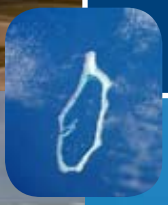
# Journal of MICRONESIAN FISHING

Spring 2011

## Helen Reef

### Hatohobei State, Palau

Conservation success on a remote atoll rich in marine resources



INSIDE: Improving Kosrae's Mangrove Crab Stocks, Good Fish Bad Fish: The Mercury Dilemma, The Evolution of your Catch and From Catch to Kitchen

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*Journal of* MICRONESIAN FISHING

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*Helen Reef's rich biodiversity on land and sea.*

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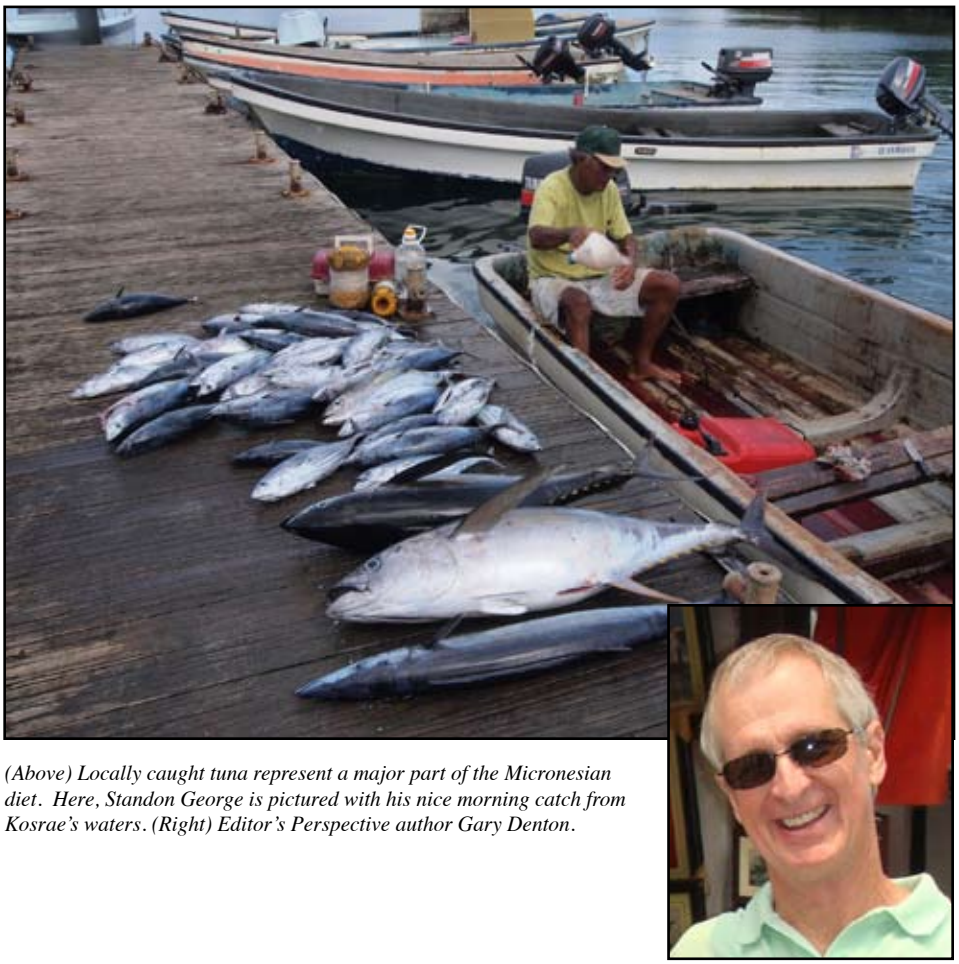
# EDITORS PERSPECTIVE
## Good Fish Bad Fish: The Mercury Dilemma

BY GARY DENTON



*(Above) Locally caught tuna represent a major part of the Micronesian diet. Here, Standon George is pictured with his nice morning catch from Kosrae's waters. (Right) Editor's Perspective author Gary Denton.*

When I was a boy my mother always used to encourage me to eat fish by telling me it was good for the brain. I still wonder how she knew that all those years ago when only recently have scientists reached the same conclusion. Fish are indeed good for the brain by virtue of their omega-3 fatty acid content. These chemicals play a vital role in our intellectual development and fish, especially oily fish, provide us with an abundant supply of them. We now know, of course, that omega-3 fatty acids are also good for the heart and afford us some protection against heart disease, arrhythmia and heart attacks. But the health benefits of eating fish do not stop here. Fish are rich in certain vitamins (A, B3, B6 and D) and minerals (potassium, iodine, iron, selenium and zinc) that are essential for our normal growth and development. They are also low in cholesterol, calories, sodium and saturated fats. These dietary attributes are thought to reduce our risk of contracting certain types of cancer and help protect us against dementia, diabetes, depression, rheumatoid arthritis, psoriasis, stroke, hypertension and autoimmune disease.

We hear a lot about mercury in the environment these days and how various human activities (e.g., mining, burning of fossil fuels, industrial discharges) have greatly added to amounts released from the earth's crust by natural processes (e.g., weathering of rocks and volcanic eruptions). The dangers of eating fish with elevated levels of mercury in their tissues are also well publicized and many people have chosen to exclude fish from their diet as a result. Unfortunately, the decision to permanently abstain from eating fish is all too often emotionally driven, borne out of fear rather than sound science. The layperson generally has very little idea of what is normal and what is not when it comes to mercury in fish.

The simple fact of the matter is that all living creatures contain traces of mercury in their tissues, even in pristine environments. Fish demonstrate a relatively high propensity for this element and we in turn acquire most of our dietary mercury through eating them. Mercury levels in ocean fish from clean environments typically range from 0.001 to 0.1 parts per million (ppm) and are usually higher in carnivores than lower trophic members. Values within this range are generally considered to be insignificant from a human health standpoint although the US Environmental Protection Agency (USEPA) advises that fish containing mercury in excess of 0.03 ppm may be harmful to children if consumed on a daily basis. Since mercury may cross the placental barrier and accumulate in breast milk, the agency also recommends that women of childbearing age and nursing mothers limit their consumption of fish exceeding this critical value. It is noteworthy that the USEPA consumption guidelines for mercury in fish are the most conservative in the world and are considered by some scientists, including

*MERCURY* CONTINUED ON PAGE 12

# Improving Kosrae's Mangrove Crab Stocks

PART ONE OF A TWO-PART FEATURE

BY KOLEA "KULUL" SCHONWALTER

I had arranged an interview with Maxwell Salik of the Kosrae State Crab Hatchery before the New Year's holiday. While I was waiting, I had hoped to read some literature from the state crab hatchery. As funding for the mangrove crab project has dwindled, or more precisely, is waiting for another start from an international financing source, I was handed instead a report entitled Fisheries Development Section: Field Report No. 6 on Fish Aggregating Devices (FAD). Attracting fish to a specific location to improve fishermen's catch and raising mangrove crabs (Scylla serata) are apparently, and ironically similar, in that current efforts of sustainable management don't always proceed as planned. It seems both the FAD project and the Lelu crab hatchery seem to have the vagaries of funding as well as the difficulties of the scientific method.

The day for the interview had arrived. I was ready to roll up my sleeves and poke my hands around in tanks, or observe the crab larvae swimming or settling in tanks. Instead, the tanks were temporarily empty. This did not bode well as the rumors I had been hearing from local fishermen were that the mangrove crabs were now becoming less abundant, and more desirable. This confirmed the guilty pleasure I felt when eating these succulent crabs.

"The whole idea of the project was to raise crab larvae and put them in protective pens in the mangrove areas. We started the hatchery in Lelu in 2004. Right now we have three pens: one in Tafunsak, one in Utwe, and one in Lelu. We are still struggling to make them more productive. We continue our research to improve the successful grow-out rate of the larvae," explained Salik.

"Female crabs lay 2-5 million eggs, but we don't have enough tanks to hold them." He continued, "There are six tanks altogether; one of these tanks is a spawning tank where just brood stock females lay their eggs, one female at a time. If we increase the density of eggs in any tank, many would suffocate."

Salik had been an educator before he became Director of the hatchery in 2008. His methodical and clear explanations made science understandable to a lay person like me.

"Then we select healthy eggs, which float to the top of the tank. Unhealthy eggs sink to the bottom. After this selection, the eggs are put in glass vials where they are counted using a microscope. After 11 to 13 days the eggs have hatched and are now put in tanks for larval development. The last stage of the crab larvae is when it changes into a discernible crab-like shape with a carapace (megalopa stage). After this stage all appendages, eye stalks, legs, and claws, begin to appear between 13 and 40 days."

This sounds to me like a labor intensive project. But where are all the workers, I wondered? Today was election day, so only Salik remained at the facility for the interview. Yet surprisingly, there are only four people working for the crab project. The empty tanks in the hatchery created suspense. But, as with all good storytellers, Salik let this story unravel at its own pace.

"Then they are transferred to nursery tanks outside to continue the grow out process, providing light and habitat. This is when we have to feed them regularly, we use trash fish."

I queried whether the source of fish was steady and sufficient for the process. Salik responded, "When we have few fish, we go fishing to provide food for the crabs." Of course, having to go fishing is not viewed as a burdensome task by any fishermen I've ever met. But, is this a cost effective use of labor, I wondered? I digress. Having never watched a Scylla serata crab eating, I sought clarification. Salik calmly explained further, "We slice the trash fish into small pieces, otherwise, the juvenile crabs will begin to fight among themselves, as they are cannibalistic." Now more of the nerve-racking logistics behind raising mangrove crabs became apparent: cannibalism starts from the larval stages and continues through adulthood.

"In the wild, crabs eat seagrass and worms. Their claws are used to grasp the food and their mouths to grind it. Here, we keep the crabs in our outdoor tanks for forty days. Then they are transferred to earthen nursery ponds in Tofol for a period of about two more months. Finally, the juvenile crabs are transferred to pens in the mangroves."

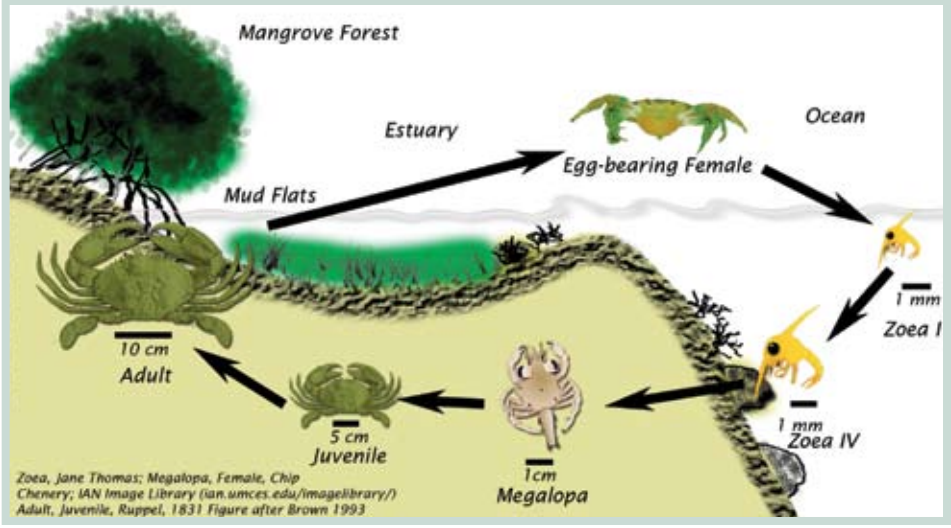
I learned that in the wild, among the millions of eggs laid, only ~1% survive due to predation and cannibalism. After hearing all these details the lifecycle chart of Scylla serata was handed to me to help digest the information. Getting back to the controlled hatchery methods, I offered my observations of the pumps at the nearby, privately owned National Aquaculture Center of Kosrae I had visited. There an elaborate pumping system was part of their commercial success in raising the giant clams in tanks.

*(Above) Staff attending to the Kosrae State hatchery tanks. According to Salik, the Hatcher has only four people working on the crab project. (Below) Hatchery staff separating out juvenile crabs that are ready to be transferred into grow-out tanks. Photos courtesy Osamu Nedlic.*

Salik explained, "Our water comes from the Aquaculture Center. If something happens to their pump, we are in trouble. We don't have funds for the pumps nor the filters which clean sediments from the brackish water we use." Salik has the patience of a scientist, I thought. "The water temperature can't go above 28 degrees Celsius, and we also have to control for salinity. Daily water quality monitoring for temperature, salinity, and dissolved oxygen are vital to our success."

Salik seemed reticent to continue. Were we approaching the frustrations of the project, perhaps an explanation of why the tanks were empty? "A few months ago, we were provided microscopic algae imported from Australia to feed the rotifers," tiny wheel-like

*(Above) Maxwell Salik of the Kosrae State Crab Hatchery; (Below) author Kolea "Kulul" Schonwalter. Photos courtesy Schonwalter.*




*(Above) Lifecycle of Scylla serata. In the wild, among the millions of eggs laid, only 1 % survive due to predation and cannibalism. Graphic courtesy John Starmer.*

animals that are commonly used in aquaculture to feed larvae. "However, we lost our culture of the algae due to water quality issues, and tried substituting a different variety that was available through our hospital. It was a medicinal algae, not appropriate for our needs, and consequently all the rotifers died."

Undaunted by the complex scientific method, nor the lack of consistent funding and technical support, Salik completed his explanation of the microscopic algae demise. "According to our monthly water quality monitoring, we could tell that the density was decreasing, and would no longer support our culture." Density of water is related to the mix of fresh and salt water, as well as the proportion of warm and cold temperatures. From his serious tone I concluded that help in the form of funding and capacity was deeply desired to make the Kosrae State Crab Hatchery a success story, and not just a work in progress.

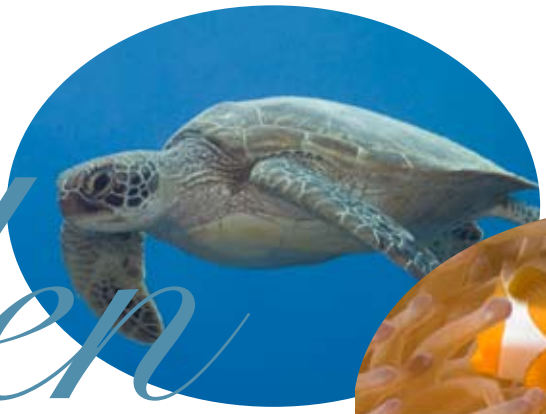
At this point I was curious about the current crab populations and how they may have changed over time. Salik described, "In the 1960s, there were thousands of mangrove crabs in our streams. During a full moon, we could see these with our naked eye. We boiled them, and those that were left over, we buried in the uhm, an underground oven. After two days, although they were dry, they were still edible. We also exported them to our families living abroad. They were so abundant."

Today, they seem to be scarce and desirable. At restaurants, crab dinners are at the top of the price range, $17 for an entrée. Since there were few regulatory measures in place over the years, such as gender or quantity restrictions on crab catch, the problem of over harvesting emerged. Only a difficult-to-enforce size limit existed. Salik explains some good news for the future of the wild crab populations, "Years ago when the total allowable catch limit was first passed, the fishermen didn't care. However, after these fishermen were cited and penalized with a fine they began to pay attention."

There is now an urgent use of the summarized life history data available to support mangrove crab management. Salik summarized, "We now know that male crabs are white, females are larger and pinkish. When the female gonads are ready to be fertilized, the eggs fill the entire stomach cavity. Two-to-five million eggs are laid at one time, and while the lifespan is not known yet, the females begin spawning at 8-10 months. There are three spawning periods, the first spawning is usually the best in terms of the number of eggs laid."

Salik concluded on the status of future activities, "Right now we are waiting for funding from a fishing company from China. First, they have to renovate the fish processing facility at the Okat commercial dock. When they get this facility running, then the crab project will benefit by having a steady, reliable source of crab food. The Federated States of Micronesia (FSM) recently gave congressional approval to the Chinese fishing company's request. ◻

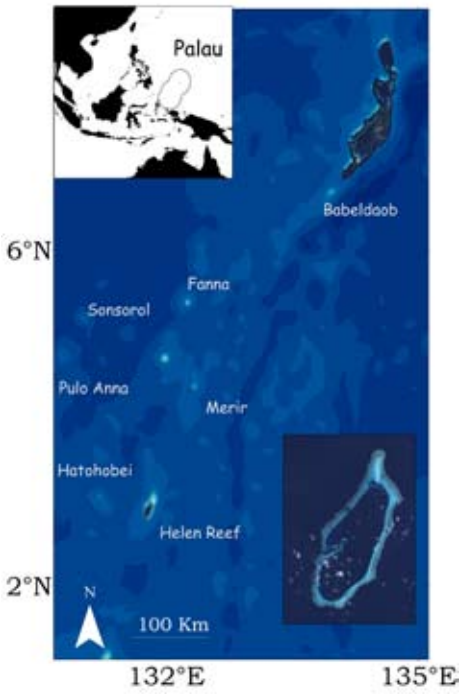
# Helen Reef



# Hatohobei State, Palau

## Conservation success on a remote atoll rich in marine resources

WORDS BY WAYNE ANDREW,
HATOHOBEI STATE REPRESENTATIVE, PALAU




*(Right, from top down) Green Sea Turtle in Helen Reef; Clownfish in Helen; Hatohbei Governor Thomas Patris; and Hatohobei state representatives discussing Helen Reef. Photos courtesy Wayne Andrew.*

"We the Hatohobei people envision our islands to have an abundance of natural resources, a pristine healthy environment, and sustainable use and management by our community, exploiting only the scientific and traditional knowledge gained from our natural resources, that benefits us and our future generations."

In a thoughtful mission statement Hatohobei State spells out its hopes for the persistence of thriving marine resources. Yet, unsustainable harvesting, illegal poaching and climate change threaten this vision. Despite these threats, community-based management efforts cling to the vision and continue adapting to the challenges that face Hatohobei's vibrant marine resources.

Helen Reef, locally called "Hotsarihie," is one of the Pacific's most outstanding atolls in terms of its size, ecological integrity, and wealth of marine resources. Located in the Southwest of Palau, Helen Reef is a large enclosed atoll with extensive reef flats, a large channel complex, and a small sand island supporting nesting sea turtles and migratory birds alike. At 163 square kilometers in extent, the reef is roughly two-thirds the size of Palau's largest island, Babeldaob.

The proximity to Indo-Pacific centers of coral and fish diversity has resulted in a high species richness and unique fauna relative to the rest

*Numerous sea bird species, including great-crested turns brown-and-red footed boobies, great-and-lesser frigate birds, great-crested turns (pictured above), black-naped terns, sooty terns, white terns, and black noddies are common sightings at Helen Reef. Photo courtesy Wayne Andrew.*

of Micronesia. Envision thriving populations of giant clams, large economically-valuable reef fish swimming without fear, marine mammals abound, and schools of pelagic fish that are easily caught in the nearshore waters.

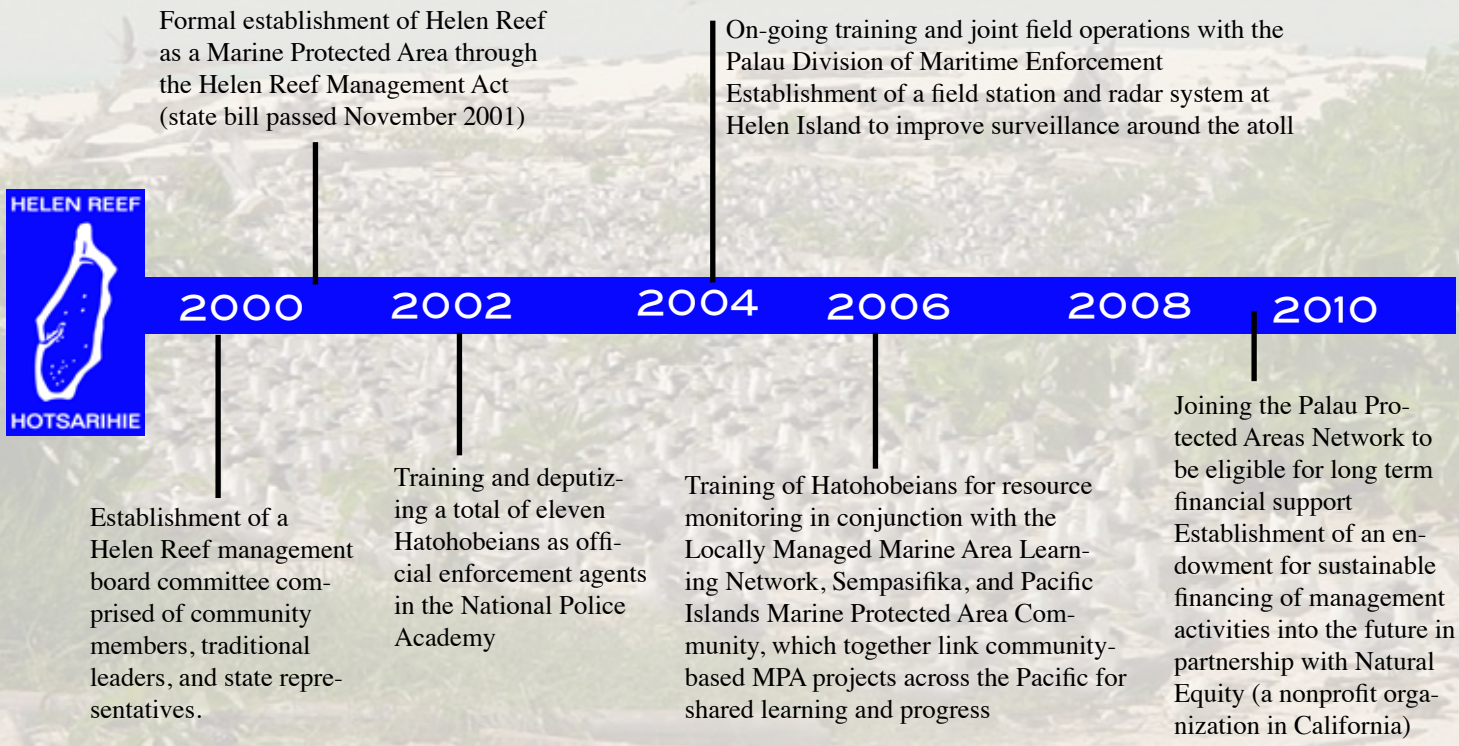
On the single, tiny, sand island that represents the only landmass on Helen Reef, nesting populations of green and hawksbill turtles, brown-and-red footed boobies, great-and-lesser frigate birds, great-crested turns, black-naped terns, sooty terns, white terns, and black noddies all are common sightings. All and all, very limited scientific efforts have already found more than 500 species of reef fish, 43 species of soft coral, and the highest recorded hard coral diversity of any Pacific atoll, 282 species. Indeed, natural beauty and ecological integrity thrive on this remote atoll, as well as a culture that respects the resources.

"Helen Reef Island as I remember it then was huge with thousands of swarming birds of different species," recalls Hatohobei State Governor Thomas Patris. He had traveled to the reef with his father, Patris Tahemaremoh, when he was about five years old. "I remember this trip because we stayed on Helen Reef for three months and my father along with other Tobians collected trochus and clam shells for a local company based out of Koror, Palau. I remember the huge Giant clams that were harvested because some of them were so huge that we used them as showering tub."

*"I remember the huge Giant clams that were harvested because some of them were so huge that we used them as showering tub."*
*- Gov. Patris*

Helen Reef is traditionally owned by the ~200 people that constitute the Tobian community, represented by Hatohobei state. Remembering a childhood trip to Helen Reef, Governor Patris recalls how Tobians used traditional canoes to transport green turtles and smoked fish for food to Hatohobei Island, 40 miles west of Helen Reef where the community resides. "Sustainable harvesting of marine resources from Helen Reef is intertwined with our culture," said Patris. The Tobians have historically relied upon the rich populations of giant clams, trochus, sea cucumbers, turtles, and large reef fish at Helen

# Helen Reef Resource Management Timeline




Reef, and today, these marine resources still drive their cultural, subsistence, and economic livelihood.

In recent decades however, Helen Reef became the target of unsustainable fishing practices, both legal and illegal, in search of valuable marine commodities. Pillaged by numerous fishermen from countries nearby, such as the Philippines and Indonesia, and distant countries, such Taiwan and Korea, and impacted by unsustainable local harvesting, some of Helen Reef's key resources and habitats have been exploited or harmed to the point where wide-scale damage is evident.

One example comes from the multi-species grouper spawning aggregations that emerge each spring. In the past, the seemingly endless supply of groupers was able to support authorized and unauthorized live food-fish ventures from Southeast Asian countries. But over time, the boats were too many, and unsustainable harvesting inevitably depressed populations. However, this situation didn't go unnoticed by the traditional Tobian community. Growing situations like these made the community realize they need to merge traditional management policies with modern technology in order to realize their conservation vision.

But what about the growing impacts from climate change, such as a sea-level rise and warming ocean temperatures? In the eyes of Patris, "it's very sad because the island now has only one coconut tree left and the island has eroded so fast that we could lose it in a few years. The worst part about it is that we do not know what to do about this problem. The area needs help from all its friends and partners to help mitigate and adapt to this huge change.

In 1998, when the sea temperature was very high, many of the corals at Helen Reef bleached. The good news is that they are coming back, probably because we still have healthy populations of fish and invertebrates to help rebuild our corals. Our favorable coral recovery may even help nearby impacted areas by providing a source of larvae."

Today the Hatohobei islands are a place for the majority of Tobians to visit, but no longer to live. Most of the people have left to look for economic prosperity and other social benefits that can be found in main islands of Palau, primarily in the capital city of Koror. Regardless, Helen Reef continues to serve as an important place and resource for the people of Hatohobei. Income from sustainable trochus and live grouper harvesting continues to support the people, and limited harvesting of fish, sea turtles, sea birds and other items for consumption continues.

**Conservation of marine resources in a distant land**

In recent decades, the Hatohobei people have actively searched for a means to protect Helen Reef for sustainable use and living. With little community, State, or National resources to effectively deal with illegal plundering from quick-moving business ventures, improving surveillance and enforcement was a top priority.

The first attempt by Hatohobei State to deter and enforce against poaching was the year round placement of community members and surveillance staff on Helen Island. Despite improved communication, insufficient funding hampered the response to calls from Helen Reef, and although documented, poaching continued. While the Palau National Patrol Boat includes Helen Reef on its monitoring cycle, patrols occur infrequently and are not sufficient to protect the reef. Further, the staff that were stationed at Helen Reef had no enforcement authority or sufficient defense to protect themselves in possibly dangerous situations.

Recognizing the desires of the community and the severe limitations they face, several agencies, organizations, and reports began to identify Helen Reef as needing improved conservation strategies and actions based upon the outstanding resources present, and the eminent threats. These include local, regional, and international organizations such as the Palau National Government and The Nature Conservancy. Following suggestions made by the numerous reports, Hatohobei State, in partnership with the Community Conservation Network, a non-governmental organization based in Hawaii, began a successful collaboration to address their pressing management concerns in 2000.

Since 2000, our year-round enforcement presence has achieved almost complete protection of Helen Reef. Only a handful of illegal fishing instances have occurred and legal overharvest has been curtailed. Currently, Hatohobeians and Palauans are limited to subsistence level fishing in about 30% of the reef. The success that the Helen Reef project has achieved is a result of the high level of community involvement, supporting partnerships, and funding the project has received.

Through the collective efforts of the community and its partners, this influential Pacific atoll has gone from a condition of ongoing resource depletion and degradation to recovery and ongoing conservation. This achievement is an outstanding conservation story, and model for others, considering all of the challenges that exist.

However, the long-term conservation and sustainable use of this area is not yet secured. The focus of our future years will be to efficiently maintain activities and adapt to new challenges as they may arise. □

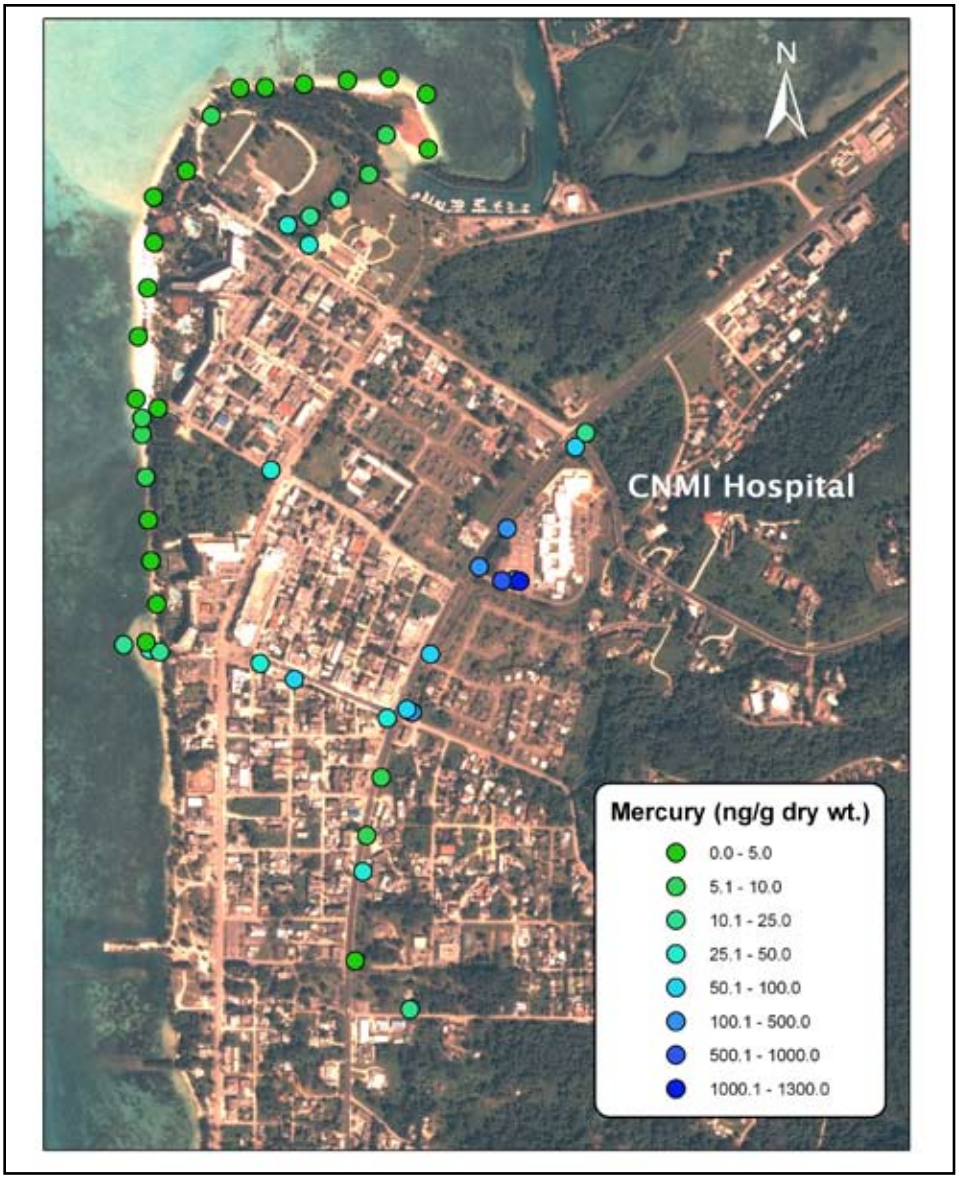
*All and all, very limited scientific efforts have already found more than 500 species of reef fish, 43 species of soft coral, and the highest recorded hard coral diversity of any Pacific atoll, 282 species. Pictured below is a white tip reef shark in Helen Reef. Photo courtesy Wayne Andrew.*

*MERCURY* CONTINUED FROM PAGE 3

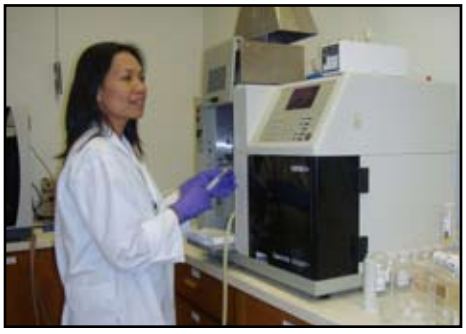
myself, to be overly protective. I will talk a little more about this later but for now I'd like to turn my attention to mercury in fish from the CNMI.

In 2005, my colleagues from the CNMI Division of Fish and Wildlife provided me with several hundred fish from the northern half of Saipan Lagoon for mercury analysis. Levels determined ranged from 0.001-0.619 ppm and were less than 0.1 ppm in 80 percent of all fish examined. While the findings were suggestive of a relatively clean environment overall, localized pockets of mild mercury enrichment were identified near the port, the docks and the dump. Surprisingly, fish captured in the vicinity of Hafa Adai Beach were also found to be mildly contaminated with mercury that we later traced back to a medical waste incinerator at the Commonwealth Health Center. Waste streams from hospital and health care facilities are typically high in mercury from all sorts of things including dental wastes, old fluorescent tubes, broken thermometers, and other medical devices, personal care products and medicinal compounds.

The Commonwealth Health Center incinerator had been in operation for about 20 years before it was shut down by the USEPA, in January 2006, for multiple violations of the Clean Air Act. During that time frame, stormwater runoff from the hospital grounds had mobilized residual mercury from the incinerator ash into a storm drain network that discharged directly into the ocean just south of the Hafa Adai Hotel. Fish from this area were reevaluated for mercury in 2007, almost two years after the incinerator was dismantled. Levels were found to have attenuated significantly and will almost certainly have returned to normal by now.




*(Above) The level of mercury in hundreds of fish from the northern half of Saipan Lagoon ranged from 0.001-0.619 ppm and were less than 0.1 ppm in 80 percent of all fish examined. (Below) Jennifer Cruz, water quality lab manager, analyzing fish mercury levels using an Atomic Absorption spectrometer. Photo courtesy Gary Denton.*



Emperors are among the most commonly encountered carnivorous fish in Saipan Lagoon and specimens examined in the 2005 survey generally had the highest mercury concentrations overall. Even so, levels rarely exceeded 0.2 ppm and were mostly less than 0.1 ppm. I am quite happy to consume these as often as I can get them despite the USEPA guidelines recommending consumption frequencies no greater than once or twice a week. Many longer-lived, predatory species such as sharks, marlin and swordfish frequently accumulate much higher levels of mercury in their tissues and have never been implicated in mercury poisoning episodes.

I recently had the opportunity to determine mercury in all three of these fish types captured in remote waters approximately 150 nautical miles NW of Saipan. One silky shark yielded a

mercury concentration of 3.8 ppm, the highest level recorded. The marlin and swordfish averaged 1.6 ppm and 1.4 ppm respectively. USEPA advises that fish meals containing 0.5-1.0 ppm mercury should not be eaten more than once a month while those above 1.9 ppm should not be consumed at all. So would I eat these kinds of fish? Certainly I would, and I have frequently done so in the past! Stupid, some may say. Maybe, but in my defense let me reiterate that no documented evidence exists to suggest the regular consumption of large pelagic species poses a significant health risk. And, as far as I am aware, no commercial fisherman has ever suffered mercury poisoning from eating such fish while at sea for an extended period of time.

Yet we know that elevated mercury levels in fish from polluted coastal waters can have disastrous consequences for unsuspecting consumers. In the late 1950s, for example, several hundred people died and many others were incapacitated through eating mercury contaminated fish and shellfish from Minimata Bay in Japan. The bay had for some time served as a dumping ground for liquid wastes discharged from a chemical manufacturing plant that had used mercury as a catalyst in the production of acetaldehyde. Mercury levels in fish and shellfish from the bay mostly ranged from 5-50 ppm.

So why is it that mercury poisoning has never been seen in consumers of fish that are naturally high in mercury? The answer to this conundrum is quite simple. Fish from uncontaminated environments tend to accumulate mercury from their food along with another very important element called selenium. Selenium has long been known to have a protective effect against the toxic effects of mercury. This has been clearly demonstrated in laboratory rodents and birds, and there is a growing body of evidence


*(Above) No documented evidence exists to suggest the regular consumption of large pelagic species poses a significant health risk. (Left) Canned tuna is a staple in many diets. Ocean fish are particularly rich in selenium derived from their food and commonly exhibit selenium-mercury molar ratios of 10 or more.*

to suggest consumers of fish naturally high in mercury are protected in much the same way, regardless of how much mercury the fish contain. The one caveat in this statement is that the selenium-mercury molar ratios in fish must be greater than one to ensure all biologically active mercury is detoxified. It just so happens that ocean fish are particularly rich in selenium derived from their food and commonly exhibit selenium-mercury molar ratios of 10 or more. It has been said that the more selenium fish contain the safer they are to eat. Why then are fish from polluted environments so different? Well, in mercury contaminated waters, the balance between biologically available amounts of selenium and mercury is altered resulting in selenium-mercury molar ratios in fish of less than one. The protective interaction between the two elements to consumers is therefore eliminated, or at least greatly reduced.

The USEPA are understandably cautious about relaxing their fish consumption advisories in the absence of irrefutable evidence to support such a change. But fish consumption guidelines based on selenium-mercury molar ratios, rather than mercury levels alone, has scientific merit that is becoming more and more difficult to ignore. There is certainly strong advocacy for such a move among commercial fisherman, many of whom feel the industry is already severely compromised by mercury regulations and advisories that are far too restrictive.

While selenium-mercury molar ratios in fish from Saipan Lagoon, or elsewhere in Micronesia, have yet to be determined, it is unlikely that they are less than one given the fact the mercury levels are within the normal range for fish in these waters. That said, it might be prudent to limit the regular consumption of carnivorous species captured close to the more industrialized sections of coastline between Muchot Point and Flores Point until we know more. □

## 1940s

*Day catch of a military personnel and Okinawan fishermen from 1946-1947. Catch was from the shallow Saipan lagoon using boots, goggles, and a pole spear with no rubber. Photo provided from the Brand Collection, courtesy of the NMI Council for the Humanities.*

## 1970s

*Day spearfishing catch from an experienced fisherman who participated in one of the first competitions that was held in Guam's southern embayments. Photo courtesy of the TTPI archives, University of Hawaii.*

## 1990s

*Luis Cepeda, an experienced day fisherman from Tinian, shows his catch from the south-west side of Tinian in the mid 1990s.*

# Evolution of Your Catch

## 2000s

*A team of experienced day spearfishermen, with a boat and operator, show their catch from Saipan's western coastline.*

Throughout Micronesia, when many interviewed fishermen reflect upon the past, they tell stories of having better catches, not having to travel as far to harvest what they need, and not having the more efficient technology that is available today. Reduced stocks not only hurt our economy and food supply, but they also threaten the integrity of the oceans that are intertwined with Micronesian livelihoods. Take a moment to talk with your elders, and spread the knowledge you gain to improve the future.

# From Catch to Kitchen

**Recipe from Sakopaten Foforin Mongon Truk – Different ways of preparing local food in Truk**

by Justina Salle and Nancy Rody, Nutrition Education Training Program, Moen, Truk [Chuuk]

*Ingredients*

*1 cup chon tapioca*
*(1 cup young tapioca leaves)*
*1 cup ik mi kata*
*(1 cup fish - cooked, boned and mashed)*
*1 tsp. sol*
*(1 tsp. salt)*
*1 tbsp. arung*
*(1tbsp. coconut oil)*
*1 kukun onion*
*(1 small onion)*

Kukun chon tapioca lon konik waitu osupwalo chonun, furani onion walong ewe ik me kata ese wor chun, pwal walong chon tapioca arung me sol ren an epwe nene anno.

Boil water and then drop tapioca leaves in and stir once. Remove the pot and drain. Rinse in cold water. Sauté onion and add fish. Cover and cook for three minutes. Add tapioca leaves, salt to taste, cover and cook for another five minutes and remove from heat. Serve hot with boiled green bananas.

## WORKING WITH *THE MICRONESIAN FISHING JOURNAL*

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# Size Matters

Midi "Measure" your catch - so we can fish tomorrow

## Are the sizes listed in the poster and ruler a new law?

No, this is not a new law or regulation. The sizes listed are recommendations based on the average size at which our fish begin to produce eggs, this size is called L50.

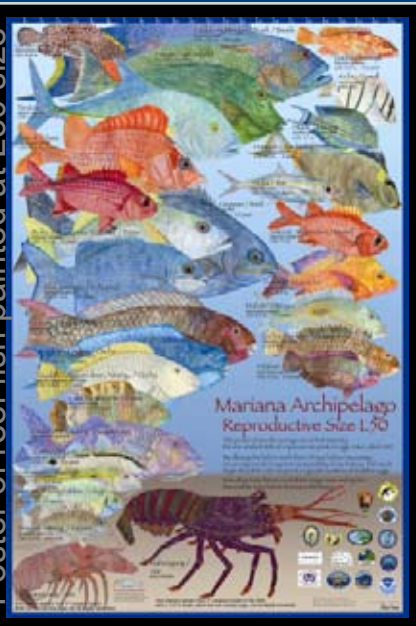
## How does only taking, buying or eating fish that are the 'right size' help the reef?

Harvesting, buying or eating fish below the listed L50 sizes reduces the number of spawning fish in the reef, resulting in less fish for tomorrow. These recommended sizes are not applicable to early juvenile runs (like manahak and I'e), though allowing fish to reach the 'right size' will increase the size of these runs.

## Where do the size recommendations come from?

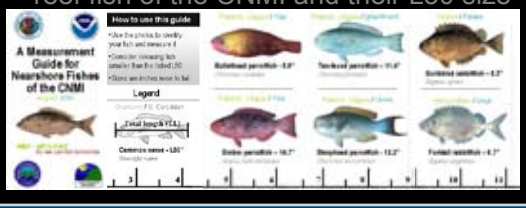
The L50 sizes are based on the best available life-history information with contributions from regional resource agencies and scientific journals. Regional variations in L50 sizes typically only vary a small amount. Feedback on these sizes from knowledgeable and experienced fishermen is invaluable to our ongoing efforts to keep our fisheries healthy.

To learn more visit - http://sizematterscnmi.blogspot.com/




Poster of reef fish painted at L50 size

Waterproof ruler lists some of the favorite reef fish of the CNMI and their L50 size






## *WRITE FOR THE JOURNAL*

**SUBMISSIONS:**
Contributions can be as simple as photos of your catch or as detailed as a transcribed interview. Mainly we are looking for stories (600-1200 words long) about fishing, cultural importance of fishing, management, community efforts, history, why Uncle Semo is the best fisherman ever, and related topics.

**FORMAT:**
Electronic submissions are preferred and may be emailed to jmf@pacmares.com.

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