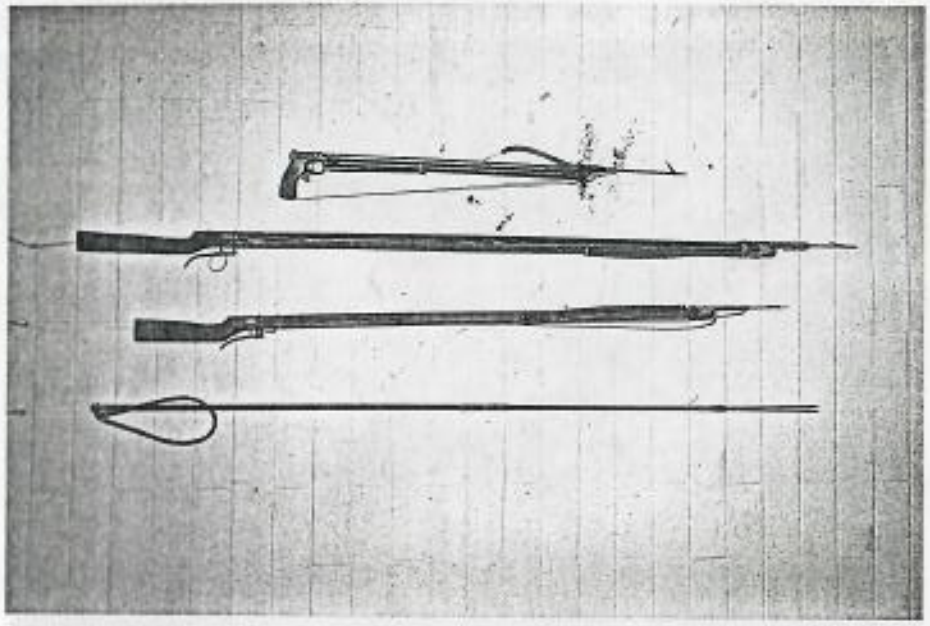
21. Leader which directs fish into the fish weir. The trap is in the background.



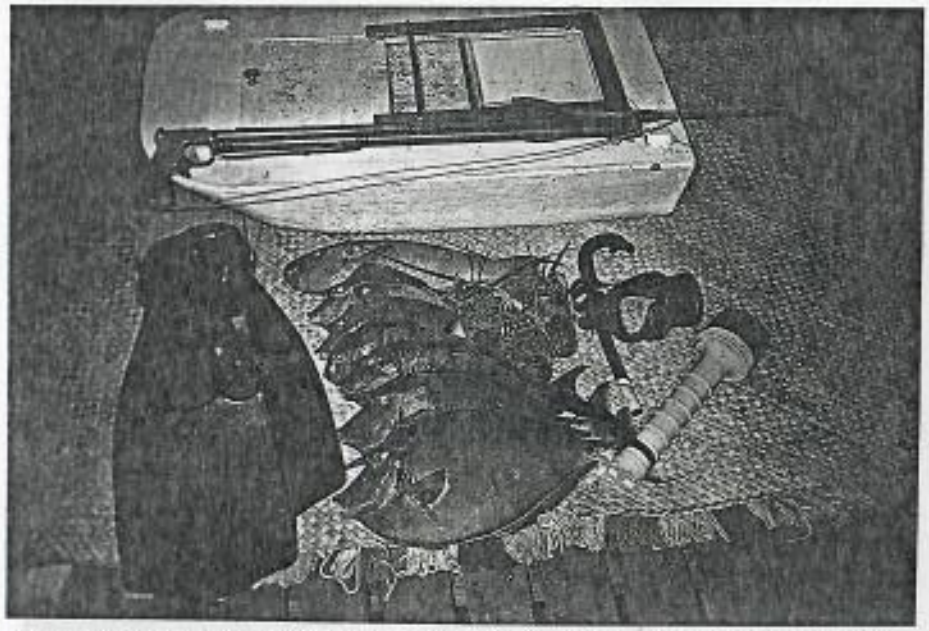
22. A view of the "bedroom" of the fish weir. Fish concentrated in this enclosure are likely to enter the trap.

23. Hook-and-line fishing for atulai at the Pasco.

24. Atulai fishing along the Agana Marina channel.

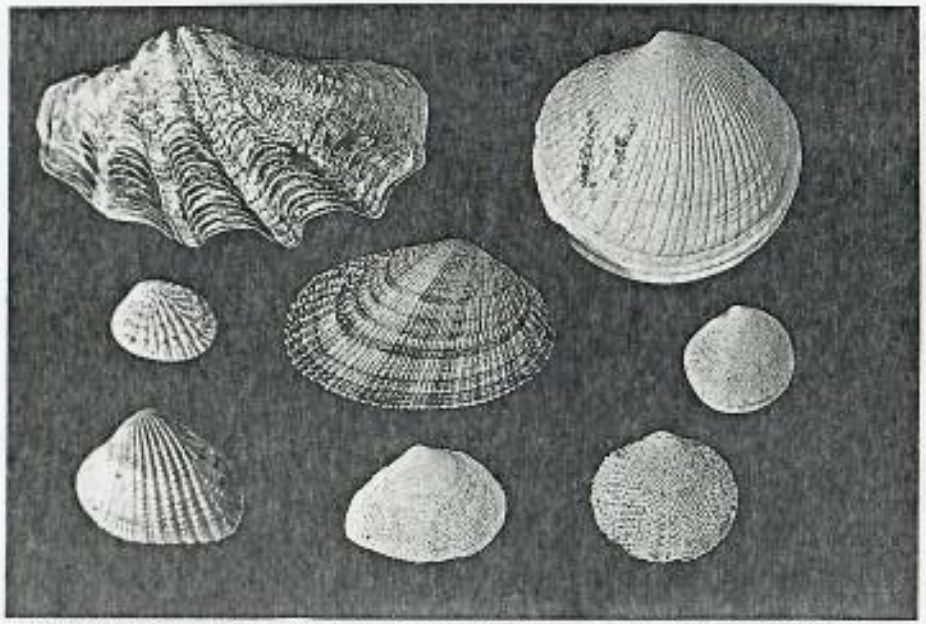


26. Four types of spear guns. From top, arbolet, daytime Palauan gun, nighttime Palauan gun, and pole spear.



27. Nighttime spearfishing gear and catch. "M-boat," at top, is used to hold the catch to prevent blood from attracting sharks. Catch consists of tataga (unicornfish), lagua (parrotfish), and lobster.

28. Gastropod molluscs (sea snails) harvested on Guam. Upper left: Tectus pyramis; upper right: Trochus niloticus; center left: Turbo setosus; lower left: Turbo argyrostomus, lower right: Vasum ceramicum.

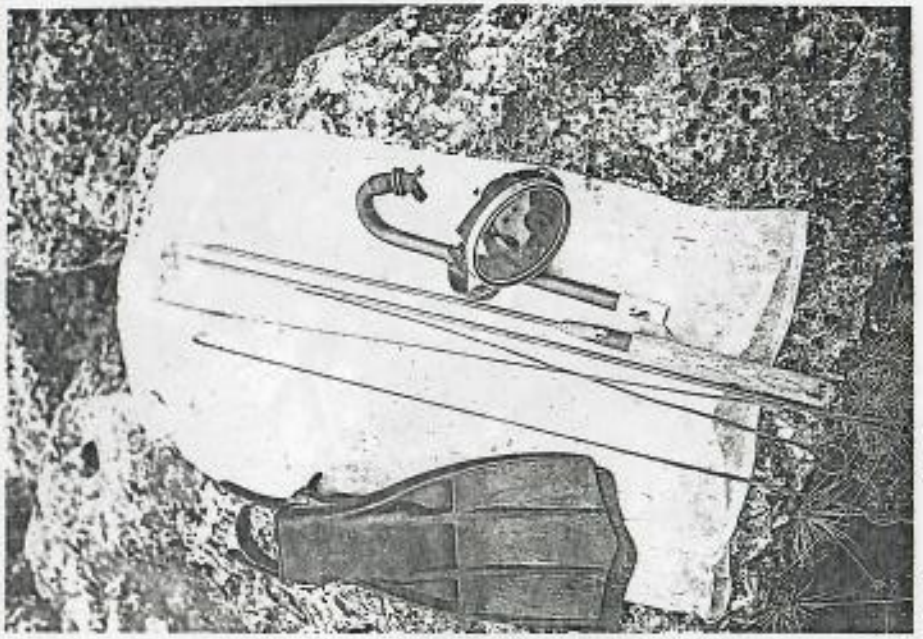


30. Bivalve molluscs harvested on Guam. Upper left: Tridacna maxima; upper right: Codakia punctata; center left: Gafrarium pectinatum; center middle: Asphus violascens; lower middle: Quidnipagus palatum; lower right: Scutarcopagia scobinata.

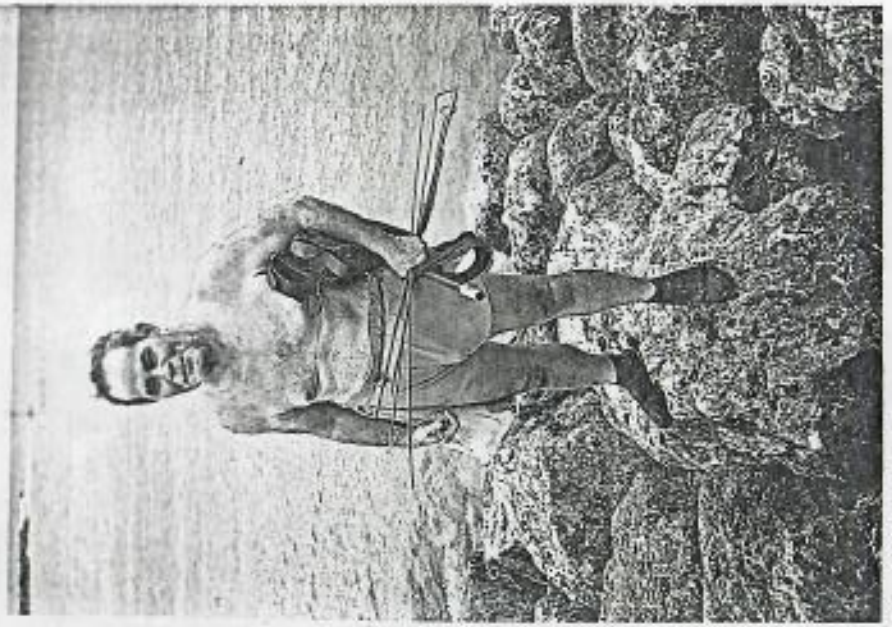
31. The giant clam Tridacna maxima on the reef.

32. The giant clam Tridacna squamosa on the reef.

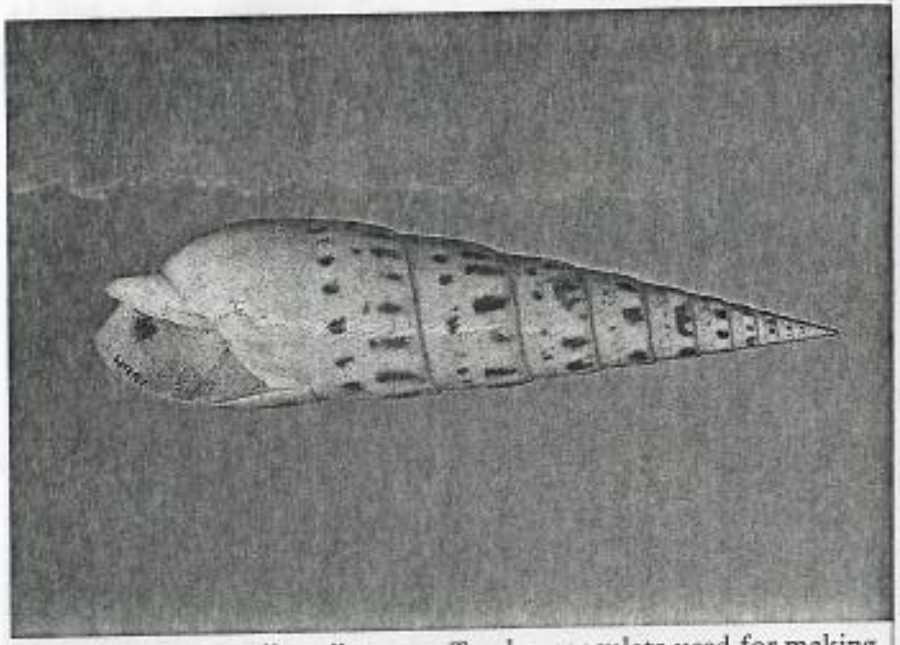
33. Octopus exhibiting courtship display.



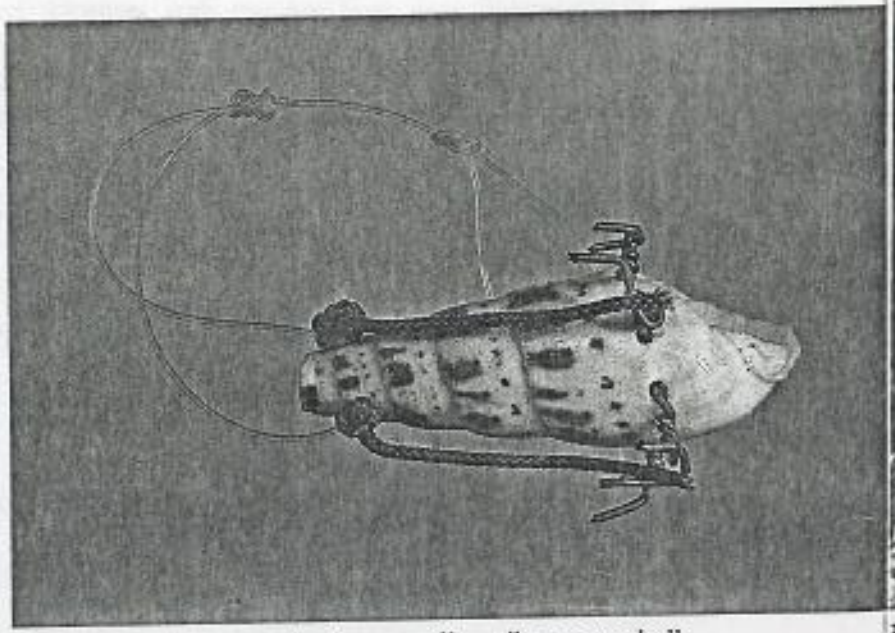
35. Octopus fishing gear.



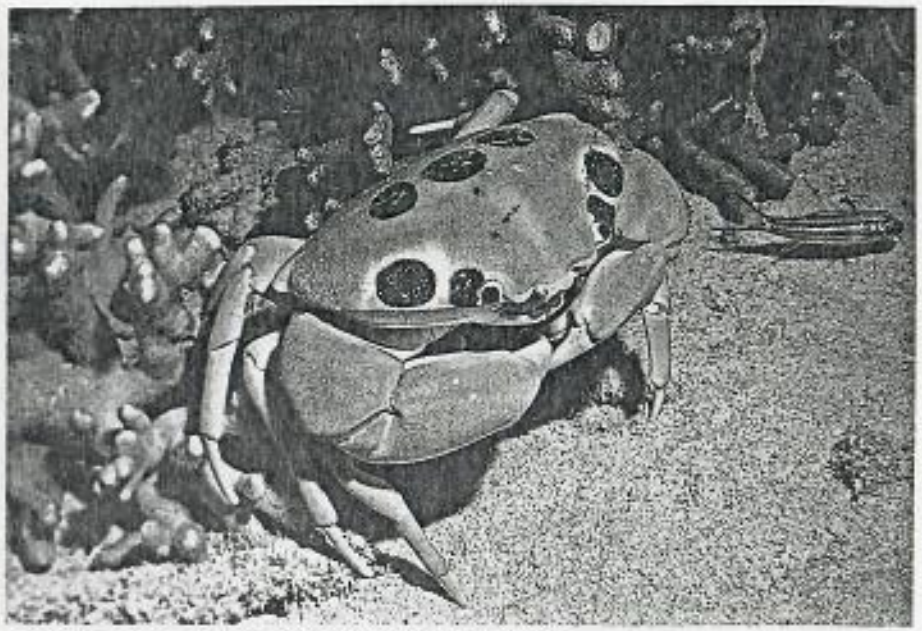
34. Octopus fisherman.



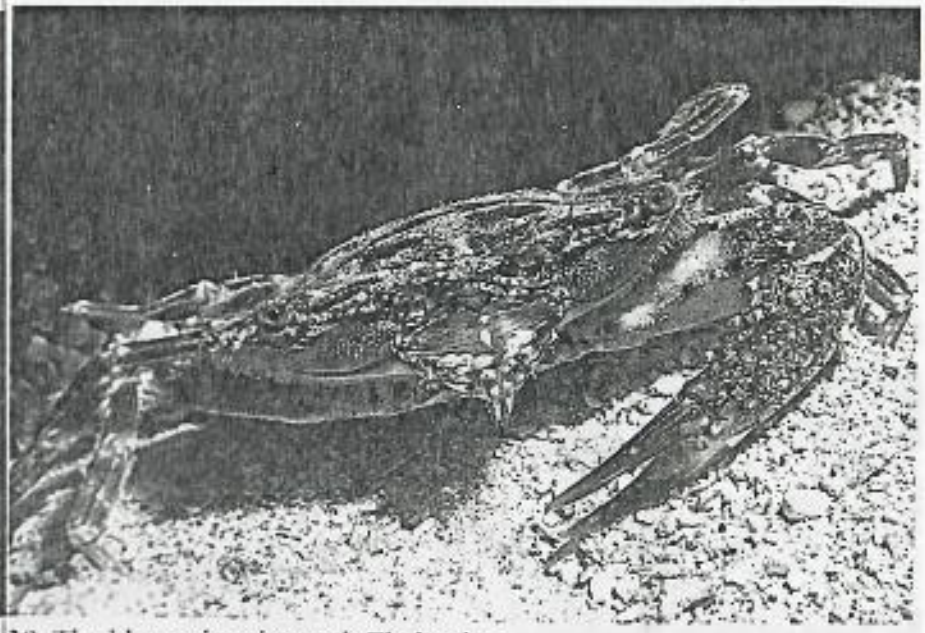
36. Shell of the marlin-spike auger Terebra maculata used for making cuttlefish lure.



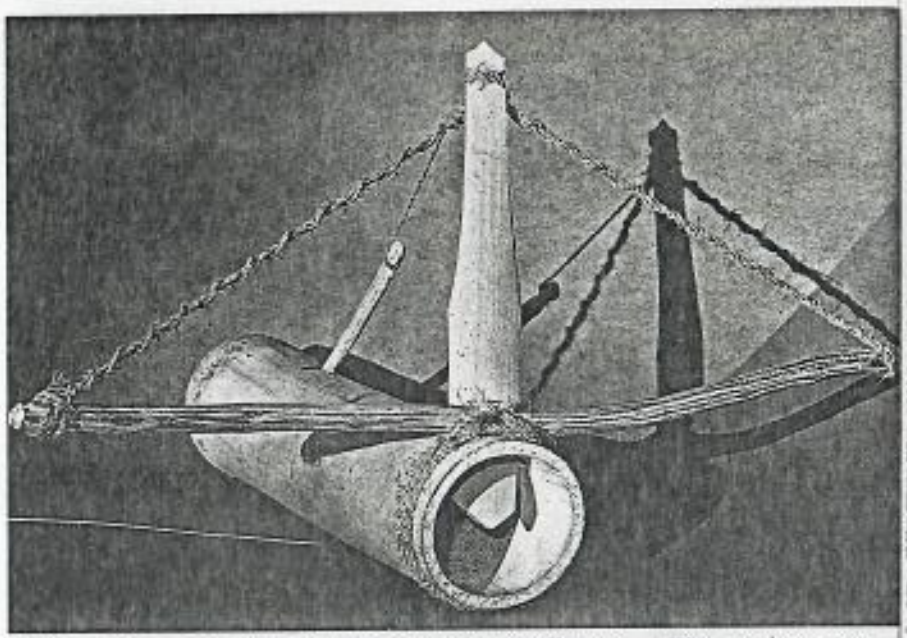
37. Cuttlefish lure made from marlin-spike auger shell.



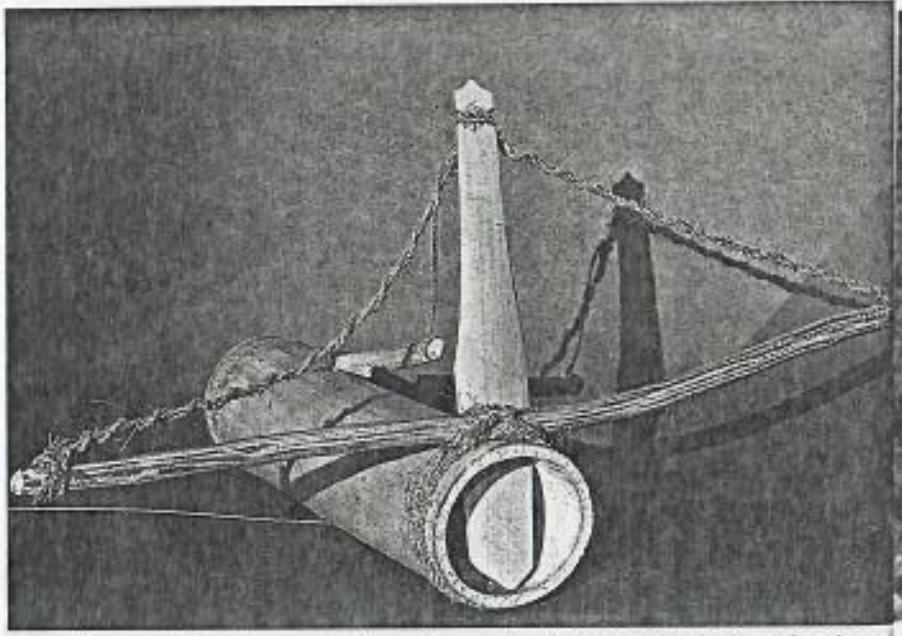
38. The seven-eleven crab Carpilius maculatus.



39. The blue swimming crab Thalamita.

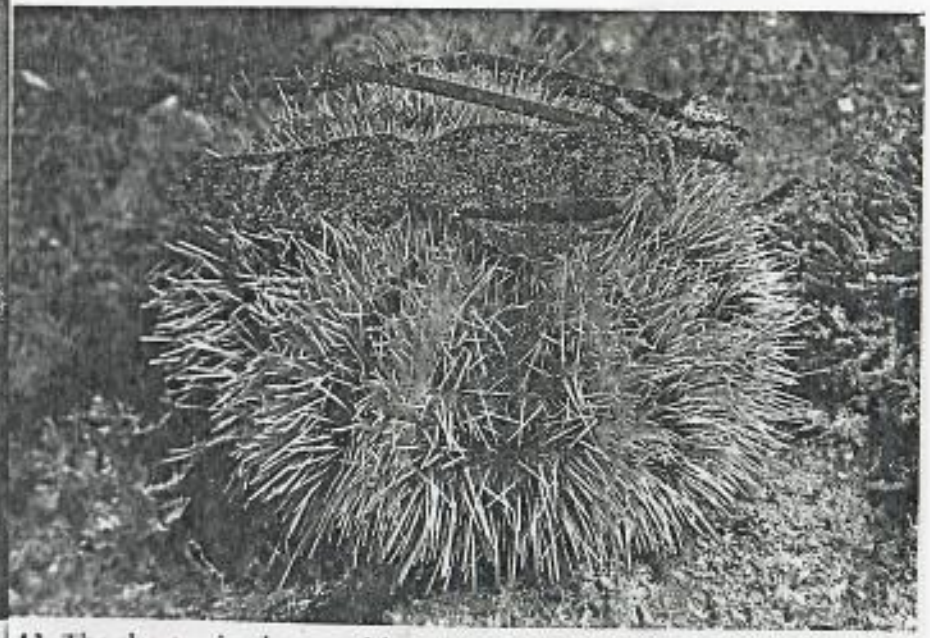


40. Bamboo trap for the land crab Cardisoma. The crab enters the mouth (foreground), attracted by bait at the rear of the trap.

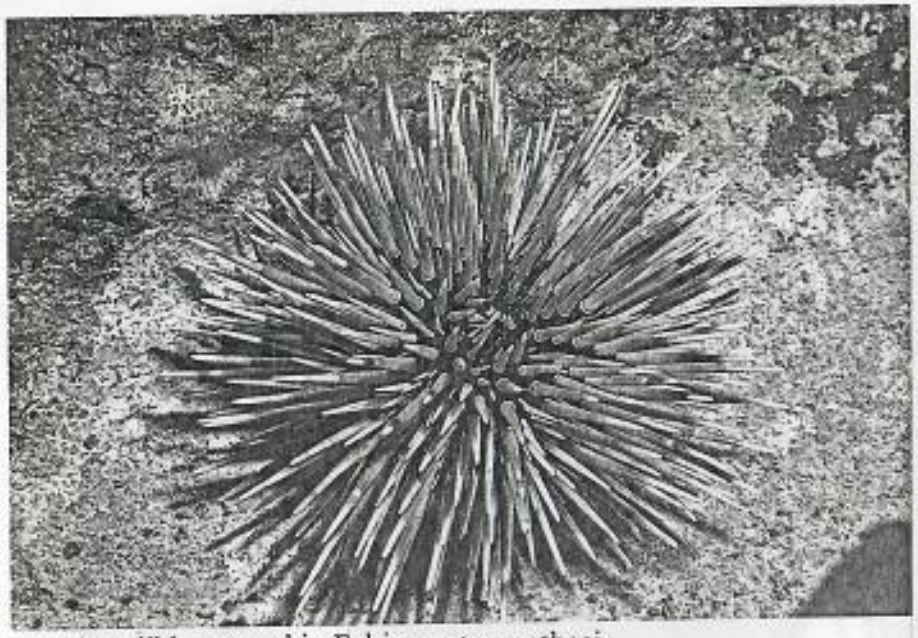


41. The trap is triggered when the crab disturbs the bait, releasing the trigger (background). When the trigger is released, the bow-like apparatus forces the stick across the mouth of the trap, preventing the escape of the crab.

42. The spiny lobster Panulirus penicillatus.



43. The short-spined sea urchin Tripneustes gratilla.



44. The edible sea urchin Echinometra mathaei.

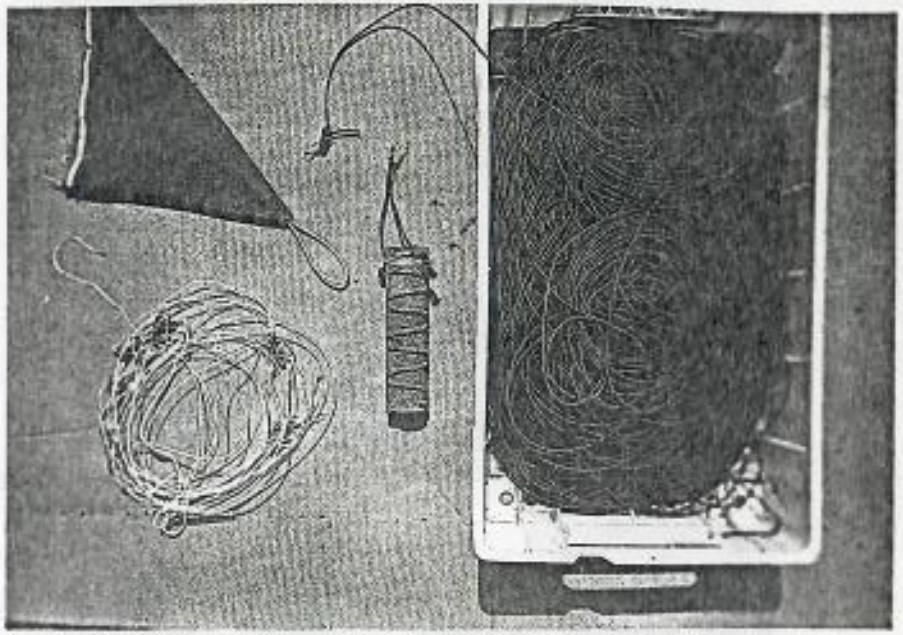
45. A cluster of the common balati or sea cucumber Holoturia atra.

46. Antonio B. Lujan constructing a freshwater shrimp trap.

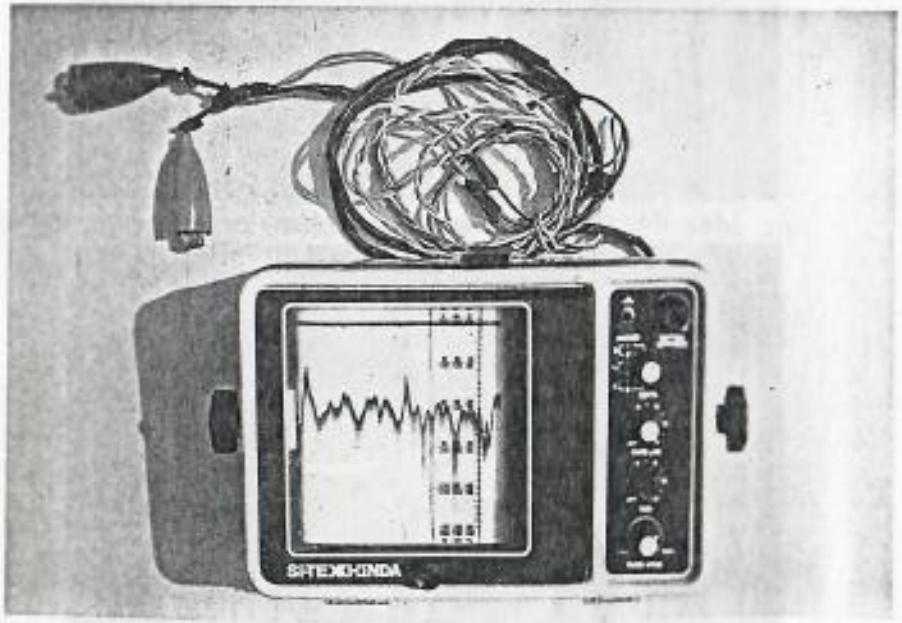
47. A shrimp trap under construction and two completed traps.

48. View of the mouth of the shrimp trap. The half coconut in the background

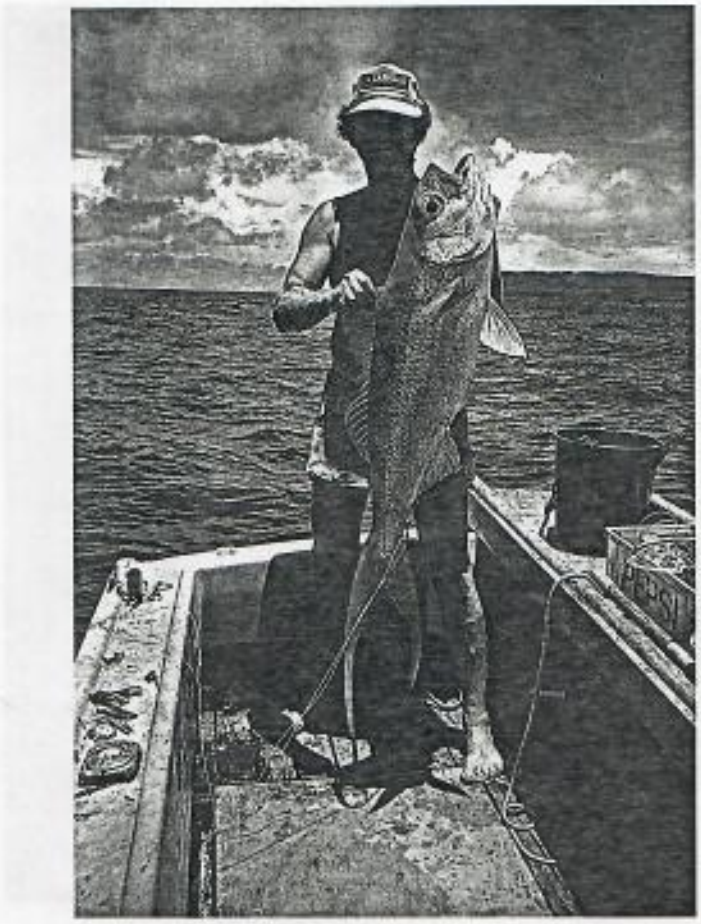
49. Large groupers are usually fished out rapidly after new bottomfishing grounds are found.



50. Bottomfishing gear. Upper left: chum bag, lower left: bottom rig; center: weight; right: mainline.



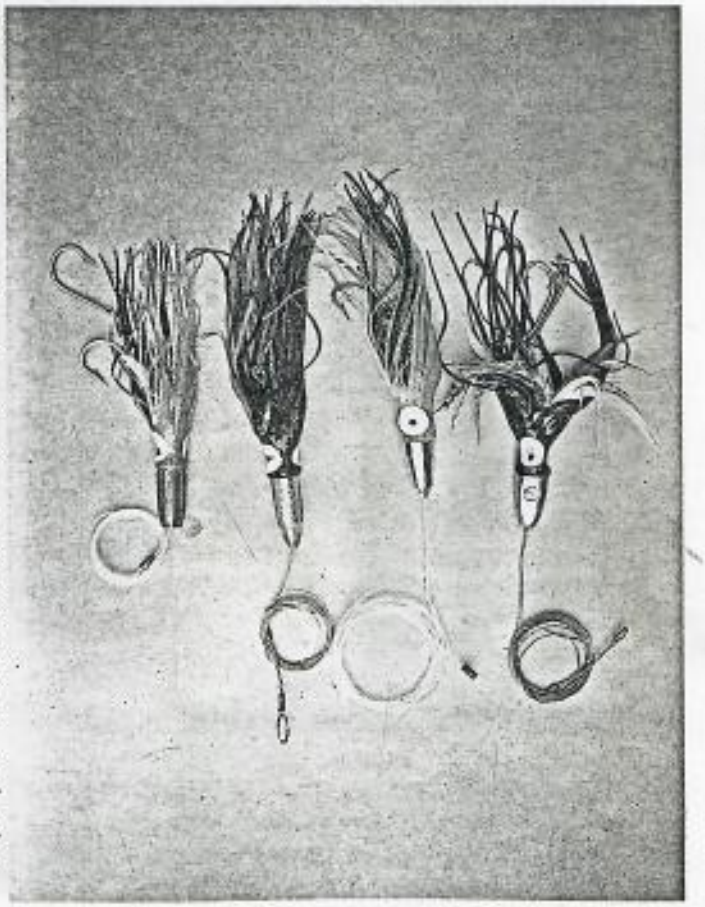
51. Fathometer used for finding proper bottom configuration and depth for bottomfishing.



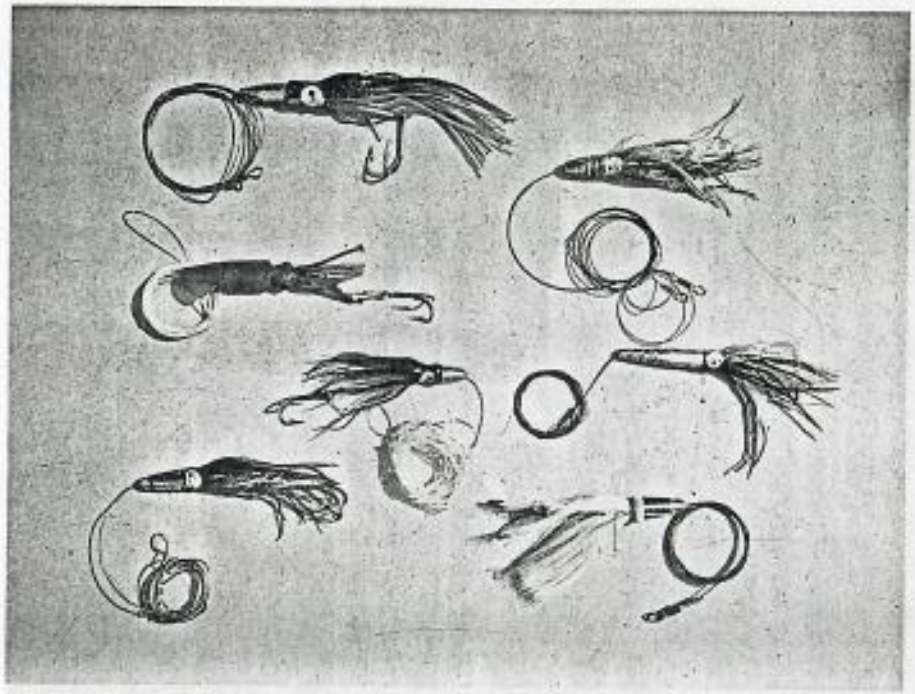
52. Onaga (Etelis coruscans), the queen of bottomfish.

53. Blue marlin caught by trolling.

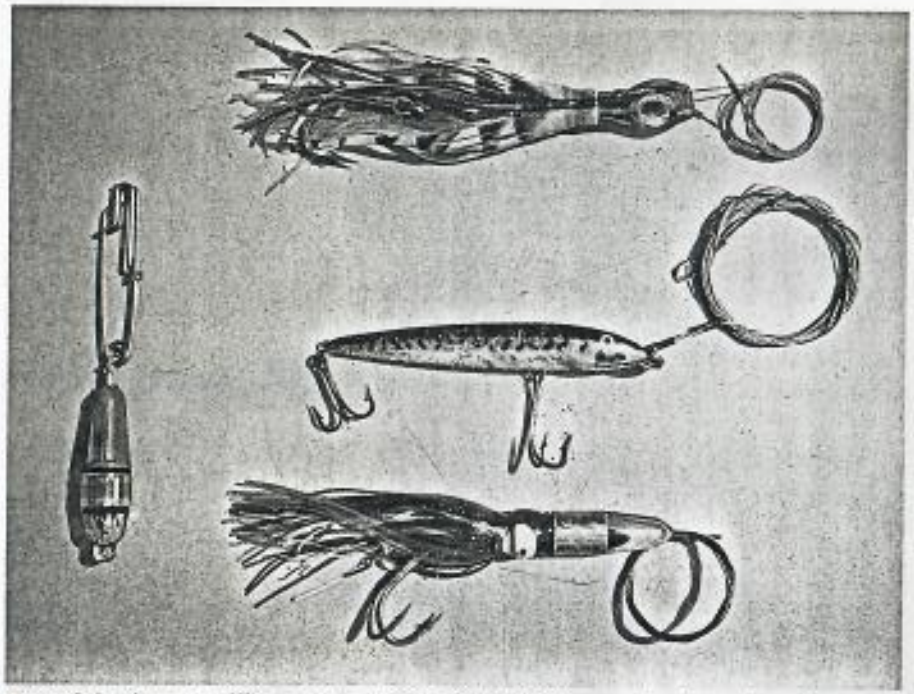
54. Trolling lures for larger pelagic species such as marlin and yellowfin tuna.



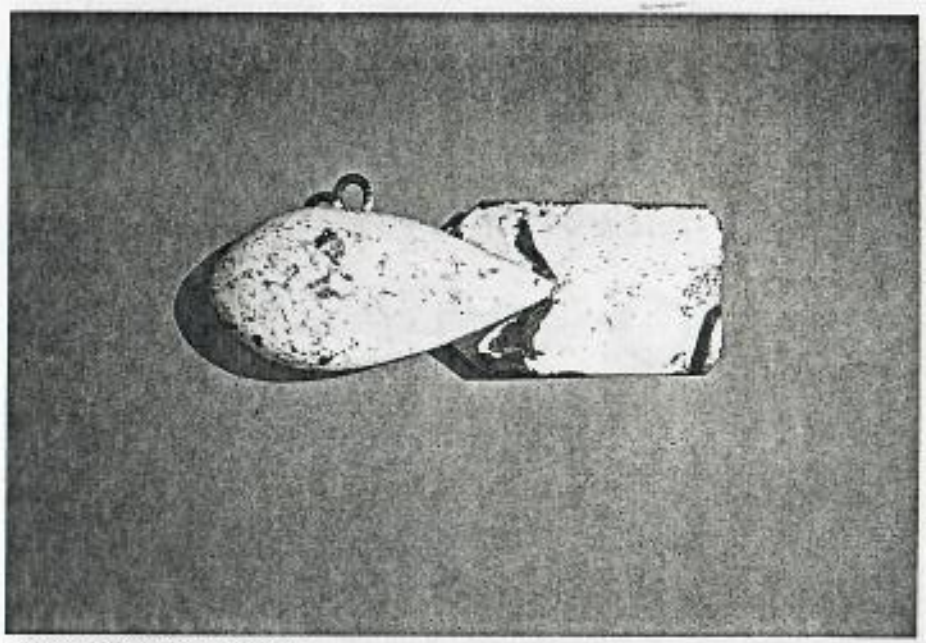
55. Trolling lures used primarily for mahimahi, wahoo, and other medium-sized pelagic fish.



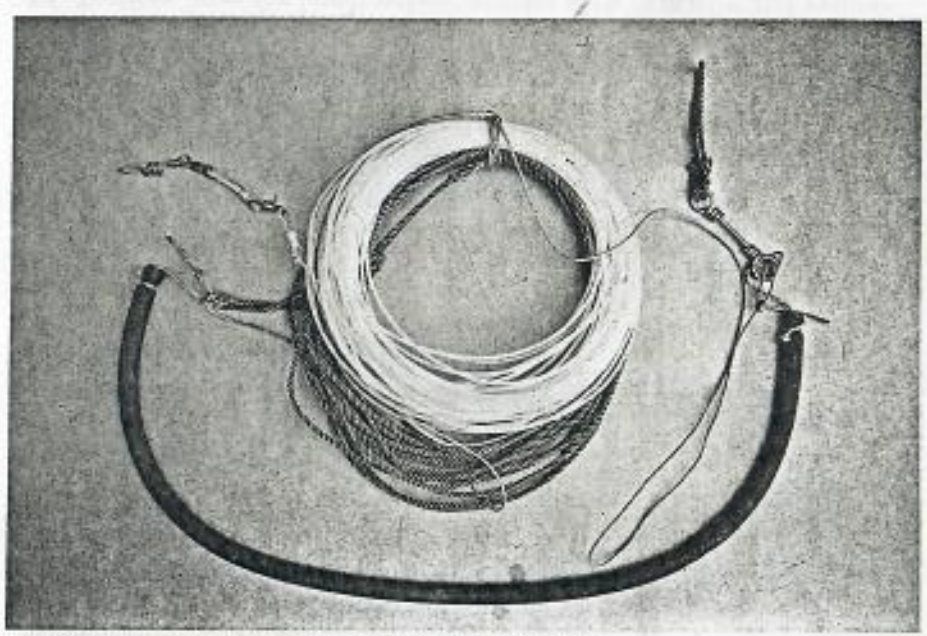
56. Trolling lures for skipjack tuna and small yellowfin tuna.



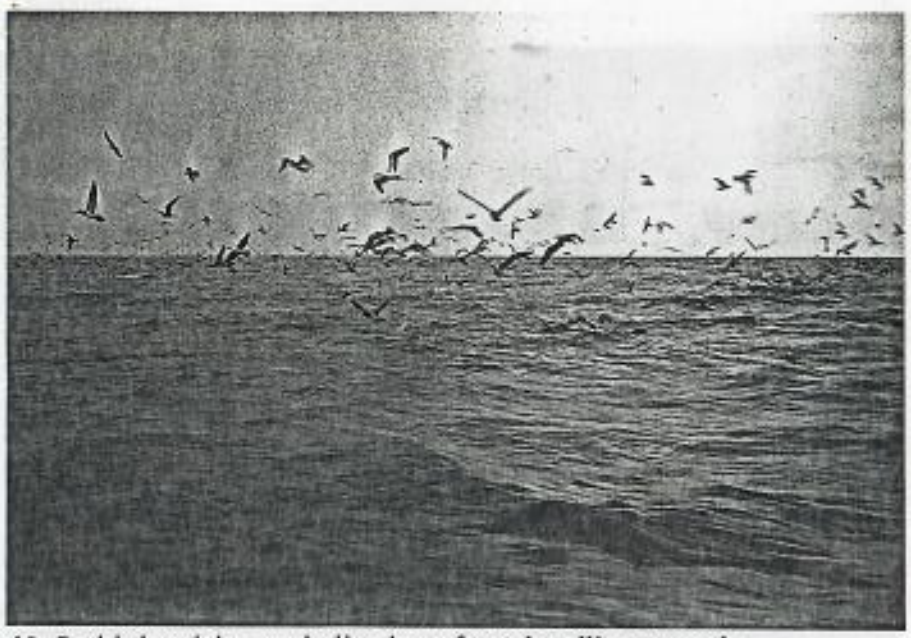
57. Nighttime trolling gear: Light (at left) is attached to line above the lure; repala (center) oscillates in the water because of spoon in front; other lures have luminous skirts.



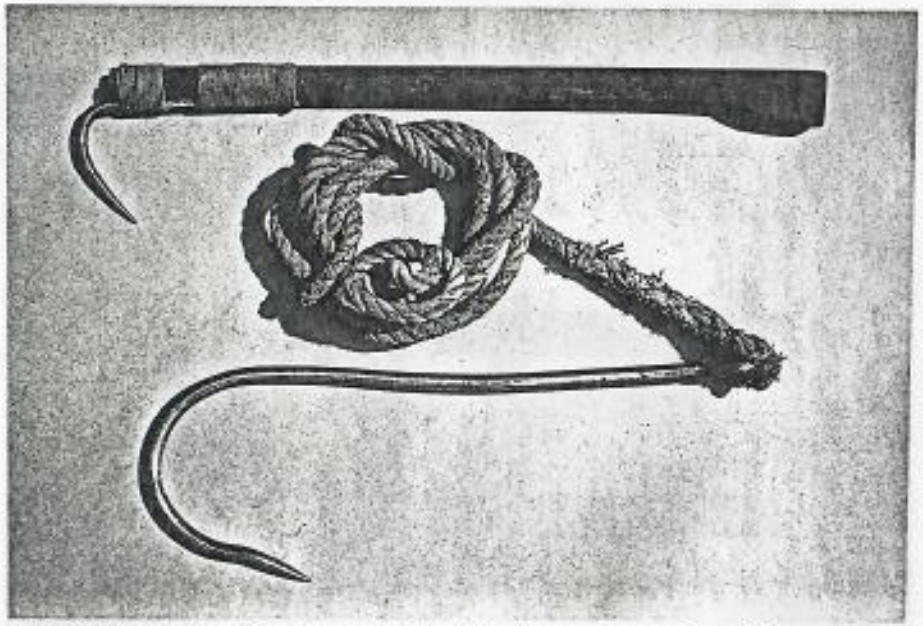
58. Trolling downrigger.



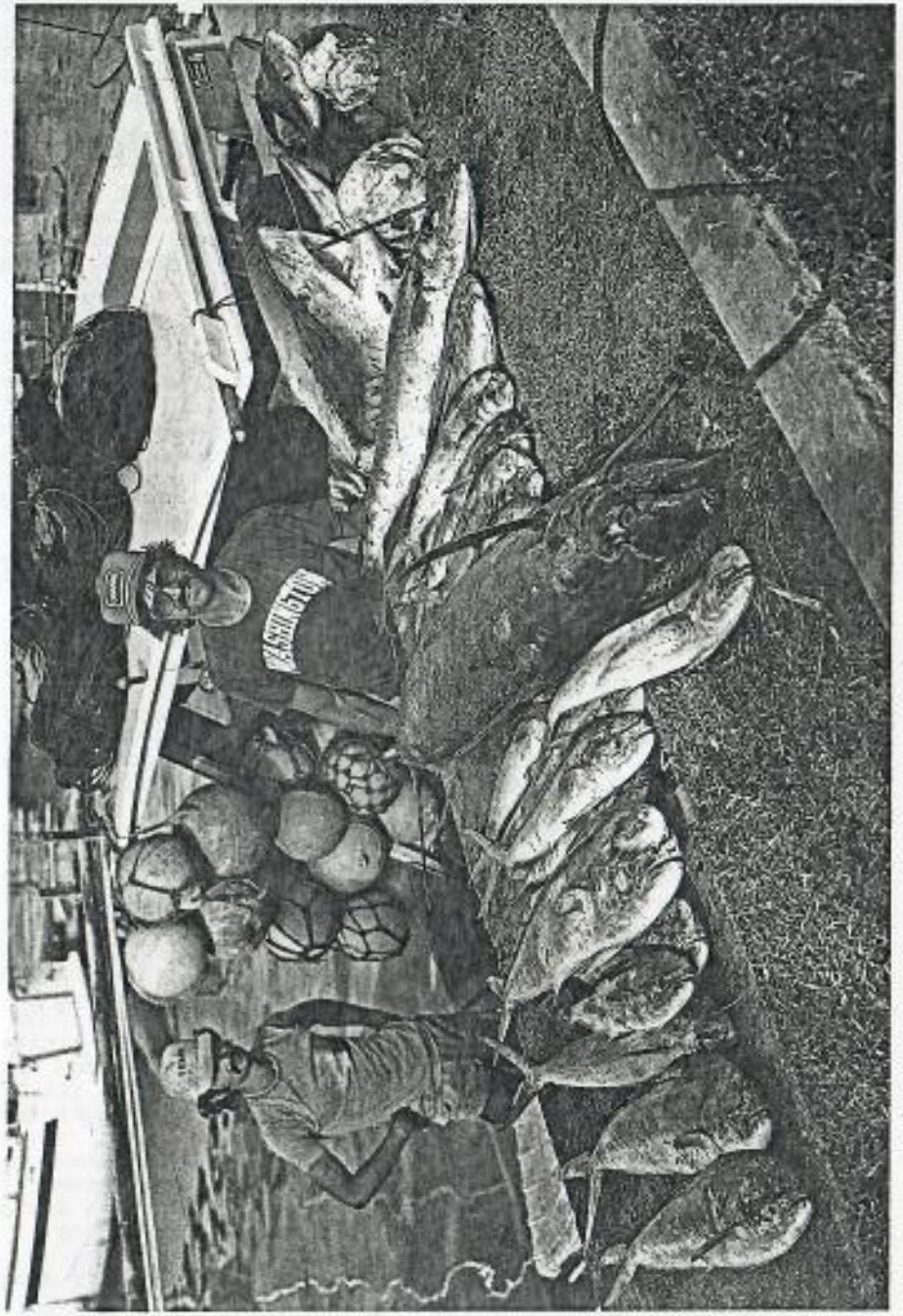
59. Trolling handline with elastic surgical tubing.



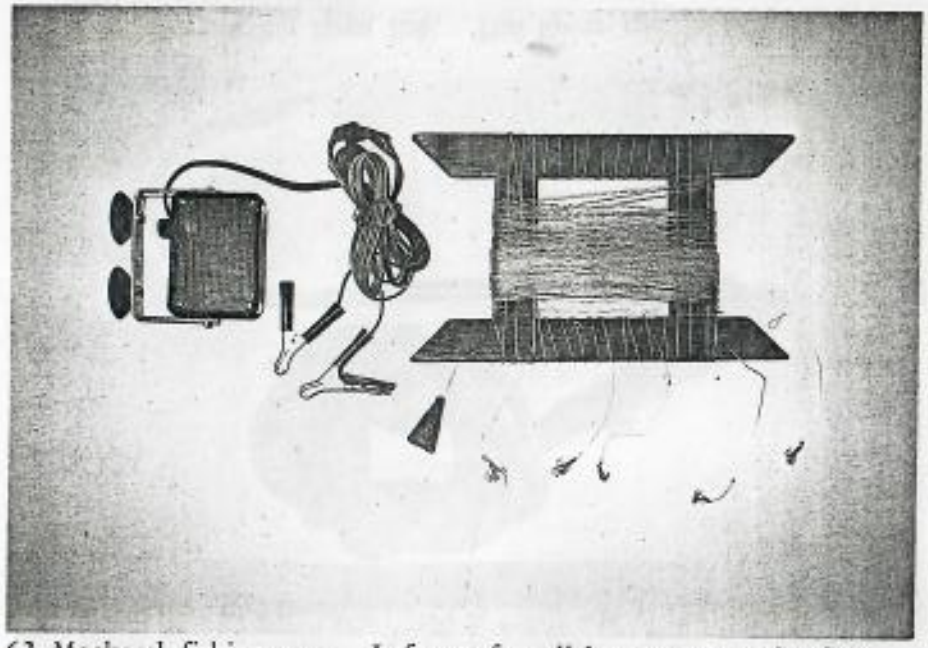
60. Seabird activity, an indication of good trolling grounds.



61. Gaffs for boating large fish. The lower one is a flying gaff used for boating marlin.



62. A good longline catch of mahimahi, marlin, barracuda, and shark.



63. Mackerel fishing gear. Left: surface light to attract the fish; right: mackerel rig - mainline, lures, and weight.

64. Fishing boats at the Agana Marina.

are active by day, and at night they bury themselves in the sand to sleep. Most species have very vivid sex lives involving sex changes and color changes during various stages of their lives.

Goatfishes (satmonete) are adapted for feeding on invertebrates buried in the sand. Species in this family have a pair of fleshy barbels under their lower jaw with which they probe the sand seeking prey items. The barbels are sensitive to taste. When a prey item is encountered and "tasted," the goatfish extracts it from the sand and eats it. There are several species of goatfishes on Guam and all are harvested. The young of goatfish (ti'ao) are also captured when they recruit to the reef in the spring.

The triggerfishes (pulonnon) have strong jaws and teeth adapted for crushing hard-shelled crustaceans and molluscs and capable of biting off pieces of coral as well. The largest triggerfishes (Balistoides viridescens and Pseudobalistes flavimarginatus) can exceed 1 1/2 feet in length. Several species lay their eggs in shallow depressions which they excavate in the sand. These eggs are aggressively protected by the parent fish while they are developing.

The fish groups described above are the most important invertebrate feeders in the reef fish catch. Other fishes feed on invertebrates and may be important to reef ecosystems, such as the butterflyfishes (Chaetodontidae), many of which eat coral polyps, but they are not major contributors to the fishery. In addition, many of the piscivorous (fish-eating) fishes discussed below also eat invertebrates.

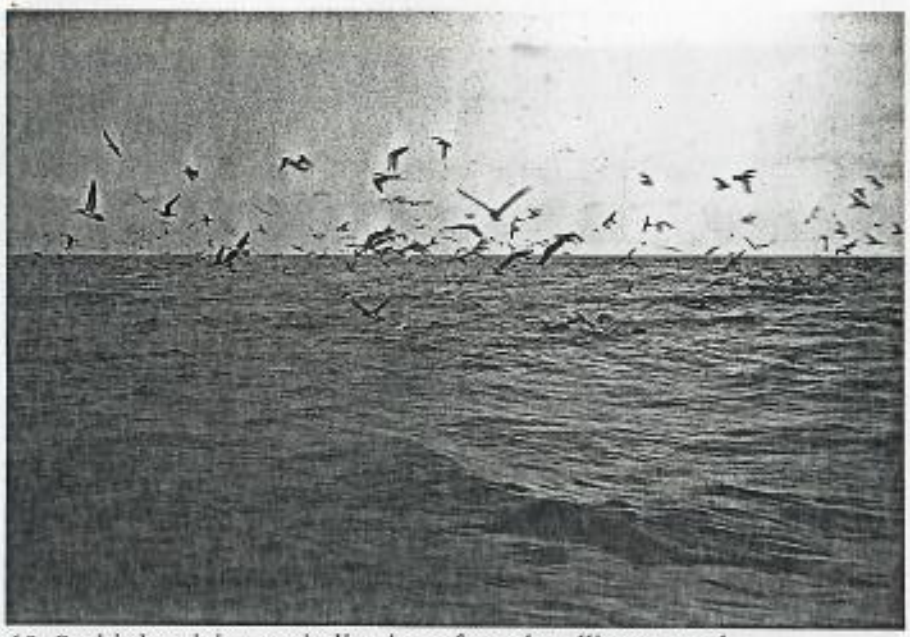
Piscivores

At the top of the coral reef food chain are the piscivores which feed on the various fish types described above. A few piscivorous families contain small fishes (the lizardfishes Synodontidae and the sandperches Mugiloididae, for example), but most piscivores are relatively large and are highly valued by fishermen. The most important piscivorous fish families in the Guam reef fish catch are the groupers (Serranidae), jacks (Carangidae), snappers (Lutjanidae), needlefishes (Belonidae), and barracudas (Sphyraenidae).

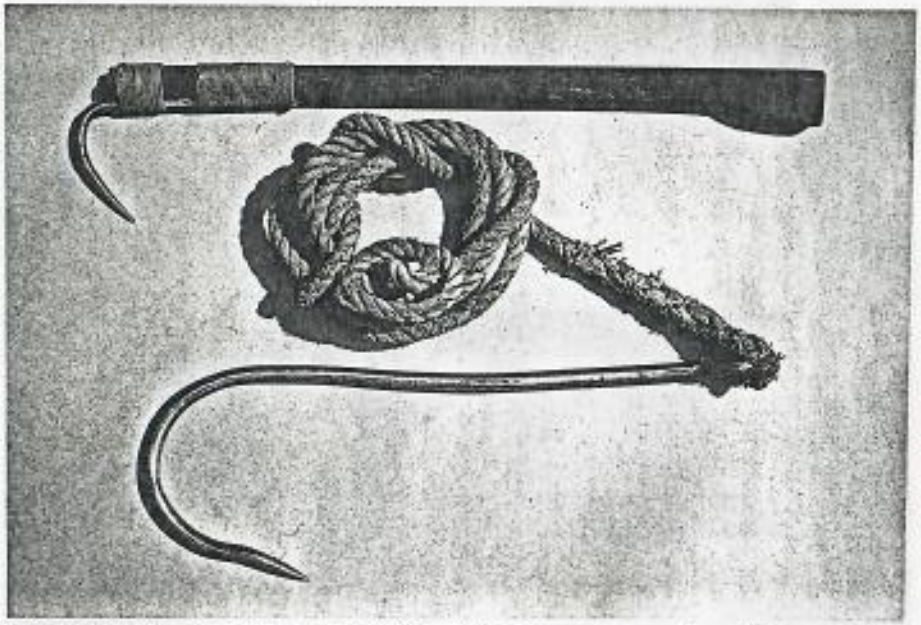
There are some 40 or more species of grouper (gadao) on Guam. Several of these are small and of little importance to the fishery. Some species can reach sizes of 350 pounds, but these are rare on Guam. Groupers typically have mottled color patterns that camouflage them on the reef and large mouths. They are solitary, ambushing predators, not usually seen in groups unless engaged in spawning activities.

Snappers tend to be more active than groupers, and several species, such as kaka'ka' (Lutjanus fulvus) and sa'as (L. kasmira), form schools or aggregations. Large red snappers (tagafi, L. bohar) often have ciguatera fish poisoning and should not be eaten.

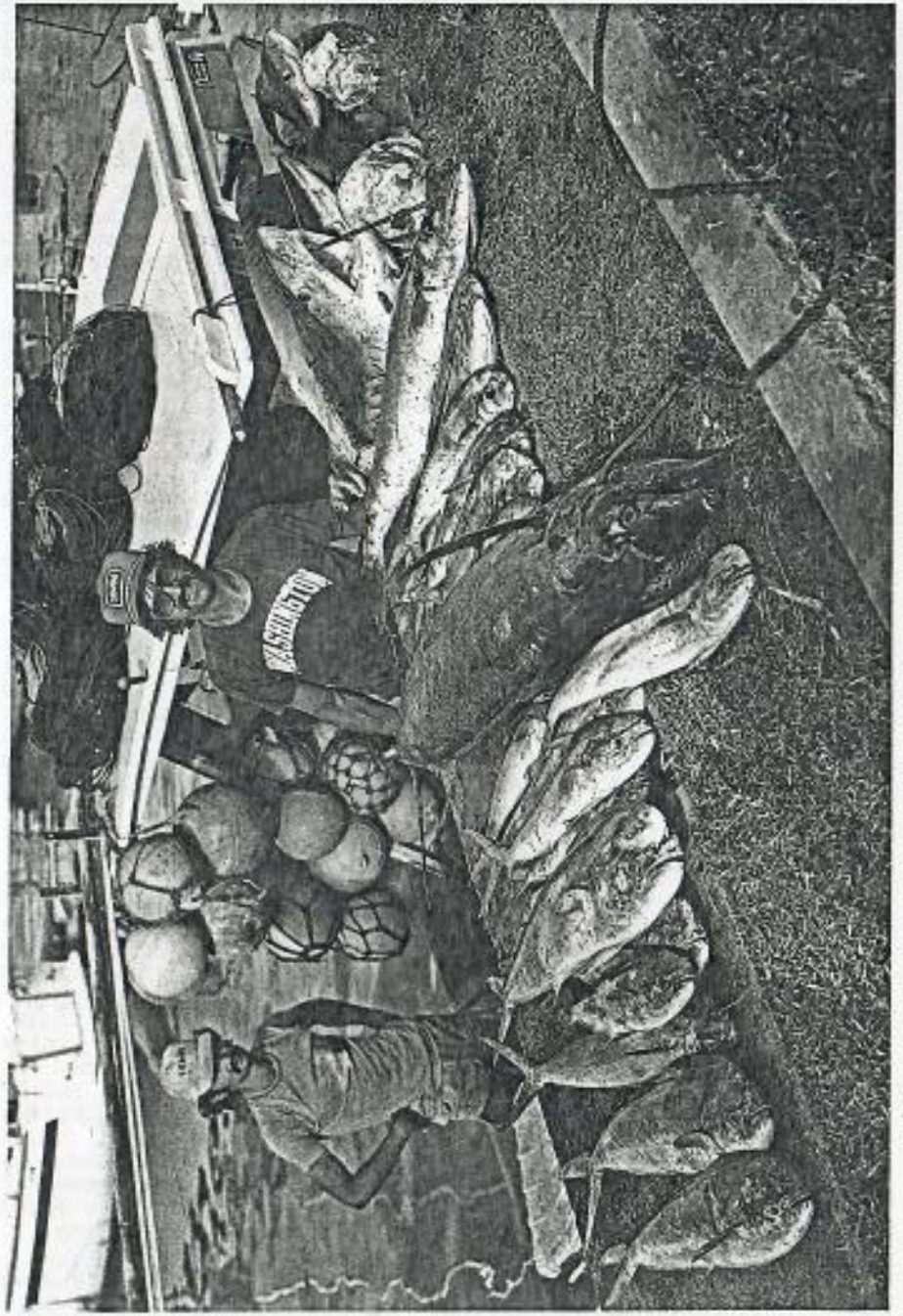
Jacks (tarakitu) are predators adapted for pursuit of prey. They swim, often in groups, over the reef and feed on fishes as well as invertebrates. Most commonly, adult jacks are found in waters just beyond the reef margin, while the



60. Seabird activity, an indication of good trolling grounds.



61. Gaffs for boating large fish. The lower one is a flying gaff used for boating marlin.



62. A good longline catch of mahimahi, marlin, barracuda, and shark.

young (i'e') enter inshore waters in runs during the months of May to December. Caranx melampygus is the most common reef-dwelling jack on Guam, but several other species of the genus Caranx, Carangoides, and Gnathanodon also occur here. Other members of the jack family are caught by trolling (rainbow runner), nighttime jigging (atulai), and deep bottom fishing (black jack). Their habits are described elsewhere in this book.

Needlefishes (pulos) are surface-dwelling predators occurring in water above the reef and in bays and channels. Their long jaws are equipped with many sharp teeth, and they feed on small fishes of the surfaces water.

Large barracudas (alu, Sphyraena barracuda) occur in offshore waters and are taken by trolling, but several smaller species occur on the reef, often in schools.

There are several other groups of piscivores that play an important role in the reef ecosystem, but which are not especially numerous in the fish catch. Among these are the moray eels (tituge'), trumpetfish and cornetfishes (ba'yak), scorpionfishes (nufo'), and sharks (alu'u).

Seasonal Fish

By comparison with temperate areas of the earth, the tropics have a reputation for year-round uniformity and stability. Although this may generally be true, among tropical marine fish communites there are some significant exceptions. The seasonal variations in abundance of pelagic trolling fish (mahimahi, blue marlin, etc.) are well known and are discussed elsewhere in this book. Even among nearshore and reef fishes, however, there are some species with strong seasonal fluctations in availability, primarily related to their patterns of juvenile recruitment. Several of these seasonal fishes are targeted by specific fisheries on Guam. Among these are manahak (juvenile rabbitfishes), i'e' (juvenile jacks), ti'ao (juvenile goatfishes), and atulai (bigeye scad).

During the early life history of rabbitfish, their larvae are in nearshore waters beyond the reef. In this habitat, the larval rabbitfish feed on zooplankton. As the time approaches for the young rabbitfish to move into the reef habitat, the larvae come together in dense aggregations or "balls" which are occasionally observed offshore by fishermen. At this time, juvenile rabbitfish may be found in the stomachs of predaceous offshore fish.

These aggregations of manahak first move onto the reef during the high tide on the days of the last quarter moon phase at the end of April or beginning of May. Both species, Siganus spinus (manahak ha'tang) and S. argenteus (manahak lesso'), enter reef habitats at this time, sometimes together or sometimes separately in different reef areas. Manahak lesso' tend to be more abundant on the east side of Guam and manahak ha'tang on the west. A second run usually occurs a month after the first on the next last quarter moon. Sometimes a third run occurs later in the year during November, again on the last quarter moon.

The manahak harvest lasts for only the first few days that the fish are on the reef. After that, the manahak undergo a major change in their digestive systems, shifting from a diet of zooplankton to one of reef algae (especially the green filamentous alga Enteromorpha). Once the fish have begun to feed on algae, their flavor changes and they are no longer sought for food. The herbivorous juvenile stage of rabbitfish is called dagge'. Later, as the rabbitfish grow into adults they are again harvested by reef fishermen.

I'e' are the young of Caranx melampygus and other similar jacks. They recruit to inshore areas, particularly to the Agana Marina and Apra Harbor, where they are caught by hook and line and with throw nets. The recruitment runs are not as predictable as those of manahak but occur throughout the latter part of the year from May to December. I'e' feed on zooplankton, and as they grow and mature there is a general shift to larger invertebrate and fish prey. These jacks are harvested throughout their lives.

The young of several species of goatfish contribute to the seasonal ti'ao harvest during the spring (March and April). During November, another type of ti'ao (ti'ao santamaria) becomes abundant. Ti'ao are harvested in shallow inshore areas with throw nets.

Mackerel or bigeye scad are caught by several fishing methods around Guam. Larger adults (called haiteng) are caught in nearshore waters beyond the reef year-round by nighttime jigging. During the months of August to November (and in some years beginning several months earlier) there is a major seasonal run of the young (called atulai) which enter into bays and harbors and onto the reef. In these inshore areas, the atulai are caught with throw nets, gill nets, and hook and line.

The mackerel (Selar crumenopthalmus) is a member of the jack family Carangidae. It is a medium sized (up to 10 inches long), slender, silvery fish with large eyes. On the hind margin of the gill cavity is a deep groove which can be seen by lifting up the gill cover or operculum. Haiteng (adults) feed on zooplankton in offshore waters; inshore atulai (juveniles) eat a variety of benthic and swimming invertebrates.

The life span of the mackerel is relatively short. Spawning occurs in groups in waters beyond the reef. By age four months the juveniles begin to enter inshore waters in the seasonal run. Sexual maturity is reached within a year, and within two years the fish grow to a length of 12 inches. Few survive much beyond two years of age.

Ciguatera Fish Poisoning

Some reef fishes, such as puffers, are naturally toxic with a poison which they produce themselves. This toxicity helps to protect these fish against predators. Other fish can become poisonous as a result of the food they eat. There are several types of diet-related fish toxins but the most common type is called ciguatera. The source of the ciguatera poison (called ciguatoxin) is a microscopic marine alga known as Gambierdiscus toxicus. This alga lives on the surfaces of

rocks and seaweeds in shallow reef areas. It is not known whether the ciguatoxin produced by Gambierdiscus actually aids the alga in some way, but nonetheless it does produce it, and when these tiny algae are eaten by a fish, the toxin becomes stored in the fish's body. The fish most frequently implicated as the primary consumer of Gambierdiscus is the comb-toothed surgeonfish Ctenochaetus striatus which feeds by scraping surfaces of seaweeds and rocks on the reef to obtain the various small algae that adhere to these surface. If these surgeonfish ingest and store sufficient amounts of the ciguatoxin, they can become poisonous for humans to eat. More commonly, however, these surgeonfish are eaten by piscivorous reef fishes (snappers, groupers, etc.), and the toxin contained in the surgeonfish now becomes stored in the flesh and viscera of the predator. Because these piscivorous fishes eat many toxic surgeonfish during their lives, they can accumulate high concentrations of ciguatoxin, with the concentration being highest in large, old piscivores. People who eat these fish can, in turn, take up the toxin and be poisoned by it. The effects of eating this poison can range from mild symptoms (a "tingling" of the lips and tongue) to more serious one (nervous and muscular collapse and even death). Although there are several reported cases of ciguatera poisoning annually on Guam, there have been no reported deaths from this cause here. In other places in the Pacific and Caribbean, however, deaths have occurred.

As yet there is no known antidote to ciguatera poisoning and medical treatment can only attempt to alleviate the symptoms. There is also no readily available, rapid way to tell whether a fish has ciguatoxin or not, although current research in Hawaii is on the verge of developing a quick indicator technique.

In the meantime, it is best to avoid eating large, reef predators, especially red snappers (tagafi) and moray eels (tituge'). Fish viscera (liver, gills, gonads, and gut) tend to accumulate higher concentrations of toxin than fish flesh, and should be avoided when eating predaceous reef fish. Unfortunately, humans also store this toxin in their tissues, and over a long time of eating reef fish with small amounts of ciguatoxin, concentrations can eventually build up to harmful levels.

Because this toxin is produced by a reef-dwelling alga and is transmitted through the food chain, fishes which do not feed on Gambierdiscus or on Ctenochaetus are unlikely to be toxic. Thus, reef planktivores and invertebrate eaters are generally safe to eat, as are offshore pelagic fish and deepwater bottomfish.

REEF INVERTEBRATE HARVESTING

(By Barry D. Smith)

One of the most widely practiced fisheries in the Pacific is subsistence fishing for coral reef shellfish. Despite the common name "shellfish," these organisms are not fishes and not all of them possess shells. They are more accurately described as invertebrates because they do not have backbones.

Invertebrates have played an important role in subsistence since the earliest occupation of the islands. Archaeological examinations of precontact village sites on Guam have yielded large numbers of invertebrate remains. Besides being an important protein resource for inhabitants of islands lacking domesticated livestock, invertebrates provided raw materials for the manufacture of food scrapers, fishing hooks, ornaments, and tools such as chisels, adzes, and drills.

Although their value as tool-making materials has diminished with the introduction of iron, invertebrates are still important in subsistence fishing on Guam for the variety they provide in the diet of the island household. The types of invertebrates still harvested for consumption today are grouped into three categories: molluscs, crustaceans, and echinoderms.

Molluscs

Molluscs comprise a group of soft-bodied invertebrates which usually possess a hard, external shell for protective armor. Snails, clams, mussels, and chitons are among the edible, shelled molluscs. Squids and octopuses, however, are molluscs which possess no external shell, but which rely upon their swimming ability to escape danger.

With few exceptions, shelled molluscs in subsistence fisheries are gathered for human consumption. Little or no equipment is necessary for their harvest. Following a centuries-old practice, fishermen walking the reef flat at low tide glean these invertebrates from beneath reef rocks, in sand, and in seagrass meadows. Gloves may be worn to protect the hands from abrasions when turning over rocks. In some instances, a sturdy stick or small steel bar may be used to move larger rocks.

Chitons are frequently exposed on the sides of rocks along the shore at low tide. A quick flick of a knife or screwdriver is necessary to collect these molluscs. Once disturbed by an unsuccessful attempt to remove them, chitons cling to the rock with such force that they will be mutilated before they are pried free. Preparation of chitons for the table is an involved process, requiring hours of soaking and boiling before final incorporation into a meal.

The reef snails called alileng are highly prized food items. This term actually applies to two species of turban shells and to the topshell or trochus (PLATE 28 and 29). The topshell was introduced on Guam in the early 1950's in hopes of establishing a commercial fishery which would allow Guam fishermen to participate in the valuable mother-of-pearl trade. One reason for the popularity of alileng is that these snails can be roasted in their shells over an open fire and eaten with no further preparation. However, roasting destroys the strength of the mother-of-pearl and therefore any value associated with the shell.

Conchs and nerites are other groups of popular food snails. Conchs, commonly called do'gas on Guam, are collected in sandy areas of reef flats and near channels at low tides. Nerites, or pedes, are found in the intertidal zone of rocky shores. Both types are cooked by boiling and then eaten with coconut milk.

An assortment of clams and mussels is gathered in the extensive seagrass meadows near Merizo and Agat (PLATE 30 to 32). Harvest of these bivalves is usually performed by the elderly and the children of the village during extreme low tides occurring during daylight hours from May through August. No digging implements are employed; the bivalves are removed as the sand is sifted through the fingers. This method is effective to a depth of about three inches, and it is environmentally sound because the roots of the seagrasses are not damaged as they would be by an implement such as a shovel. A list of shelled molluscs collected for home consumption is presented in Table 1.

Only one type of shell is still known to be collected as raw material for making fishing lures. The marlin-spike auger Terebra maculata is used by a small number of fishermen to make cuttlefish lures (discussed below).

Of the unshelled molluscs, octopuses are the most sought after in the subsistence fishery. The octopus resides in a hole in the reef except when it is foraging for food (PLATE 33). For protection, the octopus camouflages the entrance to its hole with coral and shell debris, making it difficult to detect to the inexperienced eye.

Octopuses may be harvested with four-pronged spears or with homemade octopus hooks (PLATES 34 and 35). The octopus hook is a small steel rod about 3/16 inch in diameter and 3 feet long. One end is sharpened to a point and bent to from a 2-inch hook.

The hook can be inserted behind the octopus and pulled to impale it. After pulling it forcefully from its hole, the fisherman kills the octopus either by everting its body through the gill opening or by biting its head to crush its brain.

Squids and cuttlefishes make up only an incidental part of the catch. They are usually taken by spearfishermen snorkeling beyond the reef. However, a few fishermen manufacture a lure incorporating a small marlin-spike auger Terebra maculata for catching cuttlefish (PLATES 36 to 37). The spire of the auger shell is broken, and a hole is drilled through it about 1/4 inch from the end. A series of ten holes, grouped in pairs, is drilled around the midline of the body whorl of the shell. Short lengths of galvanized wire are inserted through the holes, and adjacent ends are twisted to tighten them firmly in the holes. The ends of the wire are then bent towards the spire of the shell, forming hooks.

A piece of line is passed through the spire hole and knotted on each side of the shell. The ends of the line are streamed backwards and cut just below the level of the hooks. A monofilament leader about 6 inches long completes the lure.

This lure is used with rod and reel to catch cuttlefish schooling in Apra Harbor. The lure is reeled in rapidly, creating a vertically undulating action. Cuttlefish attacking the lure are impaled on the hooks.

Fishermen using this lure report that if a cuttlefish successfully escapes after taking the lure, there will be no further catches. One explanation for this behavior is that there is a feeding hierarchy, or peck order, among members of the school. When a member escapes the lure, he will no longer attack it, and the remaining members can not feed upon it in his presence.

Crustaceans

The crustaceans are primarily aquatic invertebrates characterized by having a hard, external skeleton covering a jointed body and jointed legs. Edible members of this group include crabs, lobsters, and shrimps.

Nine species of crabs are known to be harvested from land, seashore, and reef. The seven-eleven crab Carpilius maculatus (panglao oru) (PLATE 38) and the crab Etisus splendens are captured at night along the reef margin and reef front. These crabs are taken by spear or by hand.

Several species of crabs comprise part of the incidental catch of net fishermen. The box crabs Calappa calappa and Calappa hepatica frequently become entangled in monofilament gill nets and are taken for household consumption.

Traps are set to catch other species of crabs. The blue swimming crab Thalamita (PLATE 39) is caught by means of baited lift nets set in silty areas of the reef, usually near rivers. The lift net is constructed of a galvanized wire ring and net. When baited and set, the bridle is held above the trap by a small float. To increase the efficiency of the trap, fishermen cover the bait, usually a fish head, with wire screen and tie it to the center of the net.

The mangrove crab Scylla serrata is a nocturnal and elusive swimming crab that inhabits brackish water areas near rivers and mangroves. This crab is also trapped near river mouths with baited lift nets, but the fisherman must employ a bamboo pole with a forked stick as a pivot (fulcrum) to lift the net rapidly so that the crab does not escape. In the mangrove swamps, mangrove crabs are caught in baited crab pots constructed of rebar and wire screen.

Two species of crabs in the subsistence fishery are primarily land dwellers, although they must return to the sea to reproduce. The land crab Cardisoma was traditionlly caught in traps constructed of bamboo (PLATES 40 and 41). Because these crabs are nocturnal, they enter the dark interior of the trap for refuge during the day. As the crab enters the trap, it releases the trigger mechanism, closing the trap upon itself. However, in recent years fishermen have taken advantage of the seaward migrations of the land crabs during the breeding season. The crabs are harvested at night along the roadways as they move to and from the beach on the full moon to release their larvae into the sea.

The coconut crab Birgus latro (ayuyu) is caught along the raised limestone cliffs of northern Guam. This crab is nocturnal, and it feeds upon coconuts at night. The harvester locates crevices and rocks that are likely habitats for these crabs and places a bait of a fresh coconut which has part of the husk and shell cut away to expose the coconut meat. The harvester then may check his sites nightly to catch coconut crabs gathered at the bait, or he may examine them in the day

to determine if the crabs have been feeding on the bait. If a coconut has been eaten, the harvester may catch the crab in the day by searching the immediate vicinity. Although coconut crabs are capable of rapid movement and vicious self-defense with their claws, they are usually pinned down by the harvester and captured by hand.

Lobsters (PLATE 42) are highly prized delicacies in the subsistence fishery. The spiny lobsters (Panulirus penicillatus and Panulirus versicolor) and slipper lobsters (Family Scyllaridae) are harvested along the reef front at night by snorkelers using four-pronged spears. Some older fishermen report that in former times lobsters were caught by hand on exposed limestone benches during low tides on nights of the new moon.

Mantis shrimps are crustaceans that are sometimes mistaken for lobsters by inexperienced fishermen. They are occasionally harvested with the incidental catch that becomes entangled in monofilament gill nets set on the reef flat at night. There are reports of some Filipino fishermen fishing specifically for mantis shrimps. These fishermen cut the bowl of a spoon from the handle and then reattach it with a hinge. A string is tied to the handle, and the folded spoon is then lowered into the mantis shrimp burrow. When retrieved, the spoon opens at a right angle to the burrow, forcing the mantis shrimp out of the burrow. This is a modern adaptation of a Palauan method of catching mantis shrimps described by Johannes in Words of the Lagoon in which a mantis shrimp claw is inserted into a burrow to extract the mantis shrimp living inside.

Echinoderms

Echinoderms are marine invertebrates which have a skeleton of fused, spiny plates. Starfish, or sea stars, are perhaps the best known members of the group, but the edible echinoderms are restricted to the sea urchins and the sea cucumbers.

The short-spined urchin Tripneustes gratilla (PLATE 43) is the more highly favored of the two species of sea urchins harvested for human consumption on Guam. This species is found among seagrasses or areas of mixed sand and rubble on the reef flat. Because they do not survive long when removed from the sea, sea urchins are usually consumed as they are collected. The top hemisphere of the skeleton is removed with a knife by tapping around the equator in much the same way as a coconut is opened for grating. Only the ripe gonads are eaten. This may explain why they are sometimes called "sea eggs."

The other species of sea urchin harvested for consumption is Echinometra mathaei (PLATE 44). Smaller and having sharper spines, this species lives in crevices in coral and rocks on the reef flat. The fisherman must use a knife or prongs to pry these urchins from the substrate.

There are also two species of sea cucumbers, or balate', collected in the subsistence fishery on Guam. Strangely enough, neither of them is a commercial species in the highly valued beche-de-mer trade of South Asia. Stichopus horrens is collected from beneath rocks on the reef flat and is reportedly fried before consumption. The most common sea cucumber on Guam, Holothuria atra (PLATE 45), is harvested in small numbers

Table 1. Shelled molluscs commonly collected from Guam reefs for home consumption. ORF = outer reef flat; RM = reef margin; RFS = reef front slope; IT = intertidal; RF = reef flat; LG = lagoon; MG = mangrove flats; Rk= rock; Sn = sand; Sn/Rb = sand and rubble; Sg = seagrass meadows; Md = mud.

Scientific Name (Common Name)	Chamorro Name	Habitat
POLYPLACOPHORA (Chitons)		
Family Chitonidae		
Acanthopleura gemmata	tagula	IT (RK)
GASTROPODA (Snails)		
Family Trochidae (topshells)		
Trochus niloticus	alileng	ORF, RM, RFS
Tectus pyramis		RM, RFS
Family Turbinidae (turban shells)		
Turbo argyrostomus	alileng	RM
Turbo setosus	alileng	RM
Family Neritidae (nerites)		
Nerita plicata		IT (Rk)
Nerita polita		IT (Rk)
Family Strombidae (conchs)		
Strombus gibberulus	do'gas	RF (Sn)
Strombus luhuanus	do'gas dankolo	RF, LG (Sn)
Lambis chiragra		RF, RFS
Lambis lambis	toru	RF (Sn/Rb)
Lambis truncata		RFS (Sn)
Family Vasidae (vase shells)		
Vasum turbinellus		RF (Sn/Rb)
BIVALVIA (Clams and mussels)		
Family Mytilidae (mussels)		
Modiolus auriculatus		LG (Sg)
Family Chamidae		
Chama spp.		RF/LG (Rk)
Family Lucinidae		
Ctena bella		LG (Sg), RF (SN)
Codakia punctata		RF (Sn/Rb)
Family Cardiidae (cockles)		
Fragum fragum		RF (Sn), LG (Sg)
Family Tridacnidae (giant clams)		
Tridacna maxima	hima	RM, RFS
Tridacna squamosa	hima	RM, RFS
Family Tellinidae		
Quidnipagus palatum		RF/LG (Sg)
Scutarcopagia scobinata		LG (Sg), RF (Sn)
Family Psammobiidae		
Asaphis violascens	pa'gang	IT (Sn/Rb)
Family Veneridae		

FRESHWATER SHRIMP TRAPPING

Mr. Antonio Bautista Lujan of Ordot makes and uses a bamboo trap for catching freshwater Macrobrachium shrimps in the streams near Ordot (PLATES 46 to 48). He learned how to construct this trap from his father. The trap design may have originated in the Philippines.

The trap is made of bamboo strips and is shaped like a large, wide-mouth bottle approximately 3 feet in length and about 10 inches in diameter at the large end and 6 inches in diameter at the "neck." An opening or funnel is built into the base of the trap (at the large end) for the shrimp to enter. A bait can (an aluminum beverage can with many holes punched in it) is suspended inside the narrow end; the narrow end is sealed with a half coconut shell (convex side inward) which has a hole bored through it. The coconut shell plug is removable so that the shrimp can be emptied out of the trap. The bait consists of ground coconut meat, fish, or meat.

The shrimp trap is used both day and night. Typically, the trap might be placed in the stream in the morning, checked, emptied of catch, rebaited, and replaced in the late afternoon, and then checked again the following morning.

Ideally the trap is submerged in a narrow part of the stream with the narrow end upstream and the funnel entrance downstream. The trap is camouflaged with branches and weighted down with rocks. In addition, a line is tied to a loop built into one side of the trap and then tied to a rock or a tree to prevent the trap from being washed downstream. As the water flows past and through the trap, the odor of the bait drifts out through the entry funnel. Shrimp (and occasionally eels and crabs) home in on the bait, enter through to the funnel, and are caught.

OFFSHORE FISHING

Bottomfishing

On Guam, bottomfishing is concentrated in two depth ranges, a shallow zone from approximately 20 to 40 fathoms and a deeper zone from approximately 70 to 140 fathoms. Each of these depth zones has its own characteristic group of fishes which are targeted by handline fishermen.

Shallow Bottomfish

The fishes taken by handlines in the 20- to 40-fathom depth range are a diverse assemblage of species, some of which are also found in shallower reef habitats where they are harvested by spearfishing and other reef fishing methods. The most important species in the shallow bottomfishing catch are the mafute' and lililok (family Lethrinidae). These snapper-like fishes are carnivores, feeding on fishes, crustaceans, and molluscs. The most frequently caught species is Lethrinus rubrioperculatus, the red-gilled emperor, a species that reaches a length of 13 inches. A larger species, L. miniatus, reaches a size of 25 inches. It differs from the red-gilled emperor in its exceedingly long, sloping forehead.

Several species of snappers (family Lutjanidae) are also caught in this depth zone, particularly the kaka'ka' (Lutjanus fulvus) and the uku (Aprion virescens). This latter species can reach a size of nearly 50 pounds. Among the grouper or gadao (family Serranidae) taken by shallow handlining are various species of Epinephelus (generally with brown and white markings) and Variola louti, a reddish grouper with purple spots and a crescent-shaped tail. Jacks (tarakitu, family Carangidae) of several species are also frequently caught. The rest of the shallow-water bottomfishing catch consists of an assortment of goatfishes (Mullidae), wrasses (Labridae), triggerfishes (Balistidae), squirrelfishes (Holocentridae), bigeyes (Priacanthidae), unicornfishes (Acanthuridae), and others.

Almost all these fishes are carnivorous or planktivorous, as edible plants become scarce at these depths. Most species, with the exception of the jacks and uku, probably spend their adult lives within relatively limited home ranges, principally in areas of hard substrate with high topographic relief.

Deep bottomfish

The deeper assemblage of bottomfishes consists primarily of three groups, the snappers, groupers, and jacks, of which the snappers are the most important.

The deepest dwelling snappers are the onaga (Etelis coruscans) and ehu (E. carbunculus), which occur at depths of around 120 fathoms. Several species of Pristipomoides (opaka-paka, P. flavipinnis; pink opakapaka, P. filamentosus; yellow-tail kalekale, P. auricilla; gindai, P. zonatus; and pink kalekale, P. sieboldii) are distributed between 90 and 120 fathoms. Another snapper, the lehi (Aphareus rutilans), occurs at an average depth of 95 fathoms.

Intermixed with these snapper species are jacks (principally the black jack Caranx lugubris) at about 90 fathoms and groupers (mainly Epinephelus sexfasciatus) centered at 120 fathoms. These depth figures represent average depths for these bottomfish species which actually occupy broader depth ranges extending both shallower and deeper than the average depth.

Of these species, the main contributors to the deepwater bottomfish catch around Guam are onaga, ehu, and yellowtail kalikali. Gindai appear to be more abundant in the northern Marianas and are delivered to Guam by fishermen who handline in that area. The large grouper Epinephelus septemfasciatus (PLATE 49) takes a hook more readily than do other bottomfish species and so is rapidly fished out. The few individuals that are harvested by Guam fishermen are usually caught in lightly fished off-shore banks. The other species occur in catches from time to time and may be numerous in some specific locations.

Various features of the biology of the deep bottomfishes make them particulary vulnerable to overfishing. They appear to take up permanent residence at particular pinnacles and

other locations within their depth range, and do not, as adults, migrate from place to place. Thus, if a particular spot is heavily harvested, other adult bottomfish are unlikely to replenish the area, and a new stock of fishable-sized bottomfish depends on the settlement and growth of juveniles. Growth, however, is slow among these species, and rebuilding of stocks may take many years. Haputo Pinnacle off the northwest coast of Guam was fished heavily from 1967 to 1968 and has never recovered its former productivity.

All of the deepwater bottomfishes are carnivorous, feeding on fishes and crustaceans. Details of their feeding habits are not well known because their swimbladders expand as the fish are hauled to the surface and the gut contents are lost as the fish's stomachs evert out their mouths.

The same bottomfish species that occur around Guam are also found at other island areas in the Pacific, although in other areas depths may be somewhat different (in the Caroline Islands, for instance, most of these species are shallower than on Guam) and the relative abundance of the species may differ.

Bottomfishing Gear

The basic bottomfishing gear consists of a mainline, chum bag, bottom rig, and weight (PLATE 50). The mainline is, ideally, 200-pound test Toto Super line. This line is large enough to be easy to handle, coils well, and does not stretch. Monofilament and nylon line stretch and make it difficult to feel the fish taking the hook. Lighter test line is difficult to handle.

The mainline is attached to a three-way swivel to which are also attached a chum bag and the bottom rig (Figure 4). The bottom rig consist of 4- to 5-foot lengths of 120-pound test monofilament line joined by three-way swivels. To the swivels are also attached the hooklines (50- to 80-pound test monofilament, 2 to 3 feet long) and the hooks. Four to ten hook lines may be used on a single rig. The bottom swivel connects to a 4-inch length of cotton string (weaker than the other lines) and a 2- to 5-pound weight. The weaker line attached to the weight allows the bottom rig to be retrieved even if the weight is fouled on the bottom by jerking the line and breaking the string. Several weights should be carried to replace weights lost by fouling.

Hooks are recurved, barbed circle hooks ranging in size from No. 16, for smaller fish such as kalikali, to No. 26, for large onaga. For shallow bottomfishing, No. 16 hooks are used.

Hooks are tied so that the monofilament hook line passes through the eye of the hook from the hook side (rather than the back side). This keeps the hook from dropping backward, allowing the fish to come free.

The chum bag is a cone made from a 9-inch by 9-inch piece of denim cloth. The cone is made by folding the denim square across the diagonal and sewing the edges together on one side. A loop of string, large enough for the empty chum bag to pass through, is attached to the apex of the cone. The chum bag is attached to the upper swivel of the bottom rig by inserting the loop through the eye of the swivel and then passing the empty

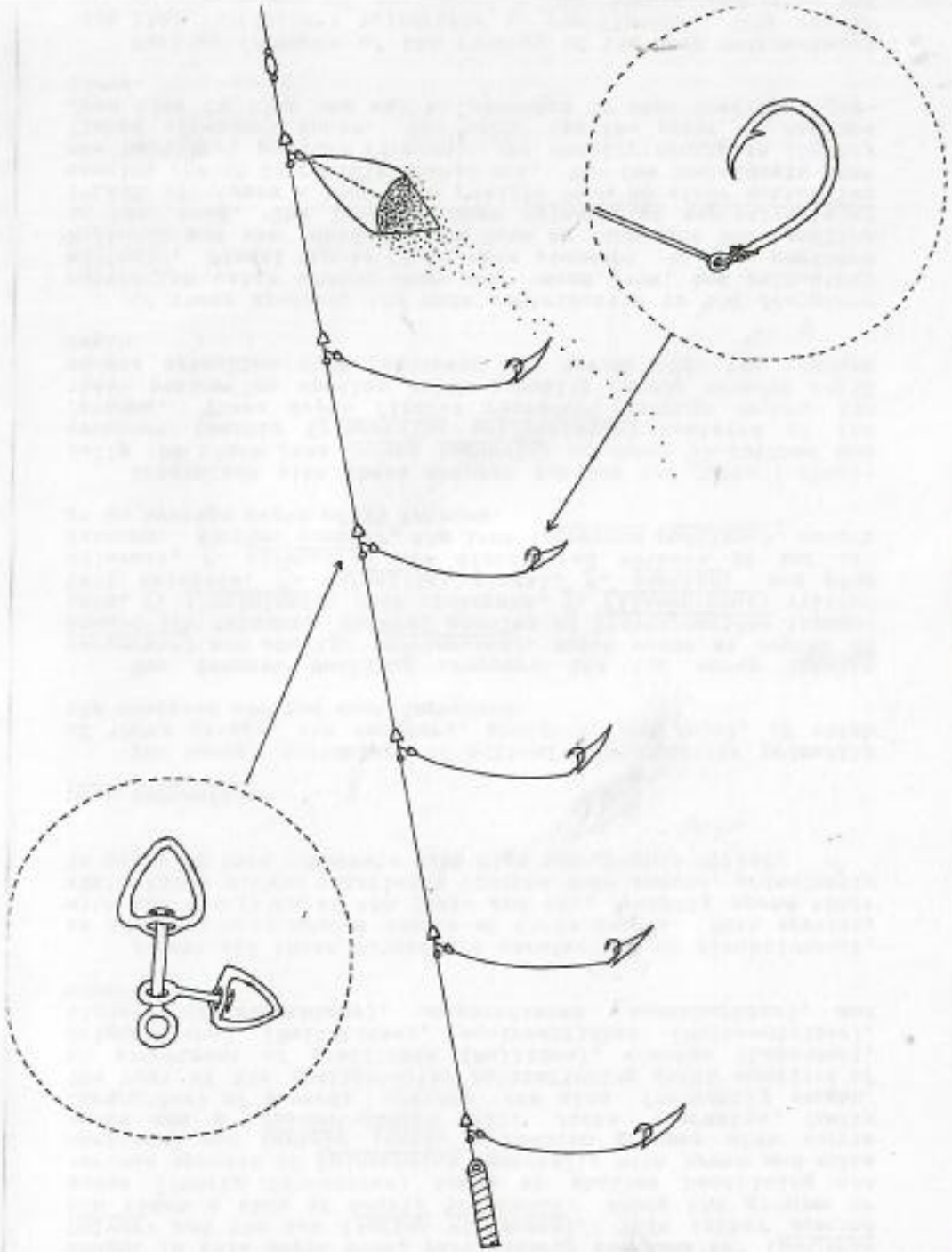


Figure 4. Diagram of bottomfishing rig showing position of chum bag, hooks, and sinker. Upper inset: method of tying hook. Lower inset: 3-way swivel.

chum bag through the loop. The chum bag is filled with chum (described below), and the upper flap of the chum bag is tucked into the bag to keep the chum in place.

Skipjack tuna is the most commonly used bait. The tuna is filleted as close to the backbone as possible, leaving the skin on (Figure 5). The fillet is then placed skin-side down and is cut into half-inch strips beginning at the thin (rear) end (Figure 6). The cuts are made to slant down and back so that each strip has a section of skin attached to it. Each of these strips is then cut longitudinally into four or five baits. Each of these baits is attached to the hooks by inserting the point of the hook through the flesh side of the strip and out the skin side. The tough skin helps to retain the bait on the hook.

The parts of the skipjack tuna not used for bait (the head, backbone, and internal organs) are used for chum. These parts are chopped finely on a chopping block and mixed with an equal part of old bread. The bread extends the chum (like Hamburger Helper) and makes the chum lighter so that it diffuses in the water rather than dropping to the bottom.

Many fishermen use finger rubbers to protect their fingers from cuts from the line. These are made from pieces of inner tube sewn to fit on the index fingers. In a pinch, electrical tape can be wrapped around the fingers instead. Finger rubbers are better than gloves, because they fit around the first joint of the index fingers, but leave the rest of the fingers free to attach bait, remove hooks, and feel the line.

Bottomfishing Method

The key to catching bottomfish is finding the right spot to fish. Both depth and bottom configuration are critical considerations. The depth range for shallow bottomfish is 20 to 40 fathoms and for deepwater bottom fish 70 to 140 fathoms. In both depth ranges, irregular bottoms with mounds and ridges are the most productive areas. For deepwater bottomfish, ideal spots are sheer dropoffs or pinnacles that lie within the appropriate depth range.

The best time for deepwater bottomfishing is from dawn to 10:00 a.m. and again from 4:00 p.m. to dark. If there is a bright moon, fish may bite after dark. Shallow bottomfishing can be done during the day and at night; in fact, mafute' usually bite better at night.

A fathometer (PLATE 51) with a depth range down to about 300 fathoms is an essential piece of equipment for the bottomfisherman, both for finding appropriate depths and for checking the topography of the bottom. The extra depth range (down to 300 fathoms) is necessary because the fisherman may not pass directly over the top of a pinnacle; if he passes over the side of a pinnacle, detecting it at, say, 250 fathoms, he can follow the contour up and perhaps find a shallower spot which lies in the appropriate depth range.

Once a good location has been found, the fisherman fixes its position by lining up conspicuous features on the shore so that he can find the spot again. Some boats are equipped with loran allowing them to fix positions quickly and accurately.

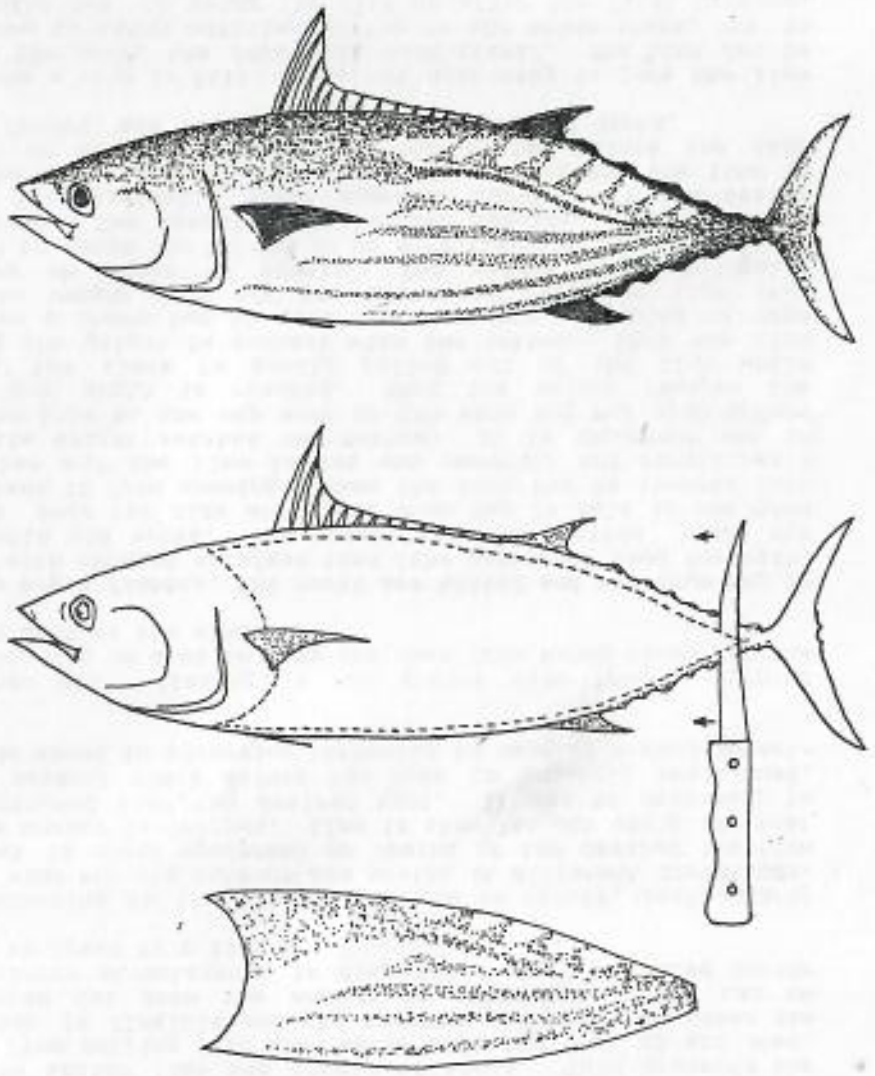


Figure 5. Filleting skipjack tuna to prepare bottomfishing bait.

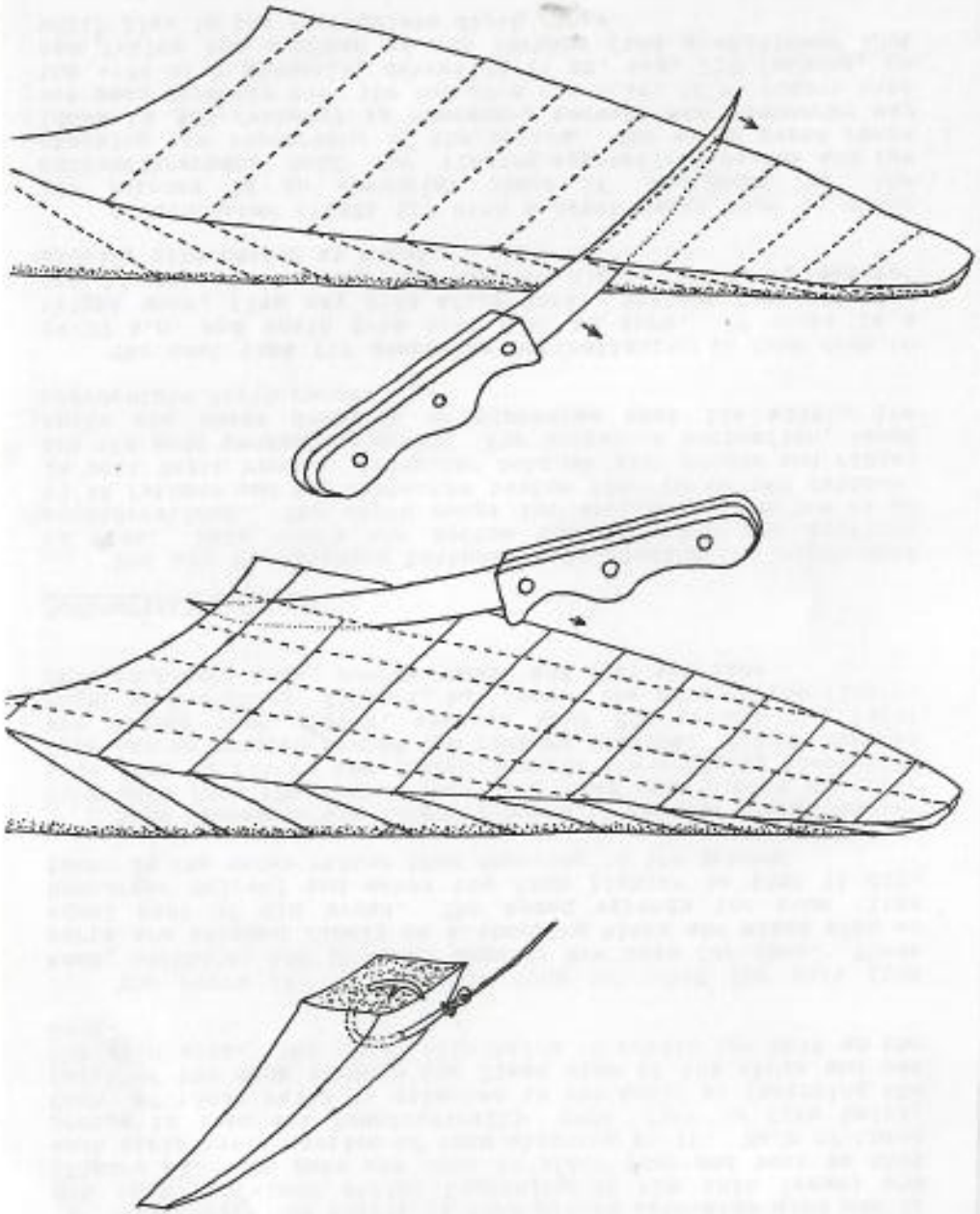


Figure 6. Cutting the tuna fillet to maximize the number of pieces of bait produced.

For relocating fishing spots on offshore banks, such as Galvez Bank, loran is particularly useful, as shoreline features are too far away to use as position indicators.

Fishermen often test a spot first with a baited hook to see whether the fish are biting. If so, they may anchor their boat over the spot or drift fish. If there is little wind and current, anchoring is not necessary, but if the boat drifts away from the fishing spot too quickly, an anchor must be used.

A commonly used bottomfishing anchor is made from several pieces of rebar welded together at one end (Figure 7). The free ends of the rebar are bent up in a hook-like configuration. Approximately 300 to 400 fathoms of line are used so that the anchor line has plenty of scope. This prevents the anchor from pulling free when waves lift the boat up and down. The rebar is flexible enough, however, so that the hooks can straighten out when the anchor is retrieved. This can be particularly advantageous in deep water where a fouled anchor cannot be freed by a diver.

Anchoring at the proper spot can be tricky, particularly if the wind and the current are moving in different directions. The boat is moved upcurrent or upwind of the desired location and the anchor is dropped. Line is then let out until the boat is positioned over the desired spot. It may be necessary to anchor several times before the boat is properly positioned, but time spent in anchoring correctly is usually a good investment.

When drift fishing, a sea anchor made from a surplus parachute can be used to keep the boat from being blown off the fishing spot by the wind.

To begin fishing, the hooks are baited and the chum bag is filled with chopped skipjack tuna (the parts not used for bait) mixed with old bread. The weight and the baited hooks are lowered over the side while the chum bag is held in one hand to prevent it from opening. Then the chum bag is lowered into the water and the line is let out smoothly and continuously until the weight reaches the bottom. It is important not to stop the line on the way down or the chum bag may open before the proper depth is reached. When the weight reaches the bottom, the slack is gently pulled out of the line while keeping the weight in contact with the bottom. Then the line is given a sharp tug to open the chum bag. Fishing is done with the weight just off the bottom to keep the line from tangling on rocks or corals. The weight is periodically lowered to touch the bottom to be sure that the proper depth is maintained. Two deepwater bottomfish species, lehi and onaga (PLATE 52), typically occur somewhat further off the bottom than the other species. To catch these species, the line is brought up about 3 fathoms off the bottom before the chum bag is opened, and the hooks are fished at that depth.

When a bite is felt, it is not necessary to jerk the line to set the hook; the fish will hook itself. The line can be left down to catch additional fish on the other hooks, but it is usually best to bring the line up after the first hook-up, particularly if there are sharks around. The line is brought in slowly for the first ten fathoms as other fish may follow the line up and bite on the other hooks. Then the line is brought in steadily, playing the fish, but keeping a constant

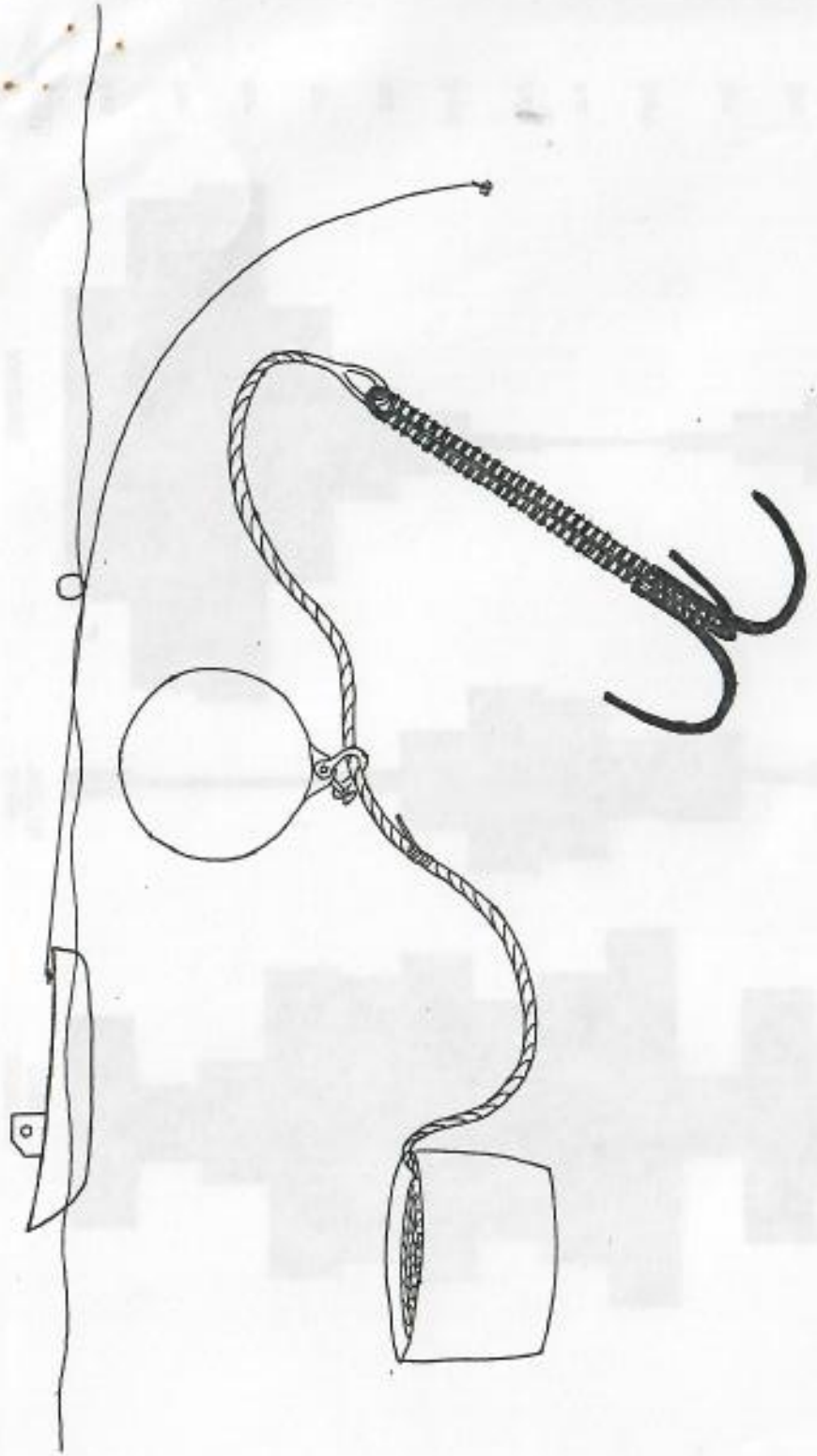


Figure 7. Bottomfishing anchor constructed of rebar. The sliding fishing float allows the anchor to be retrieved without a winch.

tension on it. Bottomfish have an air bladder which expands as the fish is brought to the surface because of the decreasing pressure at shallower depths. This causes the fish to float after a while, and it often feels as if the fish has come off the hook. Occasionally, the fish does come off the hook, but if its air bladder has already expanded significantly, the fish will float to the surface on its own. A long-handled scoop net can be used to scoop the fish off the surface without having to pull anchor or to swim after the fish.

When the hooked fish is at the surface, the entire line is brought into the boat before unhooking the fish: baited hooks left in the water may be hit by surface predators, jerking the line back out of the boat and possibly hooking the fisherman. The fish should not be dropped on the coiled mainline, however, as it will thrash around and tangle the line. A gaff or scoop net can be used to boat larger fish.

The hook is removed from the fish's mouth and the fish is placed on a cool part of the deck (a spot that has been previously cooled by pouring a bucket of water on it). Then the hooks are rebaited and the chum bag refilled, and the line is put back in the water. As the line goes down, the previously boated fish is killed by thrusting an ice pick or killing gaff into its brain or by clubbing it on the head. The fish is placed in an ice box with brine solution to preserve its quality.

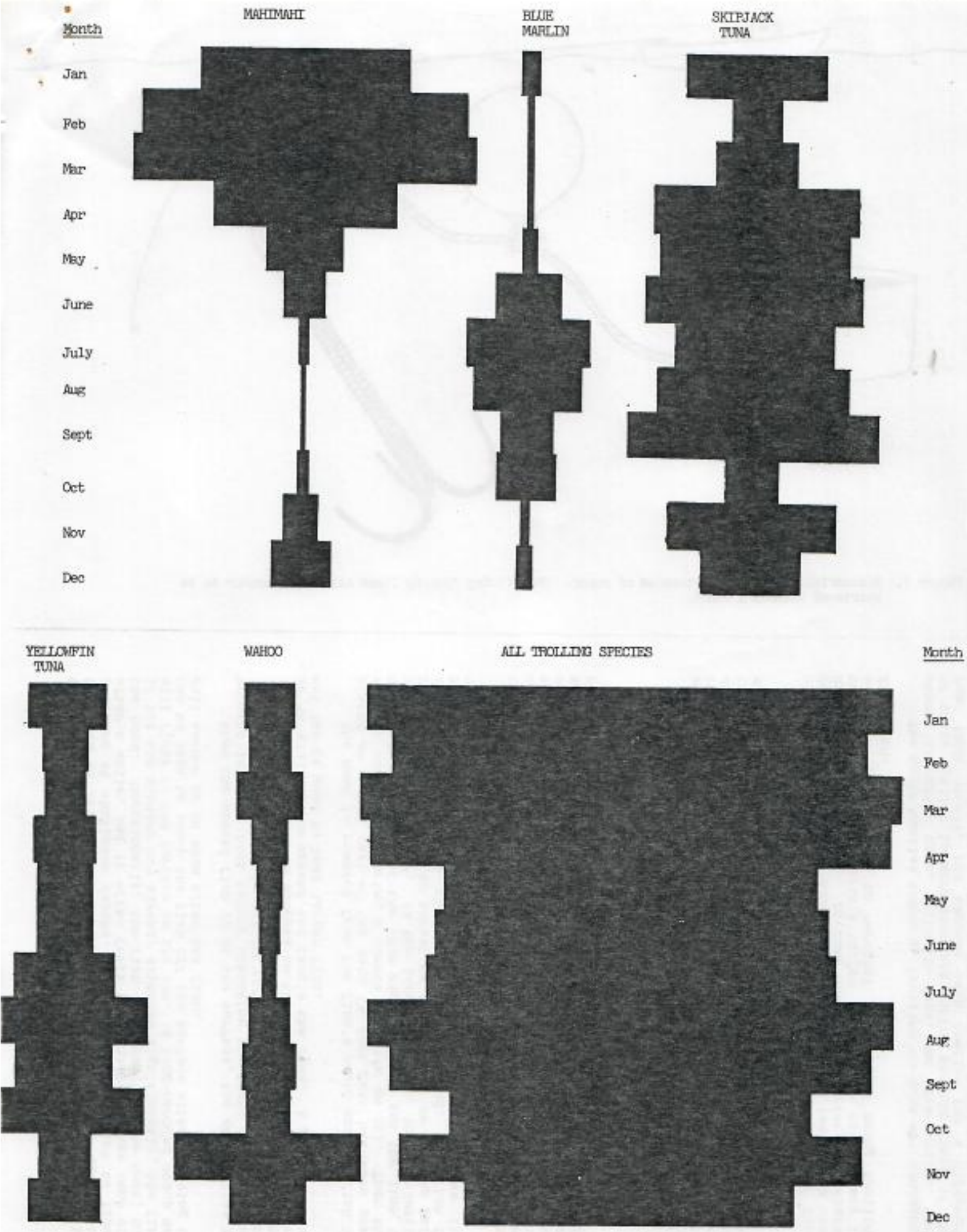
The techniques for shallow bottomfishing are the same as those for deepwater bottom fishing, except that smaller hooks are used. Squid and octopus are often used for bait for shallow bottomfishing because there are several bait-stealing species (particularly triggerfishes) at the shallower depths, and the squid and octopus are more difficult for these fish to pull off the hook.

Trolling

Trolling is the most popular method of small-boat fishing on Guam. The method consists of towing a lure or baited hook through the water to catch various pelagic species of fish which occur in nearshore waters. Power boats are used for trolling today, but in earlier times on Guam, paddled canoes were used.

Although trolling seems fairly straightforward, it is one of the most complex fishing methods presently used on Guam because of the great variety of gear types and techniques used by different fishermen. In some cases this variety is related to the variety of possible target species; in other cases it seems to relate more to personal preferences among trolling fishermen.

The major species taken by trolling on Guam are mahimahi, wahoo, skipkjack tuna, yellowfin tuna, and blue marlin. Each of these species is more abundant during certain times of the year than others, but because each species has a different pattern of seasonal abundance, there is something to troll for year round (Figure 8).



ure 8. Average monthly trolling catch rate (1978 - 1984) in kilograms per man-hour.

The total trolling catch around Guam varies throughout the year, being greatest during February, March and April, with secondary peaks during June and November. Two factors influence the monthly landings of fish: the number of boats out trolling (which is, to a large extent, controlled by weather) and the seasonal availability of trolling species. The heavy catches during February, March, and April occur during the months of greatest trolling effort on Guam and are also at the time of year when mahimahi, wahoo, and skipjack tuna are running. Trolling effort is not particularly high during either June or November, but the large trolling catches during these two months reflect the availability of blue marlin and skipjack tuna (June) and wahoo and early running mahimahi (November).

Mahimahi

Mahimahi (Coryphaena hippurus) is a major component of the trolling catch around Guam. It is a highly seasonal species, first showing up in November and December, becoming abundant from January through April, and then rapidly disappearing. Guam waters are part of the migratory path of mahimahi stocks, but little is known of their whereabouts before the run starts on Guam or after the fish leave island waters. Although the seasonal occurrence of the mahimahi run is predictable, the strength of the run in any particular year is not. In some years when the run is strong, mahimahi make up approximately 40% of the annual trolling catch on Guam (and as much as 90% of the catch at the height of the season); in poor years less than 10% of the annual trolling catch is mahimahi.

Mahimahi occur in shallow (less than 15 fathoms deep) pelagic waters throughout the world tropics, most frequently in waters near land. However, the species also occurs in the open ocean, where it is generally associated with floating logs and debris. Mahimahi are sometimes caught by purse-seiners who set their nets around this floating material to catch tuna.

Flyingfish are the major food of mahimahi caught around Guam (nearly 75% of the stomach contents by weight), with other fishes, squids, and crustaceans making up the balance.

Feeding occurs principally during the daytime, although there is evidence that mahimahi may also feed during moonlit nights. Mahimahi themselves are eaten by a variety of other pelagic fishes including marlin, yellowfin and skipjack tuna, and larger mahimahi.

There are, in fact, two species of mahimahi: the common mahimahi (Coryphaena hippurus) and the pompano dolphin (Coryphaena equiselis). The common mahimahi is generally a larger fish, commonly 30 to 40 inches (maximum 80 inches) in length. The pompano dolphin is smaller (generally 8 to 20 inches in length with a maximum size of 30 inches) and has a short pectoral fin, equal to half the head length. In both of these species, large adult males develop a bony crest on the front of the head. The common mahimahi is the principal species of mahimahi caught around Guam. Because the two species are rarely distinguished by fishermen, it is not known to what extent pompano dolphin are caught in our waters; however the pompano dolphin is generally thought to have a more open ocean distribution than the common mahimahi.

Mahimahi grow rapidly and have a short lifespan. They become sexually mature within one year, and within two years they can achieve sizes in excess of 3 feet. They probably do not live much longer than four years. Spawning occurs year-round in the tropics. The western Pacific waters around Guam have high abundances of juvenile mahimahi but relatively few individuals of the largest sizes.

Blue Marlin

The blue marlin (Makaira nigricans) is the largest of the major trolling species caught around Guam (PLATE 53). A 1153-pound blue marlin caught off Ritidian Point was, for many years, the International Game Fishing Association record for this species. From 2 to 13% of the annual trolling catch around Guam is blue marlin.

The blue marlin is highly seasonal on Guam with best catches occurring from June through October. Migration patterns have yet to be worked out for this species, and evidence currently available is contradictory: fishery data suggest that a single blue marlin stock may extend across the entire north Pacific (and perhaps into the South Pacific as well) while biochemical data suggest that blue marlin caught around Guam is of a different stock than those caught in Hawaii.

Blue marlin are top predators of the oceanic ecosystem. Nearly 60% of the diet of blue marlin from Guam consists of yellowfin and skipjack tuna. Other fishes and squids make up the rest of the diet.

Guam is located in an area of the western Pacific where relatively high concentrations of blue marlin larvae have been found, indicating that blue marlin spawn in this area. Females reach considerably larger sizes than males.

Yellowfin Tuna

Yellowfin tuna (Thunnus albacares) make up a fairly consistent 15% to 20% of the annual trolling catch around Guam. Yellowfin catch rates are highest from July through October, but this species is harvested year-round.

Yellowfin are known to be migratory, but the paths they follow in the western Pacific are not yet well known. There is some indication that some yellowfin tunas may remain around Guam for prolonged periods of time.

Yellowfin tuna occupy a fairly broad depth range in the ocean with larger individuals occurring at greater depths. The deeper dwelling yellowfin are harvested by longliners (and in past years Japanese longliners have taken as much as 1300 metric tons of yellowfin per year in the 200 mile zone around Guam), and the surface-dwelling yellowfin are caught by purse-seiners. Some of the largest yellowfin have been caught by trollers, however, indicating that the large individuals do come to the surface.

Studies on the stomach contents of yellowfin tuna around Guam show that most of their diet consists of fishes of various species with squids and crustaceans making up about 20% each.

Yellowfin grow rapidly, attaining weights of 200 pounds within five years. Maximum size is around 300 pounds.

Skipjack Tuna

The most important trolling species on Guam, in terms of weight harvested, is the skipjack tuna or bonito (Katsuwonus pelamis). In any given year, from one-quarter to one-half of the trolling catch is this species. Skipjack tuna are caught year-round on Guam, most consistently during the months from April to September.

The South Pacific Commission has been studying the migration patterns of skipjack tuna through a fish tagging program initiated in 1977. Although no skipjack tuna from Guam have been tagged, the program did tag some in the Northern Marianas, one of which was later caught in the Federated States of Micronesia. More spectacularly, a skipjack tuna tagged in New Caledonia was caught over a year later in the Northern Marianas, a migration of almost 2,500 miles. Although the data are meager at this point, they do indicate that Guam's skipjack tuna migrate extensively throughout the tropical western Pacific before and after they come to Guam. Other studies indicate that skipjack tuna from Guam waters may migrate north to Japan.

Skipjack tuna is a relatively small species, reaching a maximum size of approximately 50 pounds. Individuals reach their maximum size within three years and probably do not live much beyond that. Skipjack tuna caught around Guam feed on a variety of small pelagic fishes and squids. Approximately 5% of their diet consists of the young of their own species.

These schooling, surface-dwelling tunas are caught throughout the Pacific by purse-seiners and pole-and-line boats. Most of this catch goes to canneries.

Wahoo

The wahoo (Acanthocybium solandri) is a member of the tuna family but is easily distinguished from other tuna species by its elongate body and its long jaws with many strong, triangular teeth. Wahoo are found in tropical waters around the world and, like mahimahi, tend to be caught most commonly near land.

On Guam the wahoo season preceeds the mahimahi season. The fish begin appearing during August and September, reach their greatest abundance in November, and then decline. In some years wahoo make up almost one quarter of the trolling catch by weight; in poorer years they may only account for 5% of the trolling catch. Wahoo are not found in organized schools such as characterize other tuna species; nonetheless, they apparently aggregate to some extent, and there are certain locations around Guam where trollers are more likely to hook up a wahoo.

The diet of wahoo consists almost entirely of fish, particularly jacks and skipjack tunas, and a small proportion of squids. Large prey are bitten into chunks before being swallowed.

Wahoo grow extremely rapidly, reaching a length of 4 feet by the time they are two years old. Maximum size is about 6 feet (140 pounds), but individuals of that size are uncommon around Guam.

Other Trolling Species

The five species (mahimahi, wahoo, yellowfin and skipjack tuna, and blue marlin) make up more than 95% of the trolling catch around Guam. The rest of the catch consists of a variety of pelagic species including barracuda (Sphyraena barracuda), rainbow runner (Elegatis bipinnulatus), dogtooth tuna (Gymnosarda unicolor), kawakawa (Euthynnus affinis), black marlin (Makaira indica), sailfish (Istiophorus platypterus), jacks (Caranx), and various species of sharks. Because of the small amount of data available on these species, little can be said about their habits around Guam. All are widely distributed pelagic predators which are occasionally taken by trolling gear. Barracudas are caught more frequently from October to January; catch rates for rainbow runners are slightly greater from June through October.

Other Trolling Species

The basic trolling gear is a line and a lure. Many trollers also use a rod and reel for greater convenience and ease in bringing in the fish, but handlines, usually wrapped on a frame, are still quite commonly used.

Trolling lines range from 80- to 130-pound test; smaller test line can be used for mahimahi or skipjack tuna, but larger fish, such as yellowfin and marlin can break lines less than 80 pound test.

A wire or monofilament leader connects the lure to the end of the trolling line. Monofilament leaders have the advantage of being transparent and thus less visible to the fish. However, for large fish, such as marlin and yellowfin, and for fish with strong teeth, such as wahoo, barracuda, and shark, wire leaders are used to prevent loss of the fish (and loss of expensive lures). For marlin, at least 15 feet of wire leader is used to prevent the line from being cut by the thrashing bill; shorter wire leaders can be used for the other species.

Most trolling lures (PLATES 54 to 57) consist of three parts:

1) The head--This is made of chrome-plated metal and forms the front part of the lure. There is a hole in the head through which the leader is threaded. This allows the head to slide freely on the leader. When the lure is being towed through the water, the head slides back on the leader to the top of the hook. When a fish is being taken off the hook, the head can be slid forward to get it out of the way. The standard lead head is a single bullet-shaped piece of lead. The Kona head is made of plastic and has a concave front which causes it to oscillate while being towed, giving it a more realistic appearance of swimming. Knuckle heads are made of two hinged parts for even more oscillating action. Jet heads have holes running through them from

front to back; water streaming through the holes makes bubbles and causes the attached skirts to flap.

2) The skirt--Skirts are generally made of plastic, although some fishermen make skirts from the skin of mahimahi or the leatherback (Scomberoides lysan, an elongate member of the jack family with pearly skin). Plastic skirts come in a variety of colors, often speckled with glittering spots to make them more appealing. The skirt is attached to the head, and the trailing strips (or "tentacles") hide the hook.

3) The hook--Both single and double hooks are used. For mahimahi and skipjack tuna, which have weak mouths, a small double hook is usually used. This prevents the hook from tearing through the mouth allowing the fish to escape. The hook is attached to the end of the leader. A second hook, or trailing hook, can be attached 3 to 6 inches behind the main hook. If a fish hits the lure from the side, the trailing hook will flip around and snag the fish on the head and help to prevent its escape.

Most trolling lures resemble squids but are even brighter and more conspicuous than real squids. Their effectiveness may lie in their extraordinary appearance more than their accurate resemblance to real prey organisms: fish may strike them just to find out what they are.

It is possible to catch marlin without using a hook on the lure. To do this, the skirts are replaced with a 8-inch length of nylon rope, unwoven so that the individual strands trail behind the head. Marlin usually strike first with their bill to kill their prey, and the bill, with its many, tiny, backward-pointing spines, gets firmly entangled in the nylon.

Live bait can also be used to catch marlin. A freshly caught skipjack tuna is attached to the trolling line by a bridle which is threaded, using a long needle, through the fish's head from eye socket to eye socket. The hook is attached to the line just behind the bridle so that it trails along the top of the skipjack tuna. A marlin, striking this live bait, will swallow the fish head first and will be caught by the hook.

Some trollers make occasional use of devices designed to keep the lure bouncing at the surface of the water or, alternatively, to keep the lure down deep in the water for hooking deeper-dwelling pelagic species. The first of these devices is called a "bird" and looks like a small airplane with a curved body. The end of the trolling line is connected to the front of the bird, and the leader and lure are attached behind. As it is towed, the bird flutters on the surface of the water. This activity is attractive to yellowfin tuna and other species.

A downrigger is used to keep the lure below the water's surface. Although various designs may be used, an effective one looks like a small torpedo made of lead (PLATE 58) and weighs about 10 pounds. The downrigger is attached to the boat by a strong line about 10 feet long, and the trolling line is attached to the downrigger by a breakaway. As the downrigger is lowered from the boat, it carries the trolling line down with it. When a fish hits the lure, the line breaks away from the downrigger and the fish is pulled in with rod and reel or hand line.

If a handline (PLATE 59) is used in trolling, the trolling line is not connected directly to the boat, because it will break if a large fish takes the lure. A piece of surgical rubber tubing about 12 to 16 inches long is attached to a rear cleat, and the trolling line is attached to the other end. The remainder of the trolling line is given some slack (so that it is longer than the surgical tubing) and then attached to the cleat or to some other part of the rear of the boat. Finally, a piece of cotton line, slightly shorter than the surgical tubing, is tied from the cleat to the point where the surgical tubing is attached to the trolling line. When a fish hits the lure and runs with it, the strength of the cotton line will set the hook in the fish's mouth. Further strain on the line will cause the cotton line to break and the surgical tubing will provide sufficient tension to keep the fish from getting off the hook but will also allow some "play" in the line so that it does not break when the fish leaps or jerks on the line. Alternatively, the length of the cotton line can be somewhat longer than the length of the surgical tubing. The elasticity of the surgical tubing will prevent the mouths of smaller fish from being torn when they fight the line.

For large fish, such as marlin, the trolling line can be attached to a fishing float kept on the deck at the rear of the boat. The remainder of the line, at least 200 feet, is coiled and tied to a wooden box, and then tied to a cleat on the boat. When a marlin hits the line, it will pull the float into the water and the fish will be fighting the float. The fisherman can wait until the marlin tires and then pull the line, float, and fish into the boat.

The size of a hooked marlin can be estimated by how far it leaps out of the water. If it jumps completely out of the water, it is a relatively small one (less than 300 pounds). If the tail remains in the water when it leaps, it is a 300 to 400 pounder. A hooked marlin over 400 pounds will only shake its head out of the water.

Rods and reels, though expensive, are increasingly popular with trollers. For large fish, a 16/0 reel is best as it holds enough line to let the fish run. A 12/0 reel can be used for most everything except the larger marlin and yellowfin (although the current world record blue marlin, at 1,376 pounds, was caught using a 12/0 reel). Trolling reels are adjustable so that the "drag" on the line can be set as appropriate for different sizes of fish. The drag must be set so that line will be paid out as the fish runs (to prevent the line from being broken) but also so that sufficient tension remains to keep the hook firmly in place while tiring the fish before it runs away with all the line. The reel must be firmly attached to the rod and both rod and reel attached to the boat with a safety line to prevent the loss of the whole rig when the fish jerks on the line.

Trolling is routinely done while traveling to and from fishing grounds, and handlines are often used. For full-time trolling, however, several poles and lines are used, and these are arranged to maximize trolling effectiveness. Five lines are deployed from some of the larger sportfishing boats on Guam.

The outer two lines are connected to outriggers, long bamboo poles extending off each side of the boat (Figure 9). These lines are the heaviest gauge and the longest and are connected to larger lures for marlin and yellowfin. These lines are attached to the outriggers by breakaways so that when a fish strikes, the line falls off the outrigger and can then be reeled in with a rod and reel. The next two lines are attached to rods and reels placed on the two sides of the stern of the boat. These lines are shorter, and carry smaller lures. A fifth line can be run from a rod and reel positioned in the center of the stern. This is the shortest line with the smallest lure.

Trolling Method

Once underway, the troller's first order of business is to find fish. Seabird activity is one of the most important indicators of fish schools (PLATE 60), and trollers usually spend a lot of time scanning the sky for birds. Terns, boobies, tropic birds, and frigate birds feed on the same types of small fish as do mahimahi, wahoo, tunas, and other large pelagic species. Ordinarily these small fish are swimming too deep in the water for the seabirds to catch them, but when the small fish are attacked by large pelagic fish, they try to escape by swimming to the surface. This makes the small fish vulnerable to the seabirds which begin to dive down to the water to catch them.

Frigate birds do not dive into the water to catch fish, because their feathers lack waterproofing oils, and their large wings make taking off from the sea surface very difficult. Instead they get their food by attacking boobies which have caught fish, forcing the booby to drop its prey. The frigate bird then swoops down to catch the fish as it falls. Frigate birds tend to remain high in the sky waiting for other feeding seabirds to ascend, and they can be seen from considerable distances, indicating the presence of pelagic fishes.

If no seabirds are visible, trollers usually head for areas where pelagic fish are known to be most commonly encountered. Best trolling grounds are offshore of points of land, such as Ritidian and Pati Points in the north, outside of Apra Harbor, and outside of Cocos Lagoon to the south. Converging ocean currents at these points apparently act to concentrate the planktonic food of small fishes, and the greater abundance of small fishes attracts the larger species. Trolling is also usually productive around offshore banks such as Rota Bank, the Icebox, 45° Bank, 11-Mile Bank, Galvez Bank, Santa Rosa Reef, and White Tuna Bank. Morning hours and the late afternoon are the most productive fishing times. Some fishermen have had success trolling for barracuda and dogtooth tuna in the evening with a waterproof underwater light attached to their trolling line ahead of the lure.

If floating logs are encountered, trolling is often successful around these. Many pelagic species will congregate around floating objects, presumably to feed on the small fishes which gather there.

Fish aggregating devices (FADs) are specially designed buoys tethered in deep water to attract pelagic fishes. They function in the same way as floating logs, but they are more-

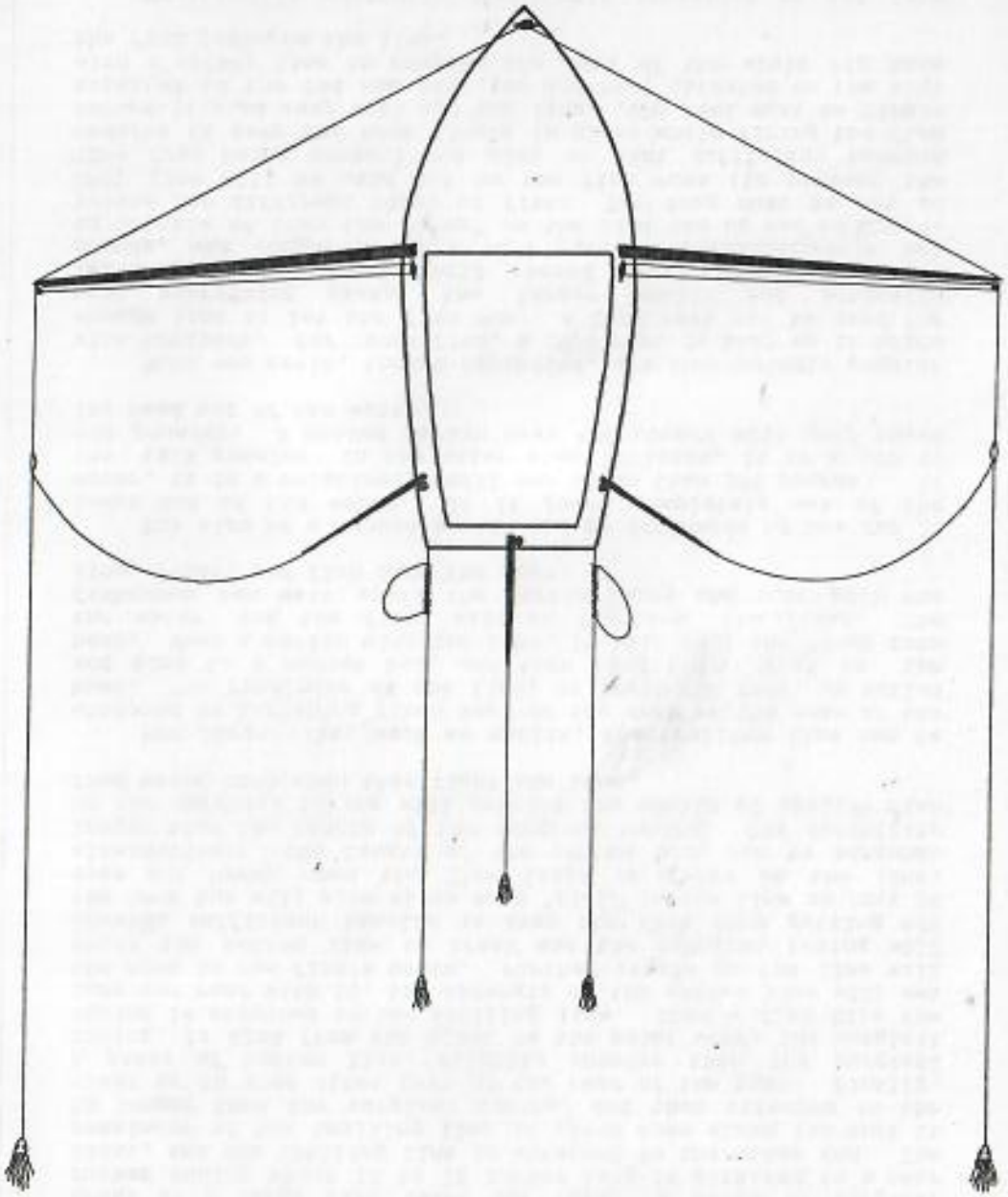


Figure 9. Arrangement of fishing lines for small boat trolling.

or-less permanently moored so that trollers can locate them consistently. FADs have proved to be effective in enhancing the trolling catch in various areas of the Pacific. Several have been set around Guam over the years, but they have all been lost, and at present Guam does not have any.

Once a school has been located, it is usually possible to determine what type of fish is present by observing the individual fish that jump out of the water. If necessary, the lures are changed to those most likely to be attractive to the particular species in the school. If the school is moving, the lines are trolled along the side of the school in the same direction as the school is moving, at a speed of 7 to 12 knots. If the school is stationary and feeding, the lines are trolled around the edges of the school. For most pelagic species, trolling through the center of the school will scatter the fish and spoil the chances of making additional passes at the school. Yellowfin, however, can be caught by setting the lines extra far out (until the lures are just out of sight behind the boat) and then trolling through the center of the school. The yellowfin will descend as the boat passes overhead but will then return to the surface as the lures are passing by.

Wahoo do not form schools and are found closer to shore than most other pelagic species. These fish are trolled by following the shoreline, zigzagging between depths of 40 to 60 fathoms of water.

Marlin also do not school and tend to be found in more offshore waters. Encountering a marlin is essentially a matter of luck.

Once a fish has been hooked, the boat should not be slowed (in fact, for marlin and large tuna, the boat speed should be increased for a moment to set the hook). Large fish must be played to tire them before they are brought in. Smaller fish, such as skipjack tuna, can usually be brought directly to the boat. Boating the fish requires the use of a gaff (PLATE 61), as the hook may slip or tear through the fish's mouth if the fish is pulled into the boat with the line. The gaff, a pointed steel hook mounted on a long straight handle, is positioned with the hook pointed upward under the fish's head or gill region. The gaff is then pulled sharply upward, piercing the fish and pulling it up into the boat with a single motion. A flying gaff (a gaff with a detachable hook connected to a rope) is used with marlin and other large fish which may fight strongly after being gaffed. When the fish has quieted down it can be hoisted into the boat. When boating a marlin, the bill is held with the gloved left hand while the gaff is pulled with the right. The fisherman must stand clear when boating wahoo or barracuda which have large teeth and usually try to bite anything they can.

It is essential to subdue and kill the fish as soon as it is boated to keep if from injuring someone or damaging its flesh as it beats wildly against the deck. A mallet or bat is used to deliver a sharp blow to the top of the head of marlin, wahoo, barracuda, and tuna. For mahimahi, a burlap bag or piece of canvas is thrown over the fish and the fish is held down until it is quiet. The fish is then killed with a short killing gaff thrust into the head behind the eye. The killing gaff may have to be moved around until the fish's brain has been destroyed.

To maintain top condition, the fish is bled immediately upon being killed. This is done by ripping the gill with the killing gaff or by piercing the heart with the gaff or with a knife. For large yellowfin or marlin, an additional cut is made 2 or 4 inches forward of the tail on one side. This will sever a major blood vessel and the marlin's blood will pour out. Once bled, the fish is rinsed with water to prevent discoloration of the flesh by the blood and to wash off bacteria. The fish should then be packed in crushed ice to maintain maximum quality. Subsequent care must also be taken in unloading and handling the iced fish. The fish's tissues become rigid, and the fish must be lifted with two hands supporting the front and rear parts of the fish's body to prevent the flesh from splitting or cracking. A fish in top condition will have clear eyes and red gills and the skin will not be discolored nor the fins and tail shredded.

Longlining

Longlining is a widely used method world-wide for harvesting deep-dwelling pelagic fishes, principally tunas and billfishes. On Guam, one fisherman (Frank Cushing) has been experimenting with longlining for the past two years on a research project supported by the National Marine Fisheries Service. The objective of the project was to investigate the feasibility of small-scale longlining as a technique for local use for the harvest of pelagic species.

Gear

The basic unit of longlining gear is the basket, which consists of the following components:

1) 240 fathoms of mainline, made of 1/4-inch treated cotton.

2) Nine branch lines which are attached at 24-fathom intervals along the mainline. Each branch line consists of 8 fathoms of 3/16-inch treated cotton line connected by a swivel to a 5-fathoms sekiyama (linen-wrapped wire leader) to which is attached 1 fathom of wire leader and a No. 3 longline hook.

3) A 10-fathom float line, made of 1/4-inch treated cotton, which connects the end of the mainline to a spherical plastic fishing float and a flagpole to enhance the visibility of the longline from the surface of the water.

Various numbers of baskets can be connected together to make different lengths of longline. During Cushing's trials, between 17 and 37 baskets were use at a time, resulting in a total longline length of 4 1/2 to 10 miles.

A hydraulic line hauler is used to retrieve the longline, and a set of rollers on the gunwale guides the line as it comes in.

Method

A typical fishing day and details of deployment and retrieval of the gear are as follows:

Prior to departure, fuel and ice are loaded and bait is removed from the freezer to begin thawing. Departure from the Agana Marina is around 3:00 a.m., and the fishing area is reached by 4:30 or 5:00 a.m.

Upon arrival at the fishing area, gear deployment begins. The vessel is maintained on a predetermined course at a speed of approximately 5 miles per hour. Two crew are stationed at the stern for gear deployment. One deploys the main line, floats, and flag poles, while the other baits the hooks and deploys the branch lines. The helmsman occasionally leaves his station to assist. Gear deployment takes from one to one and a half hours and is completed by sunrise (6:00 to 6:30 a.m.).

The line is allowed to soak for about five hours (for that end of the mainline deployed and retrieved first) to eight or ten hours (for that end of the mainline deployed and retrieved last).

Retrieval begins at the end of the line first deployed, and commences at about 10:00 a.m. The mainline is brought in through rollers and is engaged into the longline hauler. One person tends the rollers and retrieves the floats, flag poles, and float lines as they come in and also detaches and coils the branch lines. Another person tends the hauler to ensure proper coiling of the mainline, and a third person reassembles the baskets, by stacking the coils of mainline and reattaching the previously coiled branch lines at their proper locations. The helmsman follows the mainline from float to float, adjusting the vessel speed as necessary.

The catch is unhooked as it comes in, killed if necessary, and stored on ice in the fish hold. Gear retrieval takes from four to six hours depending upon the number of hookups.

On the trip back to port, the gear is stacked and secured, ready for the next trip, and, after reaching the dock, the boat is washed down.

Catch

Many different pelagic fish species were caught during the longline experiment (PLATE 62). Most numerous were mahimahi and yellowfish tuna. Also a substantial proportion of the catch consisted of various species of sharks, including gray reef, thresher, tiger, blue, and hammerhead sharks. Most interesting was the catch of several albacore tuna and broadbill swordfish. These species are very seldom caught by local fishermen around Guam, although they do show up in the catches of Japanese longliners in the waters around Guam and the Marianas. The swordfish were caught during nighttime sets with underwater lights attached to the leaders.

Mackerel Fishing

The bigeye scad (Selar crumenopthalmus) is commonly called mackerel on Guam although it is actually a member of the jack family Carangidae rather than the mackerel family Scombridae. Two different phases in its life cycle are recognized by Chamorro names: atulai for the young, seasonal fish and haiteng for the larger adults. The inshore fishery for the seasonal atulai is described earlier in this book; the offshore fishery, primarily for haiteng, is the subject of this section.

Mackerel Gear

The mackerel rig (PLATE 63) consists of a 50-fathom mainline of 30-pound test Toto Super or monofilament line. Connected to this by a ball swivel is a 6-foot length of 15- to 20-pound monofilament line attached to a 3- to 9-ounce weight (Figure 10). At approximately 1-foot intervals along this line, small loops are made by pinching out a bight of line and tying two overhand knots in it. The leaders (6- to 8-pound monofilament, 4 to 6 inches long) carrying the hooks are attached to the loops by passing the eye of the leader through the loop and then threading the rest of the leader through the eye.

The hooks (No. 4 to No. 6 size) are made into lures by unraveling strands of nylon rope, threading the strands through the eye of the hook, and tying them just below the eye with red nylon thread. To complete the lure, a glow bead is slipped over the leader and positioned just above the hook.

Recently, manufactured mackerel rigs from Japan have become available on Guam. These consist of five to seven ready-made lures and glow beads and can be attached directly to the swivel at the end of the mainline. These manufactured rigs are much more convenient than the homemade kind, but they do not last as long.

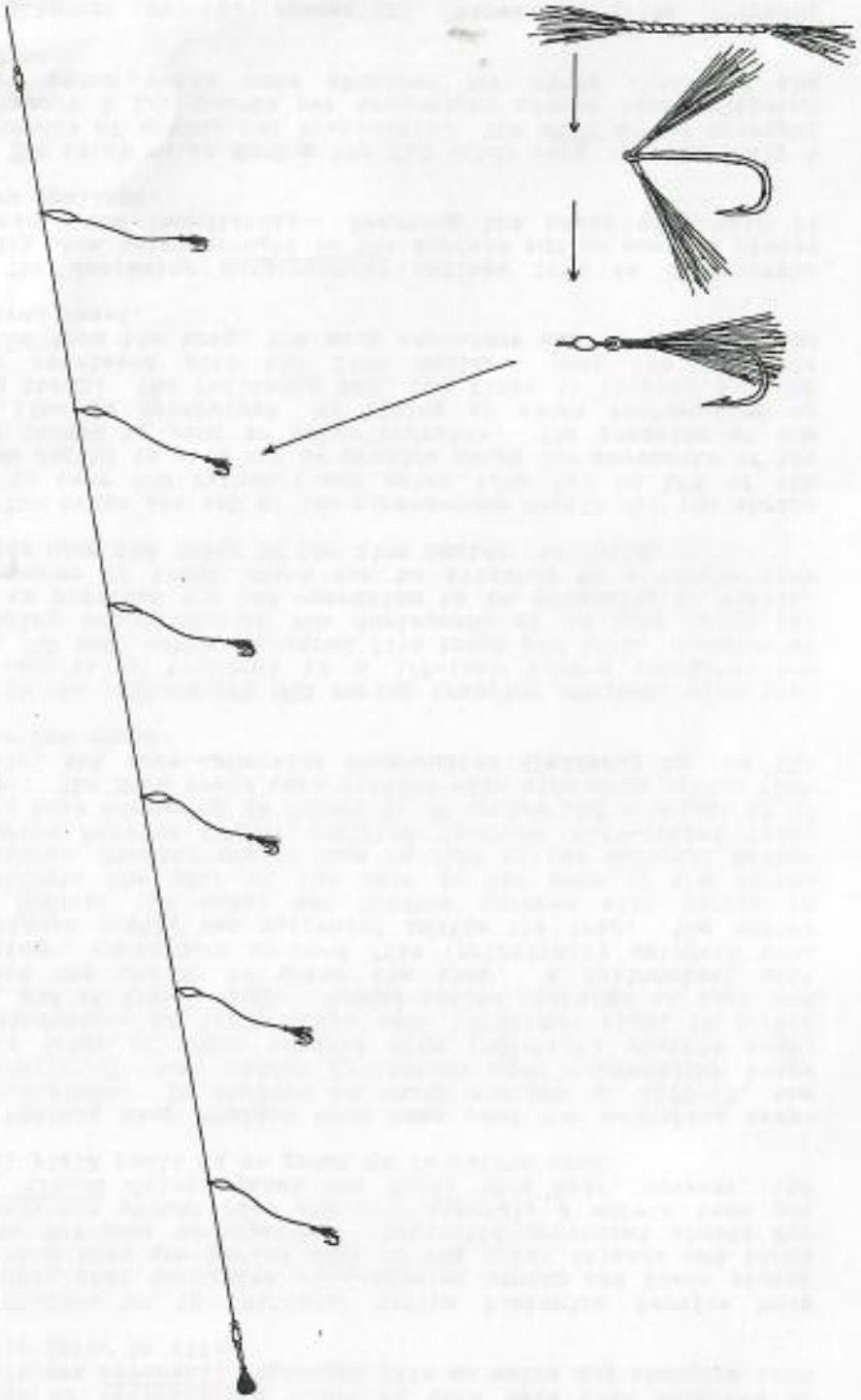
Offshore mackerel fishing is done at night, and a night light is needed to attract the fish to the boat. The night light can be a gasoline or kerosene lantern suspended over the water or an electric lamp powered by a battery.

Mackerel Fishing Method

The main mackerel fishing grounds on Guam are outside Alupang Cove and near Ritidian, Orote, and Uruno Points, but other areas are often productive as well. The bottom depth should be 40 to 50 fathoms. Moonless nights are necessary for good catches.

The boat is anchored before dark at the appropriate depth, and the light is turned on as bright as possible before the sky is completely dark. Mackerel bite best from 8:30 p.m. to midnight and again from 2:00 to 4:30 p.m. when the moon is down.

Occasionally the mackerel attracted to the light are visible at the surface, but generally they aggregate at depths between 25 and 75 feet. The mackerel rig is dropped to these



depths and then brought to the surface in 6-foot steps, jigging the line up and down after each portion is brought in. Although there may be up to six or more hooks on a rig, it is best to bring the line in as soon as one fish is hooked, both to prevent larger predators from taking the fish and also to get the mackerel boated before its mouth breaks the thin leader.

As the mackerel start biting, the light should be dimmed. This will cause the mackerel to become more densely concentrated and to move closer to the surface.

Mackerel are fragile fish and must be placed in brine solutions as quickly as possible after they are boated.

Large mackerel (haiteng) are available all year round, but during the atulai season (August to January), the smaller atulai are caught along with the haiteng, and total catches of the species are greater. The smaller atulai weigh approximately 3/8 pound each; the maximum size for haiteng around Guam is about 3/4 pound.

If, during the course of mackerel fishing, many of the fish are lost to predators (sharks, barracuda, jacks), a surface predator line may be used to catch these larger fish. A large hook is baited with a live mackerel and attached to a 10- to 15-foot line. The line, in turn, is attached to a float, and the float, tethered to a rope, is allowed to drift away from the boat. This keeps the predator line from becoming fouled on the mackerel lines. If the float begins to move erratically, it indicates that a predator has taken the hook.

Chumming the water does not improve mackerel catches; in fact, it has the opposite effect as the mackerel seem to avoid lures once they have eaten real food.

Deep Water Shrimp Trapping

Three species of deepwater shrimp have been found in potentially economic quantities on the outer slopes of Guam and the Marianas. The shallowest species, Heterocarpus ensifer, occurs between 200 and 350 fathoms, with greatest quantities at the shallow end of the depth range; H. laevigatus, a larger species, occurs from 225 to 575 fathoms, peaking between 300 and 425 fathoms. The deepest species, H. longirostris, occurs below 600 fathoms, with greatest abundance at the lower end of its known range.

Heterocarpus shrimps feed on organic detritus and small invertebrates. They are preyed upon by fishes, particularly the large conger eels that live at those depths. There is some evidence that these shrimps move into the shallower parts of their depth range at night and descend into deeper waters during the day. This vertical movement may be related to feeding or predator avoidance.

Berried, or ovigerous, females carry their fertilized eggs under their abdomen until the eggs hatch. Berried females are found throughout the year. Males outnumber females by three or four to one in H. ensifer and H. laevigatus, and males are, on the whole, smaller than females. Many shrimps related to the

species of Heterocarpus found on Guam have been reported to exhibit sex reversal, beginning life as males and changing into females later in life.

Studies by the National Marine Fisheries Service have indicated that densities of deepwater shrimp are lower around Guam than they are around most of the other islands and banks of the Marianas archipelago. Estimated potential yields for Heterocarpus around Guam are approximately 4 metric tons per year; around Galvez Banks and Santa Rosa Reef, however, the annual yield could be as great as 20 metric tons.

Various trap designs have been used for capturing deepwater shrimps. In studies on these shrimps in 1975-77, the University of Guam Marine Laboratory used rectangular traps with a frame of rebar covered with industrial plastic mesh. The dimensions of these traps were 18 inches wide, 36 inches long, and 18 inches high. Funnel-shaped openings at each end allowed the shrimp to enter the trap. A cylindrical bait container, containing chopped fish (principally skipjack tuna and bigeye scad), was suspended inside the trap. The entire trap (except the ends) was further covered with burlap to concentrate the odor of the bait in the area of the funnel entryways. Studies around Guam in 1984 by the National Marine Fisheries Service (NMFS) utilized "quonset hut"-shaped traps with a base measuring 26 inches by 36 inches and a height of 18 inches. The NMFS traps were covered with wire mesh rather than plastic, but were otherwise constructed similarly to the UOG Marine Lab traps.

In the exploratory UOG shrimp trapping project, each trap was separately tethered to a 3/8-inch buoyed polypropylene line; the NMFS survey operated five traps per line. Commercial shrimping would require the deployment of as many traps per line as possible for the operation to be economically viable. The number of traps which can be attached to a single line depends upon the power of the line hauler available.

The traps are set at the appropriate depths for the shrimp (200 to over 600 fathoms) and extra line (25 to 50% of the bottom depth) is paid out to provide scope for movements of the float caused by wind or water currents. The location of the trap line is determined by lining up shore features or by using loran. The following day, the float is located and the traps retrieved with the line hauler. Once the catch is emptied from the trap, the bait container can be refilled and the trap reset.

The deepwater Heterocarpus shrimps tend to deteriorate rapidly upon being brought to the surface and so must be placed in iced brine immediately. Removing the heads will help to retard spoilage.

The catch rates during the UOG study were approximately 4 1/2 pounds of shrimp per trap-night. The NMFS survey averaged only about 1 1/2 pounds per trap-night around Guam, although higher catch rates were obtained for other areas of the Marianas.

Although several commerical deepwater shrimp trapping operations have been attempted on Guam, none has been successful. Perhaps new technological developments may make this fishery economically viable.

OVERSEAS FISHERIES INVOLVING GUAM

Over the years Guam has served as a fishing base and port-of-call for various fishing enterprises originating in Europe, Asia, and the mainland U.S. During the early 1800's, whalers from England and the United States began to stop on Guam for provisioning and relaxation. Apra Harbor was the major anchorage used by whaling vessels, although ships often stopped briefly at Umatac where water was more easily available. Food and firewood were the main supplies obtained by the whalers, for which they traded cloth and other commodities or paid cash. During its early years, trading with whaling ships was reasonably big business on Guam. However, by the end of the 1800's whaling had declined world-wide, and most Pacific whalers were stopping at other ports-of-call, such as Hawaii, rather than Guam.

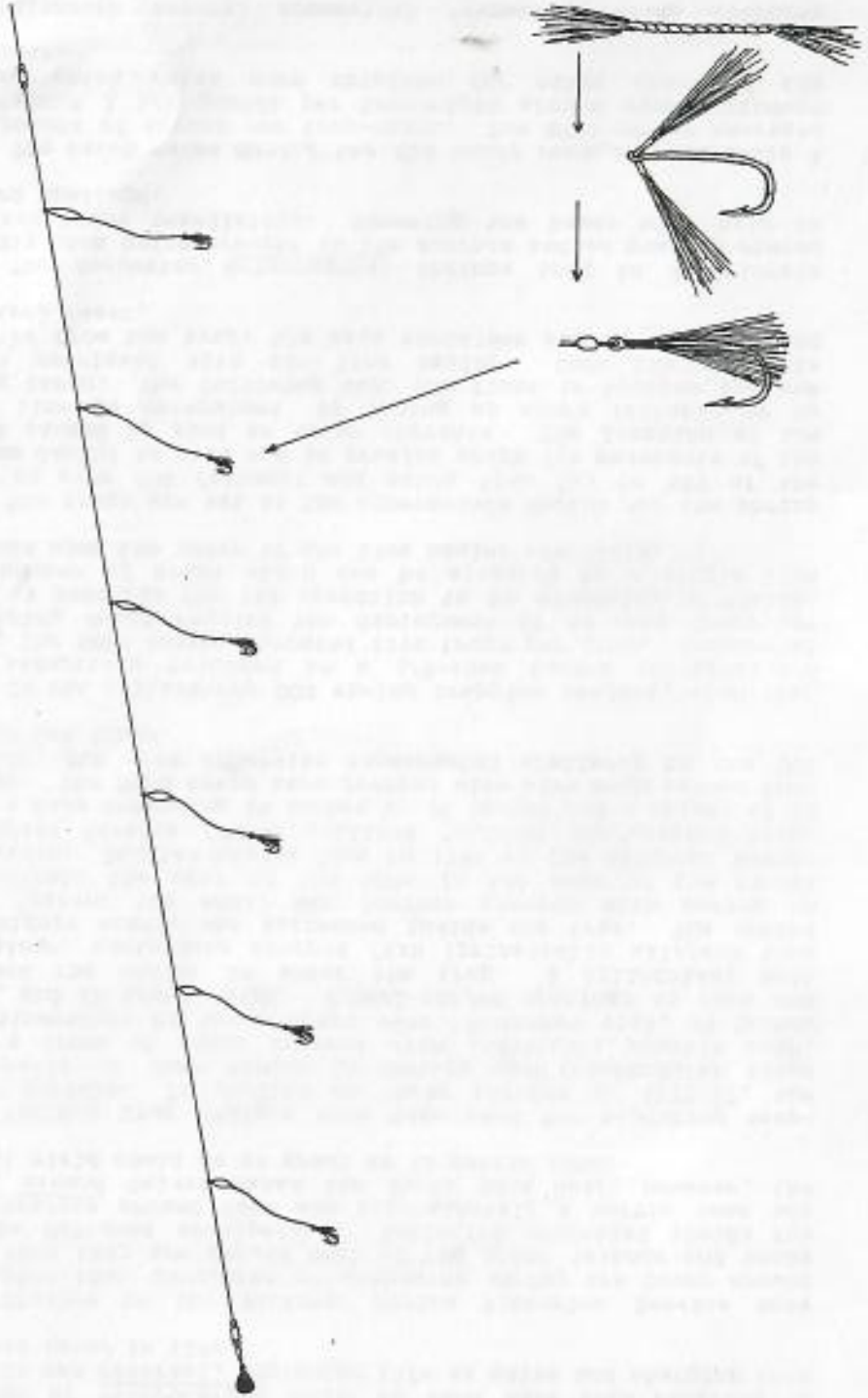
During their mandate over Micronesia (except Guam), which began after World War I, the Japanese developed live-bait, pole-and-line fisheries for skipjack tuna in almost all the Micronesian areas, including the Northern Marianas. These fisheries proved to be quite productive, but the fishermen engaged in them were almost all Japanese. However, local people were involved to some extent in the shore-side operations of these fisheries. This type of fishery was not developed in Guam during its occupation by Japan in World War II, and the other Micronesian pole-and-line fisheries eventually ceased during wartime.

After the war, the Japanese began rebuilding their fishery industry, and pole-and-line vessels as well as longliners began to extend their fishing range into the waters surrounding the Mariana Islands. The pole-and-line boats harvested skipjack tuna and surface-dwelling yellowfin tuna; longliners targeted deepwater yellowfin and bigeye tuna, with smaller catches of albacore and billfish. The Japanese were followed by the Taiwanese and Koreans, who began the development of their offshore fishing fleets with used longliners and bait boats purchased from Japan. The Japanese, meanwhile, began to develop purse-seining for surface-dwelling skipjack and yellowfin tuna.

These foreign fishing operations in the waters near Guam and the Northern Marianas provided no benefit to Guam until 1962, when U.S. Government restrictions on the use of Apra Harbor by foreign vessels were lifted. This made it possible for foreign fishing boats to call at Guam's Commerical Port to purchase fuel and provisions.

In 1974, the Commercial Port began tuna transshipment operations. Tuna fishing boats and carrier vessels working in the western Pacific could unload their tuna catch at the Commercial Port. The tuna was then loaded onto U.S. ships and carried to tuna canneries in California.

Initially, virtually all the vessels transshipping tuna through Guam were foreign vessels. In the 1980's however, U.S. tuna purse-seiners, which were originally operating in the eastern Pacific, began to move out into the western Pacific. These vessels fish primarily in equatorial waters, and most of them deliver their catch to the canneries in American Samoa. One U.S. company, Zee Enterprises, has located its center of operations in Guam.



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Heterocarpus shrimps feed on organic detritus and small invertebrates. They are preyed upon by fishes, particularly the large conger eels that live at those depths. There is some evidence that these shrimps move into the shallower parts of their depth range at night and descend into deeper waters during the day. This vertical movement may be related to feeding or predator avoidance.

Berried, or ovigerous, females carry their fertilized eggs under their abdomen until the eggs hatch. Berried females are found throughout the year. Males outnumber females by three or four to one in H. ensifer and H. laevigatus, and males are, on the whole, smaller than females. Many shrimps related to the

Guam also serves as a market for fish caught in the Philippines and Micronesia. Many of the fish imported from the Philippines are marketed on Guam by Filipino-run stores and purchased primarily by Filipino consumers. Similarly, Palauans living on Guam purchase much of the fish brought here from Palau. However, a considerable amount of the fish imported from off-island is purchased by consumers of all kinds, and recent studies indicate that more than two-thirds of the fresh and frozen whole fish consumed on Guam is imported, principally from the Philippines and Micronesia. The sources of this imported fish are areas of low labor costs, and so most of the imported fish can be sold at prices lower than prevailing prices for locally produced fish. If the island nations of Micronesia look to Guam as a market as they develop their local fishing capacity, there may be major impacts on local fishing on Guam.

CONCLUSION

During the 3000 or more years that Guam has been inhabited, the methods of fishing have changed in response to the development of new ideas and the introduction of new kinds of fishing gear. These technological changes have been accompanied by changes in the economic and social roles of fishing within the island community.

Despite these changes, there has been an underlying thread of continuity throughout these thousands of years. If a Chamorro resident of Guam of 1000 B.C. could be transported to the 1980's, he would no doubt be amazed at today's power boats (PLATE 64) and hydraulic line haulers, but he would recognize the fish caught, and he might even know some tricks to improve catch rates; he would appreciate modern nylon and monofilament net materials, but many of the net designs would be familiar to him; and he would understand and approve of the custom of sharing the fish catch, a practice which still exists alongside of commerical marketing.

Fishing will continue to be important on Guam if care is taken to manage resource stocks, and if fishery development occurs in a rational, considered manner. Proper management is particularly important for reef resources, because Guam's reef areas are of limited size, and their close proximity to the island makes them particularly vulnerable to pollution and to overharvesting.

The most important management consideration for reef species is the preservation of environmental quality. During the course of their lives, reef species, both fishes and invertebrates, occupy a variety of reef habitats. Juveniles often live in different habitats than adults, and spawning may take place in yet a different habitat. Sigificant disturbance of any of these habitat areas may disrupt the life cycles of some of these important resource species and result in declines in future harvests. To preserve these habitats, it is essential that present and potential sources of pollution be identified and that steps be taken to eliminate or ameliorate the effects of these pollutants on reef habitats.

A significant cause of habitat destruction is the use of explosives and chlorine bleach for harvesting fish. These destructive harvesting methods not only kill the species of fish that are being sought, but they also kill fishes too young to be profitably harvested as well as nontarget species that may play an important role in reef food chains. Even more importantly, they destroy habitats which provide food and living places for resource species.

The second resource management consideration is controlling overharvesting. Overharvesting occurs when a stock is fished heavily enough to remove most of the large individuals. As harvesting continues, the catch is made up of an increasing proportion of small fish. These fish are caught before they have had an opportunity to grow, and the total fishing yield, in terms of weight, declines because, although many fish may be caught, they are all small. This form of overharvesting is known as "growth overharvesting." If the fishing effort on the stock continues to be heavy, a more serious form of overharvesting, "recruitment overharvesting," can occur. This type of overharvesting results in a decline in reproduction and subsequent recruitment to the stock because only small fish, which carry fewer eggs, or fishes which are too young to reproduce, are left in the population. Recruitment overharvesting can result in collapse of a stock to a point where it becomes rare or absent in fishery catches.

There are various ways to control overharvesting, but one of the simplest ways is to restrict the harvesting of small sizes of fish. For some species this can be done by establishing minimum mesh sizes for nets, which will allow the smaller fishes to escape, providing them an opportunity to grow and reproduce before they are caught.

Management of offshore fishery resources is more difficult. Pelagic species (tunas, billfishes, mahimahi, etc.) spend only part of their life around Guam and the rest of it elsewhere where they may be caught in other fisheries. Managing these resources will depend upon international management programs involving all the countries whose waters are visited by these species.

Deepwater bottomfish and shrimps do not migrate significantly (as far as is known), and so they can be managed unilaterally. The difficulty is that these species are relatively poorly known biologically, and optimal management strategies have not been worked out. Minimum size restrictions have limited use for these deepwater resources, because undersized bottomfishes or shrimps are unlikely to survive being thrown back into the water after they have been brought up from great depths. Perhaps some system of rotating fishing areas (to provide opportunities for heavily fished grounds to recover) would help to maintain the productivity of these resources.

Further fishery development on Guam will necessarily be concentrated on offshore stocks, as reef species are probably being harvested at near their maximum levels now. Improvements in inshore fishing technology may make reef harvesting more efficient, but there do not appear to be many opportunities to increase overall reef catch. There may, however, be opportunities to increase the local catch of pelagic species or to develop new deepwater fishery resources not presently being

harvested. The challenge to fishery management and development on Guam for the future will be to maintain (or enhance) the yield of presently harvested species, while developing new fisheries for currently underexploited resources. The people of Guam should be up to the challenge.

NOTES

Rather than including extensive citations in the text of the book, we are indicating our major sources of information for each chapter in these notes. Full bibliographical references are contained in the Bibliography.

INTRODUCTION-- Darlene Moore and L. G. Eldredge provided information on archaeological remains of domestic animals and on the probable introduction of the monitor lizard by the early Chamorros. With regard to the human introduction of the monitor lizard (Varanus indicus), Eldredge points out that Guam has two native species of ground-nesting birds which probably would not have survived on the island in the presence of the egg-eating monitor lizards. The monitor lizard is known to have been introduced to other Micronesian islands.

ANCIENT FISHING PRACTICES-- Hiro Kurashina of the University of Guam's Micronesian Area Research Center (MARC) has obtained a radiocarbon date of 1740 70 years BC for the Tarague site in northern Guam. Anell's (1955) study contains a wealth of information on fishing technology throughout the Pacific islands. Early archaeological work in Guam and the Marianas is documented by Laura Thompson (1932). Information on recent archaeological excavations was provided by Hiro Kurashina and Darlene Moore.

FISHING DURING SPANISH TIMES-- the University of Guam's Micronesian Area Research Center (MARC) was the source of historic Spanish and other European documents describing Guam during the Spanish period. Marjorie Driver, Albert Williams, and L. G. Eldredge (who also provided us with copies of documents from his own files) were exceedingly helpful. Marjorie Driver's (1983) translation of Juan Pobre de Zamora's diary was the source of Sancho's account of flyingfish fishing. An unpublished translation (by Sylvia Cheng), of the report of the Freycinet expedition was the source of information on Guam fishing methods in the early 1800's. Don Felipe de la Corte's account of fishing on Guam is contained in a translation of his lengthy report by the MARC staff.

THE PREWAR AMERICAN PERIOD-- The information in this chapter came from the reports of Fritz (1984; translated by E. Craddock) and Safford (1905).

FISHING DURING THE 1930'S AND 1940'S-- We were extremely fortunate to be able to interview several knowledgeable old-time fishermen who provided us with a wealth of information on past fishing practices on Guam, including Juan Rivera Chaco and Johnny Chaco of Agat, Albert Topasna of Umatac, Tony Quitugua of Talofofo, Frank Mendiola of Yona, and Judge Ramon Diaz.

THE JAPANESE OCCUPATION-- Information on this period of time on Guam was also provided by the individuals listed above.

POSTWAR YEARS-- Robert O. Smith's report ("Survey of the Fisheries of the Former Japanese Mandated Islands") was published by the U.S. Fish and Wildlife Service, U.S. Department of Interior.

MODERN FISHING PRACTICES-- The Guam Division of Aquatic and Wildlife Resources was especially helpful in providing published and unpublished data on fisheries that the Division has been collecting over the years. We wish to thank Harry Kami, Mike Molina, Rob Myers, and Gerry Davis for their assistance. In particular, Gerry Davis, who has developed a real understanding of local fishing practices through his day-to-day contact with local fishermen, was extremely helpful to us.

REEF FISH HARVESTING-- Our information on atulai fishing was provided by the acknowledged authority, "Johnny Atulai" Taitano. Further information on reef fish biology and behavior is contained in Guide to the Coastal Resources of Guam Vol. I. The Fishes by Amesbury and Myers (1982).

REEF INVERTEBRATE HARVESTING-- This chapter was authored by Barry Smith of the University of Guam Marine Laboratory. The cuttlefish lure he describes was made by Gerry Davis based on local models; the description of the bamboo crab trap is based on one from the collection of L. G. Eldredge. Further information on coconut crabs can be found in the report by Amesbury (1980).

FRESHWATER SHRIMP TRAPPING-- Antonio Bautista Lujan of Ordot demonstrated the construction of his shrimp traps and explained their use to us.

OFFSHORE FISHING-- The National Marine Fisheries Service (NMFS) Honolulu Laboratory conducted a two-year survey of offshore fishery resources around Guam and the Northern Marianas (Polovina et al., 1985). Information on bottomfish distribution was analyzed by Polovina (1985). Information on the seasonality of trolling catches was obtained from Guam Division of Aquatic and Wildlife Annual Reports as well as from unpublished information graciously made available by the Division. Jerry Oberheim provided information on trolling areas around the island. Michael Wilder's (1977) Master's thesis contains additional information on deep-water shrimp trapping.

OVERSEAS FISHERIES INVOLVING GUAM-- The history of the whaling industry on Guam was described by Doty (1972). Callaghan and Simmons (1980) described the tuna transshipment operation at Guam's Commercial Port, and Myers et al. (1983) documented the fish imports to Guam from the Philippines and Micronesia.

CONCLUSION-- The Territory of Guam Fisheries Development and Management Plan (Amesbury and Callaghan, 1981) outlines various fishery development options for Guam.

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Rob Myers:	Plates 25, 29 31-33, 38-39, 42-45
Barry Smith:	Plates 28, 30, 36-37, 40-41
Tom Guest:	Plates 49, 62

Erratum

Two bivalve species names were inadvertently omitted from the caption of Plate 30: center right: *Ctena bella*; lower left: *Gafrarium tumidum*

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Pacific Daily Ne

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Commission
Japanese rel

From Daily News Wires

WASHINGTON — Sending 120,000 Japanese Americans to relocation camps during World War II was not militarily necessary and followed "a long and ugly history" of racism against them on the West Coast, a federal panel said Thursday.

The Commission on Wartime Relocation and Internment of Civilians condemned officials, starting with President Franklin D. Roosevelt, who it said did not calm the public hysteria after Pearl Harbor and 10 weeks later signed the order to round up the Japanese Americans.

"A grave injustice was done to American citizens and resident aliens of Japanese ancestry, who without individual review or any probative evidence against them, were excluded, removed and detained by the United States during World War II," the commission said.

The commission made no recommendation in its report, but will issue those separately. The recommendation are believed to include reparations, although far smaller in amount than the $3 billion some Japanese-

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By FRANK QUIMBY
Daily News Staff

The U.S. Army wants to build a large incinerator on Johnston Island in the central Pacific to dispose of toxic chemicals used in weapons because federal law bans returning the hazardous material to the United States.

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Daily News photo by Manuel

Turtles return to sea

Alan Hosner of the Division of Aquatic and Wildlife Resources pets a hawksbill turtle on its way back to the sea. Five hawksbill and one green turtle were measured, tagged and released yesterday off Ritidian Point by the Coast Guard cutter Cape George. The endangered reptiles, smuggled from the Philippines, were confiscated on the West Coast and turned over to amusement parks to raise. After they were mature enough, they were sent to Guam to be released.

The chemicals — identified in an Army news release as nerve agents GB, VX and mustard, a blistering agent — are stored in obsolete rockets, mines, bombs and projectiles now on Johnston.

The weapons and chemicals were shipped to Johnston from Okinawa in 1971, and should be disposed of as soon as possible, according to the Army's Toxic and Hazardous Materials Agency.

The plant could be under construction by 1985 and the disposal could begin three years later, according to the agency, which would carry out the disposal.

Public Law 91-672, passed in 1070, prohibits the Army from returning the material to the United States.

Johnston, a 625-acre island about

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PHOTO BY CHRIS WILLE

GUAM WILD PIG

If you walk carefully and quietly through the deepest jungle on Guam you may see a wild pig. Although pigs are common farm animals, some live in the forest completely away from people. These wild pigs are intelligent and adaptable animals. They are very secretive and may hide when people come near.

The pig was shipped to Guam many years ago and is related to the European wild hog. It is a small hog, often black, with stiff bristle-like hair. Some wild pigs are spotted with white and red. These mixed colors come from breeding with farmer's pigs.

Pigs have one litter of babies each year. There are usually three to eight piglets in a litter. They nurse from the sow, or mother pig, for milk and quickly begin finding their own food.

Wild pigs are omnivorous. This means that they can eat almost anything. They dig around in the forest floor with their nose looking for fallen fruits, young plants, coconuts and even animals like worms and snails.

Wild pigs are protected by law and may not be hunted except during the legal hunting season. There aren't as many pigs as there used to be because of illegal hunting and loss of good pig habitat.

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PHOTO BY CHRIS WILLE

BLIND SNAKE

Many islanders have never seen Guam's only native snake, the blind snake. This tiny snake got to Guam without help from people. Our only other snake, the rat snake, got to Guam by hiding in a boat.

The blind snake is shy and secretive. It lives underground and is often found in rotting logs or piles of leaves. At first glance it may be mistaken for a worm. In fact, it is often called the "worm snake." But take a close look and you'll see tiny scales covering the blind snake. It also has a forked tongue. Like other snakes, the blind snake uses its tongue for smelling.

The blind snake can move quickly above ground and seems to almost swim through loose soil. It feeds on ants, termites, worms and insect larvae. Eyesight is not very useful underground, but the blind snake is not really blind. It has small, weak eyes that can tell dark from light, but that's about all.

No one knows very much about the blind snake's life and habits. We do know that it lays eggs in the soil. The eggs are like grains of rice and are left to hatch on their own.

The next time you're digging in the forest floor, watch out for Guam's unusual little blind snake.

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PHOTO BY CHRIS WILLE

GECKO

The gecko is one of the most common animals on Guam. These small lizards have learned to live in harmony with people. Geckos may be found anywhere, but are most numerous in and around houses. The lights attract flying insects, the gecko's favorite food, so they can find both food and shelter under our roofs.

Most reptiles are silent, but geckos make a loud ticking sound. They call at all times of the day and night, possibly to warn other geckos that are entering their territory. Another unusual feature of geckos are their five, specially shaped, toes which help them run on smooth vertical serfaces such as walls.

Geckos lay two, small, pea-shaped eggs that hatch in about a month. The baby geckos have to immediately begin finding their own food and avoiding predators such as birds. If a gecko is caught by the tail, it simply loses its tail and escapes. In time it can grow a new tail.

Geckos are harmless and many people consider them a sign of good luck to have them in the house. They are called "gualiig" in Chamorro. Geckos are native animals, arriving on Guam before people. They may have reached Guam by riding across the sea on a floating log.

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PHOTO BY CHRIS WILLE

MONITOR LIZARD

This handsomely spotted lizard is often called an iguana, but there are no iguanas in this part of the world. The monitor or "halitai" has a pattern of yellow or white on a dark green background which blends in perfectly with jungle leaves.

No one knows how monitors got to Guam but it is certain that they have been in Micronesia a long time. They are very well adapted to island living. They can run with considerable speed, climb trees, dig holes and swim.

A three-foot long monitor is about average size. Deep in the jungle they may grow to five or even six feet. These reptiles will eat almost anything that they can catch including: insects, snails, smaller lizards, rats, crabs, birds, and bird eggs. They can even catch fish in the water.

The monitor digs a hole under a rock or tree for a nesting den. In this hole the female will lay eggs about the size of a chicken's egg, but with a soft, leather-like shell. Baby monitors make good pets as they are easy to feed. Monitors are found everywhere on Guam. There are not as many monitors as there used to be.

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PHOTO BY CHRIS WILLE

PHILIPPINE RAT SNAKE

The rat snake appeared on Guam soon after the Second World War. No one knows for certain where it came from, but biologists guess that it came to Guam by ship. It may have been hiding in a shipload of military supplies from the Philippines, Malaysia or Australia. Rat snakes are common throughout the Pacific. Most are about three to four feet long but some rat snakes over ten feet have been found.

As its name suggests, the rat snake eats rodents like rats, mice and shrews. It also enjoys birds and bird eggs. Since it is an excellent climber, the snake can hunt for birds in the treetops. Rat snakes are nocturnal, hunting mostly at night. Like most reptiles, they can go for long periods without food.

Rat snakes are constrictors, killing their prey by wrapping around it and squeezing. Their poison is not dangerous to people because the snake must hold onto its prey and chew, allowing the poison to slowly leak into the victim. Rat snakes will strike and bite if cornered, but people have little reason to fear them.

Guam's rat snake performs a valuable service for people by eating rats and mice. Unfortunately they may also be part of the reason why we have so few forest birds left.

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PHOTO BY COURTESY OF GEORGE H. HARRISON

TOAD

Frogs and toads are amphibians which means that they live part of their lives in water and part on land. Guam has just one kind of toad and a few little frogs. Toads usually have dry, bumpy skin while frogs have smooth, moist skin.

Guam's toad was brought to the island in 1937 by people who hoped it would eat up insects and the black garden slug. It cleaned up most of the pesky slugs and few are seen today. They still eat lots of insects.

The toad makes a white juice on its skin which is poisonous to small animals. This juice keeps animals like dogs and cats from eating them. It's okay to pick up toads. They will not give people warts. It wouldn't be a good idea to put one in your mouth, as the toad's protective juice could make you sick, too.

Toads lay their eggs in fresh water. Any puddle or pond will do. An amazing thing happens with toad eggs. They hatch into animals that look more like fish than toads. The little tadpoles quickly grow legs, lose their tails, and adapt to life on land.

Toads have become very common on Guam and can be seen in large groups on streets and lawns during the rainy season.

Toads feed mostly at night. They catch insects by zapping them with their long, sticky tongues.

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PHOTO BY CHRIS WILLE

SKINK

It would be difficult to walk anywhere on Guam without seeing a skink. These quick little lizards are everywhere. There are several different kinds, or species, of skinks on Guam. One species has a bright blue tail. Another is brown from head to tail. Some kinds are very rare, found only on Guam. Others are common and have relatives all over the world.

Skinks have scales, like snakes, that are arranged in neat rows and overlap like shingles. Skinks, like other lizards, are cold blooded. This means that their body temperature is the same as the outside air temperature. They like to stay warm so you'll see them laying in the sun on rocks and logs.

Skinks eat insects so there is plenty of food for them on Guam. They can run very fast to catch insects or escape predators like birds. If a skink is caught by the tail, it will just run away and leave its tail behind. They can quickly grow a new tail.

While geckos enjoy living in people's homes, skinks avoid people and stay on the edge of yards and in wooded areas.

Skinks are harmless and make interesting pets. Like any animal, they require food, water and shelter, whether outdoors or in captivity.

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DEPARTMENT OF AGRICULTURE
GOVERNMENT OF GUAM

PHOTO BY ANNE MABEN DIVISION OF AQUATIC AND WILDLIFE RESOURCES

Rattus exulans **POLYNESIAN RAT**

Chaka

The Polynesian rat is found throughout the Pacific and probably arrived on Guam on a floating log. This brown furry rodent lives in grasslands, forests and weeds around villages.

Like other rodents, its front upper and lower teeth grow throughout its life. These razorsharp teeth allow them to cut through tasty grasses, seeds and coconuts.

Polynesian rats have more than one litter per year with three or four babies in each litter. The babies leave their nests at about three weeks. They are able to reproduce when they are three months old.

Most rats are nocturnal - they are active at night, but this rat is also active during the day (diurnal).

Guam has two other species of rats that arrived by hiding in cargo ships. Rattus rattus, the roof rat, looks almost like the Polynesian rat but is a darker color and feeds at night. Rattus norvegicus, the Norway rat, can grow as big as a small cat, and is usually only found around old buildings. They can cause serious damage to food and other goods stored in these buildings.

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PHOTO BY CHRIS WILLE

ANOLE

This beautiful, bright green lizard can change colors slightly to match whatever it's sitting on. This makes it hard for predators to find him. Another lizard, the chameleon, is famous for its ability to change colors so the anole is sometimes called the American chameleon.

Skinks live mostly on the forest floor. Geckos prefer to live in people's homes and the anole spends most of its life in trees and bushes. Anoles are somewhat larger than either geckos or skinks. The adult male anole has a bright pink throat pouch which he blows up to attract females. A full grown anole may be over seven inches long.

The female lays just one egg at a time in a hidden place. She may lay an egg every two or three weeks. When the eggs hatch, the baby anoles must begin finding their own food.

Anoles eat insects, spiders and other small creatures. They are especially good at catching flying insects with a flick of their long, sticky tongue.

The anole has been a favorite pet of children for centuries. They are harmless, easy to keep, and can be tamed somewhat.

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PHOTO BY COURTESY OF GEORGE H. HARRISON

MARIANAS FRUIT BAT Endangered Species

Guam's fruit bat, "fanihi," is an endangered species. At one time huge flocks of bats filled the evening sky, but now there are only a few hundred left. The Marianas fruit bat lives only on Guam and some of the Northern Marianas Islands.

Fruit bats roost in trees. They live together in groups or colonies. They have good eyesight and are most active during the early morning and evening hours. These graceful flyers eat guavas, custard apples, bananas, pandanas fruit, breadfruit, banyan fruit, papayas and many other fruits and blossoms. Fruit bats are mammals and have only one baby a year. The young bat clings to its mother and nurses her for milk until it is old enough to find food on its own.

Bats live deep in the forest where there is lots of fruit and where they will be undisturbed by people. Since most of Guam's forest has been destroyed, there is not much room left for bats. Another problem is that bats are good to eat. Too many are being shot and eaten by people who don't care whether we have any bats in the future. Fruit bats on Guam are completely protected by law and may not be hunted or chased.

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PHOTO BY COURTESY OF GEORGE H. HARRISON

GIANT AFRICAN SNAIL

This large land snail can be seen everywhere on Guam after a few days of rain. Snails usually hide from the heat of the sun and come out to feed only at night. They are most active during the rainy season.

The Giant African Snail is an expert hitchhiker. It started out in Africa and has hitched rides on boats to most warm places around the world. They came to Guam during the Second World War, probably by hiding aboard a military ship. Some biologists think that people also brought the snail here on purpose because they liked to eat them.

Snails grow quickly and may be full size in two years. Some snails over seven inches long have been found, but most are about three inches. Each snail is both male and female. The adults mate and lay hundreds of eggs in loose soil and under leaves.

Snails are interesting to watch as they slide slowly along, tasting everything in their path.

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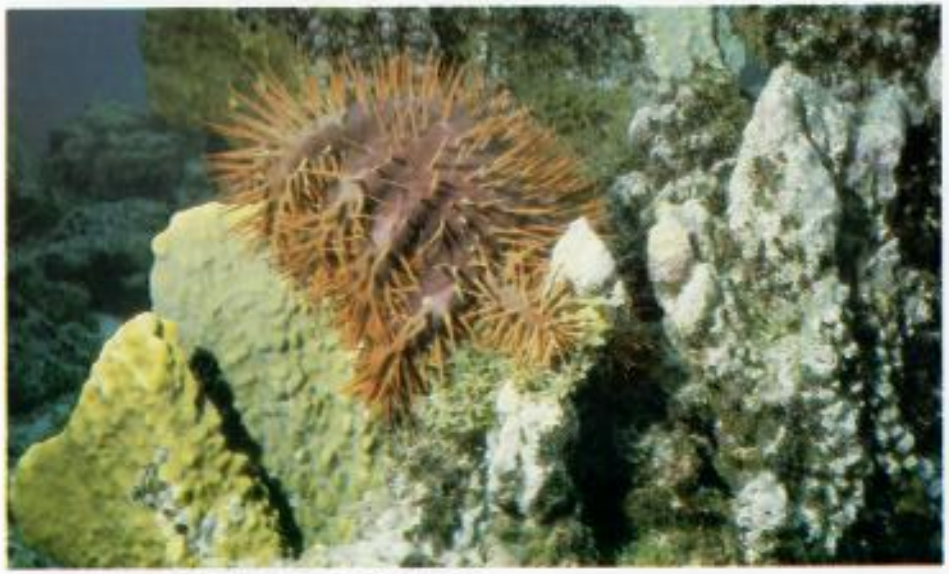
GRADUATE PROGRAM IN TROPICAL MARINE BIOLOGY AND ECOLOGY



MARINE LABORATORY, UNIVERSITY OF GUAM

THE PROGRAM

The University of Guam offers a graduate program of study leading to the Masters of Science in Biology with specialization in

the university's IBM 4300 series computer which has SAS and BMDP statistical packages available in addition to several IBM personal computers.

220 species of marine plants, 350 species of molluscs, and 800 species of coral reef fishes indicate that Guam is within one of the richest biogeographic provinces yet studied. The

Robert H. Richmond, Ph.D.,
State University of New York at Stony Brook;
Coral physiology and larval ecology.

tropical marine biology. The M.S. degree requires a total of 30 semester credits of course work and thesis research. The program is designed for careers in marine (especially coral reef) ecology, environmental protection, aquaculture, fisheries, marine zoology, microbiology, and botany. It also prepares students for future entry into Ph.D. programs. The program provides a balance between laboratory, field, and theoretical studies and emphasizes the use of modern equipment and research techniques.

FACILITIES

The Graduate Program in Biology is supported by the facilities of the Marine Laboratory and the Department of Biology. A 38-foot research vessel, two smaller outboard motor crafts, as well as inflatables allow access to the diverse coral reef habitats which surround the island. The Marine Lab maintains a flowing seawater system with numerous tanks for the culture and maintenance of marine organisms. A shop/technical services wing at the laboratory and three marine technicians provide technical support for research projects. Field and laboratory equipment include a current meter, an underwater color video system, oxygen and specific ion meters and probes, a Gilson respirometer, a lyophilizer, a chloride titrator, microbomb calorimeter, light meters, ashing ovens, refrigerated centrifuge, an environmental chamber, a CHNS analyzer, electrophoresis equipment, histological equipment and supplies, and chromatographic equipment and supplies. The lab has an IBM 3276 terminal linked to

THE UNIVERSITY

The University of Guam is a public Land Grant institution established as the only U.S. university in the Western Pacific. It serves as the primary institution of higher learning for a region of the Pacific almost as large as the continental U.S. The campus is located on a bluff overlooking the ocean about 6 miles from Agana, the capital of Guam. Total enrollment is approximately 2500 students, presently including 8-15 students in the Graduate Program in Biology.

GUAM

Guam is a U.S. territory (pop. 115,000) with an elected local government. The 205 square mile island is situated at 13° N, 143° E in the western Pacific with New Guinea as the nearest large land mass. Air temperature ranges from 78-93 F. Water sports, diving, fishing, and beachcombing are favorite pastimes on the island. The economy is highly dependent upon tourism and military expenditures. Guam is within the U.S. domestic mail system. There are good telephone connections to the U.S. mainland and other countries. Modern hospitals and medical facilities are available.

THE REEFS AND ENVIRONMENT

Guam is surrounded by thriving, diverse coral reefs and therefore provides excellent opportunities for the study of tropical marine biology. About 300 species of scleratinian corals,

lab is unique among U.S. marine laboratories with modern laboratory facilities and equipment situated less than 100 yards from a biologically-rich coral reef, with other reef habitats within easy access by land and small boats.

FINANCIAL SUPPORT

Graduate student financial support is available through research assistantships on grants or contracts awarded to faculty of the program.

THE FACULTY

Steven S. Amesbury, Ph. D., University of Hawaii; Ichthyology, population biology.

Charles E. Birkeland, Ph. D., University of Washington; Community ecology, species interactions.

Lucius G. Eldredge, Ph. D., University of Hawaii; Invertebrate biogeography and taxonomy.

Stephen G. Nelson, Ph. D., University of California-Davis; Aquaculture, coral reef ecology.

Valerie J. Paul, Ph. D., Scripps Institution of Oceanography; Marine chemical ecology, natural products chemistry.

Richard H. Randall, M.S., University of Guam; Coral taxonomy and ecology, island geology.

EXTENSION FACULTY

Barry D. Smith, M.S., University of Guam; Marine Extension Agent, University of Hawaii-University of Guam Sea Grant Program.

David P. Crisostomo, M.Ag., Texas A&M University; Cooperative Extension Service aquaculture agent.

AFFILIATES

Narayana S. Balakrishnan, Ph.D., University of Hawaii; Physical organic chemistry, NMR spectroscopy.

James A. Marsh Jr., Ph.D., University of Georgia; Energy and nutrient flow.

Ernest A. Matson, Ph.D., University of Connecticut; Marine microbiology. (Coordinator, Graduate program in Biology).

Chu-Tak Tseng, Ph.D., Cornell University; Modeling computer programming.

Roy T. Tsuda, Ph.D., University of Hawaii; Algal taxonomy and ecology.

For applications
and further information,
please write:

Graduate Program Coordinator
Marine Laboratory
University of Guam
UOG Station
Mangilao, Guam 96923
(671) 734-2421
Telex: 721-6275

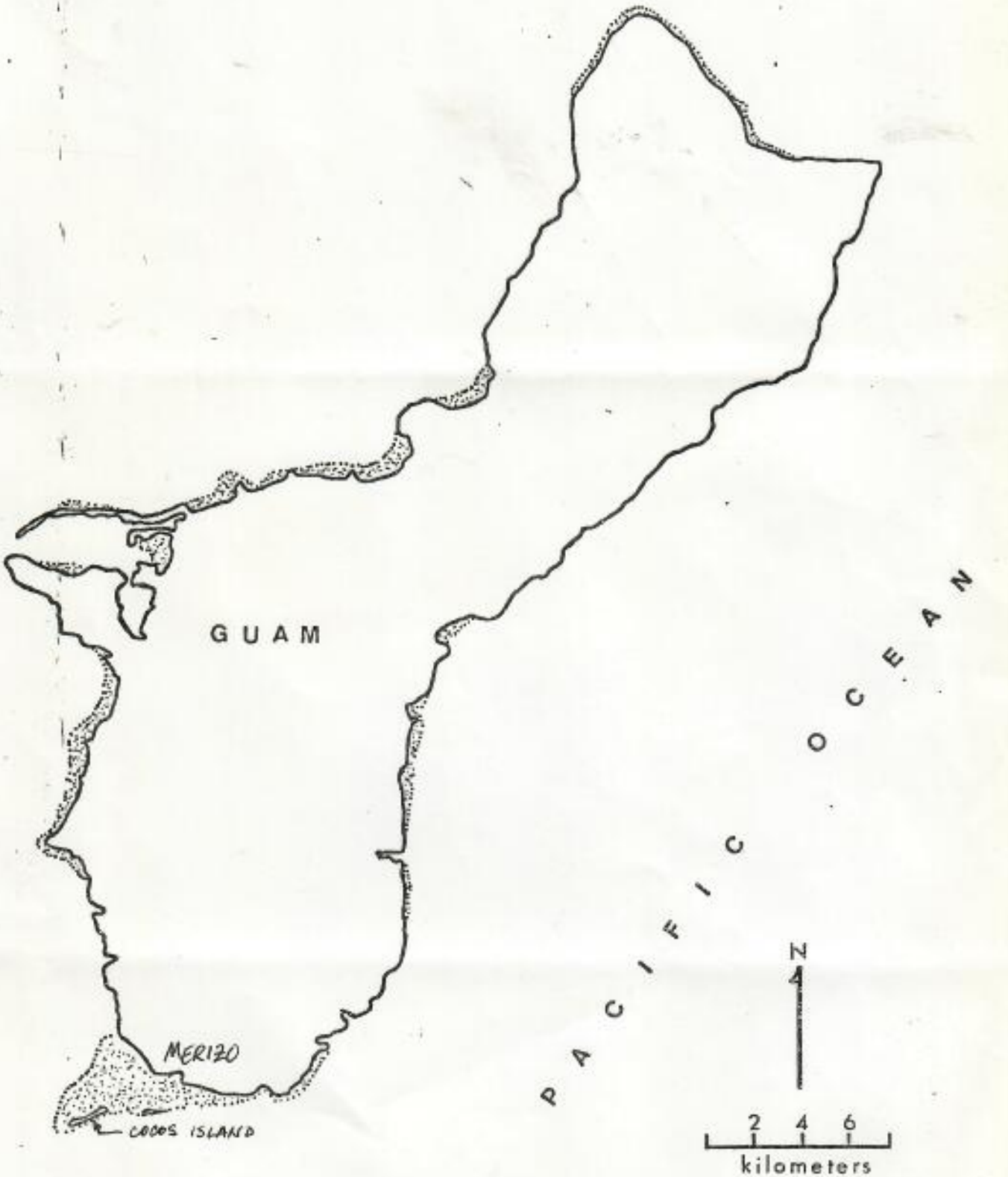


FIGURE 1. MAP OF GUAM SHOWING THE LOCATION OF COCOS ISLAND.

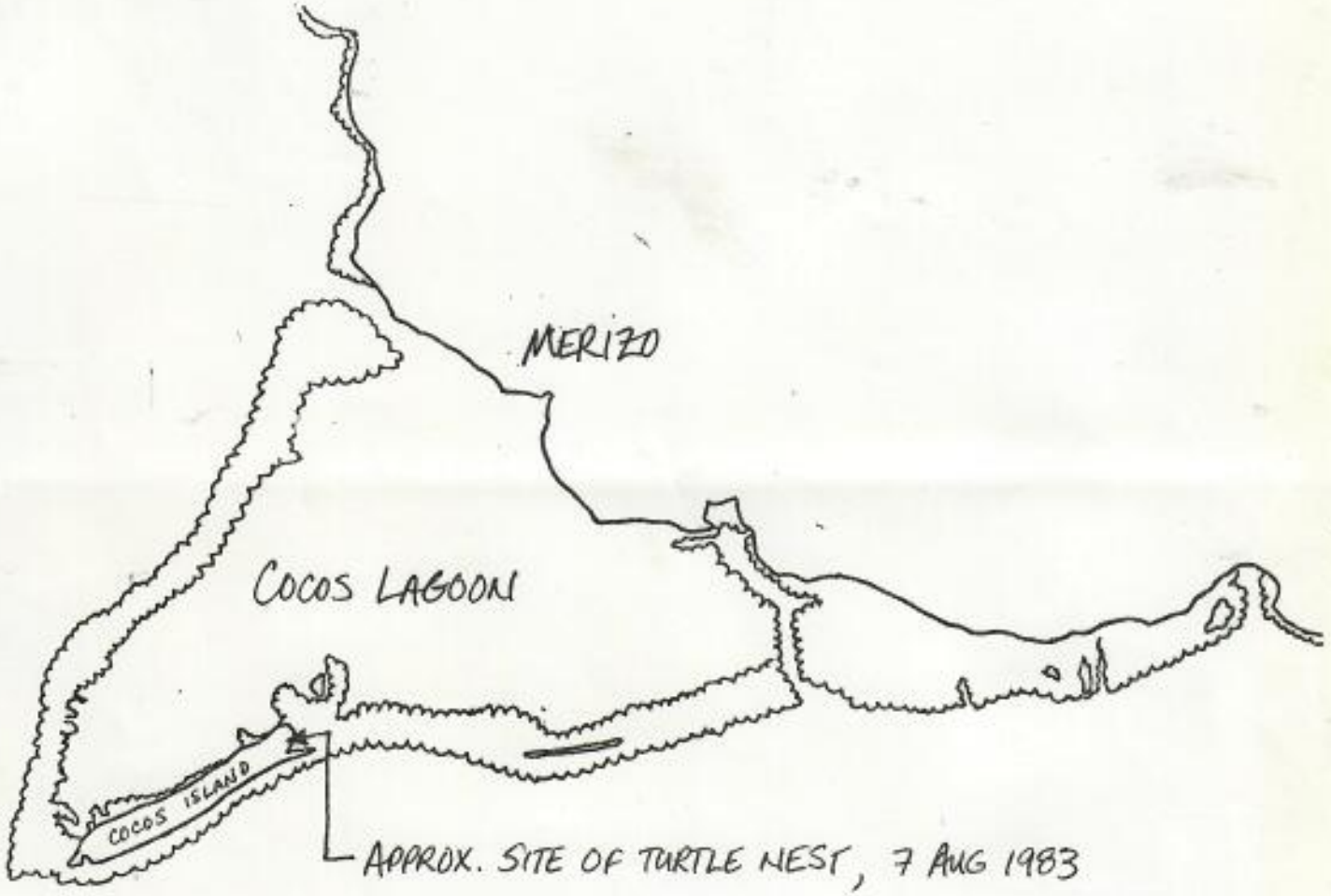


FIGURE 2. MAP OF COCOS LAGOON & COCOS ISLAND SHOWING THE APPROXIMATE SITE OF THE TURTLE NEST SIGHTED 7 AUG 1983.

KEY TO SLIDES:

These are photos of the apparent "false-turtle-nest" found on Cocos Island, Guam on August 7, 1983.. The general location is the northeast end of Cocos Island on the lagoonward side.

Slide #	Description
1	Close-up of the "Nest Site" just in front of a man-made mound.
2	The "Nest Site" looking north toward Guam across Cocos Lagoon.
3	The "Nest Site" looking east toward Guam and the eastern barrier reef.
4	The beach on the lagoonward side of Cocos Island adjacent to the "Nest Site".
5	On the beach adjacent to the "Nest Site" looking north toward Guam across Cocos Lagoon.
6	On the beach adjacent to the "Nest Site" looking east toward the eastern barrier reef.

the lagoon. Several of these seemed confused and returned to shore, but all were finally returned successfully to the sea. The officers photographed the hatchlings and we are now awaiting our copies of the film, as well as the exact date of the hatch. I should be able to forward both of these to you within the next two weeks. Apparently, the original nest site may have been a "false-nest" since as of today, it has remained unchanged. The slides I've enclosed with this letter are of this "false-nest" and the beach directly adjacent to it.

I hope this information will be beneficial to all concerned. If I can be of further assistance do not hesitate to contact me. Take care.

Sincerely,

MICHAEL E. MOLINA
Fishery Supervisor
Aquatic & Wildlife Resources

Enclosures

ENFORCEMENT SECTION
ANNUAL REPORT

Beginning June 1, 1978 to September 30, 1979, fourteen (14) separate arrests for illegal hunting were made by the Conservation Officers. All apprehensions were made at night during late evening and early morning hours. Of these arrests, a total number of 36 adults and one minor were involved. The suspects in these cases either pleaded guilty or were deferred by the Attorney General.

Incidents which didn't materialized into cases were also recorded. They are as follows: Seven incidents of illegal capturing of wild game; twenty seven illegal spotlighting as an aid to take game; seven fish poisoning; five dynamiting; and one illegally constructed fish weir.

A joint civil/military operation was conducted in Naval Magazine to prevent illegal hunting and unauthorized personnel from trespassing. One daylight sweep was conducted in the area by Marine personnel and the Conservation Officers. Four night patrols were set up by the Conservation Officers with the Marine securities, Navy securities and the SED of the Department of Public Safety participating in the operations.

All four Conservation Officers attended the Consolidated Law Enforcement Training Program and completed 90 hours of courses including self-defense and qualifying with a .38 Cal. revolver.

Report prepared by: Charles R. Bonds

Fishing?