KOROR STATE GOVERNMENT

Tour Guide Training and Certification Program

Contents

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Ann Kitalong, PhD, The Environment, Inc.(TEI);
Tiare Holm, Sustainable Decisions (SD); and
Meirang Sengebau, MPH, Belau Environmental and Health Solutions and Technologies (BEHST)

Reference:

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Final edits and contributions to the text by Koror State Tour Guide Certification Working Group: Carol Ngiraidis, Belau Tourism Association (BTA); Nanae Singeo, Director of Palau Visitors Authority (PVA); Marcel Hagendijk from Sam's Tours; Heather Ketebengang from Palau Conservation Society (PCS); Ann Kitalong, PhD Project Manager, The Environment, Inc. (TEI); Ministry of Natural Resources, Tourism, & Environment (MNRET); Division of Marine Law Enforcement (Bureau of Public Safety); Sunny Ngirmang, Director, Bureau of Arts and Culture (Ministry of Community & Cultural Affairs); Ltelatk H. Fritz, School of Hospitality and Tourism (Palau Community College); Legislators Jason Nolan, Chairman of Tourism Committee and Vaan Isaac, Tourism Committee Member, 10th Koror State Legislature; Scott Yano, Director, and Bethwel Emul, Supervisor Cultural/Historical Sites, Department of State and Cultural Affairs (Koror State Government); Jose Ise, Director, Ilebrang Olkeriil, Coast Management Officer, Jennifer Olegeriil, Ranger Chief Coordinator and Rondy Ronny, Tourism Liaison Officer/Public Relations, Department of Conservation and Law Enforcement (Koror State Government); Gail Rengiil, Director, Department of Finance, Koror State Government; and Earnest Ongidobel, Chief Administrative Officer, Koror State Government).

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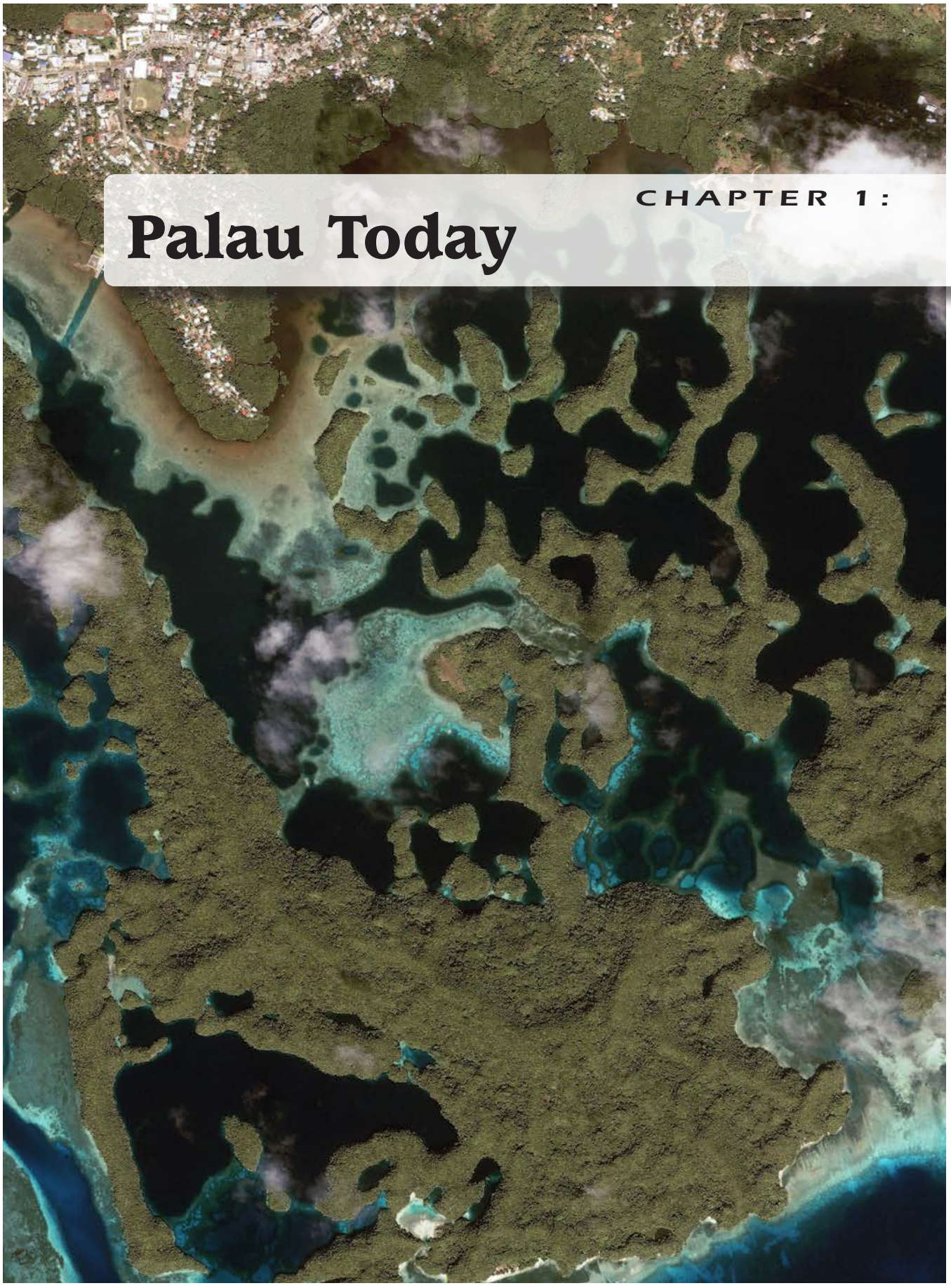


CHAPTER 1:

Palau Today

Message from the Koror State Governor

Governor Yositaka Adachi

Welcome to Koror State. The people of Koror State are very proud of our state's inspiring history and rich culture as well as our renowned pristine environment. Our communities are dedicated to maintaining the integrity of our unique culture and environment while developing a thriving tourism industry. We have established the Rock Islands Southern Lagoon as a managed area, which became an internationally recognized World Heritage Site in 2012. The dossier for the inclusion of the Rock Islands Southern Lagoon (RISL) in the UNESCO list of World Heritage Sites includes the following Statement of Outstanding Universal value:

"The RISL has superlative natural and cultural features. The RISL is an outstanding example of human interaction with a precarious environment."

Thank you for your interest in being a part of our tourism industry. Your commitment is extremely valuable to us. As a member of the tourism community in Koror State, you are our invaluable partner, sharing the responsibility for upholding our cultural values and ensuring adherence to state and national rules, and regulations for all users of the RISL. Your commitment will work to promote and enhance sustainability of this valuable resource for future generations. We are extremely pleased to be ale to work with you in partnership to help ensure that our guests have an enriching and high-value experience during their stay with us.

Tourism is extremely important to Palau and the Koror State economy. Your certification as a Tour Guide for Koror State will complete the cycle of accurate information, smart practices and safe conduct that will provide our visitors and all users of the RISL a rich, safe, and memorable experience. It is our pleasure to warmly welcome you to our Koror State family and we look forward to our continued partnership. Our successful partnership depends upon your commitment to ensure practices by our guests respect our cultural values and help us keep our islands clean, healthy, and safe, while we share the wonders of the breathtaking beauty and rich culture of the RISL and all of Koror State with them.

Thank you for your partnership. We look forward to working with you as a Koror State certified tour guide.

Good luck and best regards,

Governor Yositaka Adachi

UNESCO WORLD HERITAGE SITE

Statement of Outstanding Universal Value

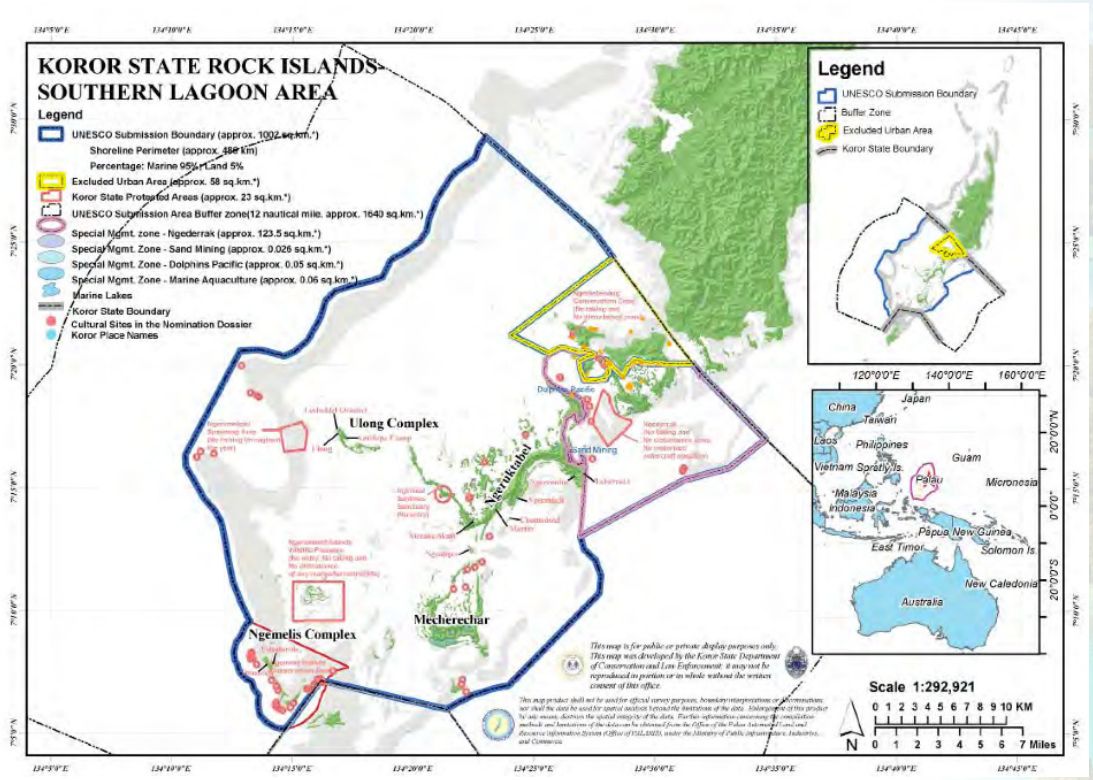
The Rock Islands Southern Lagoon (RISL) is an exceptional example of man and nature's ability to coexist and co-evolve in unique ways. The Rock Islands Southern Lagoon is an outstanding example of human interaction with a precarious environment. The abandonment of Rock Island villages in the 2nd millennium AD is an exceptional illustration of the intersection and consequences of climate change, population growth, and subsistence behavior to a human society living in a marginal environment. The Rock Islands are small limestone islands with sparse pockets of sand plains and arable soil. This terrestrial environment is highly susceptible to climatic fluctuations such as those that occurred during the transition from the 'Medieval Warm Period' to the 'Little Ice Age' in the first and second millennium AD. A combination of human impact on coral reef resources and the decline in productivity of terrestrial resources during the 'Little Ice Age' made it impossible to sustain permanent settlements in the Rock Islands. As a result, villages in the RISL were abandoned at AD 1650-1750 and the population migrated to adjacent larger islands with more plentiful resources.

Photo by Mark Downey

The Rock Islands Southern Lagoon bears exceptional testimony to a living cultural tradition. Contemporary Palauans state that they originated from ancestral Rock Island settlements. Hence, the significant aesthetic and cultural values of the RISL are integral to the identity of the nation. The limestone islands have sustained a range of prehistoric sites, such as cave burials and rock art, and evidence for past cultural behavior not preserved elsewhere in the archipelago. Continuing knowledge of the lagoon ecosystem is fundamentally related to the current capture and collection of life sustaining marine foods. Rock Island archaeological sites and culturally significant places are recorded in Palau's oral history, legends, myths, dances, proverbs, and in the traditional place names of the land and seascape.

The Rock Islands Southern Lagoon is among the most diverse, complex, and breathtakingly beautiful places on earth. Hundreds of unique mushroom-shaped islands and sparkling white sand beaches are scattered across a pristine turquoise lagoon. Moss-covered stones whisper secrets about man's abilities, and paintings on nature's walls tickle our senses. Barrier and fringing reefs, channels, tunnels, caves, arches, and coves filled with diverse assemblages of organisms of every color create a wonderland of natural beauty and discovery. Ancient legends and chants, award-winning films and

documentaries, hundreds of photographs and works of art, and shelves of books and magazines try to capture the timeless magnificence of the RISL in words and images.



The Rock Islands Southern Lagoon contains 52 marine lakes — one of the most unique habitats in the world. No other place on earth has this number and variety of marine lakes within a similarly sized area. The lakes are diverse in biota and habitats making each one unique. Ongoing research on the marine lakes is increasing scientific understanding of evolution and speciation. Five new subspecies of Mastigias papua jellyfish have been described from these marine lakes and logic suggests that populations of many other species will also, when studied, be discovered and recognized as endemics with long evolutionary histories delimited within individual lakes.

Photo by Ron Leidich

The Rock Islands Southern Lagoon has exceptionally high biological and marine habitat diversity compared to similarly sized areas in the world and is a universally important coral reef ecosystem. In a near pristine area of high diversity, it is one of the best managed coral reef systems outside of the Coral Triangle. Located just east of the Coral Triangle, the RISL's coral reef systems are potentially an important producer of coral larvae for the entire region. The resiliency of the RISL's reefs make it a critical area for the protection of biodiversity. With low fishing pressure, little pollution, and minimal human impact, the Rock Island reef

systems serve as a natural laboratory for scientific understanding of coral reef recovery from a major warming event caused by climate change. All the endangered megafauna of Palau, 746 species of fish, over 385 species of corals, at least 13 species of sharks and manta rays, seven species of giant clams, and the endemic nautilus are found in the RISL. The RISL forests include all of Palau's endemic birds, mammals, herpetofauna, and nearly half of Palau's endemic plants.

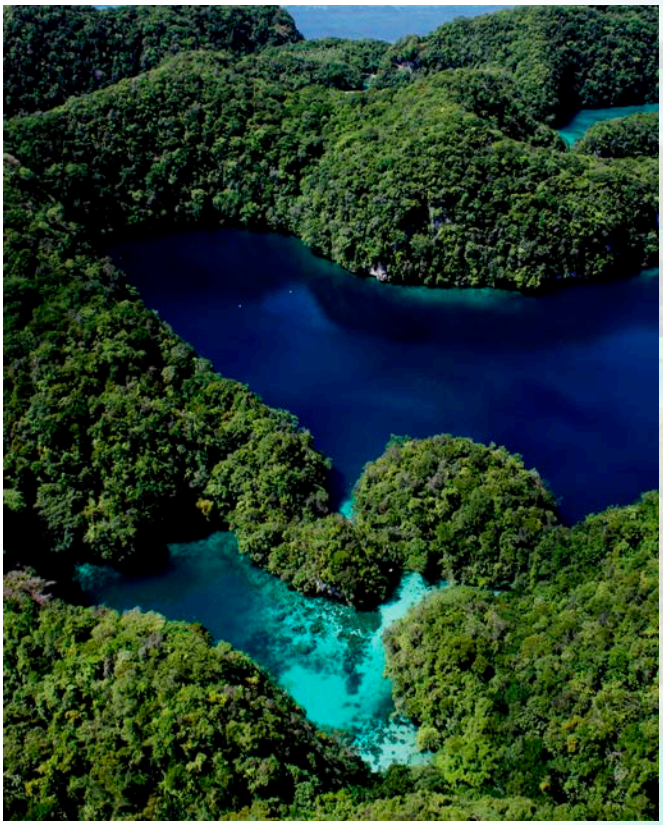


Photo by Ron Leidich

The Rock Islands Southern Lagoon is among the best managed and protected areas in the Pacific, and possibly the world. The traditional laws or *bul* of the people of Palau, the Constitution of the Republic, National laws, and Koror State Laws protect all significant cultural and natural resources including endangered species, critical habitats, and cultural sites. Traditionally, Palauans have conserved and protected these rare and valuable resources for thousands of years. The Ngerukewid Islands Wildlife Preserve established more than 50 years ago shows the foresight of the National Government to protect its most valuable and aesthetically beautiful Rock Islands. The State of Koror has been a leader within Palau and the world by showcasing effective management and conservation of the RISL. The community and leadership of Koror fully supports the establishment of the RISL as a World Heritage Site and is committed to keeping the RISL as one of the last great places on earth.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

GEOGRAPHY OF PALAU

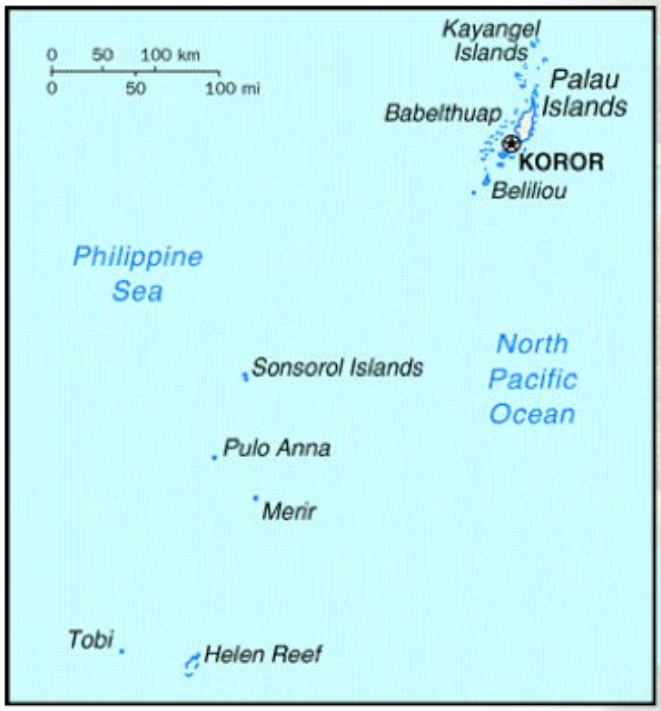
Location and Population of Palau

Palau is part of a longer chain of islands within the group of islands known as Micronesia (meaning "tiny" islands). Palau sits approximately 800 kilometers north of New Guinea, southeast of the Philippines and southwest of Guam in the Mariana archipelago. Its closest neighbor within the group of Micronesian islands is Yap, which is a member of the Federated States of Micronesia. Palau has a total land

area of 525 square kilometers surrounded by a 112 km (70 miles) long barrier reef that forms a lagoon approximately 1,137 square kilometers in size.

Palau also owns an exclusive fishery zone of twelve nautical miles (1.85 km) beyond its baseline.

Palau is an archipelago stretching between 8 and 3 degrees latitude from north to south and 134 to 132 degrees longitude from east to west. There are 586 high and low islands with the low islands mostly situated near the extreme ends of the archipelago. At the northern end of the archipelago are the islands of Ngeruangel, Ngcheangel (Kayangel), and Babeldaob; Oreor (Koror), Ngerekebesang, Ngemelachel, Chelbacheb (Rock Islands), Ngerchong, Ngemelis Islands, Ngebed, Beliliou, and Ngeaur are at the southern portion.



Source: www.geography.about.com/library/cia/blcpalau.htm

Some 320 to 480 kilometers from Koror are the Southwest islands of Sungesol (Sonsorol) and Fana, Bul (Pulo Anna) and Merir, Hatohobei (Tobi), and Helen Reef. The largest island, Babeldaob, covers 400 square kilometers running about 35 km north to south and 20 km east to west . While relatively low (the highest point is Mt. Ngerchelchuus at about 213.5 meters altitude and found in the state of Ngardmau. Rivers and Lakes can be seen throughout the various states of Babeldaob including the longest river, the Ngermeskang River along the west coast that flows into Ngeremeduu Bay, the largest coastal estuary, watershed area and conservation area in Micronesia. Along the east coast is the second longest river, the Ngerdorch River with the Ngerdorch Watershed that includes Lake Ngardok, the largest freshwater lake in Micronesia. (Natural History of Palau)

According to statistics from the 2012 census survey conducted by the Graduate School USA, EconMap (www.econmap.org), Palau's total population was 17,445 people in 2012.

Ethnicity	Number of Residents
Palauan	12,814
Non Palauan	4,631
Total	17,455

Climate

Palau has a maritime tropical climate with a high amount of rainfall. The average daily temperature throughout the year is 81°F (28°C) while the relative humidity is about 82%. An average of 381 cm of rain feeds into the rivers and streams of Palau, contributing to the humidity levels. Wind direction shifts occur with the trade winds blowing from the northeast and east during November to May. From June to September, monsoon winds come from the southwest. These wind directions, rainfall and temperatures contribute toward the conditions of survival for the flora (plants) and fauna (animals) of Palau. In addition, the changing physical characteristics of the islands have been affected throughout millions of years by the natural forces wind, rain, and movement of the Earth's crust. Presently, man and technology have played a major role in changing Palau's physical characteristics including its rich and diverse marine resources.

"During the winter and spring the consistent east to northeast trade winds produce sheltered conditions outside the western barrier reef where most of the most popular dive sites are located. The trade winds do make the ride out there from Koror choppy, but you can tell customers that things will be better once their boat gets outside the reef. During the summer the monsoon winds from the southwest to west can rise up and produce very rough conditions on the western reefs and in the lagoon. At such times it is impossible to dive at the sites like Blue Corner, New Drop Off and any others on the western reef, as the winds and seas can be massive there." *Pat Colin 2014*

Photo by Rpn Leidich

Tides, Currents and Physical Oceanography

By: Patrick L. Colin, CRRF 17 Jan 2015

Ocean currents in an area like Palau are the result of two different driving forces. The first is the general ocean currents that occur around Palau. The second is the tide and how the structure of reefs and channels affects the flow of water produced by the rise and fall of the tides.

The tides in Palau have a maximum range of about 1.7 meters or six feet between high and low. These spring tides occur around the time of the full and new moons. Smaller tide ranges, called neap tides, occur on the first and last quarters of the moon, and have a tide range of around one meter or a little over three feet. Palau has a semi-diurnal tide, meaning there are two high and two low tides most days, although the cycle is a bit longer than 24 hours, so some days may lack twin highs or lows. The changing tides mean that water has to move into the lagoon, on the rising tide, or exit the lagoon on the falling tide. Given the overall area of the Palau lagoon, that is a lot of water to be exchanged and consequently the currents produced by this flowing water are strong, and sometimes dangerous to divers and snorkelers.

The strongest tidal currents occur on the mid-tides, between high and low water, while slack currents can occur at either high or low tide. Knowing the tidal patterns, easily determined from tide calendars that tell the predicted times and levels of high and low tide, is important for tour guides. Rising tides, low water moving towards high, can

produce great dives, such as at Ulong Channel, when divers can ride the current into the lagoon with the clear oceanic water flooding into the lagoon. At other times, tides can make dives unpleasant, such as when the murkier lagoon water starts exiting the lagoon and reduces the visibility at dive sites.

Tidal currents are found in the large channels, such at Ulong Channel, German Channel or West Channel *(Toachel Lengui)* and their effects easily seen. More subtle are the currents that course across the shallow barrier reef with the tides. At low tides much of the barrier is too shallow even for snorkelers, even dry in places, but higher tides allow water to flow across the shallow reef with currents reaching a half knot or more in the spring tides. Even back in the Rock Islands tidal currents run through the channel and open areas, either helping kayakers paddle along or fighting against them. Guides should try to work with the currents, and not have guests fighting Mother Nature! All you need is a good understanding of the tide patterns and how they affect the area where you are guiding.

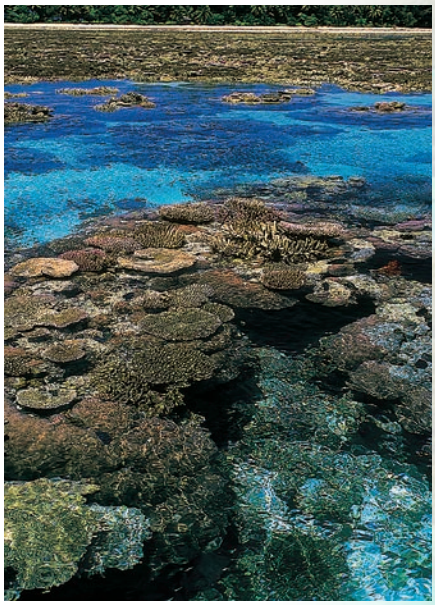


Photo by William E. Perryclear

Corals exposed by an unusually low tide radiate with color.

The second type of currents of importance to tour guides are the oceanic currents which hit Palau. Palau is between two large ocean currents: the North Equatorial Current (NEC), found to the north of Palau and running from east to west, and the North Equatorial Counter Current (NECC), found south of the main Palau group and running from west to east. The NEC is usually found just north of Velasco Reef while the NECC is often at the latitude of Sonsorol/Fana or others of the Southwest Islands. The positions of the currents shift a bit with the seasons, and the main area of Palau has somewhat changeable offshore currents because of this connection. The oceanic currents can produce circulations, called eddies, along the barrier reefs which make the current flow one direction or another along the reef itself. At times the current may switch and flow the opposite direction but still along the reef. With these ocean currents, the tidal currents can also come into play producing a complicated pattern, particularly in shallow water, along the barrier reef.

Drift diving is often the rule along the outer reefs, the current taking dive groups where it wants. Blue Corner and particularly the southern end of Peleliu are notorious for their strong currents. When the ocean or tidal currents run counter to the wind, real problems can occur. Wind against the current causes steep short waves that make being on the surface difficult and often dangerous. They also make it very hard for dive boats to spot people on the surface after a dive, particularly if the current has carried the group some distance from its starting point. As a tour guide, you need to be aware of these and plan accordingly so your guests are safe. They are not familiar with Palau, and rely on you to understand the dangers of the ocean so they can remain safe and have a great experience diving, snorkeling or kayaking in Palau.

Photo by Kevin Davidson

Aerial view of Ulong Channel. This natural channel extends from the barrier reef to the edge of the inner lagoon.

The water near the surface in Palau is warm, some of the warmest water found in the

entire ocean. The annual range of temperatures is generally about 28 to 29.5°C or about 82 to 85°F. These are ideal temperatures for coral reefs and help produce the lush reefs of Palau. Water temperatures can vary with El Nino/La Nina cycles, however, with the surface water being colder, as low as 26.5-27.0°C, during an El Nino and much warmer, as high as 30-31°C during a La Nina. La Nina's are bad for Palau, the high water temperature causing coral bleaching and death. This happened in 1998, and to a lesser extent in 2010, when there was coral mortality all over Palau.

The water temperature also decreases as you go deeper, to the freezing depths of the deep ocean. When descending and you hit a layer of cooler water, that is what is called a "thermocline". That is not a problem for tourists in Palau, but during El Nino's, when surface water is cool, the colder water comes closer to the surface so the thermoclines are shallow, so that at normal scuba diving depths it can be as low as 22-24°C at times. Your guests will be shivering! On the flip side, when there is a La Nina the much warmer water also extends deeper, so there are no thermoclines found in the depths safe for recreational diving. Nice for divers but bad for corals, even those that live down deep.

Geology and Formation

Geology

Islands within the RISL are carbonate fossil islands formed during the Miocene era. Coral reefs were uplifted to form dry islands, which have eroded over millions of years to form the iconic islands known today as the Rock Islands (Colin 2009).

Geologic diversity

Millions of years of uplifting, erosion, and other processes have yielded an abundance of geological diversity within the RISL, including high- and low-lying limestone "Rock Islands", coral reefs, marine lakes, and caves. The RISL is enclosed by a vast barrier and fringing reef system that is well developed and continuous on the west side and less developed on the east side. This reef system, enclosing a shallow lagoon with an estimated area of over 120,000ha, contains approximately 683 patch reefs and 11.6 km of fringing reefs (Yukihiraet al. 2007). Within the Property, there are about 445 karstic islands (Yukihira et al. 2007; PALARIS 2011), the majority of which are rugged and steep islands, although there are a small number of low islands on the barrier reef. Most of the Rock Islands range from 10-100m above mean sea level (Mason 1955). Many display distinctive mushroom-like shapes due to the presence of sea-level notches, overhangs extending around their perimeters which were believed to have formed from chemical, biological, and physical processes (Corwin et al. 1956; Hodgkin 1970; Colin 2009). Over time, rainwater has dissolved the interior of many of the Rock Islands creating features such as fissures, sinkholes, caves, arches, and speleotherms (Fitzpatrick and Kataoka 2005). Most of Palau's Rock Islands are components of major complexes of different size islands containing marine basins and lakes that have extremely complex and deep marine channels (Colin 2009). Minor Rock Island complexes are smaller and in outlying areas. While these islands are also separated from other complexes by deep lagoons, within them they have shallow bottomed waters.

Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

The volcanic islands of the Pacific were formed as floating plates (moveable sections of the earth's crust) on top of the mantle (part of the earth between the center and the plates) deep within the earth pushed against each other. Palau is part of a mountain range that formed as a result of the Philippine plate pushing down on the Pacific plate approximately 40 to 70 million years ago. The movement resulted in volcanic activity that created large islands in the Pacific. The main islands of Palau were formed from submarine volcanic eruptions and include the islands of Koror, Malakal, Arkabesang, and Babeldaob. Originally these islands were much higher, but over time have been worn down by erosion from wind and rain to their present stature. The reefs started growing on the ancient volcanic basement in waters that were shallow enough for light to penetrate and allow corals and other limestone producing organisms to flourish and build the reefs. The reefs that bordered these islands continued to grow and expand close to the surface of the ocean where there was abundant sunlight for their symbiotic algae to grow. This reef growth resulted in the formation of atolls and low coral islands where ancient volcanoes sunk or subsided. The formation of raised limestone islands occurred where the underlying plate uplifted. These limestone islands are composed of ancient reef structures formed by corals, calcareous algae and many marine invertebrates. The jagged harsh surface of the limestone, called "karst," is caused by years of erosion from rain and wind. The mushroom shape of the Rock Islands is the result of its famous natural "sea level notch" where the margin of every island is undercut. This notch is formed by three processes of erosion: biological, chemical, and physical. Bioerosion is caused by countless grazing and boring by intertidal invertebrates like chitons, sea urchins, and worms. Chemical dissolution is caused by carbonic acid that is formed from water and carbon dioxide from the plants on the islands. Physical erosion is caused by the constant tidal fluctuations and to a lesser extent wave action. Notice in areas that are very calm, without wave action, the sea level notch still occurs – so its existence is not due to waves alone. The notches are still growing, and measurements have estimated they grow back into the island at a rate of about 1 mm per year, or one meter for a thousand years! As the notch eats back into the island, eventually the overlying rock can no longer be supported and the limestone above the notch collapses, with large blocks of rock now sitting on the bottom. This can be seen all over the rock islands and is an interesting natural phenomenon you can point out to your guests.

Photo by Kevin Davidson

The Rock Islands Southern Lagoon is located in the Pacific island archipelago of the Republic of Palau. The center of the island chain is located near seven degrees north latitude and 134 degrees east longitude, 850km north of West Papua in Indonesia and 900km east of the island of Mindanao in the southern Philippines. Palau forms the southwestern most island group of the Caroline Islands of Micronesia. The RISL is located in Koror, one of Palau's 16 states. Approximately 70 percent of Palau's population

resides in Koror, the commercial and tourist hub of the nation. The marine and terrestrial areas of the Rock Islands Southern Lagoon have unparalleled biological, cultural, and economic value to Palau and the world. The RISL provides the foundation for Palau's tourism industry and in turn, the nation's economy. The Property also contributes substantially to the people of Palau's health and well-being through commercial and subsistence harvesting of its natural resources. The RISL is an essential component of Palau's extraordinary biological diversity, and home to critical habitat for the majority of the country's threatened and endangered species. These resources are under increasing pressure as Palau develops.

Photo by Mark Downey

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing
History of Palau. 1997. Heritage of an Emerging Nation. Elizabeth D. Rechebei and Samuel F. McPhetres. Ministry of Education. Republic of Palau.
Ann Kitalong, 2002. A Personal Tour of Palau.

MODERN PALAU

Government Structure in Palau

The Palauan Government has three interdependent authorities – national, state, and traditional. The constitution effective in 1981 is the supreme law of the land.

The national government has an executive branch, led by the President, a two-house legislature, and a judiciary. The country is divided into 16 states, most of which were municipalities under the Trust Territory Government. Each state has its own executive and legislative branches. The state governments are subsidiaries of the national government and derive their power from the national government. The Palau constitution provides that the

Photo by David Mendoza

Koror State Government – **Tour Guide Training and Certification Program Manual**

states have only those powers specifically given by the national government or denied to the national government.

Palau's traditional system still exists and operates both within and outside the constitutional government. Participation by titled leaders in the national government is limited. The government has a Council of Chiefs that has the authority to advise the President on customary matters. There is no participation of traditional leaders in the national legislature (OEK).

President Tommy Remengesau Jr.

In contrast to the national government, the state governments are constitutionally mandated to follow both "democratic principles" and "traditions of Palau," and chiefly power is consequently much greater at the state level. Nearly all the state governments integrate titled leaders into their executive and/or legislative branches.

The amount of real authority granted to such leaders, however, varies widely among the states. In the executive branches, for example, three states give complete decision-making power to their chiefs or high chief. At the other extreme, six states include no participation of traditional leaders in their executive branches. The remaining seven states have opted for an intermediate participation level by their chiefs, giving them limited decision making power or merely advisory functions. This range of power is similar in the states' legislative branches. The legislature of two states contains only titled leaders. Seven have a mix of elected and titled members. One has two houses – one elected and one titled. The remaining six states have legislatures that are entirely elected.

Governance in Koror

The House of Traditional Leaders consists of the Paramount Chief Ibedul, *Ngarameketii* (absolute chiefs representing the four main hamlets ten main clans of Koror) and *Rubekulkeldeu* (principal chiefs representing the other seven hamlets in Koror). This organization is the supreme authority for the state of Koror. The organization and function of the House of Traditional Leaders is in accordance with traditional law. The Legislative branch of the government consists of representatives elected by each hamlet in addition to five members elected at large. The House of Traditional Leaders and the Legislature may propose and approve and/or disapprove bills that each submits but only the House has the authority to veto a bill and prevent it from becoming a law. The primary responsibility of the administration of Koror State government is vested in the Governor, who is voted into office every four years by a general state election.

The Governor's duties include enforcing and executing the laws of the government of the State of Koror. The Koror State seal features three *bai*, representing the House of Traditional Leaders, the Governor, and the Legislature. The Rock Islands Southern Lagoon Area is a successful example of a state resource that has been governed and is being actively managed under both traditional and constitutional law.

Information Source: Constitution of the State of Koror

The Rock Islands – Southern Lagoon Area is owned and regulated by the traditional leadership of Koror and the Koror State Government, who have appointed the Koror State Public Lands Authority and the Koror State Planning and Zoning Commission to oversee all land and designate land use and zoning, respectively. The State's Department of Conservation and Law Enforcement is responsible for running the Management Area and enforcing State environmental laws. The Koror State Rangers

was first established in 1989 to enforce State curfew laws, and later became the Department of Conservation and Law Enforcement in 1994. In the ten years that the department has been established, it has, and continues to work closely with a range of locally based agencies and organizations on management and research activities within the Management Area. This has resulted in the development of State regulations on resource use and activities and designation of protected areas within the Management Area.

High Chief Ibedul Gibbons

National domestic fishing laws also apply to the Management Area and are enforced by national enforcement officers at the Division of Fish and Wildlife. The State cannot currently enforce national laws but is working to remedy this. Additional national regulations that control access to specific areas in the Management Area have been reinforced by State Law, and are thus enforced by the Rangers. This includes Palau's first protected area, the Ngerukuid Islands Wildlife Preserve, which was established by the Trust Territory Government in 1956 and the State in 1999; and restrictions on fishing in Ngerumekaol Spawning Area that were established by National Law in 1976 and strengthened by State Law in 1999.

Long before modern conservation laws were developed, Palau's resources were managed by Traditional controls, such as *bul* (harvest restriction) and marine tenure. Although traditional marine tenure no longer exists within the Management Area, traditional controls have been maintained and are the basis of many modern day conservation initiatives. A Traditional Decree declared by the Ngarameketti Chiefs Council of Koror in 1973, still restricts harvesting of marine and terrestrial resources in the Rock Islands and the surrounding waters in the Management Area.

Modern day conservation initiatives are supported by a range of State laws that regulate: general resource use, recreational activities, and designate protected areas within the Management Area (see Table 1). The Year 2000 Rock Islands Management and Conservation Act, which regulates recreational activities, provides much of the basis for current management activities in the Management Area.

Land and Sea Tenure

Traditionally, Palauan land was divided into political units called *beluu,* or villages. Boundaries were in flux, determined by warfare and other factors, and generally extended as far out to the sea as one could travel by canoe and still see the islands. The territory of each *beluu* was divided into clan lands, *chetemel a blai,* and public domain land, *chutem buai*. Public domain land, which comprised the bulk of the land in Palau, was land not claimed by any clan, lineage, or individual. This land was managed by the village council. Land owned by clans and lineages comprised less then half of Palau's land. Alienation of clan land could be done via trade, sale, mortgage, service reward, marriage exchange, or punitive fine, and with the exception of the last option, could not be alienated without the approval of the strong members of the clan.

Palau was governed by a series of occupying powers during most of this century, and these governments took large portions of Palauan land under their control. Land not being used at the time, regardless of ownership, was taken as public land. What was not declared public was registered as private in the official land registry under the names of individuals. This was done regardless of whether the land had belonged to an individual or to his or her clan or lineage.

Today land in Palau is owned either privately by individuals, clans, or lineages, or publicly by the national or state governments. With Palau's recent independence, there has been a move to return wrongfully taken land to its original owners.

The Palauan Land Court, created in the Land Claims Reorganization Act of 1996, is responsible for determining ownership of all land within the Republic. The goal is that by the end of the century, all land once owned by individuals, clans, or lineages will have been returned to those persons or groups and the remaining land will be public domain. Public land is managed by the Palau Public Land Authority and eventually will be transferred to each of the state public land authorities.

The Palau constitution grants the states "ownership" of all living and non-living resources from the land to 12 miles (1.85 kilometers) seaward from the "traditional baselines," provided that traditional fishing rights and practices are not affected. The national government retains control over the resources that Palau claims beyond 12 nautical miles.

Traditional Authority and the Management of Natural Resources

In the past, Palau's traditional leaders were the caretakers of the resources of the land and sea. Palauans established a society closely tied to reciprocity and respect for both members in the community and the natural environment. The Palaunan word *'omengull'* literally translates into 'respect,' and this respect plays a vital role in how the consciousness of Palauan culture proliferates in these modern times.

Today, much of that responsibility has been taken over by the national and state governments. But as described above, the constitution grants chiefs considerable authority to continue in their traditional roles. They may exert their authority both through purely customary processes and through the state governments.

In fact, both the states and the chiefs appear to be taking more control over how Palau's natural resources are used. There have been more and more examples of chiefs declaring *bul* (moratorium or closure) over certain areas or resources.

The state governments, with their mixed titles and elected leadership, are also becoming increasingly active with regard to the management of community resources. Several states have established permit systems for fishing and tourism. These systems control access to community resources and ensure that the community receives at least some of the benefits from those activities.

Information Source: Palau Conservation Society Government Fact Sheet

The Economy of Palau

Palau's economy consists primarily of tourism, fisheries, and agriculture. The government is the majority employer of the work force, relying heavily on financial assistance from the USA. Business and tourist arrivals numbered over 140,000 in FY2014. The population enjoys a per capita income twice that of the Philippines and much of Micronesia. Long-run prospects for the key tourist sector have been greatly bolstered by the expansion of air travel in the Pacific, the rising prosperity of leading East Asian countries, and the willingness of foreigners to finance infrastructure development.

Tourism Industry

The national economy is driven by tourism that accounts for over 70% of the national GDP. Revenues from departure tax, room taxes, and gross revenue taxes as well as support business. The top attraction is Palau's rich marine life especially the Southern Lagoon of Koror that is currently nominated as a World Heritage Site. Babeldaob is slowly developing a small cottage industry with nature and culture tours. Palau has great potential in geotourism that is slowly being realized. Tourism is the most important sector in Palau with tourist arrivals increasing from 109,057 in 2011 to 118,754 visitors in 2012 and over 140,000 in 2014. During a 2012 Sustainable Tourism Forum, participants supported less large scale development and more island sized projects. The most promising export in years to come will continue to be Tourism. Palau's goal is to develop a sustainable tourism industry through climate and disaster proofing tourism assets; enabling greater participation of communities; ensuring equitable and sustainable development from tourism; and catalyzing small and medium enterprises using tourism as the leverage. (SIDS Report Kitalong 2014).

Photo by William E. Perryclear

One of the unique and irreplaceable attractions of Palau is its marine environment. The unequaled beauty of the Rock Islands has become the worldwide symbol of Palau. In 1989 Palau's reefs and waters were declared one of the seven wonders of the underwater world by CEDAM (Conservation, Education, Diving, Awareness, and Marine Research) International. The result of this exposure has been a unique blend of international tourism. The industry has generated other economic activities such as arts and crafts production, agriculture, retail shops, and marine related sports activities. Tourism has also increased the amount of employment opportunities within a broad range of skills. Land based activities focusing on cultural sites, mainly in Babeldaob, have recently begun to rise as well. Foreign visitors are now interested in the marine and terrestrial resources that Palau has to offer within its unique island environment.

Information Source: History of Palau. 1997. Heritage of an Emerging Nation. Elizabeth D. Rechebei and Samuel F. McPhetres. Ministry of Education. Republic of Palau.

TOURISM NETWORK AND ACTIVITIES

The "Tri–Org" is a coordination group comprising all board members of the three organizations associated with Palau tourism: the Palau Visitors Authority (PVA); the Belau Tourism Association (BTA); and the Palau Chamber of Commerce (PCOC) that assisted in the development of a 2008 Tourism Action Plan which called for establishing a dedicated tourism vocational training facility within the Palau Community College (PCC). The Tourism and Hospitality School of Excellence officially opened in 2012 with the

goal to build capacity in the tourism sector.

Palau Visitors Authority

RPPL No. 1-49 created the Palau Visitors Authority (PVA). The mission of the Palau Visitors Authority is to promote and encourage the development and marketing of tourism as one of the main revenue earning sectors of the Republic along with fishery and agriculture.

To achieve this PVA undertakes the role of the country's tourism authority whose position is to be visionary and present a strong image of Palau as a special destination appealing to the high-end and environmentally conscientious clientele. To this end it invests 60% of its annual budget on marketing and promotion activities. At the local level, PVA is responsible for generating awareness and an understanding of tourism within the community to ensure that the Palauan people understand what tourism is about, what it does, and how it affects our island nation.

The PVA is composed of seven members of the Board of Directors who are appointed by the President, with advice and consent of the Senate, to serve a term of two years. Its primary duties are to develop policies, guidelines, and work plan activities that are implemented through the managing director who oversees the day to day activities of the organization.

The Board has another key responsibility in that it recommends to the President and the Congress passages of legislation pertaining to tourism. The PVA acts as a liaison between the tourism industry and the community, particularly the states, by accessing and encouraging development of potential tourist sites and land-based activities for the purpose of spreading tourist traffic throughout Palau and diversifying tourism attractions.

The PVA is organized into four departments: 1) Marketing and Research; 2) Support Services which combines operational functions and community services of the authority; 3) Finance; and 4) Human Resources.

The customers of the PVA are visitors to the Republic, internal staff, tourism industry operators, state and national governments, and the public.

PVA's Goals and Objectives

The PVA Board has adopted the following key operational objectives:

- To continue to strengthen Palau's presence in the traditional markets of Japan, North America, and Taiwan;
- To intensify public awareness campaigns in the newly developed markets in Europe, Asia (Philippines, Taiwan, and Hong Kong.), and in particular, in response to the SARS negative publicity;
- To look into new markets, particularly in areas like Australia, Thailand, and Korea;
- To play a proactive role in the development of diversified tourism activities and develop a marketing strategy that supports it;

- To work closely with the industry, both public and private to achieve improvement in the quality of services and products offered to visitors as well as the quality of visitors to the Republic;
- To continuously develop staff professionalism for the purpose of providing excellent customer services within and outside of PVA;
- To establish and maintain clear corporate governance including personnel and financial policies;
- To improve recording and accountability of budgetary and financial transactions to ensure full compliance with laws and regulations and generally accepted accounting standards;
- To maintain budgetary and internal controls for the purpose of getting more for the limited budget.

Priority Areas

In concert with the responsibilities tasked to the PVA in the Management Action Plan (MAP), the PVA Board of Directors has adopted the following as priorities for PVA to achieve in the immediate and medium terms; (some are long term strategies).

- Establishment of the national tourism policy for the Republic: in view of the progressive infrastructure development that is expanding rapidly in Palau, it is critical that a sound policy on tourism is established to address appropriate guidelines and standards with which to sustain the long term viability of tourism in the Republic. The first step in the process, which is to identify issues of priorities and lay out the action plan for each issue, is completed. Awaiting official approval of the OEK is the creation of the National Tourism Unit or similar body that will spearhead the implementation process.
- Maintain diving as Palau's foremost attraction while developing the marketing image of Palau as a special destination in the world with unique natural and cultural attractions other than diving. There is considerable potential for Palau to diversify its attractions and therefore expand its image from just being a dive destination to nature, adventure, culture, and eco-tourism.
- With the terrorist attacks in 2001 (NYC) and 2002 (Bali bombings) and most recently with the outbreak of the SARS virus, Palau is likely to experience a substantial decrease in visitor arrivals. An aggressive marketing strategy needs to be in place to respond to these external factors and solidify Palau's position as a safe and pristine tourist destination in the immediate term. In particular, an aggressive promotions plan is to be in place for Japan, one of Palau's most important markets. Timing is opportune for an active campaign to attract visitors from Japan to Palau where visitors from SARS infected countries temporarily stopped.
- Work with the industry, state, and national governments to establish a hotel/motel rating system and dive management plan to ensure the long term sustainability of the industry.
- Administration: While not specifically identified in the MAP, internal controls and exercise of prudent management of resources will be improved and consistently followed to ensure accountability as well as "getting the most out of each dollar

spent." Improvement to financial reporting and accounting procedures consistent with acceptable accounting standards will be ensured.

- The Human Resource department will conduct a comprehensive analysis of employee job descriptions to ensure that functions do not overlap and, if so, revisions will be made to make full utilization of manpower capability within the organization. The human resource department will look into capacity building, reliable evaluation and merit systems.
- Awareness as to the importance of tourism in the Republic: continuous dialogue between and among state and national government entities, operators, and private sector as stakeholders of this important industry will continue to improve.

Belau Tourism Association

The Belau Tourism Association was established in 1993. Belau Tourism Association (BTA) was created to provide a collective voice of its members in the development and promotion of the tourism industry. BTA provides a forum for individual members' concerns to be heard and addressed by national and state government.

BTA Objectives

- To provide one collective voice of members of the tourism industry in development and promotion of the tourism industry in Palau.
- Provides a means where individual members of the tourism industry's concerns and ideas for better tourism environment and development are heard and addressed by national and state governments.
- BTA grant resources where the members of the industry can work together to promote better business practices among themselves, further better tourism through self monitoring activities, and support healthier tourism industry through sustainable use of island resources.

BTA Goals

- Develop a cohesive membership grouping of the Palau Tourism Industry.
- Create a representative voice of the tourism Industry to the Palau National Congress, Palau Visitors Authority, State governments, and other key influential groups.
- Promoting "Excellence in Tourism & Hospitality" destination.
- Promote increased tourism awareness and positive benefits of tourism in Palau.
- Play an active role in the overall tourism policy development for Palau by having an active role in The Comprehensive Tourism Plan for Palau.
- Support BTA members through cost-sharing advertisement, timely information affecting Business operations, and tracking State and National policies affecting the tourism industry.

Alii Host Customer Service

Alii Host Customer Service is a dynamic and interactive customer service based training workshop to support people working in service industries. Content ranges from enhancing core communication skills to dealing with irate customers, understanding and exceeding customer expectations across cultures, providing excellent service for customers with disabilities, empowering and coaching employees, being an effective problem solver, and much more. The Alii Host Customer Service skills program is endorsed by the Tri-Org, which consists of the Belau Tourism Association, Palau Visitor's Authority, and Palau Chamber of Commerce.

WorldHost Training Fundamentals

The WorldHost Fundamentals certificate is highly valued by employers throughout the service and hospitality industries seeking staff who are well-trained in providing exceptional customer service. WorldHost Fundamentals is a one-day (8 hour) workshop that teaches front-line employees important, practical skills, and techniques for providing excellent customer service. The result: impressed customers and clients who will not only return, but will tell others about the quality of service they've received.

Learning Outcomes

- Demonstrate an understanding of the importance of excellent customer service skills.
- Describe the communication process and the skills required to make your communication effective.
- Conduct communication with customers in a professional courteous manner.
- Demonstrate how to listen to your customers in a way that shows that you care about them and their needs.
- Identify and anticipate possible problems and take action to minimize effects.
- Handle complaints in a sensitive, courteous, and discrete manner.
- Verbally and non-verbally convey a willingness to assist.
- Explain the five key Fundamentals commitments that assist you to "go the extra mile."
- And, many, many more.

Belau Tourism Association
P.O. Box 9032 • Koror, Palau 96940
Phone: (680) 488-4377 | (680) 488-3401
Email: info@belautourismassociation.com

Source: www.belautourismassociation.org

Palau Chamber of Commerce

The Palau Chamber of Commerce is a not for profit organization in its 20th year serving its members. The Chamber is organized for the purposes of publicizing, promoting, and developing commercial and business opportunities within the Republic of Palau, including, but not limited to, the promotion and development of tourism, manufacturing, agriculture, fishing, the improvement of community

facilities such as schools, roads, housing, public works, fire, police protection, parks, and recreational facilities throughout the Republic of Palau.

Members of the Chamber of Commerce are international and local operating companies, such as lawyers, property developers, tourism companies, airlines, manufacturing companies, import and export businesses, banks, finance companies, legal advisors, IT and electronics manufacturers etc.

The Chamber of Commerce main activities are, among others, safeguarding business interests and sharing business experiences and business interests; contact with governments, civil society, local media, and the press; and organizing trade shows and events.

Palau Chamber of Commerce
P.O. Box 1742 • Koror Palau 96940
Phone: (680) 488 3400 | Fax: (680) 488-3401
Email: pcoc@palaunet.com

Palau Tourism and Hospitality School of Excellence / Palau Community College

The Palau Tourism and Hospitality School of Excellence (PTHSE) is located in the lower campus at Palau Community College (PCC). The PTHSE was built through collaborative efforts of the Belau Tourism Association, Palau Community College, Ministry of Education, and Palau Visitors Authority. The tourism school opened its doors and classrooms in the Fall of 2012. Since then, instructors and their students have been able to host and cater numerous functions and events such as AliiHost monthly training, meetings, workshops, student exchange programs between Taiwan and PCC, Australia Pacific Technical College (APTC) including the recent Pacific Island Forum (PIF). The Palau Tourism and Hospitality School of Excellence invites people to tour the facility and encourages young and old people to apply and enroll in the tourism existing program tracks. Why not be trained and join the most lucrative industry, the Tourism of Palau?

Objective

The Palau Tourism and Hospitality School of Excellence (PTHSE) will bring an improved educational experience at a new, state of the art, practical learning center, to support Palau's primary industry, Tourism and Hospitality. The School of Excellence will better prepare current and future operators and employees to host and service guests.

Rationale

Significant progress on all fronts ensures a promising industry. Tourist arrivals are increasing and new markets are developing. Airport facilities are being improved and expanded, allowing for more airline accessibility. Roads have opened access to remote areas. More hotel development projects are underway. More historical and cultural tours are opening.

The steadily growing tourism industry generates more than 85% of Palau's economy, therefore making it imperative that all stakeholders, government and private, place stronger emphasis on investing in such schools to continually train and develop to match the industry's demand, while also protecting the market, Palau's environment.

Aim

Hence, the Belau Tourism Association, Palau Community College, and the Ministry of Education were inspired and have come together, through a memorandum of agreement (MOA), to open the PTHSE to enhance and strengthen the tourism and hospitality training program in Palau by upgrading and modifying the curricula of Palau High School (PHS) and Palau Community College (PCC) that reflect Palauan culture and also meet international industry standards, thus producing qualified and confident human resources needed to service this industry and help Palau be more self-sufficient.

Program & Facility

To fulfill this aim, the School of Excellence, an advancement of the existing programs at PCC, provides a state of the art practicum center for all direct and indirect areas of study related to tourism, composing of a commercial kitchen, restaurant, bar, and an alfresco area, open to the general public at cost prices, together with a purchasing and receiving/dispensing area.

The second floor houses a mock hotel suite, reservation, reception, and concierge area, with two classrooms for practicum and theory classes. Corresponding to this advancement is the review and course articulation of the present curricula in PHS and PCC.

Palau Community College

PCC is the only post-secondary educational institution in Palau. It provides both short term trainings through Continuing Education and college degrees through Academic Affairs. At the Tourism & Hospitality Program, four degree tracks are currently being offered. One of the degree tracks is in Tour Services, where Tour Guiding is a regularly offered course (in the spring semester). Individuals can choose from either an Applied Associate of Science (AAS) or an Associate of Science (AS) degree in Tour Services.

Bureau of Tourism

In 2014, the Bureau of Tourism was created under the Ministry of Natural Resources, Environment and Tourism (Executive Order No. 357). Due to an increase in tourism and the sophistications in the tourism industry it was vital for the Republic of Palau to Institute a Bureau of Tourism in order to provide for a sustainable, "world-class" tourism industry that primarily benefits the people of Palau. The Bureau shall work with the The Tri-Org (Palau Visitors Authority, the Chamber of Commerce, and the Belau Tourism Association) to promote and develop high end tourism in the Republic. Areas of cooperation include (a) developing occupational standards and certification processes and requirements, and (b) supporting the development and enforcement of standards for tourist health, safety and response.

Visitors to Palau

Visitors are the key to tourism, keeping the entire tourism network working. Their attitudes, actions, and experiences play a critical role in sustainability for Palau in terms of both economy and ecological health of the natural resources on which tourism depends.

Country	Number of tourists per year (2014)	Percentage by country of origin
USA	8,772	6%
Japan	37,986	27%
Europe	5,192	4%
Taiwan	30,080	21%
Others	58,754	42%
Total	140,784	100%

It is important to have a general knowledge of the tourists who visit Palau, and the activities that they participate in during their stay in Palau. Palau Visitor's Authority is the primary source of information on this subject:

Palau has seen an 8% increase in the total number of visitors from 2001 to 2002. The following table gives the breakdown of visitor percentages according to ethnic background. About half of Palau's tourists visit with the primary purpose of scuba diving.

Most of the remainder is "general interest" tourists, but virtually all of them engage in marine recreational activities, including snorkeling, motorboat touring, kayaking, and fishing (PCS, 2001). A recent survey conducted by Community Centered Conservation (C3) identified seven major marine-based activities, which are offered and utilized within the tourism industry. These include scuba diving, snorkeling, kayaking, boating or jet ski rental, sea walk, parasailing, and banana boating. All of these activities take place within the southern part of Palau's main archipelago known as the "Rock Islands Southern Lagoon Area" (2003).

The Palau Visitors Authority in cooperation with MCAA has a "Night Market" that was initiated in 2010 and has become a great success. The Night Market showcases local artists, crafts, and cuisine for the community and visitors on a monthly basis. Annual Cultural Fairs, Tourism Awareness Week, and Education Awareness Week are all opportunities to showcase local culture.

Photo by Palau Visitors Authority

Local dancers provide entertainment during the Palauan Night Markets

Marine Tourism Activities and Sites

Scuba Diving

Scuba diving is one of Palau's main tourism activities. Palau provides excellent opportunities for all levels of diving, from novice through advanced. There are currently 75 dive sites in Palau and 75 percent of those are located within the Rock Islands Southern Lagoon Area (PCS, 2001). There are 22 identified tour operators in Koror who offer scuba diving tours (C3, 2003).

Snorkeling

Snorkeling is also a popular tourist activity in Palau, particularly since is requires much less training and equipment. There are 25 identified tour operators in Koror who offer snorkeling tours (C3, 2003).

Other Marine Activities

Kayaking, fishing, boating, jet ski rental, sea walking, parasailing, banana boating, and other activities are also available.

CHAPTER 2:

The Tour Guide

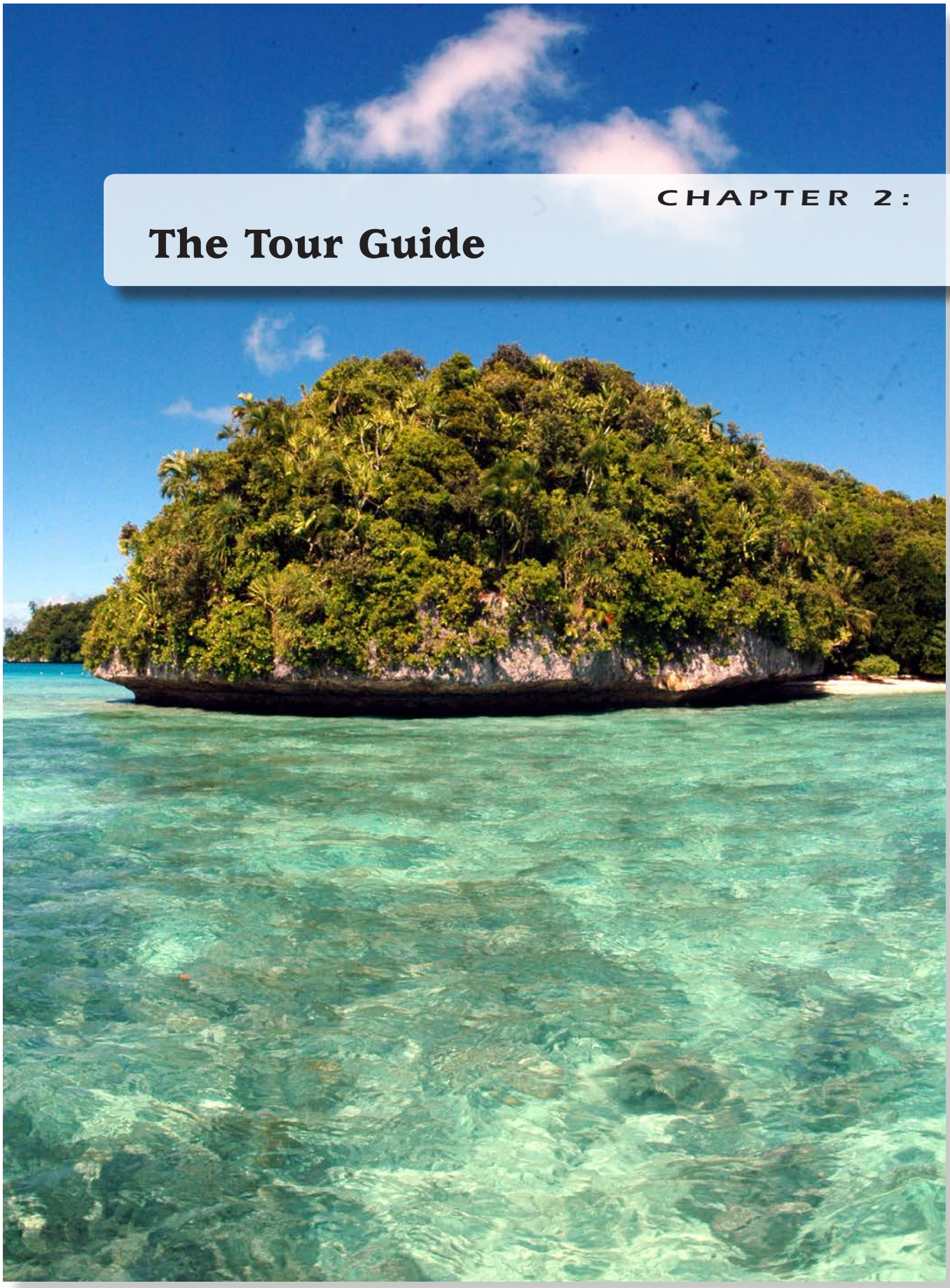


Photo by Kevin Davidson

TOUR GUIDE ROLES & RESPONSIBILITIES

The importance of the tour guide

Tour guides are important to Palau and Koror State in many ways. They are an irreplaceable part of the tourism industry, because they interact directly with tourists who generate a large part of Palau's economy and play a direct role in determining how interesting, educational, safe, and fun the tourists' experience in Palau will be. While you are guiding in Palau remember to show respect to other guides working along side you, regardless of race or gender. Show respect to the weather and the ocean, but most of all respect our unique natural environment for future generations.

Photo by Ron Leidich

Tour guides have an impact on the behavior of tourists in Palau because of the intimate role they play. Tourists take their cues on acceptable behaviour from their guides. If a tour guide behaves poorly, such as taking organisms from the reef or damaging the reef through improper dive etiquette, the tourist will likewise behave poorly and leave behind scars that mark their vacation in Palau. Tour guides that promote good dive etiquette and properly brief their clients before each dive will help preserve the beautiful marine life that tourists come to see. Tour guides are critically important to the conservation of the Rock Islands and Southern Lagoon Area. Apart from helping moderate the destructive behaviors of tourists, guides are present more than almost anyone else in the conservation areas. Guides can report on illegal activities in the area and monitor the status of the marine resources that they see nearly every day. By participating in the preservation of those resources, the tour guides help ensure that Palau retains the healthy marine environment which draws tourists here year after year.

Roles of the tour guide

The tour guide has a few major roles to fulfill while he or she is getting paid to showcase the natural attractions the tourists are here to see. The Guide has to provide an interesting, educational, safe, and fun experience for the tourists. On top of that, the tour guide needs to ensure that the tour doesn't cause damage to the environment the tourists are here to see. In order to do this, the tour guide is responsible to do the following:

- Research and collect data and information about Palau's natural, cultural and human resources, history, popular destinations, anticipate questions, and be prepared to accurately answer any questions asked by guests;
- Know local, common, and scientific names of common marine and terrestrial organisms;
- Be familiar with Koror State regulations, and be able to brief tourists on restrictions;
- Be able to give appropriate instructions on the use of the reef hook;

- Demonstrate appropriate dive etiquette and be able to explain what not to do while diving or snorkeling in Palau.

Roles of the tour guide

Apart from playing a huge role in ensuring a pleasurable experience for tourists in Palau, the tour guide also has a responsibility to make sure the experience is safe as well. If something goes wrong in the course of a tour, it is usually the guide who will be held responsible. In order for this not to happen, the guide needs to do the following:

- Prepare all gear and equipment for the tour, and make sure it's functioning properly;
- Ensure there is a properly functioning boat and safe boat operator for the tour;
- Check weather conditions, tides, and water craft warnings before the tour, and be prepared for alternate plans;
- Give proper and thorough dive briefings to tourists, including safety tips, what not to do, and what to do in case of separation from the group;
- Be certified in First Aid and CPR.

DIVING BRIEFINGS

The dive briefing is an integral part of safe and enjoyable dives. The tour guide should be sure to do a proper dive briefing before every dive to ensure that the tourists know what to expect and how to behave while on the dives. A good diver briefing should include:

- **Dive Site Name** – partly for fun but also for the divers information, often the diver will insert it into their log. If the name is unusual it is useful to tell them the story behind the name.
- **Site Description** – this includes a description of the site layout, points of interest, depth, bottom composition, currents or water movement, temperature, hazards, and other information.
- **Your Role** – tell the diver where you will be and what you will be doing.
- **Entry and Exit Points** – divers appreciate recommendations, descriptions, and reminders of techniques – it makes the dive easier and more relaxed.
- **Dive Procedures** – this includes the course to follow or direction to head, ways to avoid common problems, reminders to make safety stops, air reserve methods, maximum depths, and maximum bottom times.
- **Emergency Procedures** – this includes problems that may occur unique to the dive site and how to handle these situations, low on or out of air procedures, and diver recall practices.
- **Signal Review** – remind buddy teams to review their signals between them as well as inform them on the signals you will use regarding both the technical aspects and the observations they should make.

- **Roster/Buddy Check** – be sure to establish and review buddy teams.
- Environmental Interaction Suggestions
  - Identify organisms to respect and be cautious of;
  - Remind them not to damage environment by controlling buoyancy, not kicking or grasping the reef;
  - Discourage fish feeding;
  - Take only pictures; leave only bubbles!
- **Predive Safety Check** – remind divers and be the extra set of eyes; check air level, weight, proper set-up of gear, etc.

Information Source: PADI Dive Master Manual

RESPONSIBLE DIVING ETIQUETTE

The tour guide should be an excellent example of responsible diving etiquette and should be prepared to explain good diving etiquette. The responsible and caring tour guide does the following:

- Does not touch, handle, or provoke any marine organism.
- Does not stand, rest fins, or hold onto corals. If you must touch the reef to steady yourself in currents, use a reef hook or only your fingertips on the dead part of the reef or coral covered in algae.
- Does not alter or deface anything on the reef.
- Does not collect or remove any corals, sea grass, algae, or any other marine organisms.
- Secures equipment such as gauges and alternate air sources so that they do not drag over the reef.
- Avoids kicking up sand because stirred up sediment can settle on coral and smother it.
- Does not harass marine life; a good guide observes marine inhabitants from a distance.
- Does not dispose of his/her or tourists' garbage in the ocean.
- Does not throw anchors indiscriminately, because it causes irreparable damage to the reefs.
- Uses recyclable containers whenever possible to reduce waste.
- Does not spearfish with scuba gear (scuba fishing is illegal).

Information Source: 1994. The Environment, Inc. Tour Guide Handbook

CORAL-FRIENDLY SNORKELING GUIDELINES

Coral reefs are one of the world's most spectacular marine habitats and snorkeling is an excellent way of exploring them. As coral reefs face an increasingly uncertain future, snorkelers and other coral reef visitors can play an important role in helping to protect these fragile habitats by following a few simple guidelines.

Before setting out to explore the reefs:

- Make sure tourists have the best possible instruction you can give;
- Be sure to practice snorkeling skills in a swimming pool or sandy area until you are completely comfortable in the water;
- Make sure your equipment fits properly before you snorkel near corals, because it can be very difficult to adjust in the water;
- If tourists are feeling unsure, have them wear a snorkel vest – many operators insist on them;
- Learn all you can about coral reefs – they are fascinating and fragile environments.

Snorkel in the Comfort Zone

To get the most out of snorkeling, "stay within your comfort zone." You will see much more and be able to enjoy the beauty of the reef more by hanging back. Depending on snorkeling skills, experience, fitness, and age, each snorkeler will have their own personal safe distance from the reef from which to comfortably enjoy without causing harm.

Snorkeling out on the Reef

Be sure to avoid all contact with corals and other marine life. Not only could you be hurt but corals are fragile animals – as much as a gentle touch can harm them. Even sand kicked up by fins cans smother and kill them.

- Be careful where you get into and out of the water to avoid walking on corals.
- Be sure tourists snorkel in their "comfort zone" – don't get to close to the reef.
- Make sure tourists lie flat in the water, and avoid coming upright so they don't stand on corals.
- Tell tourists to avoid swimming with their arms to avoid accidental touching of the reef.
- Tell tourists to make sure they know where their fins are so they don't kick anything.
- Tell tourists to move slowly and deliberately in the water, relax, and take their time.
- Remind tourists to look but don't touch.

Snorkeling pros know the real way to enjoy the beauty of the reef is to slow down, relax, and watch as reef creatures go about their daily lives undisturbed.

Going on a Snorkeling Holiday

- Opt for conservation conscious accommodations and facilities, such as those saying they recycle and treat sewage and solid waste in an environmentally friendly way.
- Look out for and support coral parks and other marine conservation areas.

As a Responsible Snorkeler

- Do not touch anything in the water.
- Never chase, harass, or try to ride marine life.
- Take nothing living or dead out of the water except recent garbage.
- Do not touch, handle, or feed marine life except under expert guidance and following established guidelines.
- Do not use gloves in coral environments – it will make you much more careful about what you touch.

On Boats

- Choose operators who make use of moorings when available – anchors destroy fragile corals when set directly on the reef.
- Make sure garbage is well stowed, especially light plastic items such as cups and bags that can easily be blown overboard.
- Be sure to take away everything that was brought on board and dispose of garbage safely and responsibly.

Shore Side

- Support coral parks and other conservation projects:
  - Pay user fees in recognized coral parks and reserves which are actively supporting coral reef conservation;
  - Encourage and support the use of boat moorings;
  - Participate in local initiatives to monitor the marine environment (e.g. sighting forms);
  - Participate in cleanups;
  - Volunteer your skills to help coral parks with reef surveys, outreach and awareness;
  - Consider donating used equipment such as cameras, dive gear or Reef ID books;
- Take your garbage home with you especially items such as batteries which are toxic and difficult to dispose of safely in countries without special waste handling systems.
- Refuse to buy souvenirs made form coral, turtle and other marine life. Often this is illegal as many endangered species are protected under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and by national laws.
- Speak up: make sure snorkeling buddies understand about these simple conservation practices. We need to work together to protect and conserve coral reefs for all time.

Being a coral friendly snorkeler not only helps to protect coral reefs directly, it also helps to raise awareness for coral reef. Be sure to find out local laws and regulations as

they may differ from these general guidelines.

Information Source: These guidelines were developed by the Coral Parks Program of the Coral Reef Alliance and co-endorsed by the Project AWARE Foundation. ©CORAL. Suggestions for improving these guidelines should be sent to info@coral.org.

BEST PRACTICE GUIDELINES FOR NATURAL SITES

Even if you are aware of the following guidelines, please read them and make sure your visitors follow them in order to minimize their impacts on our natural treasures, so that they will be kept in good condition for future generations of Palauans and tourists to admire and enjoy. When taking tours to natural sites, guides need to do the following:

- ✓ Always store your trash in plastic bags and take it back with you to Koror on the boat. It looks ugly left on the beaches and can pollute the sea and suffocate marine life.
- ✓ Never stand on, kick, or hold coral or other sessile (stationary) marine life. Coral is a living organism and can be damaged easily. Explain this to tourists; and when diving, make sure their buoyancy is adjusted so that they minimize their risk of touching the reef during your dive.
- ✓ Photographers are often seen to cause damage on the reefs as they lean against and/or hold onto living animals in order to get the perfect shot. Discourage photographers from holding onto corals (especially lying on it!) before they enter the water and ask them to only hold onto rocks.
- ✓ Never allow fish feeding from your boat or the beach as it is now illegal. It changes fish behavior and upsets the nutrient balance in the water, especially at sheltered beaches, where it can promote algal growth. Let's keep our beaches white, not green!
- ✓ Do not allow divers to wear gloves – this will prevent them from holding onto living animals such as corals, sponges, and sea fans.
- ✓ Use less packaging, e.g. take lunches out in reusable Tupperware boxes rather than Styrofoam boxes. Palau already has a problem with landfill issues, so create less waste wherever possible.
- ✓ Use four-stroke engines if possible. They use less fuel and do not leak oil into the water.
- ✓ In Jellyfish Lake, keep tourists away from the edges of the lake where they may disturb animals by stirring up sediments. Ask them not to remove jellyfish from the water as they break easily. Also keep your group as quiet as possible. Encourage them to enjoy the tranquility of the lake and listen to the birds that live in the surrounding jungle. Other tourists' experiences can be ruined by loud screaming and shouting in such a peaceful environment.
- ✓ If there are already several boats moored at a beach, move to another beach so tourists don't feel crowded together.
- ✓ Cigarette butts are an ugly site on many Rock Islands and pollute our environment. If your guests want to smoke, carry a disposal box for cigarette butts on your boat and ask them to use it. Never allow them to throw this trash in the ocean or on the beach. (Empty camera film canisters are good to give guests who smoke.)

COMMUNICATION AND PUBLIC SPEAKING

Not all guides are experienced public speakers. It takes practice and time to become a good guide. Here are a few tips from the Dale Carnegie course that may help you become a better speaker:

Every speaker must consider four points:

1. Subject - three types of subjects:
   - Inform – how to get somewhere;
   - Persuade – safety precautions are critical;
   - Entertain – make your visitors smile;

2. Audience
   - Know who will be your audience;
   - Know what your audience wants;
   - Know what your audience already knows.
   - Know attitudes and opinions;
   - Build bridges of cultures with an audience;

3. Him/Herself
   - Personality is the most important single factor in influencing an audience.
   - Know-yourself and be confident in who you are and what you do.

4. Occasion
   - Think carefully about the time and place of your speech and the appropriateness of the subject.

Communication – sharing information; exchanging of information or messages between two or more people which involves attitudes, emotions, and intentions

Four types of communication:

- Gestures
- Signals
- Symbols and Pictures
- Language and Writing

Problems with Communication:

- Delivering the message
- Ensuring message gets attention
- Ensuring message is interpreted
- Ensuring message is accepted and acted upon

How to improve communication:

- Smile and follow a plan
- Be familiar with the group
- Don't assume anything – provide all necessary information
- Know your limits as a guide and refer questions to the right people

Develop Empathetic Listening Skills: Wear, feel or place yourself in the customer's shoes/position:

- Remain Calm – especially with upset customers (breathe, count silently in head and drink water)
- Give Encouraging Responses – look at customer's face and use non-verbal cues to let customers know you want to help.
- Mirror Feelings – let the customer know that you want to try to understand and know how she or he feels about the situation.
- Clarify Facts – double check to make sure you have the correct facts.
- Work Together Towards a Solution.

Tour Guide Skills and Techniques

Basics:

Outline Preparation

- Tour Objective – what information should the group know after the tour is over.
- Content – what concepts, stories, ideas, and facts can be included that explains, emphasizes, or provides an example for what you want the group to know.
- Summary – review of the information given to the group.

Tour Outline

1. Warm-up Briefing
   a. Welcome
   b. Personal introduction
   c. Smile and eye contact with group
   d. Brief personal information
   e. Ask introductory questions from the group
   f. Directions
2. Content
   Conduct the tour – give the group the information by asking questions and provide summaries of the information you wish them to know – do not overwhelm them with too many facts
3. Summary – Debrief, review, thank you, and smile

Other:

When leading a group you must willingly accept the responsibility as a leader. Much of the anxiety among tour guides is due to self doubt and insecurity about what the visitors will think of them. Rehearsal is the best method in overcoming these fears.

Good guides should always ask themselves the following questions:

- What are the characteristics of the listeners?
- Am I gauging the audiences' knowledge?
- Can they understand me?
- Should I utilize different vocabulary?

- Can my audience hear me?
- Am I speaking clearly and slowly?

DEVELOPING YOUR OWN TOUR STYLE

Personal style can be improved consciously through rehearsal of various types of communication, both verbal and visual. Style can be improved by watching performers in action on TV or by watching the style of other successful tour guides. Guides, like good teachers, interact with the audience. They are actors. Their performance is intended to inspire, enthuse, and inform the audience about the subject. Stimulating visitor enthusiasm and interest is the goal of the presentation.

CUSTOMER MANAGEMENT AND SERVICE

Remembering Names - can be easy if you consciously think about it as a process or procedure to do each time!

Three Methods:

1. First Impression
   a. The Name - listen to how it sounds, use it and repeat it in conversation, ask for its spelling, and write it down
   b. The Person – face, size, and voice
   c. Want to remember

2. Repetition
   a. Use name immediately in conversation
   b. Use it often but don't overdo it
   c. Repeat it silently
   d. Review it silently
   e. Talk about the name and its meaning.
   f. Use it when leaving or saying goodbye
   g. Refresh your memory

3. Association (ask for clues to help remember names)
   a. Business
   b. Rhyme
   c. Appearance
   d. Meaning
   e. Mind Picture
   f. Similar Name

Enthusiasm – to really want to do something!

Six steps to follow:
1. Learn everything you can about your job and its relation to the company.
2. Have a goal and stick to it.
3. Give yourself a pep talk everyday.
4. Train yourself to think in terms of service.
5. Associate with enthusiastic people.
6. Force yourself and you will become enthusiastic.

Seven Principles to Great Customer Service

1. Smile – it is universal, requires simple effort, and communicates friendliness and messages of love
2. Speed - quick service
3. Say Hello
4. Satisfaction – ensuring memorable and happy experiences
5. Safety/Security
6. Sincerity of Service – serve from the heart and love what your are doing
7. Spirit of hospitality– be enthusiastic and love what you do

Information Source: The Environment, Inc. 1994 Tour Guide Handbook

INTERESTING NATURAL HISTORY FACTS FOR GUIDES IN PALAU

Listed below are some facts your visitors may be interested in hearing about during their trip to Palau. See how many you can remember and use in your briefing:

Photo by Palau Visitors Authority

- Palau has all the major island types found in the Pacific
  - High volcanic islands (Babeldaob, Koror)
  - Raised limestone islands (Rock Islands, Angaur, Peleliu)
  - Atolls (Kayangel, Ngeruangel, Helen's Reef)
- Babeldaob is the 2nd largest island in Micronesia, after Guam, but Guam has no mangroves!
- Ngeremeduu estuary is the largest estuary in Micronesia.
- Lake Ngardok is the largest freshwater natural lake in Micronesia.
- Babeldaob has the largest undisturbed forest in Micronesia.
- Palau has the most diverse selection and greatest number of marine lakes out of any country in the world.
- Palau has over 400 species of hard corals and more than 150 species of soft corals, gorgonians and sea pens, the most in Micronesia.
- Palau has over 1,450 species of marine fish and 63 species of freshwater fish, the most in Micronesia.
- Palau has seven of the world's nine species of Giant Clams.

- Palau has eight endemic species of birds (found nowhere else in the world), the most in Micronesia
- Palau has an endangered population of dugong or sea cow, the only group in Micronesia.
- The Hawksbill turtle (endangered species) has its most important nesting sites in Palau.
- Palau has a sub-species of Fruit Bat found nowhere else in the world.
- The Micronesian Megapode is only found in Palau and the Marianas.

Information Source: Palau Conservation Society Interesting Facts About Palau Fact Sheet
Marine Environments of Palau (PL Colin)

ROCK ISLAND COMPLEXES

Photo by Palau Visitors Authority

For millennia, Palauans have used both traditional resource management techniques and, more recently, modern conservation strategies to protect the biodiversity and cultural values of the RISL while living off of its resources. Palauans remain passionate about maintaining these resources and promoting sustainable subsistence and managed tourism within the RISL in order to protect their natural and cultural heritage.

Each Rock Island complex within the nominated World Heritage Property has unique characteristics. One of the most well known, yet least visited complex is the Ngerukewid Islands Wildlife Preserve. This land group, also known as the "Seventy Islands," was designated a national preserve in 1956, and its image is widely used in marketing Palau as a tourist destination.

The Ulong Complex is noteworthy because in AD 1783, the first long-term contact with the Western world occurred when the crew of the English packet, the Antelope, camped here after running aground nearby.

Ngeruktabel Complex includes the second largest island in Palau, Ngeruktabel. This Ngeruktabel Complex and the neighboring Mecherchar Complex have a high concentration of marine lakes (Hamner and Hamner 1998).

The Kmekumer Group is located near the western barrier reef and is known for its sandy bottomed waters while the Babelomekang Group is home to lovely beaches (Colin 2009). It is common to find the endangered endemic palm, *Hydriastele palauensis,* in the Ngerukewidand Kmekumer Complexes.

The Ngemelis Island Complex, particularly its southern reef, has many of Palau's premier dive sites (Colin 2009). Its steep walls, corners, and blue holes provide opportunities for divers to have close encounters with sharks.

DIVE SITES DESCRIPTIONS

In a study conducted by Palau Conservation Society (2001), dive guides were asked to identify the dive sites within the Rock Islands that they considered to be the most commonly used and requested in the dive industry. The following section attempts to outline the top dive sites that were identified by tour guides. There is no fishing, no taking, and no harvesting year round for all dive sites in the Ngemelis complex (Blue Corner and Holes, New Drop Off, and Big Drop Off), German Channel, and Ngerumekaol.

Ngerumekaol (Ulong Channel)

Ngerumekaol or Ulong Channel is a false channel eroded into the barrier reef west of Ulong Island. The dive is usually done on an incoming tide wherein the wall is on the left, as divers approach the mouth of the channel where gray reef and white tip sharks congregate in the current. Along the wall, between 15m/50ft to 18m/60ft a marvelous drop-off showcases schooling spadefish, gold spotted trevally chasing bigeye scad, dogtooth tuna as well as the shark species previously mentioned. Along the channel one usually encounters sharks that seem to be constantly on the lookout for food. Looking up to the left divers will notice larger schools of black snapper, big eye trevally, and black spot barracuda. Upon reaching the mouth of the channel, divers usually hook in at either side of the channel at a depth between 15 and 18 meters to watch some real shark action. Along with the sharks, tunas, and a vast variety of other pelagic fish are frequently seen hunting in the blue. A stop is usually done a few minutes before drifting into the channel. The ride through the channel at an average depth of 15 meters is like a high-speed amusement park ride with lots of small reef fish, occasional sharks, threadfin pompano, various species of grouper, and Barramundi cod found along the way. There are also soft corals, sea fans, and rarely seen lettuce coral. The dive nears its end as the channel widens and deepens making an ideal spot for a safety stop while still having plenty to observe. Divers may still see garden eels, sleeping sharks on the bottom, and schools of barracuda with an occasional gray reef shark cruising within them. There is a multitude of additional sea life, which may be seen at any given time

while diving the channel. During April to September three species of groupers come to this channel where they aggregate and spawn with peak numbers around the time of the new moon. Divers can easily see hundreds of groupers on a drift through the channel at these times, but the actual spawning takes place either around sunset or sunrise or during the night. Overall visibility for this dive site is excellent ranging between 15 to 25 meters.

Yikrel a Ikulaol (Blue Corner)

Blue Corner is the most famous dive site in Palau due to consistent shark and other pelagic fish presence. The corner is a shallow plateau pointing westward into the Philippine Sea. High currents often run across the plateau generating an amazing food web. Sharks aggregate at Blue Corner due to the high currents. Gray reef, *Carcharhinus amblyrhynchos (mederarart)* and Whitetip sharks *Triaenodon obesus (ulubsuchl)* come extremely close to divers and photographers who are hooked into the reef, allowing great photography and fish watching. Sharks are most abundant on the edge of the plateau, along with king mackerel, dogtooth tuna, and giant and bluefin trevally, where the currents are stronger. These species will often be spread out over the plateau during weak or non-existent currents. Inside the plateau Napoleon wrasse, schooling big eyed trevally, barracuda, anemones, anemonefish, leaf fish, lion fish, turtles, a resident spotted eagle ray, and others can be found on a regular basis. Usually the dive ends by drifting off the plateau into blue water for a safety stop. Sometimes a large school of blackfin barracuda, along with other pelagic species can be found out in blue water. The dive is very popular so the ideal time to dive this site is either early or late in the day in order to have the site to yourself. It is recommended that diver's do this site at least twice while in Palau, once on the incoming tide and once on the outgoing tide. Visibility usually ranges from 18 to 50 meters. There are a number of "spawning aggregation" phenomena that occur at different times around Blue Corner. These include the orange spine surgeonfish, *Naso lituratus (erangel),* and other types of surgeonfish, longnose parrotfish, and moorish idols. When a particular species is aggregating there are often sharks and other predators focusing on them, trying to separate one or a few fish from the group so they can feed on them.

Aggregations of the orange spine surgeon fish and the Moorish idol are observed during January through April before the half moon.

Bkul Chotuut (Big Drop Off)

Photo by William E. Perryclear

Done on either incoming our outgoing tide, this is one of the more famous wall dives in Palau. Usually a mellow drift dive along a vertical wall covered in many soft corals and sea fans, sponges, anemones, and small reef fishes. Quite often turtles are seen feeding along the wall. Purple headed filefish, longnose hawkfish, and schools of squarespot fairy basslets are seen here. Schools of surgeonfish, parrotfish, angelfish, and butterflyfish are common. Even safety stops are exciting here, for the reef is teeming with sea fans, anemones, spotfin and clearfin lionfish, and moray eels. On top of the plateau, in rather shallow water, many new corals are growing and this may be one of the healthiest looking shallow reefs on the barrier reef. Visibility usually ranges from 18 to 50 meters.

Mesikm (German Channel)

German Channel takes its name from a man-made channel cut out of an inner reef within an inner lagoon, but diving actually is best at the outer portion of the reef area near the channel. The best time to dive at the site is during an incoming slack tide when manta rays may be feeding or being cleaned at a couple of cleaning stations. Divers descend to about 20 meters (65 feet) and swim crosscurrent along the sandy bottom. Feathertail stingrays and thorny rays may be seen. Whitetip and gray reef sharks may be either cruising or being cleaned at cleaning stations. Microscopic organisms called plankton funnel into the channel, and are a food source that manta rays regularly feed upon – especially late in the day on an incoming tide. After watching mantas or sharks or exploring coral heads, divers drift into the shallow part of the channel where leopard sharks sleep and turtles feed. There are certain times of the year when the manta rays are more common but resident rays are seen year round. Blacktail snappers, *Lutjanus fulvus,* form large aggregations each year in the channel.

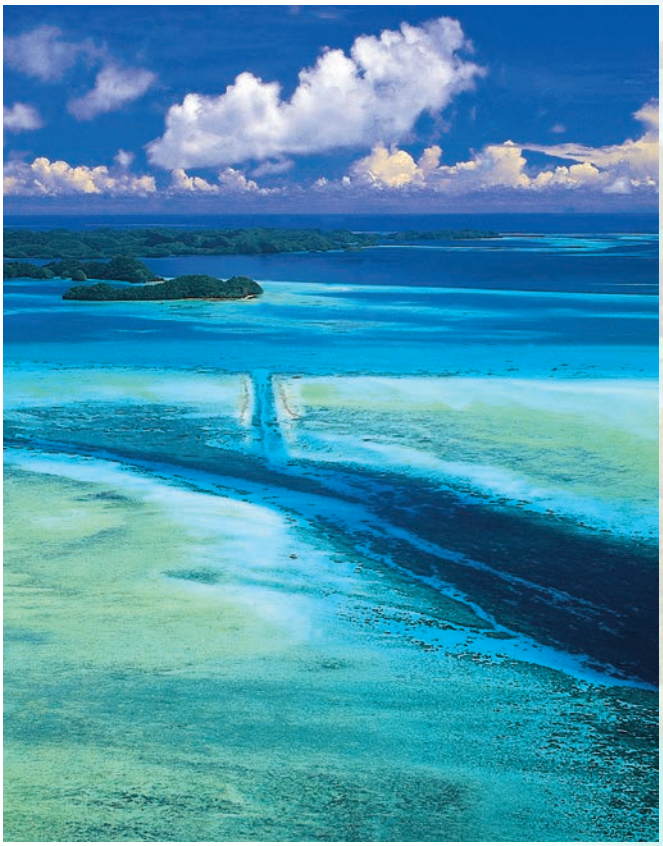


Photo by William E. Perryclear

Yikrel a Bub (Blue Holes)

This site has a large cavern with four holes on top of the reef allowing natural light to filter in and additional entrances along the reef wall. The cavern and holes were formed years ago when water levels were much lower than today. When the sea is calm, divers usually enter the cavern through one of the holes on top of the reef flat and descend slowly through a wide tube that has many lace hydroids growing on the walls. Soldierfish and fairy basslets are found inside the tube. Once divers descend to about 18 meters inside the cavern they will notice thick beams of natural light entering from the four skylights above. The bottom of the cavern consists mainly of sand and rubble. No current is present inside the cavern. Two exits are readily apparent. The larger one is between 20 and 40 meters and the other exit is around 15 meters. Divers usually spend 10-15 minutes inside the cavern, and then begin drifting with the wall on the left towards Blue Corner (only possible during outgoing tides). There is almost always an eddy of water just outside the holes. Divers will have a slight current against them for ten minutes before being pulled towards the Corner. Going slowly divers will notice lots of large marbled groupers, purple queen anthias, nudibranchs, and one spot and humpback snapper along the wall. Whitetips may often be found sleeping in crevices along the wall. If the tide is incoming then divers may spend more time inside blue holes and drift with the wall on their right once exiting. Towards the back of the cavern there is a small entrance to a cave (called the Temple of Doom). The cave goes back almost 100 meters into the reef and no natural light can be seen once entering. Two lines have been set inside the cave. The silty bottom drops to 40 meters and the top goes up at least 18 meters. There are two complete turtle skeletons inside the cave that are the only attraction. This true cave should not be entered unless all divers have proper cave diving training and equipment.

Cheleu (New Drop Off)

There is a shallow plateau south of blue corner along the barrier reef. Drop in with the wall on your left. There are *Dendronepthya* soft corals, sea fans, and large anemones along the wall. Gray reef sharks and white tip sharks cruise with the current along the edge of the drop-off. Schools of redtooth triggerfish, pyramid butterfly fish, and fusiliers are out in the current along the wall. After several minutes of drifting, divers come upon several cuts in the reef where circular currents called eddies occur. Divers feel the current for a minute or two, and possibly a down draft inside these cuts. Divers may hook in on the edge of the plateau, from 15 to 18 meters to watch shark aggregations. Large Spanish mackerel are commonly found with the sharks. On top of the plateau, that is about 10m, there are schools of blue-lined and long-spot snapper, clown triggerfish, peach fairy basslets, Napolean wrasse, and blackspot barracuda. Leaf fish can be found in sand/rubble cuts and flame angelfish are uncommon. Divers must be especially careful of nesting triggerfish around full moon, as they get aggressive and are known to nip at fins. Aggregations of the orange spine *Naso lituratus (erangel)* and the Moorish idol are observed during January through April before the half moon.

Bkul a Chomruchel (Peleliu Corner)

The southern reef in Peleliu extends far outward from the island, and eventually slopes to a sharp corner. On the western side of the plateau, there is reef cut at a depth of 15m. At this site, high currents hit the wall and go up and over the edge onto the plateau. Sharks aggregate at the cut surfing the currents along with king mackerel, yellowfin surgeonfish, and redtooth triggerfish. It is the rather strong current that brings all these predators to this area. At the start of the dive, divers generally drift along Peleliu wall for a short distance, and then use the reef hook at the cut to watch the action. After unhooking, divers usually drift into the shallower part of the plateau, also known as the Peleliu Aquarium. When the current is right, divers may begin their dive at the cut and drift along the edge of the plateau down to the corner, which is at about 25m. Peleliu cut and corner are actually two different dive sites, but can be done as one dive. The variation or combination of these dives is usually done with more experienced divers who want to see some big action and who do not mind diving while swimming against and fighting the rather fierce currents that are present here. Visibility is usually excellent, ranging from 20 to 40 meters. Aggregations of the orange spine *Naso lituratus (erangel)* and the Moorish idol are observed during January through April before the half moon.

Bkul a Ngerngas (Turtle Cove)

This dive begins by dropping into a small blue hole on top of the shallow reef flat. Walls of thr hole have small soft corals, hydroids, and sponges. Drifting with the wall on your right towards the corner, usually takes 20 minutes. There are large schools of fairy basslets and small reef fish. Close to the corner there are schools of Thompson's surgeon fishes, pyramid butterflyfish, and redtooth triggerfish. Along the wall a large school of black snapper may congregate within close view of the divers. A handful of gray reef and whitetip reef sharks around the corner, with schools of big eye trevally. Giant trevally cruise up in shallow water. Near the end of the dive, divers ascend to a plateau, which is like a giant aquarium. Divers can expect to see beautiful anemones, small reef fish, turtles, and sometimes a blacktip reef shark. Visibility is usually good, ranging from 10 to 30 meters.

Siaes (Siaes Tunnel)

Just east of Siaes Corner, is a straight swim down a vertical wall to the entrance of a large tunnel. The tunnel is like a giant worm hole with three holes. Usually little current is present inside the tunnel though it may pick up once the diver exits. Plenty of natural light filters inside the tunnel though a flashlight is recommended to see soft corals, cup corals, small fish, and inverts on walls and ceiling. There are many sea fans and black coral in the window and exit of the tunnel where they can filter plankton out of the current. The tunnel is rather wide, about 15 meters across, with a sandy/rubble bottom sloping up from the entrance to exit. On the bottom, one can find various species of dartfish, gobies, frogfish, and nudibranchs. The top of the tunnel has lionfish, Colin's angelfish, and burgess butterfly fish; many of which can be seen at no other dive sites. Aggregations of the orange spine *Naso lituratus (erangel)* and the Moorish idol are observed during January through April before the half moon.

The Wrecks of Palau

Most frequently visited wrecks are listed below with a brief description of each.

Bichu Maru

A 110m (367ft) long army cargo ship that lies at 10m (30ft) to starboard rail amidships.

Iro

A 140m (470ft) long Japanese navy fleet oiler that is positioned as follows: bow in 20m (65ft), stern in 25m (85ft), forward mast up to 10m (35ft), and bottom at 40m (130ft).

Teshio Maru

A 100m (321ft) long Japanese army cargo ship that lies at 25m (75ft).

Helmet Wreck

A 58m (189ft) long cargo ship that is positioned as follows: stern in 15m (50ft), bow dips to 35m (110ft).

Zeke Fighter

A small single-seat fighter that lies at 20m (65ft).

Jake Seaplane

A seaplane that is 11m (37ft) long and lies at 15m (50ft).

The USS Perry

This 115m (380ft) long war ship that was the first U.S. War ship hit by a land mine while mine sweeping, and lies at 72m (240ft) to 78m (260ft).

Some Others Wrecks in Palau:

Amatsu Maru

A standard fleet tanker that lies at 41m (135ft).

Buoy 6 Wreck

An identified 30m (100ft) long Japanese fishing boat that sank upright and lies at 20m (65ft) to 23m (75ft).

Chuyo Maru

A 83m (272ft) long army cargo ship that lies upright on a 35m (120ft) bottom just west of Malakal Island.

Gozan Maru

A 93m (305ft) long naval cargo/transport vessel, almost completely salvaged with a debris field on the bottom that is at a depth of 20m (60ft).

LST Type I

A 89m (292ft) long Japanese landing ship, designed to carry landing crafts, tanks, midget submarines, cargo, and troops that lies at 20m (70ft) to 30m (85 feet).

Samidare

An Imperial Japanese Navy Destroyer that lies at 5m (15ft) to 10m(30ft).

Sata

Sister ship to the Iro and lies completely capsized on a 36m (120ft) bottom. No salvaging was done on this wreck which sank on March 31, 1944. The ship is 140m (470ft) long like the Iro.

Kamikaze Maru

This motor torpedo boat tender is sunk about a mile south of the Iro on a 35m (115ft) bottom. The stern of the ship is in very bad shape having had a large explosion destroy most of it.

Ryuko Maru

A 98m (321ft) long Japanese Navy cargo steamer that sunk during air raids lies upright on a 36m (120ft) bottom, bow pointed to the northeast.

Zeke Fighter

Found upright in a few feet of water a few kilometers south of the single-seat fighter located southeast of Koror. It is a popular snorkel site but only accessible during high tide.

There are several great sources of information about Palau's dive sites to refer to including the following:

- Bailey, Dan E. 1991. World War II Wrecks of Palau.
- Barbour, Nancy. 1996. Palau
- Lindermann, 1988. Desecrate I. The Shipwrecks of Palau.
- Navot Bornovski, Shlomo Cohen and Yoram Tatzyat. 2002. D-Log Palau Interactive CD-ROM.
- Tim Rock and Francis Torbiong. 1994. Diving and snorkeling guide to Palau.
- Mandy T. Etpison 2014. 30 Years Palau.
- Mandy Thijssen-Etpison. 2004. Palau-Natural History

Information Source: Palau: Dive Sites, History, and Culture

CHAPTER 3:

The Natural Environment

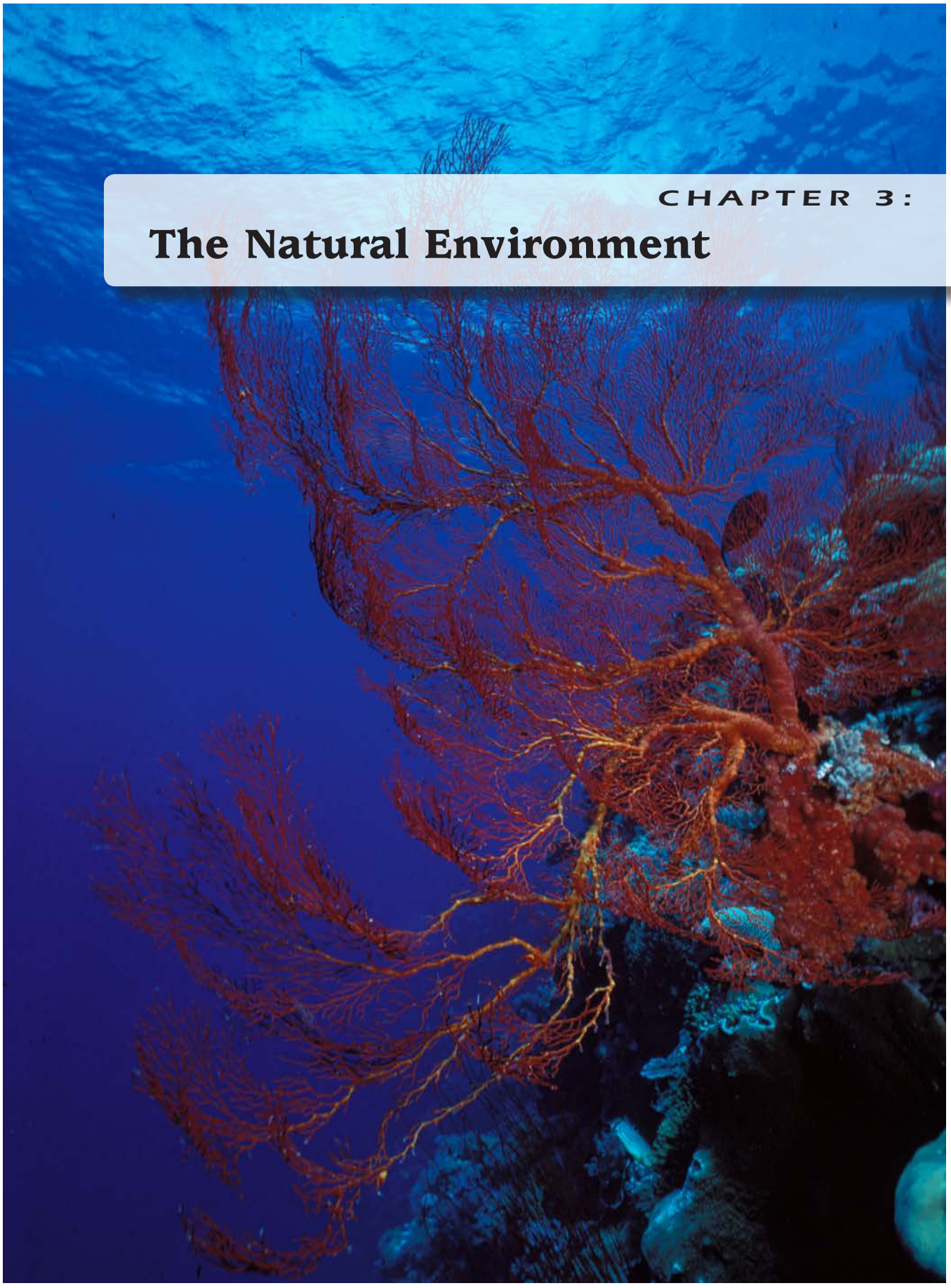


Photo by Kevin Davidson

PALAU'S BIODIVERISTY

Palau is rich in terrestrial biodiversity, with over 7,000 species including over 1,364 species of plants, 130 fungi, an estimated 5,000 insects, 92 snails, 46 reptiles and amphibians, 47 freshwater fish, and 141 birds. Palau has the most species rich forests in Micronesia, and its forests make up the largest intact area of tropical lowland rainforest in the Pacific. Most lowland rainforests in the Pacific have been cleared for coastal development.

Information Source: Kitalong et al. 2012. Native Trees of Palau. 2nd Edition.

Healthy and productive ecosystems sustain biodiversity and ecosystem services through better management, valuation, measurement, conservation, and restoration. The Palau National Biodiversity Strategy and Action Plan was developed from 2002 to 2004. The vision statement is as follows: "The people of Palau are living in harmony with their diverse natural and cultural heritage."

The Plan had eight themes: protected/managed areas, species protection biosecurity, benefit sharing, sustainable economic development, prevent or minimize waste, agricultural biodiversity, and mainstreaming of biodiversity conservation. Significant progress has been made in the implementation of the objectives of the NBSAP. Progress has been made towards a complete inventory with support from international institutions.

Biodiversity Inventories

The Belau National Museum

The Belau National Museum (BNM), established in 1955, is the oldest museum in Micronesia and promotes natural, cultural, social and historic values, and development of arts at all levels. It has over 4,500 collections of arts and material culture; over 7,522 collections of insects, and over 5,000 plant collections. The National Bird Monitoring Program is based at the BNM and has added more bird species to the national list based on an extensive monitoring program. Ongoing ethnographic studies of local environment are documenting the use of plants in Palauan culture.

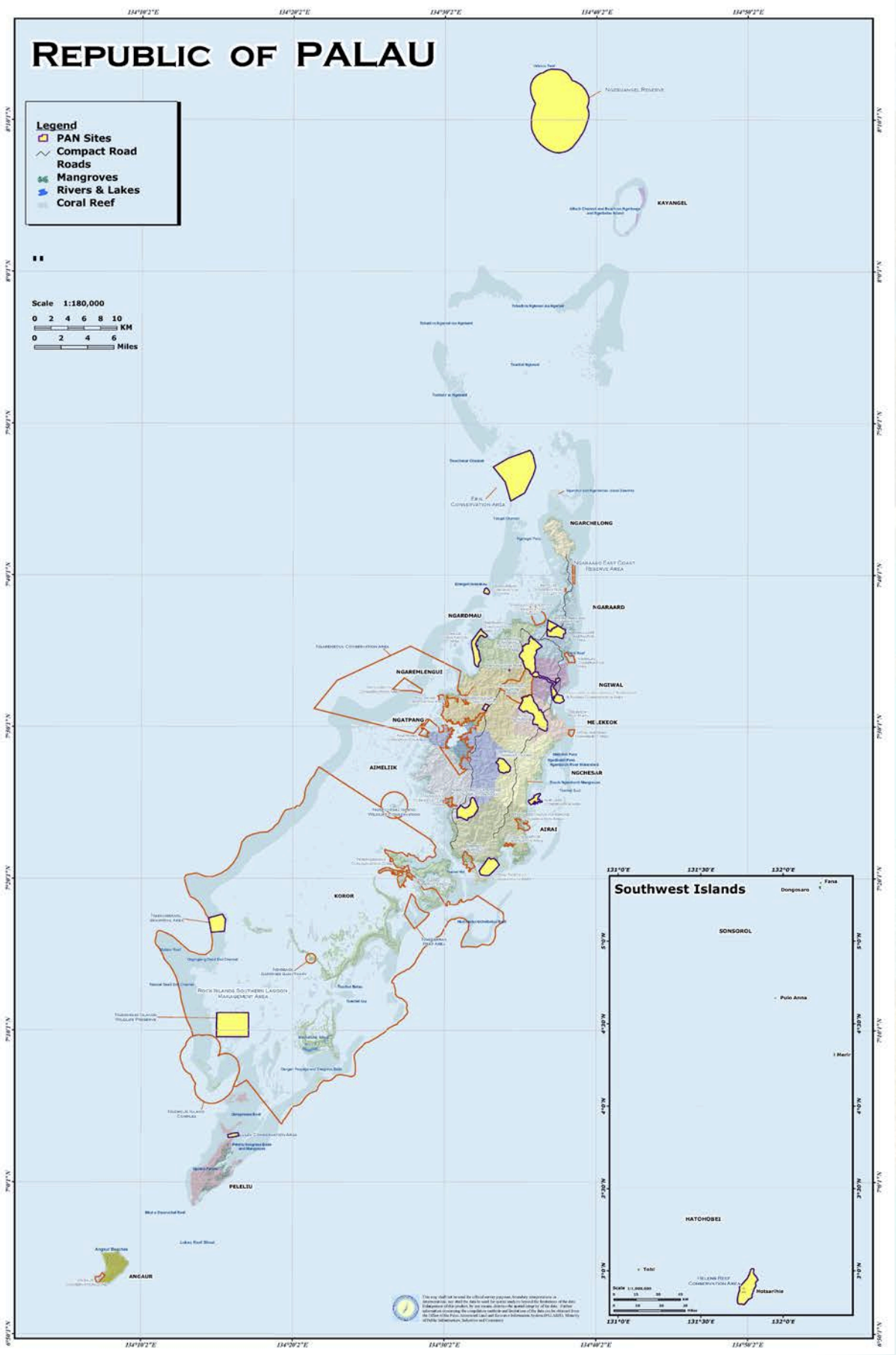
The Palau International Coral Reef Center (PICRC)

The Palau International Coral Reef Center has collections of coral and marine algae.

The Coral Reef Research Center

The Coral Reef Research Center is home to the US National Cancer Marine Collections Program since 1992 and has nearly 10,000 collections of marine invertebrates and over 100,000 photographs of these species. These collections are georeferenced with replicates at partner institutions.

Palau is blessed with abundant and beautiful natural resources, which are coming under increasing pressure from human use and exploitation. Tourism, erosion, over-fishing, pollution, invasive species, and other environmentally destructive practices currently threaten the natural resources on which we base our livelihoods. The completion of the Babeldaob road is expected to bring new business development, population shifts, and other changes that will affect all of Palau.


REPUBLIC OF PALAU
Legend
PAN Sites
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Roads
Mangroves
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KAYANGEL
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NGCHESAR
AIMELIIK
AIRAI
KOROR
PELELIU
ANGAUR
Southwest Islands
SONSOROL
Dongosaro
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NATOHOBEI
Tobi
Motoarchie
131°0'E
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CONSERVATION AREAS OF PALAU

Recognizing the value and vulnerability of our natural resources, communities throughout Palau have designated certain areas of land and water to be specially managed as 'conservation areas.'

Local communities and traditional leaders have always played an important role in resource conservation in Palau. Traditional prohibitions, or *bul,* against certain harvesting practices are still being used to protect important natural resources. The merging of traditional and modern laws has been adopted by several states to strengthen their conservation efforts. Since 1994, formal conservation areas have been created by state law. The figure on the previous page respresents protected areas in all states except Ngatpang and Angaur which are currently under development.

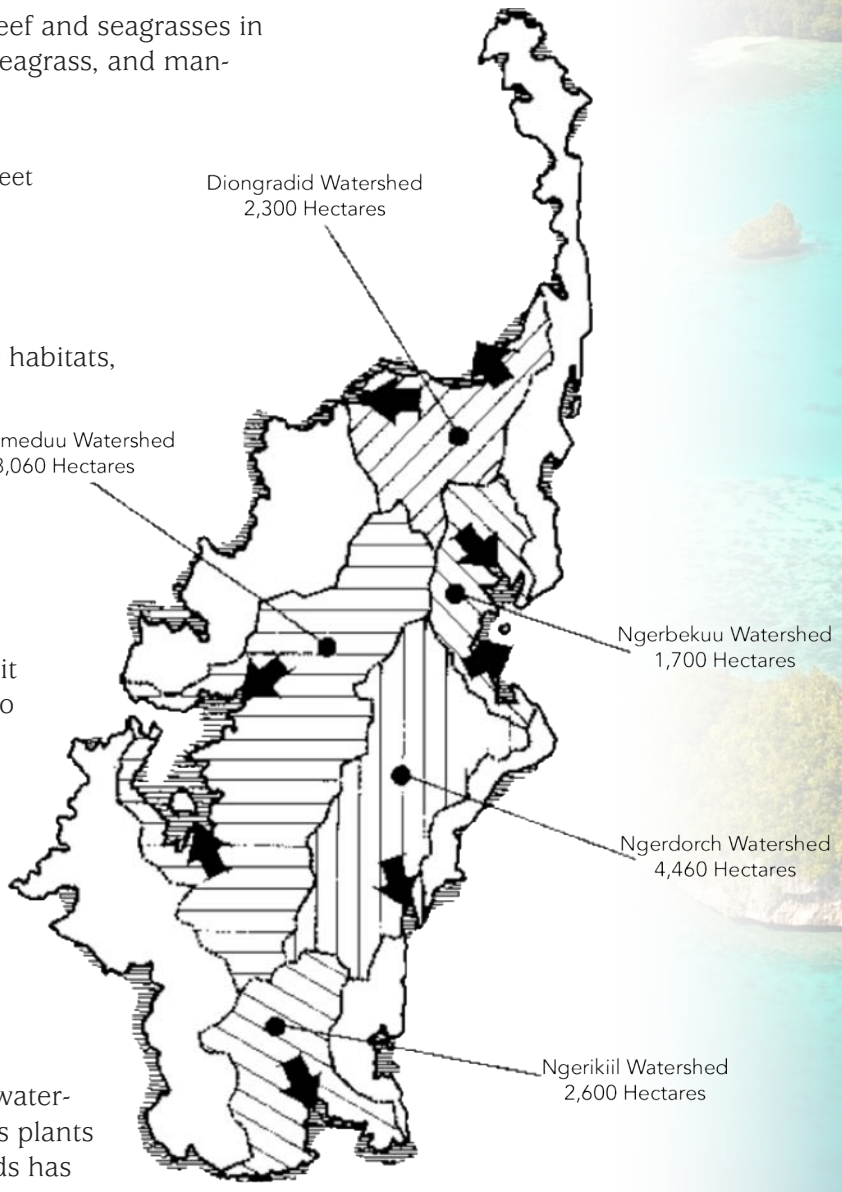
Though most conservation areas are for the protection of marine resources, Melekeok has set aside the inland Ngardok Lake for protection. Ngardmau has designated a mountain and a waterfall for protection, ensuring one of our tallest peaks and largest waterfall are protected.

Newly designated in 2003 were a fringing reef and seagrasses in Ngchesar and an area encompassing reef, seagrass, and mangrove in Ngardmau.

Information Source: Palau Conservation Society
Conservation Areas Fact sheet

WATERSHEDS

Although watersheds are not strictly marine habitats, they directly influence our coastal environment. The impacts of any activity in our watersheds affect our reefs in some way.



What is a watershed?

A watershed is an area that water travels through, from where it fell as rain to where it enters a watercourse and then the ocean. No matter where you live in Palau, whether it is up in the hills, next to the mangroves, or by the sea, we all live in a watershed. Each watershed is separated by the hills or ridges that direct the flow of water into a river or stream.

Why are watersheds important?

Water is the source of all life. Protection of watersheds is thus important for people as well as plants and animals. Water running from watersheds has

many uses. One of the most important uses for people is for drinking water. For example, the Ngerikiil watershed supplies water to Koror and Airai, so keeping the water from this watershed clean is essential for human health. Over 70% of the rain that falls on the ground in Babeldaob will end up in the ocean. The quality of this water can have a major effect on the health of our reefs and fisheries. Pollution of the water from sewerage, soil, chemicals or other sources can seriously damage the reefs.

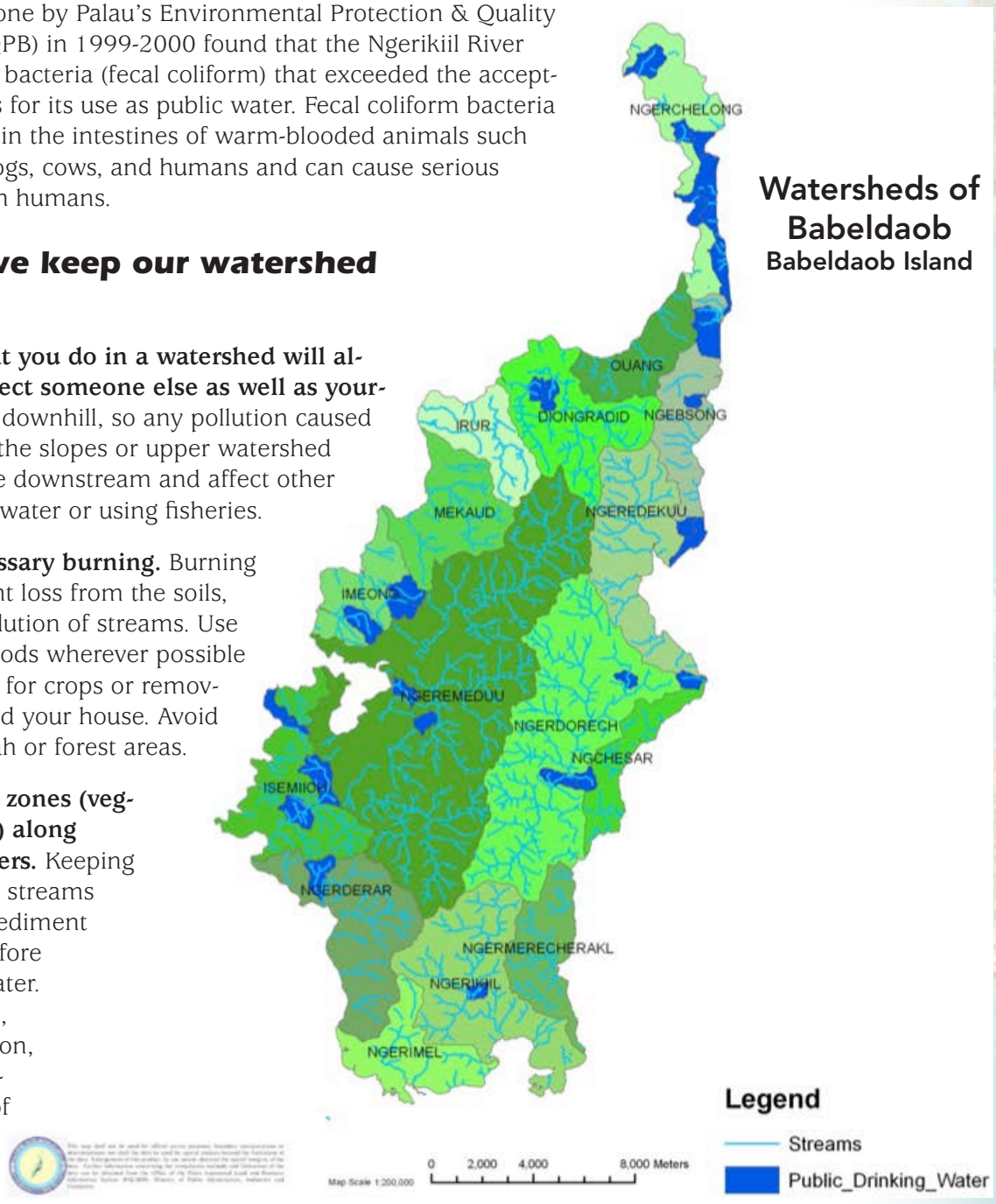
- Local residents of Ochelochel, Airai, have reported that the mangrove areas that used to supply them with fresh fish are now too silty and the marine life that used to thrive is now mostly gone.
- Fish species such as the *udech* (emperor) and *klsebuul* (rabbitfish) are now rarely found.
- A study done by Palau's Environmental Protection & Quality Board (EQPB) in 1999-2000 found that the Ngerikiil River contained bacteria (fecal coliform) that exceeded the acceptable limits for its use as public water. Fecal coliform bacteria are found in the intestines of warm-blooded animals such as pigs, dogs, cows, and humans and can cause serious sickness in humans.

How can we keep our watershed healthy?

Remember what you do in a watershed will almost always affect someone else as well as yourself. Water runs downhill, so any pollution caused by someone on the slopes or upper watershed will always move downstream and affect other people drinking water or using fisheries.

Reduce unnecessary burning. Burning results in nutrient loss from the soils, erosion, and pollution of streams. Use alternative methods wherever possible for clearing land for crops or removing weeds around your house. Avoid burning savannah or forest areas.

Maintain buffer zones (vegetation barriers) along streams and rivers. Keeping vegetation along streams helps filter out sediment and pollution before it reaches the water. Avoid cultivating, clearing vegetation, and animal grazing within 50ft of small streams and 150ft of



larger rivers.

Minimize pollution from your house or farm. Prevent contamination of drinking water by locating piggeries and septic tanks away from streams and keeping farm animals out of streams. Keep pesticides and fertilizers away from streams. Store all chemicals in a secure area.

Minimize soil erosion. Adopt farming practices that conserve soil and prevent erosion.

Encourage careful development. Promote careful land-use practices in your local community. Ensure that farm workers are properly trained. Seek advice on minimizing negative impacts and get appropriate approvals for all developments.

Protect all mangroves. Avoid clearing or filling mangrove areas.

Monitor water quality in streams. Let EQPB know if you notice any changes.

Information Source: Palau Conservation Society Watersheds Fact Sheet

The Belau Watershed Alliance (BWA)

The Belau Watershed Alliance (BWA) includes nine member states with a shared goal to protect, conserve, and restore the water resources of Belau through collaborative outreach, education, and networking, science information sharing and technical assistance by and for the communities. In 2011, the 2011-2013 BWA Strategic Plan was adopted. On September 1, 2013, the plan was revised and updated to the 2010-2015 BWA Strategic Plan. The steering committee comprises members from each state and includes the technical committee (Palau International Coral Reef Center (PICRC), Belau National Museum (BNM), Bureau of Agriculture Forestry Division (BoA), and the Environmental Quality Protection Board (EQPB)).

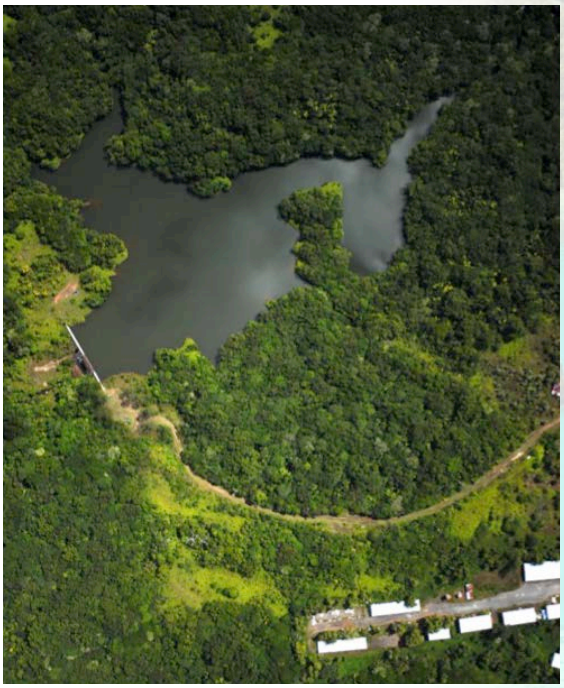


Photo by Coral Reef Research Foundation

Ngerimel Watershed

MANGROVES

What are mangroves?

Mangrove forests play a critical role in the ecology and economics of tropical coastline communities, yet they are grossly undervalued and overexploited in most regions where they are found. About half of the world's mangrove forests have already been destroyed or severely degraded by human activities such as logging, road construction, drainage operations, hydroelectric development, or conversion to agriculture or aquaculture. While the importance of forested wetlands to terrestrial and marine ecosystems is widely recognized in several industrialized countries with policies to mitigate mangrove destruction; mangroves continue to be destroyed in many developing countries, including Palau.

Forests

The RISL World Heritage Site

The mushroom shaped Rock Islands are part of an ancient reef system that after millions of years of geologic and climate change now rest like sleeping giants rising from the sea. These emerald green forested islands provide habitat to a diverse and complex terrestrial ecosystem and contribute to the unique RISL seascape. The Rock Islands are an important habitat for rare birds and animal species. The three main forest types within the Property include the dominant limestone forests, strand forests along back beaches, and mangrove forests adjacent to the marine lakes, coves, and some coastlines.

The RISL contains 55 (42 percent) of Palau's 130 endemic plants and 31 (23 percent) of these are restricted to the Rock Islands (Costion et al.2009; Kitalong et al. 2008). The steep, porous, and extremely rugged karstic substrate is species rich and includes the endangered *Cycas micronesica;* the endangered endemic palm, *Hydriastele palauensis;* and the critically endangered endemic *Ponapea palauensis,* known only from the RISL. Only two small populations of Ponapea are known, with single palms in few locations (Lewis et al. 2008 Kitalong, pers. comm.). It inhabits moist, sheltered pockets among the limestone. The Ngerukewid Islands Wildlife Preserve includes 113 native plants of which 30 are endemic, including Hydriastele palauensis (Birkeland and Manner 1989). On ten of Ngerukewid's islands, three endemic species, Hydriastele palauensis (5%), Sterculia palauensis (3%), and Timonius subauritus (3%) represented 11 percent of measured trees (Kitalong Hillmann 2008).

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Palau's forests are healthy and diverse. A large percent of its primary forest is still intact. While most of Palau may have been covered by forest at one time, at present about 87 percent is forest and about 75 percent of the total is native tropical lowland rainforest and 12 percent is agroforest (Donnegan,et. al., 2003). Palau has over 1,353 vascular plant species. Palau's forests have over 500 plants including 171 trees, 55 shrubs, 43 vines, 133 herbs, and 96 ferns. In all of Palau's terrestrial and seagrass habitats there are an estimated 730 native plants of which at least 135 species are endemic and 12 endemic varieties of trees, shrubs, herbs, orchids, ferns. The agroforest and urban forests include over 600 introduced plants including fruits, vegetables, and ornamentals.

Photo by Ann Kitalong

Limestone forest vegetation types are found on the rock islands, atolls, and coastal strand areas of Airai, Koror, Peleliu, and Angaur, On the Rock Island limestone substrate of the coral rock, the organic matter from the vegetation forms a thin layer of soil in

places in which the vegetation grows. The karstic substrate is often steep, porous, and extremely rugged.

The species-rich limestone forests includes *Aidia racemosa, Badusa palauensis, Barringtonia racemosa, Bikkia palauensis, Clerodendrum inerme, Cordia subcordata, Cycas micronesica, Cyrtandra todaiensis, Dracaena multiflora, Eugenia reinwardtiana, Flacourtiarukam* Zoll. & Moritzi var. *micronesica, Garcinia matsudai, Garcinia rumiyoKaneh.* var. *calicola, Guettarda speciosa, Hydriastele palauensis, Intsiabijuga, Ixora casei, Meryta senfftiana, Morinda latibracteata, Pandanus dubius, Pemphis acidula, Polyscias grandifolia, Planchonella calcarea, Planchonella obovata, Psychotria* spp., *Rinorea bengalensis, Scaevola taccada, Semecarpus venenosa, Soulamea amara,* and *Tarenna sambucina* (Forst.) var. *oweniana*.

Photos by Ann Kitalong

The plant and flower of Bikkia palauensis or rur

Volcanic forests are on volcanic soils; these lowland forests are dense, multi-layered, and structurally complex encompassing distinct subtypes of forest in undisturbed ecosystems. The volcanic lowland forests are considered the most species rich in Micronesia (Stemmermann, 1981) and have the highest rate of endemism.

Freshwater swamp forests tend to occur inland of mangrove forests in areas of fresh or slightly brackish water and in wet lowland areas or along the riparian zone. The dominant canopy species in swamp forests are relative as riparian verses lowlands near the coast or inland. The other layers of this forest vary less. Typically, the forest floor growth is predominantly the seedlings of the dominant trees.

The poison tree, *Semecarpus venenosa,* is found in all limestone, volcanic, and freshwater swamp forests. Its black sap is a tell tale sign to beware as this sap can cause painful reactions leading to blistering and swelling of affected areas.

Savanna grasslands and associated trees occur on volcanic soil substrates where the primary forest has been removed mainly due to deforestation and fires caused by humans. The savanna is located along ridges and found in patches throughout the volcanic islands of Koror and Babeldaob. The species presently are comprised of herbaceous shrubs, grass, and fern species along with a few scattered tree

Photos by Ann Kitalong

Semecarpus venenosa or poison tree.

and shrub species.

Information Source: Kitalong et al. 2012. Native Trees of Palau 2nd Edition.

Terrestrial Mammals

The Marianas Fying Fox (*Pteropus mariannus pelewensis)* is endemic at the subspecies level and is common in the RISL. Wiles (et al. 1997) observed large roosting areas in the RISL with a roost on Ngeruktabl Island containing as many as 500 bats. The Polynesian Sheath-tailed Bat *(Emballonura semicadata)* inhabitats cave ceilings in the RISL.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Terrestrial Invertebrates

In a recent survey that included the Property, Rundell (2010) found that the number of land snail species found in Palau far exceeds previous estimates. Approximately 95 percent of the species are endemic to Palau with 15 of these found within the RISL (Rundell 2005). The Diplommatinids are exceptionally diverse in Palau including 42 species of which 31 are undescribed.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Mangroves

Mangroves are trees or shrubs that are adapted to estuarine or saline environments. Mangroves have characteristic features that allow them to live in harsh environments with soft substrate (bottom type) and where they are often flooded with brackish water. Some of these unique characteristics include shallow roots that spread widely across the substrate and project from the mud (snorkel roots) to allow absorption of oxygen in an otherwise anoxic (no oxygen) substrate. Roots extend from the branches and trunks providing better anchorage for plants on a muddy, soft substrate. Tough and moist leaves with internal water storage tissue, and in some species, slat-excreting organs maintain salt and water balance.

Mangroves in Palau

Mangrove forests comprise a dense forest which grows in brackish to salty water along a narrow strip of the tidal zone near the shore. Mangrove forests are widespread around Koror and Babeldaob and found in low lying, coastal, muddy seashores, quiet bays, and estuaries. Mangrove forests are also found in the Rock Islands, commonly along the edge of marine lakes. Mangroves play a vital role in buffering the effects of storms and waves along coastal areas.They also provide nursery habitat for marine life and filter runoff exiting terrestrial ecosystems. The filtration that mangroves provide helps to sustain coral reef and fish habitat by reducing siltation. The species-rich mangrove forests of Palau include over 30 different species.

Mangrove trees have adaptations to help them cope with the saltwater environment they live in. These adaptations include specialized root formations for support and breathing in the mud and water environment, such as prop roots for structural support, knee shaped pneumatophores or conical roots for gaseous exchange and elaborate buttress roots for both structural support and gas exchange. The mangrove family *Rhizophoraceae* has seeds that germinate while still attached to the tree. From each

seed, a large elongated seedling (or hypocotyl) of mostly root is produced which hangs suspended from the fruit. When it reaches the right stage of maturity, it falls to the water or mud beneath. It can float on the surface of the water until it settles.

Information Source: Kitalong et al. 2012. Native Trees of Palau. The Environment, Inc.

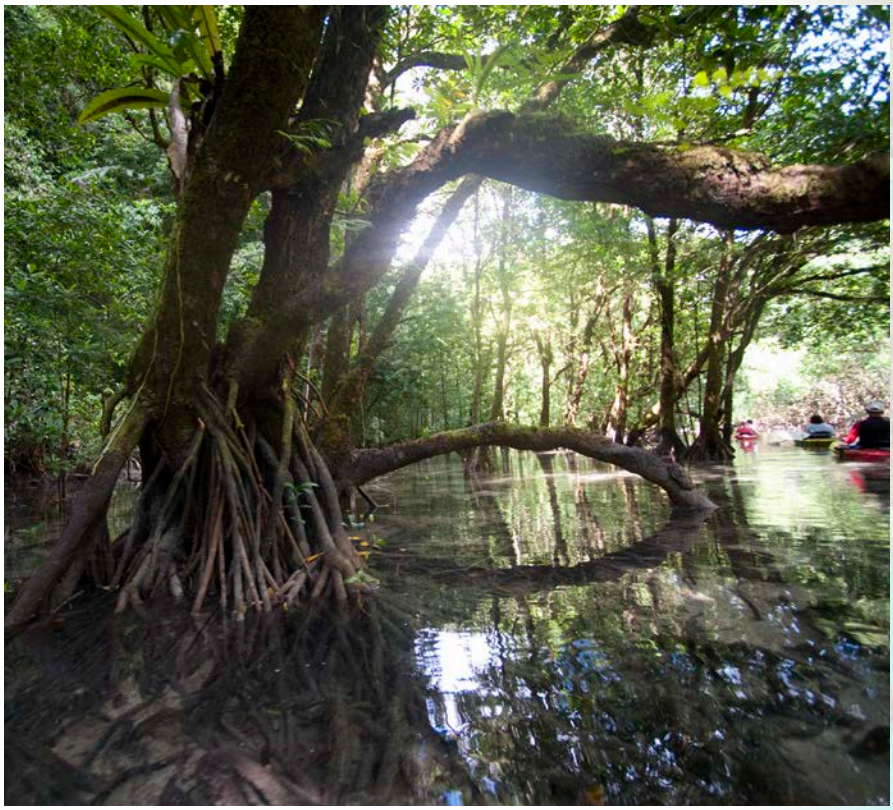


Photo by Mark Downey

Mangrove forests are among the many unique ecosystems in Palau. They are found along coastlines, river banks, low coral islands, and surrounding marine lakes. Palau has eighteen species of mangrove plants including the palm tree called *Nypa palm (touechel),* tall *Rhizopora* trees *(bngaol* and *tebechel)* and ferns. Many animals make their homes in Palau's mangrove forest, including the saltwater crocodile *(ius),* mangrove crab *(chemang),* mangrove clam *(ngduul),* mudskipper *(temaitolok),* and the banded archerfish *(uloi).*

Mangroves in Palau, like those throughout the tropics, provide a wide range of ecological services that benefit local communities directly and indirectly. Mangroves are very productive coastal resources that are useful in many ways. The leaves of the mangrove trees fall into the water and provide food for animals like crabs and fish. Much of this food is also carried out to the coral reefs and lagoon where it becomes a source of nutrients for the fish.

Roots of the mangrove trees provide shelter for many animals. Open water and reef fish come to reproduce in the forests and many juvenile fish remain there taking shelter before going to live on the reef when they are larger. Mangroves serve as nursery areas for valuable reef species including snappers *(kedesau),* rabbitfish *(meas),* mullet *(kelat),* emperorfish *(udech),* and goatfish *(bang).* Other animals that make their home in the mangrove forest include some endemic and threatened species such as the owl *(chesuch)* and fruit bat *(olik).* The mangrove forests are a critical habitat upon which these species depend for survival and if they are destroyed, the future of these species will be at risk.

Mangroves act as a buffer between the clear waters of the fringing reef and the silt-laden run-off from Palau's urban towns and red mountain peaks. When debris from the land gets washed into the mangroves, the swamp traps the pollution and sediments, leaving clean water to go out onto the nearby reefs. Their roots form a giant sieve, trapping silt that might otherwise smother the delicate corals. As long as there are limited amounts of sediment entering the mangroves, and no poisonous waste from industries or farms, the mangroves act as an excellent filter system.

Information Source: PICRC Publication 02-021 Mangrove Fact Sheet

SEAGRASS BEDS

Palau has extensive seagrass beds that grow in the shallow waters around the coast. They are vital areas for baby fish and many animals such as rabbit fish, sea cucumbers, shellfish, crabs, urchins, turtles, and dugongs. Seagrasses are just like plants that grow on land, they produce flowers, fruits and seeds, and have roots. Palau has ten species of sea grasses. Often people don't realize how important these underwater 'fields' are for supporting our commercial and subsistence fish species and endangered turtles and dugongs as well as keeping our waters clear. Around Palau today, many states have started coastal development projects, including dredging, which smothers the seagrasses and makes the water cloudy, so that they eventually become sick and die. We don't see the effects until several years later, when people start wondering where the sea cucumbers have gone and why the fish stocks are declining.

Information Source: CRC Reef Research Centre: Tropical Topics

Photo by Pat CColin

Enhalus acoroides is the largest seagrass species approximately 30-150 cm long with strap-like leaves and thick stem-like roots called rhizomes with long black fibrous bristles. *Enhalus* is one of the most common seagrasses. The blades can grow 1 to 2 cm in one day! *Thalassia hemprichii* is another common seagrass that is an important food source for turtles and dugongs. It has a shorter and thinner, linear strap-like leaf and smoother blade edge than *Enhalus acoroides*. A smaller and less common seagrass is *Halodule uninervis* that has strap-like leaves about 0.25-5.0 mm wide and produces fruit underground. Its leaf tip has three distinct points or teeth. *Cymodocea rotundata* has strap-like leaves 2-5mm wide with bluntly rounded tips. *Cymodocea* is also food for our endangered dugong and fish. Fish dislodge *Cymodocea* seeds from the sea floor, allowing the seeds to disperse elsewhere and grow. *Halophila ovalis* is a salt-loving seagrass with small, delicate, transparent oval shaped leaves. The seagrass, *Syringodium isoetifolium* has thin (1-2mm) cylindrical leaves. Unlike land plants, seagrass can pollinate underwater. The tides play an important role in the reproduction of *Enhalus.* Pollination occurs in the spring and summer during the highest tides. You can see white pollen grains floating on the surface during the high tides. Male flowers produce small buoyant white pollen grains. Female flowers are attached to a long, coiled stalk that uncoils and lifts the flower to the water's surface.

Information Source: Kitalong, A. 2012. A Personal Tour Continues. The Environment, Inc.

IMPORTANT BIRD AREA
UNESCO WORLD HERITAGE SITE

The Rock Islands are home to all of Palau's endemic, regionally-restricted, and endangered birds. Fifty-three of Palau's 151 bird species have been observed in the Rock Islands (Pratt and Etpison 2008). All terrestrial habitats within the RISL have been designated an Important Bird Area (Holm et al.2008). Many species are found in greater numbers in the RISL than in other locations. Engbring (1992) found Nicobar Pigeons *(Caloenas nicobarica pelewensis)* to have their highest population densities in the Rock Islands. The near-threatened Nicobar Pigeon population, hunted in other parts of the

world, increased in the RISL between 1991 and 2005 (VanderWerf 2007). The Rock Islands may act as refugia for certain birds. The Giant Whiteeye *(Megazosterops palauensis),* endemic to Palau and previously only observed in the Rock Islands and Peleliu, was recently observed on Babeldaob (Olsen 2009). It likely originated from the RISL. The recolonization of all endemic birds in Peleliu following the devastation of World War II is also to the refugia property of the RISL.

Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

IMPORTANT BIRD LIFE

Palau's Bird Diversity

Palau is blessed with the richest diversity of bird life in all of Micronesia. Over 150 species of resident and migratory birds have been reported from Palau. Birds are an important part of the fauna of the marine environment because they are apex predators that help maintain the balance of nature in lagoon waters and because they recycle nutrients into the lagoon.

Reminder: Wild birds of Palau are protected by national and state laws. With few exceptions, it is against the law to hunt, kill, harm, capture, harass or disturb wild birds and it is against the law to disturb, damage or remove their nests, eggs or natural habitat.

Bird Ecotourism

While most visitors appreciate Palau's birds as an interesting part of their overall tourism adventure, there are a number of tourists who visit Palau specifically to search for the unusual birds that live here. These folks call themselves "birders" and refer to their bird-watching passion as "birding." Birders normally arrive with a pre-determined "must-see" list of the birds that they want to find (and photograph) during their visit to Palau. In order to successfully lead a birding tour, the tour guide must develop the following knowledge, skills, and abilities:

- A working knowledge of the names, appearance, and songs of the resident and migratory birds of Palau. Guides are encouraged to learn the Palauan names for the most common species;
- Knowledge of the locations that have a rich diversity of bird species, especially those species on visitors' "must-see" lists;
- Skill in spotting and identifying birds in the field;

Noddies (top) and terns (bottom) photographed from boats on the waters of the southern lagoon.

- Ability to relate interesting facts about the life histories and cultural importance of the birds spotted in the field.

Birds of the Lagoon Waters

Birding tourists are very interested in the seabirds that can be seen flying over the water or resting on sand bars, rocks, and overhanging trees. If birding tourists are on board, be prepared to divert your boat en route to a destination, in order to provide a closer look and photo opportunity for the birding passengers — especially if a flock is sighted over open water (feeding on a school of fish) or resting on a sand bar. Noddies and terns are the most common seabirds in the southern lagoon. With luck, your birding guests may also spot a rare seabird such as a booby, frigatebird, gull, or shearwater.

Forest Bird Diversity of the Rock Islands

Be mindful that the pristine beaches and forests of the Rock Islands contribute to the overall beauty of the southern lagoon. Forests also sustain a rich biodiversity that in many ways is as attractive to ecotourists as the biodiversity of the lagoon waters. The forests of the Rock Islands are home to a diversity of forest birds, including 15 endemic

Common Seabirds of the Lagoon: Row 1. Black Noddy, Brown Noddy, Little Pied Cormorant;
Row 2. Bridled Tern, Greater Crested Tern, Black-naped Tern, White Tern;
Row 3. Pacific Reef-Heron (Dark Morph and White Morph), White-tailed Tropicbird

species or subspecies that can only be seen in Palau and nowhere else in the world. Three of the most important endemic birds are discussed below because they are at risk of extinction and are listed as "endangered" or "threatened" by international authorities. They are also the birds that tourists most often ask to see and photograph.

Palau Megapode (endemic subspecies)

The Palau Megapode normally lives in coastal forests near beach strands. An adult megapode is a dark bird about the size of a chicken. It can be recognized by its size, dark body, gray head, short tail, and large feet. Its food is fruit and seeds that have fallen from the trees. It also eats small crabs, insects, and other invertebrates. The nest is a large mound of dirt and sand located on the forest floor. Megapodes bury their eggs inside the nesting-mound where the eggs are incubated by heat from composting leaf litter in the center of the mound. When an egg hatches, the baby megapode digs its way out of the nesting-mound with no help from its parents and leads an independent life from then on. Although found throughout Palau, megapodes are most numerous in the Rock Islands Southern Lagoon UNESCO World Heritage Site. They are also common on Carp Island and Peleliu. The Palau Megapode is at risk of extinction due to the effects of climate change, especially rising sea levels that threaten to flood the megapodes' coastal nesting grounds.

Palau Ground-Dove (endemic species)

The Palau Ground-Dove is a small, shy bird that is found in the dense undergrowth on the floor of the forest. It can be recognized by its small size and brown color with pearly gray face and chest. A lucky tourist may spot the rare Palau Ground-Dove early in the morning along any foot-path in the forests of the Rock Islands. The Palau Ground-Dove is at risk of extinction due to its rarity.

Giant White-eye (endemic species and genus)

This small forest bird is found only in the Rock Islands and Peleliu. It is olive drab with an orange beak. There is a faint ring of bare skin around the eye and a light-colored eyebrow above the eye. Flocks of Giant White-eyes routinely travel through the forest canopy in search of their food (fruit and insects), announcing their arrival by chirping to each other as they fly. The Giant White-eye is at risk of extinction due to its limited range (Rock Islands and Peleliu).

Hints for Birding in the Forest

- As a rule, forest birds are most active early in the morning. Birding tourists prefer early (before dawn) departures for bird-watching excursions to forest locations.
- Limit group sizes as much as possible. Large groups of people frighten birds away.
- Keep voices low and avoid sudden loud noises that may frighten birds. Periods of complete silence allow birders to listen for the songs of the birds.

- Imitating the song of a bird may draw the bird closer to your position for a better view.
- Never feed wild birds. It creates dependency on an artificial diet that is deficient in the natural vitamins, minerals, and other nutrients that wild birds need to thrive.

Birding Hot Spots are places that have an unusually rich diversity of wild birds. The following are suggested hot spots in Koror State.

Long Island Park Conservation Area

Blue-faced Parrotfinch in an ironwood tree

This hot spot boasts an impressive 42 species of resident and migratory birds including every endemic bird species from Palau except the Palau Megapode, Palau Ground-Dove and Giant White-eye. In addition to endemic species, birders are likely to see two Australian species that are rare outside Palau – the Cicadabird and the Blue-faced Parrotfinch. Both species are attracted to the ironwood trees *(ngas)* growing beside the road and recreational area of the park. Many other bird species nest in the forest and several species of resident and migratory seabirds can usually be seen flying over the water. The convenient location of the park in urban Koror provides an excellent opportunity for visitors to familiarize themselves with the common bird species of Palau before exploring more remote locations.

Ulong Island

This historic rock island is also an active nesting ground for the Palau Megapode. In the early morning, megapodes can often be seen or heard near the picnic tables. The Palau Ground-Dove is frequently seen along the path to the archeological site near the picnic area. As you approach the island by boat, look for the several species of seabirds that often roost on coastal rocks or in trees overhanging the water.

NOTE: *Take care to avoid disturbing megapode nesting-mounds which are often located near the picnic facilities at Ulong Island.*

Ngchus

The picnic area at this location is visited by flocks of Giant White-eyes on an almost daily basis. Patient birders will usually be rewarded by the eventual arrival of flock of these rare, endemic birds in the treetops. Sometimes there are mixed flocks that include Giant White-eyes, Dusky White-eyes (a Palau endemic species), Citrine White-eyes (a Micronesian endemic species), or all three white-eye species at once!

Ngeremdiu

Most of the forest birds of the Rock Islands occur at this location, although usually in small numbers. This is a good location to explore for any bird species on a visitor's "must-see" list that was not found at other hot spots.

Enrichment Activities

Monthly Bird-Watch at Long Island Park

Visiting birders and local birders are invited to join local field ornithologists at 6:00 AM on the first Saturday of every month at Long Island Park Conservation Area to see, hear and learn about Palau's birds. This free birding field activity is sponsored by Koror State Government and Belau National Museum. Participants should bring their own binoculars, cameras and refreshments, and should dress appropriately for a short, easy hike. Tour guides who want to practice their birding skills are always welcome.

Museum Exhibits

Belau National Museum features pictorial exhibits of the seabirds of the southwest islands, the endangered Palau Megapode and bird eco-tourism. Etpison Museum features a gallery of high-quality photographs of Palau's wild birds.

Conservation Awareness

Palau Conservation Society and their corporate sponsors maintain a series of roadside posters that promote bird conservation awareness. The posters are attached to streetlight poles along causeways in Koror, where tour bus operators can point them out to their passengers.

Sources of Additional Information

- Publications about Palau's birds are available at the gift shops of both museums as well as other outlets.
- Recordings of the songs of many of Palau's birds can be accessed on the Macauley Library website: www.macauleylibrary.org/browse/taxa/aves.
- Reports of recent bird sightings can be accessed on the eBird website: www.ebird.org. These reports by local and visiting birders provide current information for planning the itinerary of a birding trip.

Crowd-Sourcing on the eBird Website

Belau National Museum and the Koror State Rangers co-sponsor an initiative to crowd-source bird data by encouraging citizen-scientists to submit their personal observations of birds to the eBird website operated by Cornell University and BirdLife International. You can help collect valuable information that will simultaneously foster birding tourism and enable Koror State and all of Palau to better preserve our valuable bird diversity for the enjoyment of future generations of Palauans and tourists:

- Encourage visiting birders to share their bird observations on the eBird website, either before they depart or after they arrive home.
- Learn how to identify birds and submit your own observations to the eBird website
- Alert the Koror State Rangers or Belau National Museum of unusual or noteworthy bird sightings so that the sightings can be verified for the eBird database.

The eBird website is www.ebird.org.
Prepared by Belau National Museum, 10 November 2014.

MARINE HABITAT DIVERSITY

The Rock Islands Southern Lagoon is among the most biologically diverse marine areas in the world. Its habitats provide temporary or permanent homes for an impressive number of species including several that are threatened or endemic to Palau. The RISL hosts an exceptional number of marine environments within a small area, including barrier reefs, outer reef channels, and passes; Rock Island shallow flats; southern lagoon shallow flats; reef basins, lagoon patch reefs, Rock Island notch and fringing reef slopes; Rock Island inner basins and coves; marine lakes, mangroves, seagrass and algal beds; shallow and deep lagoon sediment bottoms; and the planktonic lagoon environment (Colin 2009). Within many of these, numerous finer scale habitats are found.

Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Coral Reefs

What are coral reefs?

Reefs are the result of a fine balance between the formation and consolidation of limestone (produced by coral and marine algae) and destruction by mechanical and biological activities.

Found only in the shallow warm waters of the world, coral reefs require:

- Annual mean temperature of 22-29'C for reef growth;
- Clear water to allow adequate light for photosynthesis;
- Firm substrate for attachment;
- Stable salinity or salt content (This is why reefs don't occur near river outfalls.);
- Low sedimentation (Sediments reduce the amount of light and can smother corals.);
- Low nutrients (increased nutrients allow algae to grow over corals).

Biodiversity

Recent estimates indicate at least 385 species of coral are found in the RISL (Victor 2010). At least 343 species of the more than 400 species (78 genera) of stony corals were found in the RISL during a rapid ecological survey of Palau (Maragos et al. 1994). Based upon specimen collections, Randall (1995) lists 385 species and 66 genera of hard corals. Hence over 75 percent of Palau's hard coral species are found in the RISL. A total of 150 species of soft corals have been observed in Palau (Fabricius et al. 2007), the majority of which are found in the RISL. Ngerumekaol Channel has over 90 species of hard coral with the largest single colony of Pavona clavus. This large P. clavus colony measured 16 meters in diameter and six meters in height. Huge colonies of Turbinaria reniformis form spectacular whorls along the slopes of the reef in the central floor of the channel (Maragos 1991).

The fringing reefs surrounding the intricate arrangement of Rock Islands, found from secluded inner basins and coves to the reefs lining the Rock Island bays, and along the lengths of some of the larger Rock Islands, create a multitude of habitats (Colin 2009). The inner-most basins may have a long water residence time and relatively few corals, with high sediment and muddy bottoms. However, the still sheltered and more exposed

Rock Island fringing reefs are so unusual and spectacular that one site is popularly called Rembrandt's Wall. This habitat supports a distinct set of species. Those Rock Island fringing reefs exposed to seasonal wave action harbor yet another suite of species, similar to those found in more exposed lagoon reefs. All of these reefs have an intertidal sea level notch at their upper reaches and steep slopes extending down to a fine muddy sediment bottom. These steep reef slopes, in combination with variable shade provided throughout the day by the towering Rock Islands and overhanging trees, provide a unique underwater habitat found in few places in the world. The coral communities are dominated by large foliose or plating colonies and colorful massive faviids. The soft-bodied sponges and sea squirts display a spectacular rainbow of shapes and sizes in abundant quantities, while branching and whip black corals are interspersed along the slopes and walls. Encrusting sponges, often limited to the undersides of rocks or beneath overhangs on typical reefs, are found in extensive vibrant sheets on these often-shaded steep slopes and walls, not unlike what is also found in the marine lakes. In Rock Island channels where tidal flow is extensive, soft corals are added to the mix. It is the unusual species composition and abundance of typically more cryptic species that, in part, makes these reefs so special. Aside from its unique suite of species (CRRF unpublished data), this fringing reef habitat is the home to several newly-described species, including the Latent Slingjaw Wrasse, (Epibulusbrevis) (Carlson et al. 2008), and several sea squirts (Stolonica limbata, Aplidium controversum, Monniotand Monniot 1996; and Rhopaalea circula, Monniotand Monniot 2001).

Photo by Kevin Davidson

Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Characteristics of coral:

- Colonies consist of many individual coral polyps.
- Coral polyps have only a single opening for both food and wastes.
- The opening is surrounded by tentacles.
- Hard corals secrete limestone skeletons.
- Coral reefs are made up of colonies of individual animals called polyps. A coral polyp is a simple jellyfish-like animal living in a cup of limestone.

Role on the Reef

Coral reef structures are composed mainly of the dead limestone skeletons of previous generations of corals. Only the thin outermost layer of the reef is alive with colorful coral polyps. The structures built by corals provide a framework to the coral reef community, supplying a home for creatures like shellfish, lobsters, crabs, sea stars, and fish.

Feeding

Coral colonies are sessile or stationary. Therefore, they have to catch food that is drifting by. The stinging cells that cover the tentacles of the corals capture plankton. However, the main source of food for corals doesn't come from this prey, but rather from the sun. Coral polyps live in a symbiotic relationship (benefit from one another) with single-celled algae called zooxanthellae (pronounced zoo-zan-thel-ee). Zooxanthellae live in the tissue of coral polyps, and give stony coral most of their color. Like all plants, they produce food, including sugars and starches, from the sun's energy through photosynthesis. Polyps utilize these products as food which also provides most of the energy the corals need to produce their limestone skeletal structure. In return polyps give zooxanthellae a stable place to live and their wastes to use as nutrients.

Defense

Space is a limited resource on the reef, and corals and other reef inhabitants constantly compete with each other to survive. There are a number of ways by which corals try to out-compete their neighbors. Growing over neighboring corals cuts off the light needed to support their zooxanthellae thus reducing growth. Some species simply digest their neighbors or use long tentacles called sweeper tentacles to kill off areas of other coral which have grown too close. There is a constant back and forth among the bottom dwellers on the reef and human actions can cause this natural relationship to be disturbed, causing the loss or population explosion of one species or another.

Reproduction

Colonies of coral start with just a single coral polyp. This 'founder' polyp reproduces asexually (on its own) through a process known as budding. All the new polyps in the colony are genetically identical to the original polyp. This process is repeated over and over throughout the coral colony's life as it increases in size. As hard coral colonies grow, layers of limestone are laid down and the polyps 'move' up to the new layer. The exact rate at which the coral colonies grow varies amongst species.

The branches of staghorn corals (Acropora) can grow 3-10cm in length each year. Massive corals, like the Porites shown here have their radius increase around 1cm per year.

Many corals reproduce sexually just once a year during a mass spawning. In Palau, it appears from research conducted by the Palau International Coral Reef Center that the peak spawning times for most species of corals are between March and May or September. Usually, spawning occurs 3-5 days after the full moon. The process actually begins six months before as the eggs and sperm start to develop within the polyps. Mass spawning usually lasts about a week, with different species of corals spawning at different times during the night and on different nights. Eggs and sperm float on the water's surface, where they combine and develop into a planula, the free-swimming planktonic larval stage of a coral.

Depending on the coral species, the planula may stay as part of the plankton from weeks to months. When it is time to settle, the planula attaches itself to a vacant patch of reef and starts to grow into the 'founder' polyp for a new coral colony

Human Impacts and Use

Coral reefs are under threat world wide. Increased nutrient levels in the sea, caused by agriculture, industry, and urbanization supports algal growth. Algae may eventually outcompete and smother corals. Increased sediment loads from rivers and run-off not only decreases water clarity, but also physically smothers coral. On a localized scale, anchors and divers, particularly in high-use areas, can cause high levels of damage.

Coral Color

Many visitors are surprised that corals do not appear as colorful as they do in pictures in magazines. This is because these photos were taken using a flash.

White light is made up of all the colors of the rainbow, but water filters out these colors at different depths with red and yellow disappearing first, leaving green and blue. This gives the reef a predominantly blue-green appearance at depths over 10m. The bright colors of corals can be seen in the shallows, but in deeper water, an underwater flashlight or flash on a camera is needed.

Photo by Palau Conservation Society

Coral Identification

The easiest way to classify hard corals is by their shape and appearance. Common terms for coral shape and appearance are:

- Branching
- Table
- Plate
- Boulder
- Vase
- Bushy
- Solitary
- Mushroom

Trying to identify corals to a species level is very difficult. What makes coral identification difficult is that a single species may appear in a branching form in calm water and as a plate coral in another area. Local environmental conditions, such as wave action, light levels, and the amount of sediment in the water affect the shape of the coral – it

grows to suit local conditions.

Soft Corals and Sea Fans

Soft corals include the sea fans (also called gorgonians) and a wide variety of inflated soft corals like those found at Soft Coral Arch. They lack the hard external limestone skeleton of stony corals, but like their stony coral relatives make tiny limestone skeletal elements (sclerites) which are NOT linked into an overall structure, but still give the soft coral some rigidity. Many of the fan-like gorgonians also have a "woody" like skeleton made of "gorgonin," that is both flexible and strong, allowing the fan to keep its shape in strong current. Soft corals also have a wide variety of chemical compounds within them that make them taste bad, so fishes and other predators don't usually eat them.

In addition to their swaying bodies, soft corals can be distinguished from hard corals in that they have eight tentacles per polyp, with each tentacle having side branches giving it a feathery appearance. Hard corals have tentacles usually in multiples of six.

Coral Eaters

Probably the most notorious of all coral predators is the crown-of thorns starfish (COT). This large and very spiny sea star pushes its stomach through its mouth to digest coral polyps from the coral skeleton. If you see COTS, be careful; their spines are very sharp and venomous. Other coral predators include a number of fishes and invertebrates. The bumphead parrotfish *(Kemedukl),* and many other parrotfish, often eats the tips of branching corals or scrapes the living coral surface, passing the limestone material along with the organic matters, through their gut and defecating sand, which you can see as a white stream behind the fish as it swims along. This is a natural process, and is simply part of the normal growth and death of reef corals. Other smaller fishes, such as butterflyfishes and the beacked leatherjacket pick at individual polyps of the coral and do not ingest the skeletal materials. A small snail, Drupella, feeds by scraping polyp tissue from the skeleton, and if their numbers become too large can seriously damage many corals on the reef.

Human Uses of Corals

- Some corals are being used to replace bone in humans where the bone has been damaged through accident or disease. The coral has the same porosity as human bone, allowing blood vessels and nerves to grow into the implant, increasing repair strength and rate of recovery.
- Coral is used to make lime for bettlenut chewing. Coral is pulverized to make a powder to add to betlenut and a Piper leaf as a stimulant.
- Coral was historically used for construction and is called "bad" or rock because it served as rock base for many docks and piers an coastal roads. Today coral is dredged and used as sub-base for construction. Ancient reefs now limestone islands are also quarried for construction purposes.

THREATS TO CORAL REEFS

Predators on Corals

The Crown of Thorns Starfish (COTS) is an unusually large starfish and can grow to more than 80cm in diameter. It has up to 21 arms, covered in long venomous spines. If COTS are around your dive site, please warn your guests not to try to disturb or pick them up.

Breeding

Recent research by David Idip Jr., a researcher at the PICRC, has revealed two spawning times for COTS, March-June and September, which seem to be associated with a decrease in water temperature. (This is not true, based on limited sampling and bad interpretation of limited data.)

They release eggs and sperm into the water. When the eggs are fertilized, they become free-swimming larvae which spend two to three months drifting in the ocean currents. The juveniles settle from the plankton onto the reef when they are about 1-2mm across. They live under and among rocks and rubble on the reef and are almost invisible until they are about six months old.

A COTS can breed for five to seven years and each female can produce up to 250 million eggs in a single spawning season. The starfish gather in the shallow water to spawn which increases the chance of fertilizing the eggs. So a small population of COTS could potentially produce a very large number of offspring, but normally most larvae and young starfish die or are eaten by predators. Changes in the environment, such as additions of sewage (which fertilizes phytoplankton growth) or overfishing of predators, such as the maml (humphead wrasse), allow excessive numbers of larvae and juveniles to survive, resulting in plagues of COTS at times.

Feeding

Young COTS eat encrusting (coralline) algae which is common among rocks and rubble on the reef. The young hide beneath rocks and coral during the day, emerging at night into the open to feed. At about six months of age, they start to eat coral and begin to grow more rapidly. Over the next two years, the starfish can grow from 1cm to 25cm in diameter. Even the adult COTS tend to be hidden under corals during the day and move into the open to feed at night. They feed mainly on coral species, such as the branching Acropora specoes, that they prefer, but may prey on just about any species of stony coral if their preferred prey are not present. In one session the COTS will usually not eat the entire coral colony, as it is too large, but over time they can destroy the whole colony, then move on to another victim.

Photo by Pat Colin

Crown of thorns (COTs).

If COTS numbers are low, their predation does not threaten the entire reef, and those corals eaten are soon replaced, so the reef can recover quite rapidly from low levels of coral feeding. In fact, small populations of crown-of-thorns starfish are quite normal and occur for many years, with only a small reduction in coral cover.

However, when starfish occur in large numbers when an excessive number of larvae and juveniles survive, there is intense competition for food and most corals will be eaten, including the less-favored species. The starfish aggregate and stay in the open, feeding night and day. During a severe outbreak, there can be several COTs per square meter and they can kill most of the living coral in an area of reef, reducing coral cover from the usual 25-40% to less than one percent. Palau has gone through at least one major wave of COTS overabundance, in the 1960s and 1970s; with the COTS so abundant they wiped out corals on many reefs and people were worried that they would cause the demise of all reefs in Palau. Fortunately the plague of COTS eventually died back, probably because their preferred prey species were greatly reduced in number, but there is the potential this could happen again.

What causes COTS outbreaks?

While there have been many theories on the causes of outbreaks of COTS, there are three theories that are supported by the scientific community. Presently these theories have neither been proven nor disproved. They are:

- Fluctuations in the COTS are a natural phenomenon.
- Removal of the predators (triton shells) of the COTS has allowed populations to expand.
- Human use of the coastal zone has increased the nutrient flowing into the sea and resulted in an increase in planktonic food for larvae of the COTS. The improved survival of larvae has led to an increase in the number of adult starfish which results in outbreak.

Outbreaks documented in Palau, include (numbers of starfish removed from reefs in brackets):

1969 – (14,591) – four locations
1971 – (1191) – 15 locations
1979 – (100,000) – five locations >50,000 in 12 days from Malakal Harbor
2001-2002 – (4000) from Lighthouse Reef alone

Controlling COTS outbreaks

Natural Methods: Natural controls on starfish populations include high mortality of the larvae, predation of small starfish and diseases. Adult starfish have few predators because of their tough and toxic 'skin' and long spines. There is little evidence of major diseases in COTS.

Other control methods: It is not possible to eliminate COTS from reefs where they are in outbreak densities but with sufficient effort, local areas can be protected. The method currently used in Palau involves spearing the COTS using a wooden stake and removing them from the water. In Australia, the recommended control method involves trained divers injecting otherwise harmless chemical (sodium bisulfate solution) into the starfish, which kills them within a few days. However, other starfish can quickly move into the control areas from other parts of the reef. In an area with a large population of COTS, control is usually required on a daily basis.

Information Source: Crown-of-Thorns Starfish on the Great Barrier Reef: Current Status of Knowledge, April 2001, CRC Reef Research Centre, Townsville, Australia

Climate Change

What is coral bleaching?

Coral bleaching is the loss of zoothanthellae from corals under stressful environmental conditions. Microscopic algae called zoothanthellae live within corals and a vital source of food in the form of sugars through photosynthesis. Zoothanthellae also contain pigments that give coral their color. While any stress can cause corals to bleach, high water temperature has been the major cause of coral bleaching events worldwide in recent decades. Zoothanthellae are ejected under stressful circumstances and without them, corals dependent upon zoothanthellae will eventually die. In addition to hard corals, soft corals, giant clams and jellyfish are also dependent on zoothanthellae and experience declines during bleaching. In 1997-1998, a major bleaching event in Palau's waters and elsewhere in the world, raised concerns about the health of the reef. With predictions that temperatures will continue to rise as a result of global warming, the future of tropical coral reefs is causing worldwide concern.

Causes of global climate change

Global climate change is the result of many complex environmental factors, but a principal cause is the increasing amount of greenhouse gases in the atmosphere as a result of human activity. The most significant greenhouse gas is carbon dioxide, which has increased in concentration by more than a third in the last 200 years due to burning of fossil fuels and deforestation. The concentration of other gases, such as methane and nitrous oxide, and the ozone-depleting halocarbon gases have also greatly increased over the same period. Greenhouse gases in the atmosphere warm the air by trapping heat from the Sun that would otherwise radiate from Earth back towards space. The warming that results is similar to that which occurs inside a greenhouse.

Photo by Pat Colin

Over the 20th century, the average temperature of the Earth's surface rose by 0.6 degrees Celsius. According to a recent international study, it is projected to rise by another 1.4-5.8°C over the next 100 years. At the same time, average sea surface temperatures have also increased, although at a slower rate. Even small changes in sea surface temperature can have a dramatic effect on global climate change. These include ocean circulation patterns, increased frequency of storm events, and rising sea levels due to expansion of warmed oceanic water and loss of ice.

The temperature tolerance limits of corals

Maximum summer sea temperatures that are just 2-3°C above normal values can kill corals. The upper temperature limit of corals depends on where they are found. The extent of bleaching also depends on the length of time that the water temperature is raised. A coral which normally grows in summer temperatures of 29°C may have little reaction if exposed to temperatures of 32°C for a few hours, but could bleach if temperatures reach 31°C for a week. It is a combination of the length of time and the amount by which water temperatures exceed normal maximum values, that is critical in pre-

dicting the extent of bleaching.

Can reefs recover from bleaching?

When a reef is only slightly stressed, a few scattered corals will die and the effect will be barely noticeable. When a reef has been exposed to prolonged and extreme heating, most corals will die and it can take many years for the area to recover, particularly if large, old corals have been killed, eg. the huge table corals at Ngerchong Island.

Corals recover as a result of growth of surviving corals, and from the settlement and growth of new coral recruits. The rate at which a reef recovers from coral bleaching depends on many factors. Recent research has shown that some reefs are more likely than others to receive large numbers of coral larvae carried to them by ocean currents. The reefs that receive large numbers of larvae can have many young corals growing on them within a few years. As a result, coral communities can recover within about ten years. Other reefs that do not receive a plentiful supply of coral larvae will take considerably longer to recover, perhaps decades.

Photo by Pat Colin

While a reef is recovering, if it is subjected to high levels of dissolved or organic nutrients or has few grazing animals, the reef can become dominated by algae, which inhibits the recovery of corals.

Coral Bleaching Event in Palau

The first signs of bleaching in Palau were noticed in late June of 1998 and by September bleaching was obvious and extensive. A study by Bruno et al., in November 1998 found slightly more than 50% of surface cover of hard corals to be bleached. Only 37% of hard corals were not at all bleached and most soft corals were completely bleached. A detailed study by PCS in 1999 estimated that about one-third of all hard corals and a higher percentage of soft corals had died as a result of the bleaching. The damage was found to vary greatly by area, habitat and type of coral. Some species appear to have lost more than 99% of their cover. The outer barrier reefs, where most of the scuba-diving takes place, appeared to have been hit harder than the lagoon area, where most snorkeling takes place. PCS found that about 60% of 30 surveyed sites had lost more than half of their live hard coral cover.

What is Ocean Acidification?

A pH unit is a measure of acidity ranging from 0-14. The lower the value, the more acidic the environment. Becoming more acidic is a relative shift in pH to a lower value.

The Chemistry

When carbon dioxide (CO_2) is absorbed by seawater, chemical reactions occur that reduce seawater pH, carbonate ion concentration, and saturation states of biologically important calcium carbonate minerals. These chemical reactions are termed “ocean acidification” or “OA” for short. Calcium carbonate minerals are the building blocks for the skeletons and shells of many marine organisms. In areas where most life now con-

gregates in the ocean, the seawater is supersaturated with respect to calcium carbonate minerals. This means there are abundant building blocks for calcifying organisms to build their skeletons and shells. However, continued ocean acidification is causing many parts of the ocean to become undersaturated with these minerals, which is likely to affect the ability of some organisms to produce and maintain their shells.

The Biological Impacts

Ocean acidification is expected to impact ocean species to varying degrees. Photosynthetic algae and seagrasses may benefit from higher CO_2 conditions in the ocean, as they require CO_2 to live just like plants on land. On the other hand, studies have shown that a more acidic environment has a dramatic effect on some calcifying species, including oysters, clams, sea urchins, shallow water corals, deep sea corals and calcareous plankton. When shelled organisms are at risk, the entire food web may also be at risk. Today, more than a billion people worldwide rely on food from the ocean as their primary source of protein. Many jobs and economies in the U.S. and around the world depend on the fish and shellfish in our oceans.

Coral

Many marine organisms that produce calcium carbonate shells or skeletons are negatively impacted by increasing CO_2 levels and decreasing pH in seawater. For example, increasing ocean acidification has been shown to significantly reduce the ability of reef-building corals to produce their skeletons.

Information Source: www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F (NOAA Website)

What can be done about climate change?

The ultimate solution to protect coral reefs would be to target the source of global climate change, i.e. a reduction of greenhouse gases emissions through reduced fossil fuel burning and increased reforestation. The extent and rate of such changes are governed by complex political and socio-economic drivers and are unpredictable. Continued research into the causes and consequences of global climate change is important. Accurate predictions of the geographic patterns and rates of change, and the ways to respond to them must be available to governments and communities.

Information Source: Coral Bleaching and global climate change. Current State of Knowledge, January 2002. CRC Reef Research Centre, Australia.
Dive Tourism in Palau: Resource Use, Value and Management. Tom Graham, PCS, June 2001.

Other Threats

An estimated 30% of the coral reefs worldwide are already severely damaged, and close to 60% may be lost by 2030. There are no pristine reefs left. Until recently, the direct and indirect effects of over-fishing and pollution from agriculture and land development have been the major drivers of massive and accelerating decreases in abundance of coral reef species, causing widespread changes in reef ecosystems over the past two centuries. With increased human populations and improved storage and transport systems, the scale of human impacts on reefs has grown exponentially. For example, markets for fishes and other natural resources have become global, supplying demand for reef resources far removed from their tropical sources. On many reefs, reduced

stocks of herbivorous (vegetarian) fishes and added nutrients from land-based activities have caused ecological shifts, from the original dominance by corals to an abundance of fleshy seaweed. These changes to reefs, which can often be managed successfully at a local scale, are compounded by the more recent, superimposed impacts of global climate change. Future changes in ocean chemistry due to higher atmospheric carbon dioxide may cause weakening of coral skeletons and reduce the accretion of reefs, especially at higher latitudes.

Information Source: Climate Change, Human Impacts, and the Resilience of Coral Reefs T. P. Hughes et al. SCIENCE VOL 301 15 AUGUST 2003

MARINE LAKES & JELLYFISH

Marine Lakes UNESCO World Heritage

Photo by William E. Perryclear

One of the most defining and unique features of the RISL are the marine lakes. The RISL is home to 52 marine lakes (Koror State is home to 53 marine lakes); the Property includes 52 of these (Colin 2009; L. Colin pers. comm.). Marine lakes are isolated bodies of seawater separated from the ocean by a surrounding land barrier (Dawson and Hamner 2005). They retain connectivity to the ocean through fissures, cracks and tunnels within the porous pit and pinnacle topography. The RISL's marine lakes vary between 6,000 and 15,000 years old. They formed when rising sea levels filled basins, sink holes and natural depressions found between the karstic ridges. Many of the Rock Island complexes have marine lakes, with the highest concentration found on Ngeruktabel Island (Colin 2009). Marine lakes are generally classified as either holomictic or meromictic lakes. Holomictic lakes have a uniform water column, are generally oxygenated to the bottom and have habitats and biological assemblages similar to that of the lagoon. In contrast, meromictic lakes have stratified layers of water with an oxygenated upper layer and anoxic lower layer that are sometimes separated by a layer of a pink bacteria. The anoxic layer is filled with poisonous levels of hydrogen sulfide (Hamner and Hamner 1998). The upper layer of meromictic lakes supports a community of marine invertebrates and algae, and few vertebrates. There are physical, biological and geological features that make each lake remarkable and unique from other lakes and the ocean. The RISL's marine lakes range in depths from as deep as 60m to as shallow as 2-3m. There are lakes that have blue-green waters with reef-like assemblages and visibility to 14m.

Other lakes have murky waters with visibility of less than two meters and can be eerily unsettling. Some marine lakes are known for a single dominant marine invertebrate in

high abundance that is rarely seen in other lakes or the lagoon. Other lakes have special features such as caves full of swiftlets (Aerodramus pelewensis) and the Polynesian sheath tailed (Emballonura semicaudata) that are only accessible through intertidal tunnels. These dynamic and diverse marine lakes are hardly stagnant waters of banality, rather they are always changing whether it be through cooler temperatures or a subtly varying biotic assemblage sometimes containing a different dominant sponge every year (Coral Reef Research Foundation (CRRF) unpublished).

Ongeim'l Tketau, "Jellyfish Lake"

The most well known marine lake, and the only one open for tourism, is *Ongeim'l Tketau,* also known as "Jellyfish Lake." *Ongeim'l Tketau,* a meromictic lake, is famous for its golden jellyfish (Mastigias papua etpisoni) that have varied between five and twenty-five million between 1998 and 2008 (Colin 2009). The golden jellyfish employs an "unusual horizontal and vertical swimming behavior" (Hamner and Hauri 1981). Every day, the golden jellyfish exhibit a unique behavior by migrating with the sun across *Ongeim'l Tketau.* In their daily migration large masses of jellyfish can accumulate near the edges of the lake under shadows formed by overhanging trees. This unique behavioural pattern, found only in *Ongeim'l Tketau,* has evolved so the jellyfish avoid the true edges where their natural predators, jellyfish-eating anemones (Entacmaea medusivora),are found (Dawson and Hamner 2003). Other marine lakes of note include Ngermeuangel Lake, Goby Lake, Clear Lake, and Ongael Lake. These lakes are all home to unique subspecies of the golden jellyfish that are genetically, morphologically and behaviorally distinct from each other and the golden jellyfish found in the lagoon (Dawson 2005). In a similar context, and one lake that is still being studied, the cardinal fish (Sphaeramia orbicularis) and Rock Island snails (Nerita savieana) collected from the lagoon and different marine lakes have evolved over time in their unique habitats.

Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

MARINE LAKES & JELLYFISH

Written by Laura E. Martin, Michael N Dawson and Lori J. Bell
Edited by: Sharon Patris, Gerda Ucharm
Coral Reef Research Foundation

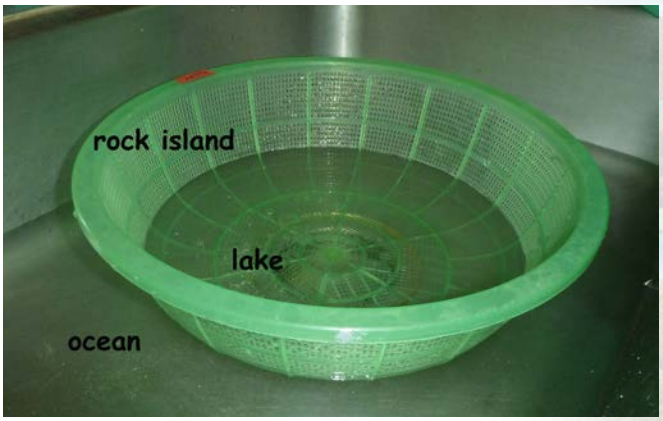
Koror State is home to a concentrated and diverse group of marine lakes. Though there are other countries with marine lakes, nowhere else in the world will you find these many different lakes in such a small area. Marine lakes, a type of marine ecosystem, come in all shapes and sizes. They can be as shallow as four meters (~13 feet) or as deep as 40 meters (~130 feet). They can be as small as a tiny swimming pool or as a big as two baseball fields. They can be found near the ocean or further inland. Even more, the different physical characteristics can determine the type of community found in each lake. Though they share similar general characteristics, each individual lake is different from the other. This chapter will provide you with information on these unique marine ecosystems, and it will cover the most commonly asked questions by tourists about *Ongeim'l Tketau* (Jellyfish Lake).

What is a marine lake?

The limestone 'Rock Islands' of Koror and Airai States are dotted with a little known but unique type of marine ecosystem called a marine lake. Simply defined, a marine lake

is a body of seawater surrounded by land. Although generally unrecognized as such, marine lakes, like coral reefs and mangrove forests, are a widespread type of marine ecosystem.

Marine lakes formed when seawater flowed through porous limestone or karst islands to fill depressions lower than sea level. These porous karst islands are ridden with channels, tunnels and fissures. Imagine a colander sitting in a sink partly filled with water. The colander is the tunnel-riddled island, its center the lake, and the water outside the colander the ocean. Marine lakes can only form where there are depressions lower than sea level and the land is relatively permeable to the ocean. This is why Babeldaob, which mostly sits on impermeable volcanic land, lacks marine lakes.



Coral Reef Research Foundation

A colander in a sink can help you understand marine lakes. The ocean would be water outside the colander, the colander is the tunnel-riddled limestone or rock islands, and the water inside the colander is the lake.

All marine lakes retain connections to the ocean through tunnels, channels and fissures found in the encircling rock island. Because of this, marine lakes experience tides, similar to that of the surrounding ocean. The number, size and length of the channels through which water must flow determine the degree to which water and organisms are exchanged with the ocean. Marine lakes with broad, short tunnels are more directly connected to the ocean, so there is a high exchange of marine organisms. For this reason, marine lakes with broad, short tunnels are similar to that of the ocean and support coral reef like communities. Longer, less direct connections isolate the lake and its organisms from the sea. These lakes typically support mangrove communities and organisms able to tolerate lower salinity waters.

The type of connection can also determine tide exchange. Lakes with broad, short tunnels mirrors that of the ocean's tide, with the lake's highest and lowest tide occurring at the same time as the ocean. Isolated lakes with longer, less direct tunnels will have damped and delayed tides; the lake's tide change will be less than the ~2 meters (6 feet) change in the ocean and the highest and lowest tide will occur more than an hour after the ocean's highest and lowest tide. For some lakes, the highest and lowest tide can occur three hours after the highest and lowest tide in the ocean.

In 1999, Koror State legally defined a marine lake as 'any body of water that is separated from the ocean by rocks, island, land barrier or which is cut off from the ocean at low tide even if there is a tunnel or cave which links another part of the marine lake to the ocean waters' (KSPL NO. K6-95-99). Under this definition, Koror State recognizes about 50 marine lakes in its waters. Another commonly offered number is about 70. In practice, the tally will depend upon the specific definition used.

How did the marine lakes form?

A lot has happened in Palau's geological history to make things the way they are today. But if we were to pick two main events that led to the formation of marine lakes they would be: (1) the uplifting of coral reefs out of the ocean and (2) sea level rise.

All of Palau's marine lakes can be thought of as young lakes in comparatively old rock

islands. Palau's remarkable rock islands formed many millions of years ago as tectonic forces slowly pushed coral reefs out of the ocean. The rock islands have topographical characteristics of reefs: a complex network of high ridges and steep faces interspersed with depressions. The limestone forming the rock islands are riddled with tunnels and small cracks. When passing through the rock islands, you can think of them as islands of corals built millions of years ago!

About 20,000 years ago, sea level was about 100 meters lower than today. During this period, Palau's lagoon was dry and Palau was a single giant, jungle covered island from the tip of Babeldaob to Peleliu! As the earth's climate began to change, vast amounts of water formed as massive glaciers melted. As a result of the melting glaciers, sea level started rising.

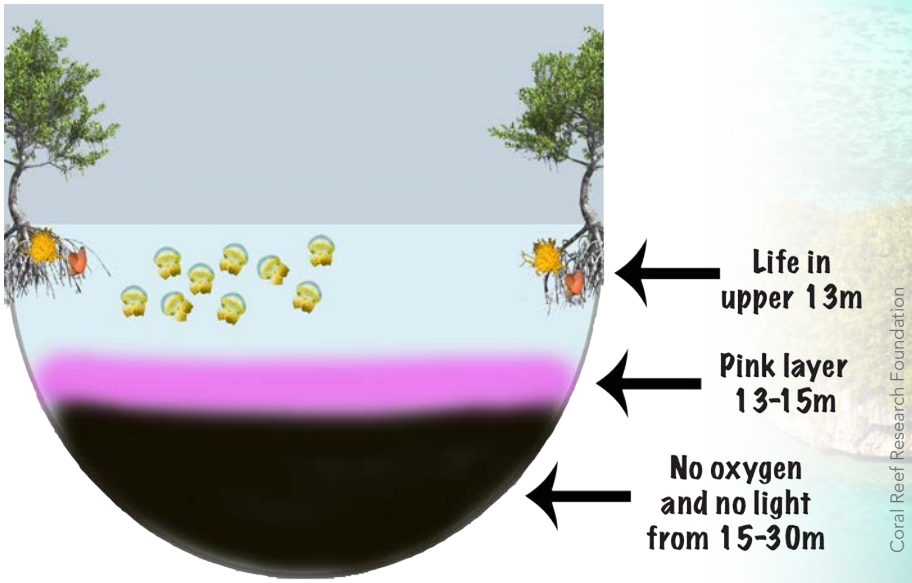
Approximately 10,000 to 12,000 years ago, marine lakes began to form as sea level rose and flooded depressions within the karst islands. (Imagine placing the colander in an empty sink and then filling the sink with water.) The deepest lakes formed first, and shallow lakes followed as sea level continued to rise. Thus, the age of a lake is directly related to its depth. In this regard, Ongeim'l Tketau's deepest depth is 32 meters (~102ft) and it is older than Ongael Lake, which is four meters (~13ft) deep.

Ongeim'l Tketau (Jellyfish Lake)

Ongeim'l Tketau (translates as Fifth Lake) also commonly known as Jellyfish Lake, is the most well known of Palau's marine lakes. Visitors from around the world visit the lake to see its spectacular population of golden jellyfish *(Mastigias papua eptisoni).* Ongeim'l Tketau is the only lake open to visitors, as all the other marine lakes are closed to visitors..

Jellyfish Lake is typical of the more isolated type of marine lake. The perimeter of the lake is surrounded by mangrove trees covered by sponges, algae, gastropods and sea squirts typical of mangrove habitats. There are no corals found in this lake. Rainfall has diluted the surface water salinity to approximately 75% the strength of full seawater. At deeper depths, the lake water has a higher salinity than that of the surface.

The lake reaches 32 meters (~100 feet) at its deepest point, however, plant and animal life are restricted to the top 15 meters (48 feet) of the lake. Below this depth, the water lacks oxygen and, instead, contains high concentrations of the toxic compound hydrogen sulfide. For this reason, all marine organisms that require oxygen to live are restricted to the top 15 meters (48 feet) of the lake. Bacteria inhabit this dark, poisonous layer. The hazards presented by this com-



Jellyfish Lake is a stratified lake with life restricted to the upper 15m. A pink bacteria layer is found between 13-15m. Below 15m is a layer of water mixed with poisonous hydrogen sulfide. No light passes through the lower layer.

pound are responsible in part for the ban on SCUBA diving in the lake.

Is the lake freshwater or saltwater?

The lake is brackish, or a mixture of both freshwater and saltwater. Freshwater enters the lake through rainfall and mixes with the saltwater of the lake in the top 13 meters of the lake. On rainy days, you will be able to see the slur of freshwater sitting in the upper two meters. At deeper depths, the lake water becomes saltier, as there is little to no mixing of fresh and salt water below 14 meters.

How did the jellyfish get into the lake?

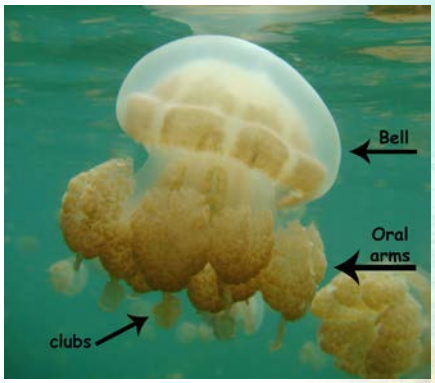
Jellyfish Lake is approximately 10,000 to 12,000 years old. The endemic species, such as the jellyfish and the lake's other current inhabitants, are all descendents of tiny, likely larval, colonizers that were washed through tunnels and channels into the lake as it formed. As time passed, the connection to the ocean through tunnels and channels became restricted, limiting any further exchange of organisms between the lake and the ocean.

Photo by Coral Reef Research Foundation

Lagoon jellyfish in Ngerchaol (right) and lake jellyfish in Ongeim'l Tketau (left). Photos are not to scale. Jellyfish in lagoon are generally larger than jellyfish found in the lakes.

Interestingly, the ancestors of the golden jellyfish that live in the lake can be seen today inhabiting coves around the archipelago. Lagoon and lake golden jellyfish share many features including their source of energy. Like corals, both lake and lagoon jellyfish get most of their energy from microscopic algae, or zooxanthellae, living in their tissues. Like land plants, the algae use the energy of sunlight to produce the sugars (energy) necessary to grow and reproduce. They share some of the sugars they generate with their jellyfish hosts. These algae also gives both types of jellyfish their color, which is reflected in their common name, the golden jellyfish.

The fact that both lagoon and lake golden jellies have algae indicate that this characteristic was inherited from an ancestor in the lagoon. The commonly repeated story – that the lake jellyfish's relationship with algae originated in the lake in response to a lack of food (i.e. the original founding jellyfish lacked algae) – is a myth. The original colonizing jellyfish already depended upon algae for energy. Similarly, the jellyfish in the lake did not lose their sting as their dependence upon algae for energy evolved. Both lake and lagoon golden jellyfish have a mild sting. These stinging structures are used to capture tiny (planktonic) prey, which constitute a part of their diet. If you bring the jellyfish close to sensitive parts of your skin, such as the area around your mouth, you will be able to feel a very, very mild sting - similar to a tiny pinch, completely harmless.



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The rounded end of the jellyfish is commonly called the 'bell' and the frilly looking structures trailing the bell are called 'oral arms'. This name reflects their function. They are covered with stinging cells and thousands of small mouths (hence the term oral). As the medusa swims forward by contracting its bell, water flows across the oral arms and small organisms (plankton) are captured by stinging cells and ingested by the mouths. The structures trailing from the ends of the oral arms are called 'clubs' and are generally much shorter in lake medusae. Their function is unknown.

So what makes the lake jellyfish different from their ocean ancestors?

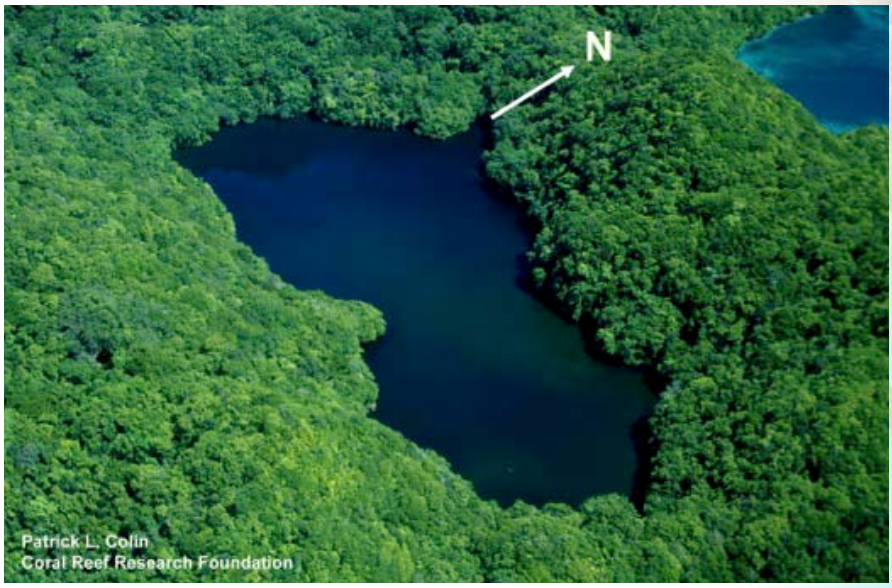
The golden jellyfish's reliance on algae and, thus, sunlight for energy

has influenced their behavior. For example, both lake and lagoon jellyfish rotate in a counter-clockwise direction as they swim which ensures algae in all tissues are exposed to the sun.

Lake and lagoon golden jellyfish also migrate on a daily basis, a behavior that serves to keep their algae in the sun. Relative to their lagoon ancestors, lake jellyfish exhibit a more complex version of this ancestral trait. This amazing behavior, the product of the jellyfish's adaptation to life in the lake, is a key feature distinguishing lake from lagoon jellies. Indeed, it also is one of the attributes that distinguishes Jellyfish Lake golden jellyfish from golden jellyfish in other lakes. No other population exhibits such a spectacular migration to produce unbelievably dense jellyfish aggregations on sunny days.

How do the jellyfish migrate?

If you were to snorkel in the lake just before dawn, you would find millions of golden jellyfish milling around the western half of the lake, swimming in all directions with no particular destination. All this changes at dawn around 6am when, with the sky brightening in the east, the jellyfish turn and swim diligently toward the rising sun. For about two hours they swim eastward, never faltering, rarely turning, with incessant contractions of their bell, until they approach the eastern end of the lake. Here, although still stimulated to swim eastward by the rising sun, they are stopped, not by the edge of the lake, but by the shadows cast by overhanging trees, which they meticulously avoid. These jellies become trapped between swimming eastward toward the sun and swimming westward away from the shade. The millions of jellyfish that were once in the west are now packed densely around the illuminated eastern rim of the lake, with nowhere else to go.



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Aerial photograph of Ongeim'l Tketau. The arrow indicates north and the location of the dock from which tourists enter.

As the day progresses, the sun passes directly overhead and then gradually begins to descend in the west, releasing the medusae from their bind. As the sun starts to track westward, the jellyfish accumulated in the east begin to follow the sun back across the lake, returning to where they started in the morning. The jellyfish swim westward until they encounter the shadow lines cast along the western edge of the lake by the sun as it descends in the west. Here they accumulate, as they did in the east, swimming around, continually avoiding the shadows, trying to stay in the sunlight and avoiding the shore.

By 3 or 4 p.m., the eastern basin which became densely packed with jellyfish between 9 a.m. and noon is again almost devoid of jellyfish as they have all returned to the western end of the lake. As the sun sets (very rapidly in the tropics), the shadows quickly move across the lake and the jellyfish can no longer swim fast enough to remain in the sunlight. Now in the shadows, and lacking any directional light by which to orient their swimming in a horizontal direction, the animals begin to swim vertically, up and down

in the water column, remaining more or less in the same position with respect to the shore. This behavior keeps them away from the shore during the night.

At this time, they may swim downward and encounter the nutrient rich boundary between the lake's oxygen-less depths and oxygenated upper layer. Here they are algal symbionts and they absorb much needed nutrients as the jellyfish continue to swim. (A symbiont is an organism that lives with another organism in a mutually beneficial relationship.) When the sun rises the next day (but before it actually illuminates the lake's surface), the jellyfish accumulate at the surface in response to the increasing light. Once again, they mill around until the first rays of sun entice them to the east.

In summary, the jellyfish complete one round-trip migration from west to east and then back to the west every day between sunrise and sunset. At no point do they ever stop swimming - during the day or night. During the day, their swimming is either strongly directional as they migrate—eastward (in the morning) or westward (in the afternoon)—or haphazard as they mill about waiting for the sun or avoiding shadows. At night, they also swim continually, but vertically rather than horizontally as during the day. The migration is the summed result of each individual animal responding to the light cues in the same way.

On cloudy days, jellyfish are evenly distributed all throughout the lake, not moving as much. On sunny days, the jellyfish will move actively on an east to west orientation. Because the angle of the sun changes during different times of the year, you will also find that the location of the migration changes during the year. Between January and May and between October and December, the sun rises from the east, but leans at a south angle. During these months, jellies will migrate on an east to west orientation, but closer to the south edge. From June-September, the sun rises on the east, but the sun shines from a north angle, so jellies swim closer to the north edge as they migrate east to west.

Why do the jellyfish migrate?

Because the jellyfish get most of their energy from their mutualistic algae, it would make sense for the jellyfish to migrate in a manner that maximizes the time they spend in the sun and, therefore, the energy they get from their algae. However, the direction the golden jellyfish migrate in Jellyfish Lake does not maximize the time they spend in the sun. To achieve this, they should migrate from west to east (as lagoon populations do), rather than from west to east and back to west.

So, why do the jellyfish migrate the way they do? Jellyfish Lake is inhabited by a large population of an important predator of the jellyfish – the medusa eating sea anemone, *Entacmaea medusivora*. In Jellyfish Lake, the direction in which the jellyfish migrate ensures that the edge of the lake, where the anemones lie in wait, will always be in shadow when the jellyfish arrive. The presence of this false edge, and the jellyfishes' avoidance of it, minimizes their contact with the real edge inhabited by their predators. Those jellies that do not respond to the shadow line, get eaten and do not reproduce. Thus, in Jellyfish Lake, the golden jellyfish's unique migra-

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Entacmaea medusivora, native anemones in Jellyfish Lake, eating the golden jellyfish.

tion has been shaped by conflicting selection pressures - the need to provide sun for the algae versus the need to avoid predators. In the end, it turns out that the medusae can miss a bit of dinner, but not be dinner, and survive.

Is Ongeim'l Tketau's golden jellyfish population considered a different species from its ancestors living in the surrounding ocean?

Jellyfish Lake's golden jellyfish are considered a distinct subspecies of *Mastigias papua,* the common lagoon golden jellyfish. This designation reflects the population's unique migratory pattern and its distinct appearance i.e. its unique adaptations to life in Jellyfish Lake. These heritable differences must be underpinned by genetic differences. Because they are a distinct subspecies, the jellyfish in Ongeim'l Tketau are named *Mastigias papua etpisoni,* named after one of the five elected presidents of Palau.

Are there other lakes in Palau with jellyfish?

There are five marine lakes in Palau with the golden jellyfish. These jellyfish are distinct subspecies of the lagoon *Mastigias papua,* and they are named after the five elected presidents of Palau. The jellyfish were named in accordance with the age of the lake and the order of the elected presidents.

There are also a few other lakes that have the golden jellyfish that resembles the lagoon ancestral type. These lakes will harbor a handful of the lagoon-type golden jellyfish sporadically. In addition, there are a handful of other lakes that have the moon jellyfish (*Aurelia* sp.) and the upside down jellyfish (*Cassiopea* sp.). One other lake is host to a tiny Coronate jellyfish.

Lake from oldest (deepest) to youngest (shallowest)	Elected Presidents from oldest to most recent	Name of subspecies of golden jellyfish
Ngermeuangel Lake	Haruo Remeliik	Mastigias papua remeliiki
Clear Lake	Lazarus Salii	Mastigias papua salii
Ongeim'l Tketau	Ngiratkel Etpison	Mastigias papua etpisoni
T Lake	Kuniwo Nakamura	Mastigias papua nakamurai
Ongael Lake	Tommy Remengesau	Mastigias papua remengesaui

How fast does a golden jellyfish grow?

Best estimates suggest that the bell diameter of a golden jellyfish increases at about 1 cm per week on average. (The bell is the top part of the animal that looks like an umbrella.) At this rate, it takes the average medusa around two to three months to reach sexual maturity, which corresponds to a bell diameter of about 7 cm. However, some evidence suggests individuals may grow more slowly when the population gets quite large, taking many months to reach sexual maturity.

How long does an individual golden jellyfish live?

It is difficult to reliably estimate the life span of the average jellyfish in Jellyfish Lake. It seems likely that a given individual lives about six months to a year before dying but it could be longer.

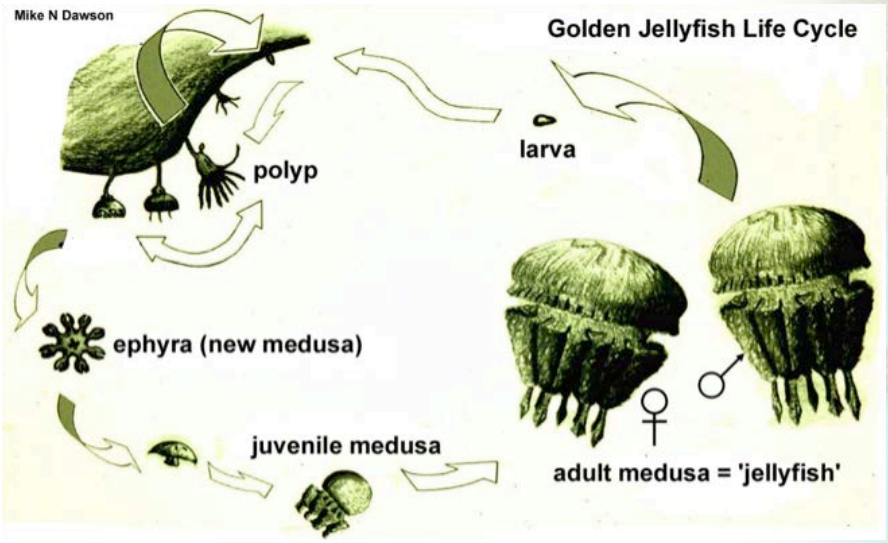
Do the golden jellyfish sting? How about the moon jellyfish (Aurelia sp. 4)?

Yes, both the golden and moon jellyfish sting although very mildly. Stinging structures are used to capture small prey. Unlike golden jellies, moon jellies rely completely on

their stinging cells, which dot most of their surfaces, to capture sufficient prey to meet their energy needs.

How do the jellyfish reproduce?

The familiar, swimming animal we identify as a jellyfish (properly called a medusa) is actually one of two very different, relatively long-lived life stages that characterize the life cycle of most jellyfish species. The second life stage is the polyp, a minute (only several millimeters in size), free-living animal that looks somewhat like a very small sea anemone – complete with a mouth surrounded by a ring of tentacles situated on the end of a stalk that attaches the animal permanently to its habitat. The medusa and polyp life stages are related to each other in the following way: medusae give rise to polyps and polyps produce new medusae. The transition between one life stage and another occurs cyclically in the following manner.



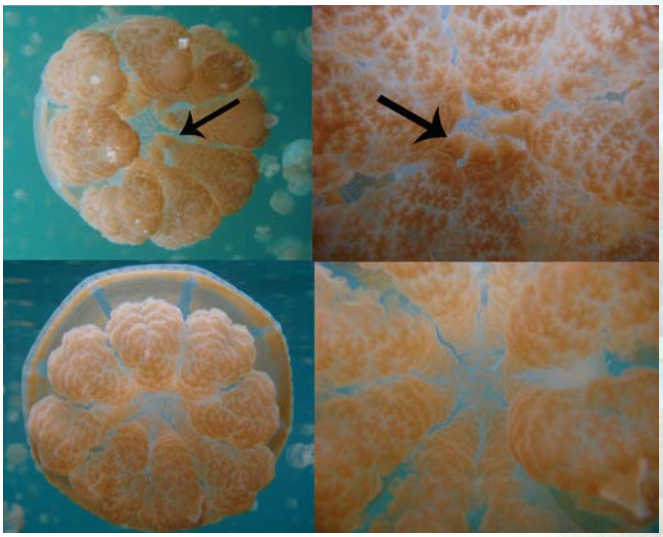
Like humans, a given medusa is either female or male. Female medusae produce eggs and male medusae sperm. The fertilization of an egg by a sperm produces a small, round, swimming organism called a larva. Upon maturation, which takes several days, the larva locates a suitable habitat on the side of the lake, usually a rock, dead leaf or piece of wood, stops swimming and settles down on it. The larva then undergoes a radical physical change, transforming itself from a round, swimming ball of cells into a sedentary polyp with tentacle-surrounded mouth and supportive stalk. The polyp then lives its entire life attached to that object, using its tentacles to capture small animals from the environment around it.

Polyps are reproductively more flexible than medusae. Medusae can only give rise to polyps via sperm and eggs and the motile larval stage. Polyps can produce both new polyps and new medusae. Individual polyps give rise to new polyps by producing a small outgrowth from their body that detaches, swims away, settles on the bottom and quickly grows into a replicate of its parent polyp, complete with all the reproductive abilities of its parent. Alternatively, under certain conditions, a polyp will produce a new medusa by physically transforming its mouth and tentacle end into a very small medusa (about 2-3mm diameter), which pops off, swims away, and grows into a mature sexually reproductive medusa. The remaining polyp then regrows a mouth and tentacles and lives on with the potential to produce additional medusae and polyps.

How can you tell a male jellyfish from a female jellyfish?

Medusa jellyfish in Ongeim'l Tketau become sexually mature (able to reproduce eggs or sperms) when they are about 7cm in diameter. To be able to tell the difference between a male and female jellyfish, you will need to get a jellyfish 7cm or larger (pick the biggest one you see). While underwater, you can gently flip the jellyfish so that it's

bell faces downward, and take a look at the center between the oral arms. If there are long, cilia-like (or orange hairlike filaments) in the center, then the jellyfish is female. You will often see white dots or specks on these filaments - these are the planula which will then swim off as larva. If long, cilia-like structures are absent, then the jellyfish is male.



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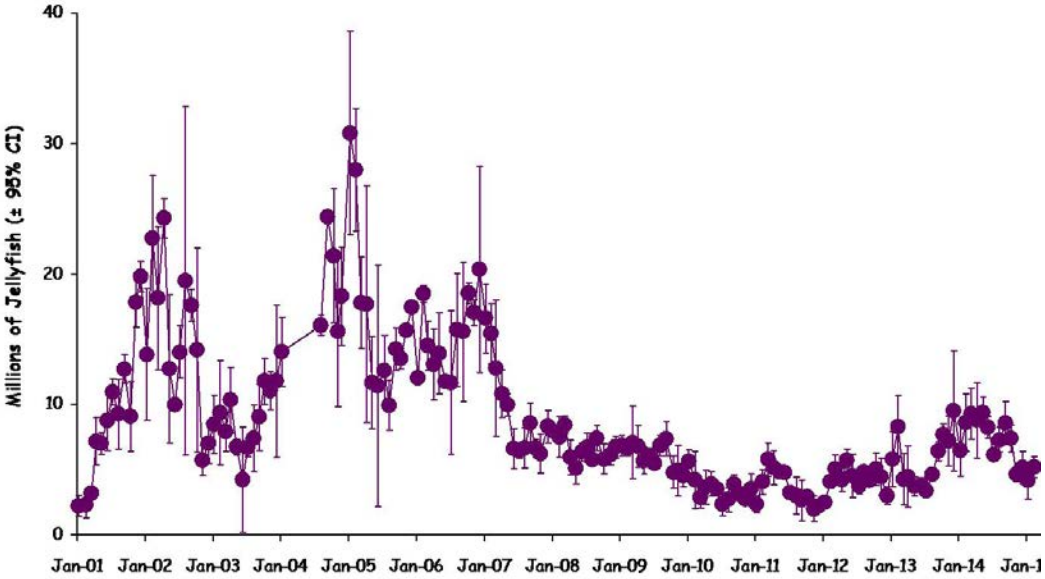
Female jellyfish (top first row) will have hairlike structures in the center of the oral mouth (indicated by arrow). These structures will be absent in male jellyfish (bottom row).

How many golden jellyfish inhabit the lake?

The number of medusae varies considerably through time. When the lake was very warm during the La Nina event of 1998-1999, the medusa stage of the golden jellyfish was completely absent. The polyp stage, however, survived this warm period replenishing the lake with medusae when the lake cooled in January 2000. Gradually over the course of about two years, the population recovered to millions of individuals.

In general, the size of the population appears influenced by lake temperature. During cooler periods, such as those observed during El Nino events, the population is generally larger, averaging between 15 and 25 million individuals. During warmer periods, jellyfish abundance can reach lows of five to ten million and during extreme warming events, like that accompanying the 1998-1999 La Nina, can disappear entirely. Monthly updates on the population's size can be found at the Coral Reef Research Foundation's website www.CoralReefResearchFoundation.org/TheLab/Research/Lake/OTMonthly.html as long as they continue to collect these data.



Changes in jellyfish population in Ongeim'l Tketau. Horizontal line represents years, vertical line represents jellyfish population (in millions) with confidence intervals. The jellyfish disappeared in 1998, but returned by 2001. Since then, the population has fluctuated over time.

Why are there so many jellyfish in the lake?

Very simply, the lake is a fantastic jellyfish habitat with very few factors to limit the production and survival of jellyfish (e.g. few species of predators, abundant habitat

for both polyps and medusae, and abundant energy sources in form of sunlight and minute prey). In the absence of negative influences, the life cycle of the jellyfish (see above) is such that millions of reproductively mature medusae produce millions of larva over the course of their lives giving rise to millions of polyps. In turn, these polyps can produce untold numbers of new polyps each with the ability to produce new medusae. Indeed, given the presence of only a single predator the jellyfish-eating sea anemone, *Entacmaea medusivora,* such profligate reproduction is virtually guaranteed.

Do other jellyfish lakes occur in Palau? How about beyond Palau?

Yes, populations of golden jellyfish occur in at least four other lakes in Palau. Each constitutes a unique subspecies. Beyond Palau, golden jellyfish populations are known from marine lakes in the Berau district of Indonesia off East Kalimantan (Borneo) and marine lakes of Ha Long Bay, northern Vietnam. Although genetically very different from those in Palau, individuals in Berau look remarkably similar to those in Palau's jellyfish lakes.

Why does Ongeim'l Tketau lack oxygen and instead contain hydrogen sulfide below 48 feet (about 15 meters)? Does anything live there?

Over thousands of years, the bacteria that break down the dead organisms that sink to the bottom of the lake have consumed all the oxygen and released hydrogen sulfide into the water. In most lakes, oxygen is replenished and hydrogen sulfide removed as oxygen-rich surface waters are mixed down to the bottom by both wind blowing across the surface and tidal action. However, the high ridges around Ongeim'l Tketau greatly reduce the strength of the wind that blows across the surface of the lake and tidal exchange is limited by the tunnels. This, combined with the relatively deep nature of the lake prevents refreshing surface waters from ever reaching its depths. Now, the only organisms that inhabit the waters below approximately 15 meters (48 feet) are bacteria that can live without oxygen and both produce and are able to tolerate high concentrations of hydrogen sulfide.

Why is hydrogen sulfide poisonous to humans?

Hydrogen sulfide is poisonous to humans because it prevents the delivery of oxygen to our tissues, which, ultimately, can kill us. Like oxygen, hydrogen sulfide is a gas that is soluble in water. Unlike oxygen, however, hydrogen sulfide can enter our bloodstream directly across our skin. Once in the blood, hydrogen sulfide binds to our hemoglobin (the molecule that binds oxygen and delivers it to tissues throughout our body), which prevents oxygen from doing the same and leads to death by oxygen deprivation (asphyxiation).

What are the threats to Ongeim'l Tketau (Jellyfish Lake)?

Threats to Ongeim'l Tketau (Jellyfish Lake) arises through human activity. Human activities include physically disturbing the natural habitat and damaging jellyfish through uncontrolled movements while swimming. It also includes the introduction of non-native and invasive species. It is through human actions that the fragile balance in this unique marine lake is threatened, and it's future remains unpredictable. It took thousands of years for the marine lakes to form, for its biodiversity to evolve, but it will take a lot less time than that for humans to alter the lake. With the recent influx of visitors to the lake, the potential of these threats have increased.

The unintentional introduction of non-native species is probably the biggest threat to the long-term survival of the jellyfish population and, more generally, the ecological health of the lake.

Mark Downey

Jellyfish in Ongeim'l Tketau.

Jellyfish Lake is isolated from the surrounding ocean, as there is no direct exchange of water between the ocean and lake. Any living organism found in Palau's waters outside the lake is considered non-native to the lake. If it does not occur naturally in Jellyfish Lake, then the organism is considered non-native to Jellyfish Lake. This includes organisms from other lakes. Thus, all organisms potentially pose a risk to the lake should they be introduced.

Unfortunately, the threat of an exotic species introduction to the lake has already been realized. A non-native sea anemone, a species of *Aiptasia,* was introduced to the lake sometime in 2003. It was first discovered near the dock from which visitors enter the lake. Since its discovery in late 2003, the sea anemone population has quickly expanded due to its impressive reproductive abilities. New anemones grow from small bits of tissue broken off of the 'parent'. The ability to reproduce asexually in this fashion highlights the fact that a devastating infestation can result from the unintentional introduction of just a single individual.

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A patch of invasive anemone (right) and an individual non-native anemone, *Aiptasia* sp. The non-native and invasive anemone has brown tentacles with a white stalk, and is easily seen on the bottom and mangrove roots.

Non-native species pose a threat to the natural habitat of Jellyfish Lake because they can overtake already limited resources, such as space and food. The invasive sea anemone, *Aiptasia* sp., has now spread from the dock in the west all the way to farthest eastern point of the lake, covering mangrove roots and the shallow bottom. Mangrove roots that were once covered with endemic species are now dominated by algae and the *Aiptasia* anemone, lowering the diversity

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Mangrove roots that were once covered with endemic species are now dominated by the invasive anemone (*Aiptasia* sp.) and algae.

of species on these mangrove roots. Though we have yet to see how the introduction of the invasive sea anemone will affect the golden jellyfish, the arrival and spread of the *Aiptasia* sp. coincides with the decrease, and subsequent disappearance, of the moon jellyfish in Jellyfish Lake.

The threat of non-native and invasive species will only increase as the number of visitors to the lake increases. For every single person that enters, it is one more potential or chance for an introduction, especially when visitors carry in shells, rocks, seaweed, algae or corals from the ocean. Non-native species also have the potential to hitchhike on visitor snorkel gear and footwear. This is why it is important that all snorkel gear and footwear be rinsed before entering the lake, and that visitors do not carry in things - like rocks or shells - picked up in the ocean.

Where can I find more information or references on marine lakes?

The Coral Reef Research Foundation website is a good source of information about marine lakes and includes a list of publications. www.CoralReefResearchFoundation.org.

GOOD PRACTICES: How can we ensure the long-term existence of the jellyfish and their home while ensuring a pleasurable experience for all visitors?

1. **Always remind your guests not to take anything but clean snorkel gear into the lake and do not take anything from the lake into the ocean.** This includes things that appear dead, like seashells or rocks, which can be home to unnoticed, but potentially invasive, organisms.

   Please help avoid additional and possibly irrevocably harmful introductions by ensuring that your guests do not bring anything but clean snorkel gear into the lake.

   The reverse is also true; lake organisms are non-native to Palau's ocean environment. Please do not move anything from the lake to the ocean, or vice versa. Help preserve the separation of Jellyfish Lake and Palau's ocean flora and fauna that originated 10,000 to 12,000 years ago!

2. **Please protect the fragile jellyfish of both species from mechanical damage by helping guests practice careful swimming techniques.** Lay prone (horizontal) at the surface and propel yourself with slow, gentle motions. Avoid quick actions with both your hands and feet as you can easily snag an animal in your hands, or on your fins or feet, unintentionally tearing or slicing them. If you need to talk to someone lift your head without righting yourself in the water, i.e. don't let your feet project down into the jellyfish. Remain at the surface. Do not free-dive through aggregations of animals.

   Jellyfish are very delicate animals whose bodies are comprised primarily of water (~96% of their weight is water) infused throughout a network of tissue. Thus, water provides virtually all of their structural support (it is the equivalent of bones), allowing them to grow large, and appear robust, without any rigid structures. The aqueous nature of these animals leaves them exceedingly vulnerable to damage. Please ensure that animals are not removed from the water, as gravity, pulling on the mass of their waterlogged tissues, will stretch and tear them. This is particularly true of the exceedingly fragile moon jelly. When lifted from the water by hand, these animals literally come apart by dripping through your fingers!

SCUBA diving is forbidden for similar reasons. Exhaled bubbles become trapped inside jellyfish tissue floating the animals to the surface, pinning them there. Unless a human gently tips the animal to release the air, the animals will remain stuck to the surface until the air bubble erodes its way through the tissues. This process results in a hole in the animal leaving it vulnerable to infection and death.

It is highly recommended that visitors wear snorkel gear, such as a mask and snorkel and fins. It will also help to have life jackets or flotation devices. Snorkel gear and flotation devices will allow any swimmer – novice and experienced – to control their movements easily. A swimmer without proper gear will often have to work twice as hard to keep afloat by kicking and waving ones arms and legs, leading to more damaged jellyfish. A swimmer with proper gear will be able to swim with gentle strokes, and thus, damage less jellyfish.

3. **Please do not disturb the bottom or sides of the lake or the organisms growing there.**

   The absence of strong water currents means the vast majority of organisms in the lake are very loosely attached to the roots, rock, algae, etc. on which they live and can easily be dislodged by even the most careful swimmer. In the case of the introduced sea anemone, dislodgement will assist its spread to unaffected areas of the lake.

   Similarly, limited water flow results in the accumulation of large amounts of very light sediment on the bottom. Again, even the most careful swimmer can easily kick up large amounts of sediment, which can resettle to smother organisms.

4. **Please do not apply sunscreen directly before entering the lake.** *If possible encourage the use of sun-proof clothing.*

   Sunscreen compounds have been detected in Jellyfish Lake water. It is possible that sunscreen could accumulate in the lake through time. The ultimate effects of this are unknown. Please advise guests to apply sunscreen at least a half-hour before they enter the lake, providing time for excess material to come off. Encourage them to use waterproof sunscreen. An even better alternative is to encourage them to wear sun-proof clothing instead of sunscreen.

5. **Please help your guests enrich their experience and that of others by encouraging them to keep their voices down along the trail and in the water.**

   Quiet visitors are likely to see much more than just jellyfish during their visit to the lake. A variety of birds, including bush warblers, the nicobar pigeon, fruit dove, fan tails, and the endemic megapode, can be seen along the trail as well as some of the island's tiny reptiles – the delicate blue tailed skink, the larger green tree skink, and the long skinny racer and Palau boa snakes. On rainy days the tiny (6cm long) native frog may be spotted crossing the trail. Even if you don't see it, you will hear it. Often mistaken for calling crickets, this tiny amphibian is the true source of the ubiquitous background chorus of the jungle.

   Avian life over and in the lake is also diverse and animated. Spectacular blue collared kingfishers sit stately and still upon mangrove branches extending over the lake, occasionally breaking their trance to call and trace trademark chord-like paths between branches along the shore. Pied cormorants sit silent and motionless on mangrove branches along the edge of the lake, periodically taking to the water to dive for small prey living on the bottom. At times white tailed tropicbirds and fairy

terns monopolize the sky over the lake and jungle socializing and intermittently plunging from the sky after the loosely schooled silverside fish that dart among the jellies. Occasionally a large, solitary fruit bat takes to sky above the jungle moving among roosts in the canopy.

6. **Please do not smoke on the trail or docks.**

7. **Please make sure to take all litter with you when you leave.**

   Litter is becoming an issue in Jellyfish Lake. Cigarette filters, water bottles, key cards, and even snorkel gear have been found floating in the lake or on the bottom near the dock. It is important you ensure no trash or litter is left behind in the lake. All customers must be cautioned to NOT take off masks, snorkels and fins while swimming in the lake; these will most likely be forgotten and dropped to depths from which they cannot be retrieved. All cameras, cellphones, and underwater gadgets should be firmly tied to the wrist, hand or any other body part that is secure.

8. **Please keep your group together as much as possible.**

   With large or small groups, it is important that you keep your group together as much as possible. This is to ensure that you can closely monitor their activities, making sure that they are following the rules while in the lake. In addition, visiting the lake – hiking up the steep rock island and swimming out to the middle of the lake – is a strenuous activity that can stress out the physical body. For the safety of the customer, it is important that you keep your group together to keep a watchful eye on your customers.

IMPORTANT MARINE LIFE

Marine Algae

The plants of the reef are often not very obvious as they lack roots, stems, leaves and even the green color of terrestrial plants. They can be brown, red or green.

Role of the Reef

As in most ecosystems, plants form the basis of the reef's food chain. Many species of marine algae contribute greatly to the overall structure of the reef. Coralline algae act as the reef's mortar; by secreting limestone, like corals and by growing between coral fragments and rubble, algae helps bind the reef together. Limestone-producing algae also make up a major component of the sand.


Pat Colin

Halimeda

Halimeda – This is a group of green algae that produces calcium carbonate or limestone skeletal elements. The remains of the disc-shaped 'leaves' are responsible for over 50% of the coral sand found in many parts of the reef! *Halimeda* can produce limestone very quickly, doubling its weight in as little as two weeks. It has been estimated that Halimeda flakes are capable of producing 13cm of reef in less than 1000 years.

The brown surface on the reef flat is actually a thin layer of rapidly growing algal turf. This is a primary food source for many of the reefs herbivores like parrotfish, surgeonfish and damselfish, which can be seen feeding in the

shallows. If it wasn't for their constant grazing; this algae would quickly grow to form a fuzzy algal layer.

Sponges

What are sponges?

Sponges are animals that filter water volumes equivalent its own body volume every 4-20 seconds. From giant vase-like structures to obscure creeping forms covering rocks, sponges are important for more than just washing the car!

Pat Colin

Sponge

Their characteristics include:

- Body covered with tiny openings called pores;
- Food particles are filtered from water;
- Skeletal structure consists of limestone or silica spines called spicules;
- Great range of colors and shapes;
- Attached to the sea floor.

Role on the reef

As in most ecosystems, plants form the basis of the reef's food chain. In addition to producing organic matter through the process of photosynthesis, many species of marine algae also secrete calcium carbonate, the basis of limestone, and as such contribute greatly to the overall structure of the reef. This calcium carbonate materials can be in the form of a "crust" laid down on rock, or even objects sitting on the bottom, or as skeletal elements contained with the tissues of the algae themselves. The "Coralline algae" produce the crust-like material and they are actually only small cells found on the surface of the crust and give it a red or pink color. These limestone crusts act as a "mortar" with the secreted limestone cementing together coral skeletons, coral fragments and rubble making this material into a solid reef framework Those algae producing skeletal elements eventunally die and when they do their elements remain and form much of the sand found on the reef. If you notice the white flattened flakes, which have a resemblence to uncooked oatmeal, found in the reef sand, those are the skeletal elements from a green algae, *Halimeda,* which is described below.

Feeding

If you inspect a sponge closely, you will find its surface is covered in small and large pores. Water is drawn in through the small pores and through a series of canals until it enters feeding chambers where food particles as small as bacteria are digested. Water is expelled from the sponge through the large volcano-like pores. Many sponges contain, like corals, algae that can produce food for them by using light from the sun.

A sponge the size of a cup could filter 5000 liters of water a day!!

Reproduction

Sponges can reproduce asexually by budding and breaking off segments. Most sponges also have both male and female sex organs. During sexual reproduction, eggs are retained by the sponge. Sperm are released into the water and are taken up by other sponges to fertilize their eggs.

Human Use and Impacts

Certain types of sponges, called "bath sponges," have been used for cleaning and scrubbing for thousands of years. Bath sponges have only fibers in the skeletal structure and are not common in Palau, so there is no large sponge fishery here. However, some can be grown in a mariculture situation and there are some small "sponge farms" found in Palau.

Most sponges have no commercial value, but some species are being explored for their biomedical properties. Many contain toxins for self-defense and these are being explored for their potential use as drugs for the treatment of various diseases, including cancer. It is interesting to know that of the 10,000 or so species of sponges found worldwide, there is not even one species that is used by humans for food! They are toxic to us, but on the reef a variety of creatures, such as the hawksbill turtle, some angelfish and others can eat many types of sponges.

Being filter feeders, sponges can easily become clogged by sand kicked up by divers and snorkelers.

Sharks

Written by Tova el Har Bornwoski

Sharks, Rays and Chimaeras known as the 'cartilaginous fish' are one of the two major class groups of fish, *Chondrichthyes.* The *Chondrichthyes* are comprised of two subgroups: *Elasmobranchs* (sharks and rays) and *Holocephali* (chimeras or ghost sharks). They all have a cartilaginous skeleton without true bone, small tooth-like scales (dermal denticles), a skull without sutures, pelvic claspers on males, and teeth that are embedded in the gums or fused into the plates that grow with the animal. They have existed for more than 400 million years. Cartilaginous fish are found in all oceans. Larger numbers are found in shallower and tropical water but they can also be found in freshwater and deeper water (more than 9000 ft).

Fish n Fins

Grey Reef Shark

Sharks have five to seven gill openings, one to two dorsal fins, anal fins and most have a well-developed caudal fin for swimming. There are over 500 living species of sharks that are divided into 34 families. The features for identifying sharks are: color, body shape, fin size and position, and tooth shape and number. Sharks range from as small as half a foot to as large as 40 feet, have an estimated life span of 15-25 years, and take six to seven years to reproduce. Most sharks are predators at the top of the food chain and very few feed on plankton.

Palau became a shark sanctuary on September 25, 2009 and was the first country to declare itself as a shark sanctuary. Palau is one of only a few destinations with a healthy shark population. There are over 20 different species of sharks in Palau. The most common sharks being the reef shark; the grey reef shark, the white tip shark and the black tip shark. Other sharks that can be seen in Palau are bull sharks, tiger sharks, silver tip sharks, tawny nurse sharks, zebra sharks, scalloped hammerhead sharks, great hammerhead sharks, oceanic white tip sharks, whale sharks, thresher sharks, shortfin mako sharks, longfin mako sharks, blue sharks, lemon sharks, dusky sharks, silky sharks, graceful sharks, six gills sharks and shark rays.

Sharks within the Rock Island Southern Lagoon

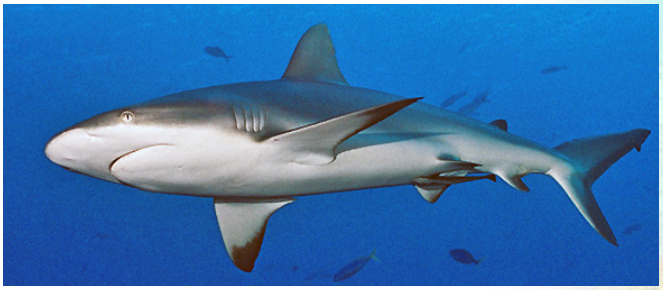
At least 13 of 17 reported species of shark from Palau have been observed at the famous Blue Corner in the Ngemelis Complex within the RISL (T. Bornovski pers. comm. 2010) including resident populations of grey reef, black tip, white and silver tip sharks, bull sharks, tiger sharks, nursesharks, zebra or leopard sharks, thresher sharks, whale sharks, and even the Bronze whaler sharks. For nearly a decade Palau has banned commercial shark finning and the use of steel leaders in its waters. In his annual United Nations address in 2009, H.E. Johnson Toribiong, then President of the Republic of Palau, declared Palau a Shark Sanctuary, the first of its kind in the world. As all of Palau's waters are now a sanctuary, harvest of sharks is prohibited, including in the RISL.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

A lot of bad publicity (and movies) have made many people fear sharks. Although some of the sharks encountered on the reef have the potential to be dangerous, most sharks are shy and will not bother divers if they are not fed and are left alone.

Characteristics

- Skeleton made of cartilage
- 5-7 gills (usually 5)
- no swim bladder
- renewable teeth
- skin covered with small teeth called denticles
- have an electrical sense to detect prey



Black-tip Shark

Fish n Fins

Role on the Reef

Like the lions of the African savanna, sharks play a vital role in the reef system, being top predator. They remove the sick, injured and old and help control animals whose populations are booming. By removing sick or injured animals from the fish populations, mostly the healthiest fish are left to breed; therefore sharks play an important role in maintaining healthy fish population that we depend on for food.

For millions of years, sharks have been top of the food chain, but now this has changed. The removal of millions of tons of sharks each year is upsetting the balance in the oceans.

Types of sharks

Sharks can be divided into two categories:

Bottom-dwellers – usually found resting on the sea floor. Easily recognized by an opening behind their eye known as a 'spiracle.' Water is pumped in through this opening and out through the gills. (I.e. Leopard shark, Epaulette shark and the Wobbegong.)

Mid-water sharks – do not possess a spiracle and most rely on a constant flow of water through their mouth and across their gills as they swim. However, some species, such as the white tip reef shark, are able to lie motionless and pump water by opening and closing their mouths.

Senses

A shark's sense of smell is of great importance in sensing prey. Blacktip reef sharks have been found to be able to sense one part grouper in ten billion parts of water. Sharks also possess a sixth sense. I.e. the ability to sense minute electric fields generated by all living organisms. This is detected through the small black pores located on the snout of sharks. Sharks can detect voltages as low as a hundred millionth of a volt!

Reproduction

Males can be easily identified by the presence of two-finger like reproductive organs called claspers, located in the pelvic region, on their underside. Females often have mating scars on their backs, from when males grip them with their teeth. The male inserts one of his claspers into the female in order to fertilize her eggs. Most reef sharks give birth to live young, which quickly swim away from the mother when born.

For each person killed by a shark, over 23 million kg of sharks and rays are killed by people!

Human Use and Impacts

Sharks have been exploited by humans for food and recreation since the earliest days of fishing. As sharks only produce a few young, they are susceptible to over-fishing. Because of this, shark stocks have to be carefully monitored and managed. Evidence of over-fishing is already apparent with the collapses of several shark fisheries and the reduction in numbers all around the world.

Diving with Sharks

Reef sharks are generally very timid animals and tend to stay clear of divers. Three simple rules to remember when diving with sharks are:

- Don't corner them
- Don't feed them
- Don't hang onto them

Whale sharks, like the gray reef shark, show characteristic behaviors if they feel threatened. They start to swim in an exaggerated, jerky manner, with their back arched and pectoral fins lowered. If provoked, they will turn quickly and chase the intruder. Attacks on divers and snorkelers are extremely rare and in most cases can be attributed to the person spear fishing or feeding sharks.

Manta Rays

Written by David Prieto, MSc Sustainability Management, The Earth Institute, Columbia University

Manta rays – *Ouklemedaol* in Palauan – are members of the Shark and Ray family denominated cartilagenous elasmobranchs. The name manta comes from the Spanish word "Mantilla" or cloak, in reference to their appearance and movement underwater. Historically considered a single species, it was not until 2009 that manta rays were re-categorized into two separate species (Marshall, 2009). The resident mantas in Palau are Manta alfredi or reef mantas, with an identified population of 275 as of 2014 (see www.mantaidpalau.org). The ventral spots on their bellies are unique to each individual from the moment they are born enabling their identification. 10% of the manta population in Palau has black morph coloration. The giant oceanic Manta birostris has not yet been recorded in Palau.

Characteristics

- Skeleton made of cartilage
- Filter water for nutrients and oxygen (Planktonic filterfeeding)
- Two colour morphs – Chevron & Black.
- Unique ventral spots
- No Sting

Palau Visitors Authority

Manta Ray

Type of Manta Ray

M. alfredi grow to an average disk width of 3.5 meters, with a maximum of five meters. They are resident to a particular location and do not travel long distances. Most diving and snorkeling encounters are with reef mantas.

M. birostris grow over seven meters in disk width with anecdotal reports up to nine meters (Compagno, 1999). They are pelagic, travelling vast expanses of ocean. Distinguished from M. alfredi by the size and bump between dorsal fin and tail.

Reproduction

Females can be distinguished from males various ways. First, female mantas are larger than males. Second, females have two pelvic fins, whereas males have two claspers in addition to the two pelvic fins.

Courtship begins when a female is pregnant and ready to give birth. A mating train commences where various males start to follow the female. Mating trains can last vari-

ous weeks and can have more than five males participating. The moment the female gives birth, the last remaining male from the mating train will copulate.

In order to copulate, a male manta will approach a female from behind and try to grab and bite her wingtip to flip her around. The male maneuvers himself to face the female belly to belly still holding her wing tip tightly in order to insert his claspers in the female. The copulation itself takes less than a minute. Gestation lasts over a year, producing one live pup. Females are sexually mature once they display mating scars from male bites. Claspers extending further than the pelvic fins indicate a male's sexual maturity.

Human Use and Impact

The resemblance of their cephalic fins to horns has garnered mantas the common name of "devilfish" – a contradiction to their docile nature. Research suggests that manta rays have the highest brain mass to body mass ratio of all elasmobranchs (Stevens, 2010). Resident reef mantas can be very social, becoming accustomed to divers and even seeking assistance when harmed by hooks and nets. Their lack of sting and harmless behaviour make these "devils" an enticing attraction for dive and snorkel tourism.

Manta rays are particularly vulnerable to over-exploitation in fisheries due to their low reproductive rates and late sexual maturity. Their gill plates are marketed as traditional medicinal tonic in Asia, which has led to a dramatic increase in demand and fishing pressure. Yet the estimated tourism value of a live manta ray over its lifetime is one million US dollars, in contrast with the fishery value of a dead manta ray between 40-500 US dollars (Stevens, 2012).

Case Study: German Channel

Sharks have long been the flagship species for Palau, however a "surprising" finding from the 2014 Palau Visitor Authority Survey shows that tourism focused on other species in Palau, specifically manta rays, is becoming increasingly popular. In 2013, it was estimated that manta ray watching tourism contributed US$ 6.8 million to the economy in Palau (O'Malley et al., 2013) and most of the manta watching tourism occurs at only one dive site: German Channel.

The number of boats and divers at German Channel has increased dramatically leading to concerns about the safety and sustainability of the site. The majority of operators have learned the right moon cycle, tide and wind direction to encounter mantas, leading to times where more than 20 boats are at the site. As it is a small, relatively sheltered area it is also the go-to dive site in inclement weather as well as for check dives. Furthermore, it is the busiest reef channel in Palau as it is conveniently located near the other major dive areas. Hooks, nets and propellers have harmed manta rays and boats speeding over the site pose a serious threat to divers and snorkelers. All these factors make German Channel a dive site with serious safety issues for tourists and mantas requiring sustainable management.

Information Source: David Prieto, MSc Sustainability Management, 2015, The Earth Institute, Columbia University

Sea Snakes and Sea Kraits

Although similar to land snakes, sea snakes are well adapted to the marine environment. They have a paddle-shaped tail that propels them through the water, and their

belly scales are formed into a keel that helps stabilize them when they are swimming.

The species most commonly encountered here is the banded sea krait, *Laticauda colubrina*.

Feeding

Sea kraits like sea snakes are among the most venomous snakes in the world possessing some of the most potent toxins known. Most feed on a variety of fish, with one species, the turtle-headed sea snake, being specialized in feeding on fish eggs.

Defense

Sea snakes are not aggressive, except during the mating season, when they are territorial. Fortunately, the fangs of the sea snakes are quite short, with only the large animals able to penetrate a wetsuit. In addition, sea snakes also have the ability to withhold venom during a strike. The Palauan sea krait is not aggressive. There are no reports of injury from a sea krait.

Reproduction

Externally, the female Palauan sea kraits are larger than males. Sea snakes may produce between two and ten live young, which are born at sea.

Diving

Sea snakes are great divers, being able to dive for over an hour. They only have one lung which is over two-thirds of their body length. In addition to breathing air, sea snakes are able to take in about 30% of their oxygen requirement from the water through their anus and skin. By taking in the extra oxygen they are able to displace the amount of nitrogen in their blood, which prevents suffering from the bends.

Information Source: Great Barrier Reef Marine Park Authority REEF MANUAL: Understanding Essentials of Communication 1999. Mandy T. Etpison, 2004. Palau-Natural History.

Fish

Nearly 1500 species of reef fish are found in Palau. Large schools of reef fish aggregate on the reefs for protection, feeding and breeding. Schooling protects fish from larger predatory species as it is difficult to target one fish when there are many. Reef fish feed in schools at specific areas rich in benthic, pelagic and planktonic food, such as dropoffs, channels, seagrass beds and even corals serve as food for some fish like parrotfish and butterfly fish. Reef fish are herbivores, carnivores and omnivores with specific food requirements in specific habitats. Reef fish aggregate at certain times and locations to breed. This could be due to the physical characteristics of an area such as the presence of offshore currents that enable fertilized eggs to disperse away from areas with many predators. It

Mandy Etpison

School of snapper

is very important not to harass or feed fish that are in schools as it disrupts their natural life cycles of feeding and breeding and threatens their very survival. Fed fish are easy targets because they become conditioned to being fed and do not seek shelter when approached by fishermen.

Spawning Aggregations and Physical Oceanography

Written by Patrick L. Colin, Coral Reef Research Foundation

Spawning Aggregations

Spawning aggregations are where large groups of fishes come together at a specific time and place to reproduce. The numbers of fishes in aggregations in Palau range from just a few dozen individuals, such as those of the smaller parrotfishes and wrasses, to huge groups numbering tens of thousands of fish, such as the bohar (red) snapper and threadfin bream. The places where aggregations of many large reef fishes occur are well known to fishermen, such knowledge helped in olden days to easily catch enough fish for their needs and the locations and timing of the aggregations did not change year to year. Traditional Palauan fishermen only caught as many fishes as they could use, but today with freezers, fast boats and larger populations of people, spawning aggregations can be the focus of too much fishing effort. That is part of the reason why some areas within Koror have been completely closed to fishing (Ngerumakaol) or a seasonal closure is put into effect for some species (groupers). Successful reproduction is the first step in having sustainable populations of fishes in the future and protecting spawning aggregation is critical in that regard.

Photo by Paul COllins

Threadfin bream

Photo by Paul COllins

School of Blackfin snapper

Spawning aggregations are a great phenomenon for your guests to see. Ulong Channel (Ngerumakaol) is well know for its aggregations of three species of groupers around the new moons from April to September. The aggregations of bohar (red) snappers and threadfin bream are found at the south end of Peleliu and some other locations with the spawning occurring early in the morning near the time of the full moon. Some fish, like the longnose parrotfish, spawn in the afternoon on many days at Blue Corner, making it easy to point this out while doing dives at Blue Corner. But to do that you have to be aware of what the fish are doing around you! Some dive shops have trips scheduled specifically to look at the aggregations and observe spawning, but to get your guests to see the actual spawning requires attention to location and time beyond that which is normally required for recreational dives and briefing your guests before the dive as to what to look for. The results when nature cooperates are well worth the trouble (photos).

Guides should also be aware that the spawning aggregations produce fertile eggs, the eggs and sperm being shed into the water where fertilization occurs, that drift away

with the current. The eggs are small and usually spherical, less than 1mm in diameter, and nearly transparent. In about a day the eggs hatch into primitive larvae, which have a large yolk sac they live off for several days. Then the young larval fish have to feed on very small animal zooplankton for the next month, finally growing into a small juvenile fish which leaves with the water column and takes up residence on the bottom. This process, the move from the water column to the bottom, is called recruitment and if the larvae have had particularly benign conditions during their life in the pelagic zone, many thousands of juveniles may suddenly appear on the reef almost overnight. Such events are spectacular to see, but many of those young that made it through their larval life will not live long, as there is often not enough shelter on the reef for all the new recruits, so they will fall prey to small predatory fishes over the course of a few days or weeks. (The Photos that Mandy Etipison has of large schools of baby surgeonfish would go well here).

Tides, Currents and Physical Oceanography

Ocean currents in an area like Palau are the result of two different driving forces. The first is the tide and how the structure of reefs and channels affects the flow of water produced by the rise and fall of the tides. The second is the general ocean currents that occur around Palau.

The tides in Palau have a maximum range of about 1.7m, or a bit over six feet between high and low. These spring tides occur around the time of the full and new moons. Smaller daily tidal ranges, called neap tides, occur on the first and last quarters of the moon, and have a tide range of around one meter or a little over three feet. Palau has a semi-diurnal tide, meaning there are two high and two low tides most days, although the cycle is a bit longer than 24 hours, so some days may lack twin highs or lows. The changing tides mean that water has to move into the lagoon, on the rising tide, or exit the lagoon on the falling tide. Given the overall area of the Palau lagoon, that is a lot of water to be exchanged and consequently the currents produced by this flowing water are strong, and sometimes dangerous to divers and snorkelers.

The strongest tidal currents occur on the mid-tides, between high and low water, while slack currents can occur at either high or low tide. Knowing the tidal patterns, easily determined from tide calendars that tell the predicted times and levels of high and low tide, is important for tour guides. Rising tides, low water moving towards high, can produce great dives, such as at Ulong Channel, when divers can ride the current into the lagoon with the clear oceanic water flooding into the lagoon. At other times, tides can make dives unpleasant, such as when the murkier lagoon water starts exiting the lagoon and reduces the visibility at dive sites.

Tidal currents are found in the large channels, such at Ulong Channel, German Channel or West Channel (Toachel Lengui) and their effects easily seen. More subtle are the currents that course across the shallow barrier reef with the tides. At low tides much of the barrier is too shallow even for snorkelers, even dry in places, but higher tides allow water to flow across the shallow reef with currents reaching a half knot or more in the spring tides. Even back in the Rock Islands tidal currents run through the channel and open areas, either helping kayakers paddle along or fighting against them. Guides should try to work with the currents, and not have your guests fighting Mother Nature! All you need is a good understanding of the tide patterns and how they affect the area where you are guiding.

The second type of currents of importance to tour guides are the oceanic currents which hit Palau. Palau is between two large ocean currents, the North Equatorial Current (NEC), found to the north of Palau and running from east to west, and the North Equatorial Counter Current (NECC), found south of the main Palau group and running from west to east. The NEC is usually found just north of Velasco Reef while the NECC is often at the latitude of Sonsorol/Fana or others of the Southwest Islands. The positions of the currents shift a bit with the seasons, and the main area of Palau has somewhat changeable offshore currents because of this connection. The oceanic currents can produce circulations, called eddies, along the barrier reefs which make the current flow one direction or another along the reef itself. At times the current may switch and flow the opposite direction but still along the reef. With these ocean currents, the tidal currents can also come into play producing a complicated pattern, particularly in shallow water, along the barrier reef.

Drift diving is often the rule along the outer reefs, the current taking dive groups where it wants. Blue Corner and particularly the southern end of Peleliu are notorious for their strong currents. When the ocean or tidal currents run counter to the wind, real problems can begin. Wind against the current causes steep short waves that make being on the surface difficult and often dangerous. They also make it very hard for dive boats to spot people on the surface after a dive, particularly if the current has carried the group some distance from its starting point. As a tour guide, you need to be aware of these and plan accordingly so your guests are safe. They are not familiar with Palau, and rely on you to understand the dangers of the ocean so they can remain safe and have a great experience diving, snorkeling or kayaking in Palau.

The water near the surface in Palau is warm, some of the warmest water found in the entire ocean. The annual range of temperatures is generally about 28 to 29.5° centigrade, or about 82 to 85°F. These are ideal temperatures for coral reefs and help produce the lush reefs of Palau. Water temperatures can vary with El Nino/La Nina cycles, however, with the surface water being colder, as low as 26.5-27.0°C, during an El Nino and much warmer, as high as 30-31°C during a La Nina. La Nina's are bad for Palau, the high water temperature causing coral bleaching and death. This happened in 1998 and to a lesser extent in 2010, and there was coral mortality all over Palau.

The water temperature also decreases as you go deeper, to the freezing depths of the deep ocean. When descending and you hit a layer of cooler water, that is what is called a 'thermocline.' That is not a problem for tourists in Palau, but during El Nino's, when surface water is cool, the colder water comes closer to the surface so the thermoclines are shallow, so that at normal scuba diving depths it can be as low as 22-24°C at times. Your guests will be shivering! On the flip side, when there is a La Nina the much warmer water also extends deeper, so there are no thermoclines found in the depths safe for recreational diving. Nice for divers but bad for corals, even those that live down deep.

Turtles

Two species of turtles are commonly encountered in Palau and use the beaches here for nesting, the Green turtle and the Hawksbill turtle. However, Olive Ridleys, Leatherbacks and Loggerhead turtles occasionally pass through Palau's waters.

Green turtle

The green turtle is the most commonly encountered species. Adults have a smooth, high-domed carapace (shell) that is green in color with brown, reddish-brown or black

highlights and a white underside. Green turtles feed mainly upon seagrasses and algae and can grow as large as 47 inches (119 cm) long and weigh 400 pounds (182 kilograms). They can live to be as old as humans but have to wait 20-35 years to lay their first eggs. Nesting occurs in low numbers throughout Palau but more nests are mainly in the Southwest Islands with some nesting in Kayangel and other areas of Palau.

Photo by Mandy Etpison

Green Sea Turtle

The endangered green sea turtles *(Chelonia mydas)* is found within the RISL. The trade of both hawksbill and green sea turtles is prohibited by the Convention of International Trade of Endangered Species (CITES), which Palau has signed. The green turtle is valued more for its meat than its shell. Population surveys are needed on both species to determine the health of the populations.

Hawksbill Turtle

The hawksbill turtle nest mainly within the Rock Islands. They grow to about 37 inches (94 cm) and weigh 145 pounds (66 kilograms), surviving on a diet of mainly sponges as well as jellyfish, shrimp, etc. The Hawksbill is valued for its thick shell, used in Palau for toluk, women's money and for jewelery, such as earrings and necklaces.

Photo by Paul Collins

Hawksbill Sea Turtle

The hawksbill sea turtle *(Eretmochelys imbricata)* or ngasech is listed by the IUCN as "critically endangered." In 2005 and 2006, the beaches in the RISL had more hawksbill nests than any other recorded location in Palau. Satellite tagging results for the hawksbill sea turtle indicated that there maybe a resident population in the RISL (Kitalong and Eberdong 2006; Klain and Eberdong 2007). Palau's nesting population is the only one known in Micronesia (Maragos et al. 1994). A five year moratorium on hunting these endangered species was enacted. Hawksbill turtles feed upon shellfish, seagrass, algae, sponges, sea anemones and jellyfish.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing
Etpison, T. Mandy. 2014. 30 Years Palau.Tkel Corp The Etpison Museum

Human Impacts

Turtle populations have declined dramatically throughout the world and all turtles are listed as "Endangered" by the World Conservation Union. In Palau, it has been estimated that there are only about 125 green female turtles nesting on beaches and only about 20 hawksbill turtles during an annual nesting period. Turtles are still killed for food and without a moratorium (ban) on turtle meat in coming years, it is likely that they will become extinct.

Turtles are valued by the dive industry. If you see a turtle underwater, keep your distance and do not chase it.

Information Source: Palau Conservation Society Turtle Fact Sheet

Hawksbill Nest Monitoring Program

Written by Yalap Yalap, Palau Conservation Society

The Hawksbill Nest Monitoring Program is visiting five index beaches in the Rock Islands Southern Lagoon, a World Heritage Site, recording hawksbill nests by taking data for successful nests, unsuccessful nests, poaching activities, and destroyed nests by predators. The index beaches are Such, Moir, Ngeanges, Kmekumer, and Ulong. The process is visiting these areas twice a month, two days after full moon and two days after new moon.

The monitoring team consists of the Education Programs Manager as the Project Manager from Palau Conservation Society, two Beach Boys and two Rangers from the Department of Conservation & Law Enforcement of Koror State Government.

Palau Conservation Society

Monitoring Team from left to right: Y.P. Yalap, Zino Asanuma, Phillip Terrenciano, Jr., James and Matlab Rumong

The partnership agencies are Koror State Government, Bureau of Marine Resources, and Palau Conservation Society. Environmental studies students from Palau Community College are in the plan to learn this monitoring program, in the hope for enticement to get into the field of monitoring for turtles of Palau.

Presently, there is a 5-Year Hawksbill Moratorium that began in December 2010 and will expire in December 2015. PCS conducted a successful *Uel a Sechelid* (Turtles Are Our Friends) conservation education campaign in 2001 to 2003. The objective of the campaign was to achieve a turtle moratorium. However, it took nine years to achieve this objective through the efforts of the Mechesil Belau with support from PCS. This program is looking into the effectiveness of the moratorium since outreach from PCS through radio, television, and newspapers to the public, has been continuing since after the campaign.

This program is supported by the Department of State of the United States Government through Palau Conservation Society.

Dugongs

Palau is the only country in Micronesia and one of the few archipelagoes in the world that still has a population of dugongs. Dugongs, or sea cows, are marine mammals similar to manatees and are herbivores, feeding on sea grasses that grow in the waters around the islands. The population here is endangered, having experienced many years of poaching. If you see a dugong out on the water, you are extremely lucky as they are shy animals

Daryl Doming

Dugong

that only come up to the surface to breathe and usually move away from boats. Female dugongs give birth to calves every five to seven years and the calf will stay with the mother, suckling her milk, for up to 1.5 years.

Be careful when driving boats in shallow waters as you could hit one of these slow-moving animals and endanger its life. If you are lucky enough to see a dugong, turn off your boat engine and wait – they have to surface to breathe every couple of minutes, so you may have a chance to watch its behavior for a while.

Palau Conservation Society's Incidental Sighting Program

Palau Conservation Society is collecting information about dugongs, turtles and crocodiles. You could help collect valuable information that will enable us to conserve these beautiful animals for the future generations to enjoy. Please call or visit Palau Conservation Society (488-3993) and collect some Incidental Reporting Cards, which you can keep on your boat or at your shop and fill them out when you encounter these animals.

Sources for Additional Reading:

There are a number of marine life identification guides available from most dive shops and the Etpison Museum. Other books describing the marine life of Palau include:

Pat Colin and C. Arneson. 1995. Tropical Pacific Invertebrates.

Pat Colin. 2009. Marine Environments of Palau.

Gunther Deichmann, K. Davidson, E. Daniels, and G. Taus. 2001. Palau.

Mandy T. Etpison. 2014. 30 years Palau.

Ileb Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

Ann Kitalong. 2012. A Personal Tour of Palau Continues. The Environment, Inc.

Ann Kitalong. 2012, A Personal Tour of Palau. Second Edition.

Sharon Patris, Michael N. Dawson, Lori J. Bell, Laura E. Martin, Patrick L. Colin and Gerda Ucharm. Ongeim'l Tketau Jellyfish Lake. Coral Reef Research Foundation.

Bill Perryclear. The Rock Islands of Palau.

Websites:

www.etpisonmuseum.org

www.mantaIDpalau.org

Internet Resources regarding coral reefs and other marine environment related information:

Palau International Coral Reef Center *(***www.picrc.org***)*

Coral Reef Research Foundation *(***www.crrf.org***)*

Palau Conservation Society *(***www.pcs.org***)*

Etpison Museum *(***www.mantaIDpalau.org***)*

Etpison Museum *(***www.etpisonmuseum.org***)*

Reef Check Up *(**www.reefcheck.org**)*
Plan for preserving and restoring coral reefs

Climate Change *(**www.reefbase.org/input/bleachingreport**)*
Filling reports to help scientists understand coral bleaching

Blue Ocean Institute *(**blueoceaninstitute.org**)*
Focuses on deepening connection between humanity and living seas.

Blue Voice *(**www.bluevoice.org**)*
Documents transgressions against marine life on film.

Conservation International *(**www.conservation.org**)*
Applies science, economics, policy and community participation to protect ecosystems.

Coral Reef Alliance *(**www.coral.org**)*
Works with global communities around the world, helping to solve coral reef conservation challenges.

The Cousteau Society *(**www.cousteau.org**)*
Dedicated to preservation of nature for future generations.

Earth Island Institute *(**www.earthisland.org**)*
Serves as an incubator and support network for more than 30 conservation and restoration projects.

Environmental Defense *(**www.environmentaldefense.org**)*
Links science, economics, and law in environmental advocacy.

Greepeace *(**www.greenpeace.org**)*
Uses nonviolent confrontation to expose environmental problems and to force solutions.

Marine Conservation Biology Institute *(**www.mcbi.org**)*
Works to protect and restore marine life.

Marine Fish Conservation Network *(**www.conservefish.org**)*
Lobbies government officials in support of marine conservation legislation.

Monterey Bay Aquarium *(**www.mbayaq.org**)*
Coordinates marine conservation and research programs.

National Coalition For Marine Conservation *(**www.savethefish.org**)*
Works to conserve the world's ocean fish.

National Environment Trust's Conserve Our Ocean Legacy Campaign
(www.oceanlegacy.org)
Is a broad national effort to build support for ocean and fish protection.

Natural Resources Defense Council *(**www.nrdc.org**)*
Uses law, science and activism to protect the planet's wildlife and wild places.

The Nature Conservancy *(**www.nature.org**)*
Works to protect more than 117 million acres around the world.

New England Aquarium *(**www.neaq.org**)*
Provides leadership for the preservation and sustanble use of aquatic resources.

Mooring Buoy Installation & Maintenance Guide
(www.coralreefalliance.org/divein/eventideas/mooringbuoys.html)

Oceana (www.oceana.org)
Works to restore and protect the world's oceans through policy advocacy, science, law and public education.

The Ocean Conservancy (www.oceanconservancy.org)
Seeks to inform, inspire and empower through science-based advocacy, research and public education.

The Ocean Project (www.oceanproject.org)
Works to promote ocean conservation through zoos, aquariums and museums.

Reef Environmental Education Foundation (www.reef.org)
Seeks to educate and enlist divers in the conservation of marine habitats.

Reef Guardian International (www.reefguardian.org)
Works to protect coral reefs and their marine life

Reef Relief (www.reefrelief.org)
Works to preserve and protect living coral reef ecosystems.

Seacology (www.seacology.org)
Works to preserve the environments and cultures of islands.

Seaweb (www.seaweb.org)
Works to link the media to marine conservation groups.

World Wildlife Fund (www.wwf.org)
Works to save endangered species and wild places.

INVASIVE SPECIES

Written by Dr. Joel Miles Bureau of Agriculture

Tourists come to Palau to see the natural beauty, and this is especially true of the visitors to the Rock Islands. For this reason, it is not an exaggeration to say that your job depends on keeping the Rock Islands and the surrounding waters clean and beautiful. There is a lot that you can do to ensure that the Rock Islands stay beautiful, and enhance your job security at the same time. One of the most important things you can do is to help prevent invasive species of plants and animals from getting into and spreading in the Rock Islands, on land and in the water.

What are Invasive Species? Invasive species are living things – animals, plants, even fungi and bacteria – that can cause damage to the environment, to humans and to society.

According to the UN Convention on Biological Diversity, an Invasive Alien Species (IAS) is "a species that has been introduced into an environment in which it did not evolve, and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health." Invasive species are usually from another country, but in the case of Jellyfish Lake, invasive species could be living things from the lagoon which are not naturally found in the lake itself.

Invasive Species can:

- Cause direct threats to economic sectors (such as tourism, as well as agriculture and fisheries);
- Interfere with the many benefits humans get from healthy ecosystems (like fresh clean water, food, clean air, beauty and so on);
- Cause the extinction of native plants & animals;
- Threaten or damage ecosystems;
- Harm human health.

In some parts of Palau, like the main town of Koror, there are many invasive species, but the Rock Islands have very few, and we want to keep them as free of these harmful animals and plants as possible. As a tour guide, you can help in this effort. Please help Koror State protect the beauty of the Rock Islands, which is essential to your livelihood.

PREVENTION

The most important thing for us to do is to prevent any new invasive species from getting to these beautiful islands and shores, and stop them from spreading from one island or body of water to another.

You can help by keeping your boats and equipment clean, and by informing your tourists, asking them to check and clean their shoes and clothing, check their backpacks, and not bring any living things to the Rock Islands, or bring any living things back either.

Here is what you can do:

- Always check your boat and all equipment and supplies carefully before departure from Koror. Repeat this check whenever you leave one island and go to another. You should look for and remove:
  - Rats, and any sign of rats, such as feces (poop), chewed materials and so on
  - Ants – any kinds of ants
  - Other insects
  - Plants, plant parts, and especially seeds
- Check your own clothing, especially pants and shoes, for soil and/or seeds;
- Ask your customers to check their clothing and backpacks for any insects and/or seeds or soil. Dirty shoes should be cleaned before getting on the boat.
- Do not bring insects or soil to the Rock Islands.
- Please discourage your customers from picking up fruits or seeds of any trees or other plants, because they could be from something invasive. If your customer accidentally drops a fruit somewhere else, they could be planting an invasive species there without even knowing it.
- Please also discourage your customers from picking up seashells, pieces of coral, etc. from the water or shoreline. This applies particularly to customers who are going to visit Jellyfish Lake – there are many types of organisms in the lagoon which are not found in Jellyfish Lake, and these should not be introduced into the lake because they could have harmful impacts on the jellyfish and other living things in the lake.

- Make sure tourists do not bring anything back from the Rock Islands. (This may also be illegal, e.g. if they bring coral or plants.)

EARLY DETECTION

It is easy to remove invasive animals and plants if they are discovered when they first arrive, and before they have a chance to reproduce. As a tour guide, you spend a lot of time in the Rock Islands, so you can become familiar with what belongs there. Getting to know the native animals and plants, as well as the corals and fish, will make you a better tour guide, because you can share this information with your customers. In addition, it can make you a security guard for the Rock Islands: if you see any new animal or plant, please inform the Koror State Department of Conservation and Law Enforcement (DCLE) right away.

What you can do: If you have a camera or cell phone, please take photographs if you can. If it is a plant, try to get clear pictures of the whole plant, a single leaf and a flower (if there are any flowers). Be sure to note exactly where you saw the animal/plant, and if you have GPS, please get the location.

"PACK IT IN, PACK IT OUT"

Always be very careful that you do not leave any food or leftovers at any of the Rock Islands. THIS IS ONE OF THE MOST IMPORTANT THINGS TO DO. Invasive animals like rats and cats will multiply if they are provided food. Be sure to inform your customers that they should not throw away food, and be sure to collect and remove all their left-over food. PLEASE DO NOT FEED THE RATS!

REPORTING

Always report any suspicious or unfamiliar plant or animal to the DCLE. Even if you have seen rats in a particular location before, please report them every time you see them. Your reports will help Koror State seek funding for control efforts. Please give the same report to the Bureau of Agriculture for invasive species on land, and to the Bureau of Marine Resources and Coral Reef Research Foundation, Malakal, for anything unusual in the water.

EXAMPLES OF INVASIVE SPECIES ON LAND

Some of the invasive animals we are concerned about are rats, cats, dogs and monkeys, as well as insects and invasive birds.

RATS: Rats eat native birds and other small animals, and can spread diseases.

CATS: Cats also eat native birds and other small animals. Many people believe that releasing cats will help control rats, but this is not true: cats have much more impact on native birds and lizards than they have on rats. (Cats can be trapped; please report them!)

DOGS: Dogs also eat native birds, and can spread invasive plants. (Dogs can be trapped; please report them!)

MONKEYS: Monkeys are the worst invasive species in Palau; they have wiped out many species of native birds on the island of Angaur, and we do not want them in the Rock Islands, where they could devastate the native birds and lizards. They also

eat fruits and seeds, and can change the composition of the native forest. If you see a monkey, or any sign of a monkey, be sure to inform DCLE immediately.

ANTS: Insects, especially ants, can have impacts on native animals by stinging them, and can also sting your customers. The ant we are most concerned about is called the Little Fire Ant (LFA). This ant has not been found in Palau, but it is in both Guam and Hawaii, so there is a chance that a tourist could accidentally bring it to Palau. Another stinging ant which is found in Koror and Babeldaob is the Singapore Ant. This ant can also live on the beaches of the Rock Islands, and it is likely to sting your customers, making sleeping on the beach very uncomfortable. Both of these ants can easily be moved with food, so you should always inspect your food containers before departing to the Rock Islands, to make sure they do not have ants in them. You can get more information, including information sheets on the Little Fire Ant and Singapore Ant from Koror State DCLE or the Bureau of Agriculture.

CYCAD SCALE: This is a very destructive tiny insect which can kill cycad plants – thousands of tiny white insects completely cover the leaves and suck out the plant's juice. Palau has native cycad plants which are found only in the Rock Islands of Koror and Airai (they look like short palm trees – see photograph to the right). The cycad scale is present on introduced cycad plants in Koror and Babeldaob, so we need to prevent its spread to the native cycad trees in the Rock Islands. Several hotels in Koror have cycad plants, so tourists could accidentally get the scale insects on their shoes or clothing and bring it to the Rock Islands. As a member of the tourism industry, you could work to ask all the hotels to remove their cycad plants, to reduce this threat.

SPARROWS: We are concerned about the spread of the Eurasian Tree Sparrow from Koror to the Rock Islands. These birds are like "flying rats," and can cause the same damage as rats, and they can spread human diseases. Please do not feed birds! If you see a sparrow anywhere in the Rock Islands, please report it to the DCLE for action. Please see the picture of the sparrow, so that you will be able to recognize it.

INVASIVE PLANTS

There are also many invasive plants that we do not want to spread in the Rock Islands. Here are a few of them, with photographs to help you identify them. You can get more information on these and other invasive plants from the Bureau of Agriculture.

Mikania – Mikania has been found on both Ulong and Long Island. The infestation on Ulong has been removed, but we need to be constantly watching out in case some of it survived. There is a lot of mikania at Long Island, especially behind the pile of sand, and along the trail to the rock art. Tourists who have been to look at the rock art should be sure to clean their clothing and shoes before going to other Rock Islands.

Chromolaena – Chromolaena has been found at Ngidech (Lee Marvin Beach) and German Lighthouse trail, up at the lighthouse. Tourists who have been to either of these sites should be sure to clean their clothing and shoes before going to other Rock Islands.

Joel Miles

Mikania flowers and leaves

Joel Miles

Flowers and leaves of Chromolaena

Bidens – Bidens is a small plant with white flowers with yellow centers. The seeds of bidens stick to clothing and shoes. There is a lot of this plant up at the German Lighthouse, so tourists who have been up to the German Lighthouse should be sure to clean their clothing and shoes before going to other Rock Islands.

Rat's Tail – There are two species of rat's tail in Palau, but only one has been seen in the Rock Islands, at Ngidech (Lee Marvin Beach) and German Lighthouse. They are called rat's tail because the small purple/blue flowers bloom along a narrow stem that resembles a rat's tail. The leaves are dark green, wrinkled, with a pointed tip and notches along the margins. The plants are usually 2-3 feet tall, but they can grow taller. The tiny seeds of this plant are in the soil, so tourists who have been to either of these sites should be sure to clean their shoes before going to other Rock Islands.

Adenanthera – Adenanthera is a large tree which can be recognized by its brown trunk, feathery leaves, and shiny red seeds that look a little like red M&M candies (or Skittles). It is very common at the beginning of the German Lighthouse trail, with individual trees along the trail. It is also common at Bital Ocheang (across from the Koror Landfill at M-Dock) and at Ngerchelngael. Please ask your customers not to pick up the seeds, because they may accidentally drop them somewhere else, where they will grow.

Joel Miles

The feathery leaves of Adenanthera

Liberal – Liberal is a small tree, very common on Angaur and Peleliu, and apparently spreading north into the Rock Islands. There is one tree beside the toilet on Ngchelobel, several trees on Ngeanges, and many trees on Ngercheu, where the CARP Island Resort is located. Although liberal is mainly spread by birds and bats, tourists who have been to these islands should clean their shoes before visiting other Rock Islands.

Joel Miles

Leaves and flower of the small tree, Liberal

Telengtungd – This plant, also known as tangantangan, is found at the German Lighthouse and Ngercheu, where the CARP Island Resort is located. The shiny brown seeds are attractive, and tourists may want to pick them up, and then later discard them somewhere else, so please ask them not to pick up any fruits or seeds, but to just look and then leave them where they find them.

INDICATORS OF INVASIVE SPECIES IN THE WATER:

MARINE INVASIVES ARE TRICKY: Because marine animals live in water that is continuous, eg. mangrove connected to lagoon connected to open ocean, and because most larvae of marine animals and plants float around in the water, animal and plant distributions are more widespread. This makes it difficult to spot a non-native or invasive species. They usually colonize around ports or moored foreign boats, especially on artificial substrates (boats, buoys, docks, chain). Being familiar with what is NORMAL is the best way to spot a potential marine invasive species.

JELLYFISH LAKE: Always keep your eyes open for any animal, plant or even rock that looks 'out of place' in the lake, remove it and give it to DCLE. Take a photo in or out of the water if possible. For example, in the past we have found in the lake, a mushroom coral and sand dollar in the water and a live clam in the basket on the

dock. Jellyfish Lake is EXTREMELY vulnerable to any invasive species that might kill the jellies – we will not get a second chance! The brown sea anemone on the sides of Jellyfish Lake is an invasive species that has become established and will always be there. Treat Jellyfish Lake like an island – do not bring any foreign material, live or dead, into it!

CLUMPS OR COLONIES OF UNUSUAL 'OUT OF PLACE' ANIMALS: Marine invasive species are more difficult to distinguish but common types in marine waters are: clams/mussels usually in dense clumps, stinging hydroids usually in dense clumps and sea squirts often on artificial substrates, or any organism that you know lives in a different habitat or looks odd. One confirmed marine invasive species is a hydroid now established in the KB Channel, and later in Ngel and Lighthouse Channels, that was brought to Palau on the floating bridge in 1997.

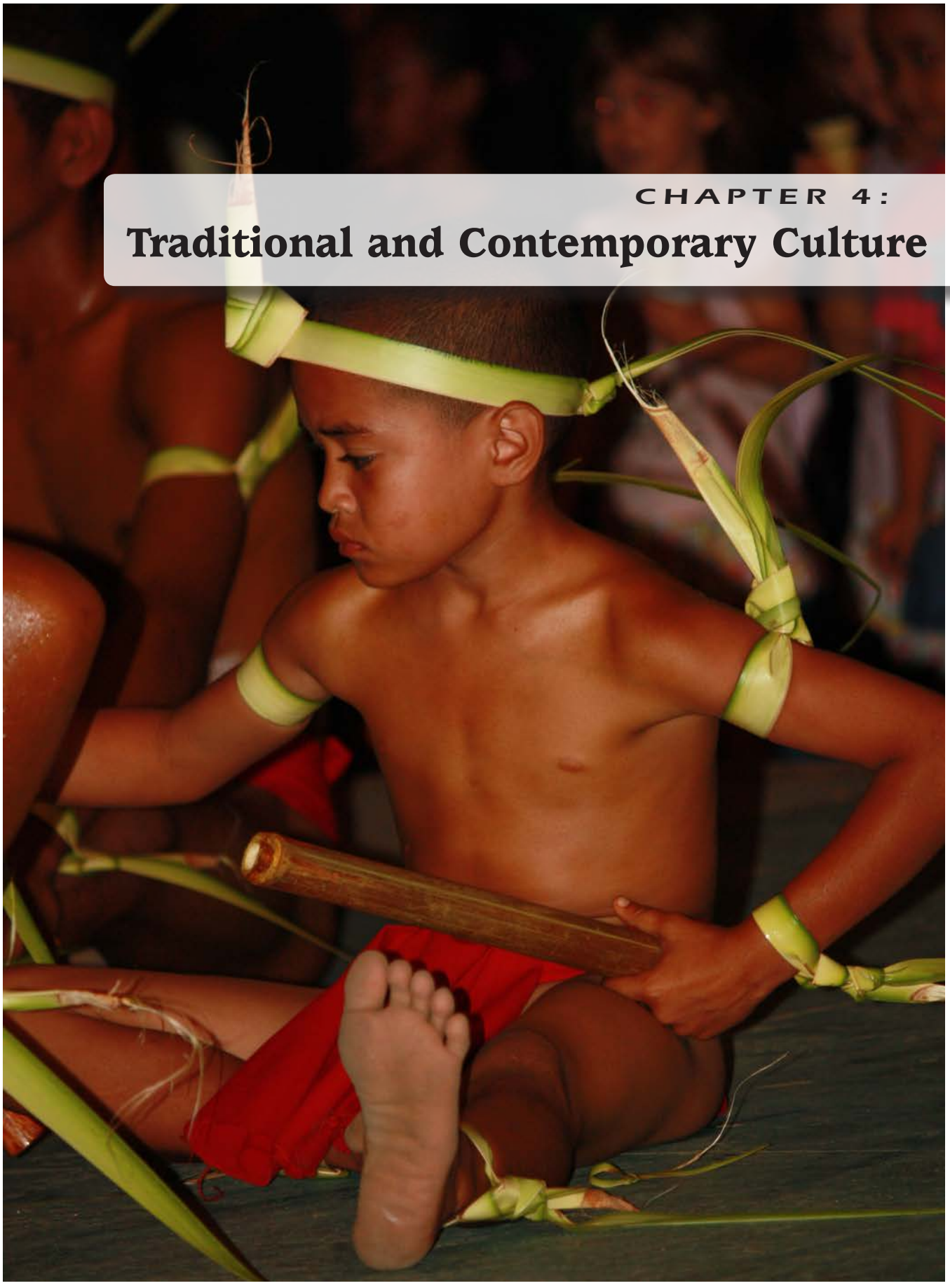
MILKY WAY: If tourists smear their bodies with Milky Way mud, make sure they rinse off in the lagoon water in the vicinity of the Milky Way, rather than traveling a long distance before rinsing off. NEVER go directly to Jellyfish Lake after tourists have been covered with mud! Milky Way mud contains organisms we cannot even see and we don't want to transport them around Palau.

SPECIAL NOTE ON CARP ISLAND:

There are several invasive plants at the CARP Island Resort that are not found at the other Rock Island tourist destinations. These include most of the plants listed above, as well as some others. If your customers have been at the CARP Island Resort, please have them check and clean their clothing, shoes and packages carefully for seeds and soil/dirt before they go to the other tourist destinations.

SPECIAL NOTE ON MONITOR LIZARDS:

Monitor lizards (known in Palau as elub) are NOT invasive: they are native Palauan animals which have been here much longer than humans. They are related to the so-called "Komodo Dragon" of Indonesia, but monitor lizards are much smaller, and are not dangerous to humans. Please show these amazing lizards to your customers, and advise them not to harass them, or to feed them. The lizards seem to have learned that tourists are a source of food, and they often appear when tourists are present, or soon after they leave. Please see the photo to see what this lizard looks like.



CHAPTER 4:

Traditional and Contemporary Culture

Palau Visitors Authority

This section covers a few aspects of Palauan culture, including an outline of cultural sites in Koror.

Palau has a rich, unique culture that is promoted through active participation in customary events within families; national, regional and international festivals; and conventions. The Ministry of Community and Cultural Affairs (MCCA) is the national focal point for history, culture and the arts. The MCCA works with traditional leaders, groups, historians and the National Archives Office; semi-autonomous Belau National Museum; and the privately owned Etpison Museum. The Bureau works closely with the Palau National Commission for UNESCO.

In 2012, The Rock Island Southern Lagoon was inscribed as a World Heritage site for its outstanding natural and cultural value. Koror State developed a Management Plan that includes a Cultural Management Component for the RISL site. Several States also have Cultural Offices and Plans. Palau has a National Register of Historic Sites that are eligible for small US grants to maintain and upgrade with repair and new signage under the supervision of staff archeologists. The Ministry works with archeologists in the region to conduct investigations of historic sites.

CREATION OF PALAU ISLAND: THE LEGEND OF UAB

Written by Society of Historians, Bureau of Arts & Culture

Creation of Palau Island: The Legend of Uab

Uchelianged created a land, Lukes, between the island of Peleliu and Angaur. A clam (kim) living on Lukes gave birth to Latmikaik. Latmikaik gave birth to a fish. After some time the land became too crowded so Uchelianged told the people of Lukes to collect matter from the surface of the water to create an island now known as Angaur. Angaur is considered to be an ancient place with pelagic water surrounding it. Place names started at Lukes when the kim gave birth to Latmikaik. Angaur then was the second place with names. It became so populated and overcrowded, the people living in Angaur divided the island into hamlets and named them. Latmikaik gave birth to a child, Uab. Day by day, this magical child grew rapidly and so did his appetite. Uab's mother sought assistance from the villagers to fulfill her child's hunger. In fear for their own lives, the people set Uab afire. Leaping high up in agony, his body crashed to the surface and fell apart. The various parts of Uab's body formed the Palau archipelago. The people derive some of their characteristics from the portion of Uab's body on which they live. It is said the people of Ngarchelong (northern tip of Babeldaob Island) talk too much because Ngarchelong is one part of Uab's head. People say Aimeliik is formed of Uab's legs and the large island of Babeldaob is the trunk of Uab's body.

Bill Perryclear

Storyboard depicting the Legend of Uab

There are certain categories of places and their names in each state that hold special significance to the community members of that state. Place names show the migration patterns of one's ancestors. Place names also show the different divisions within each state. They can reflect different characteristics or conditions in each state, for

example, names can signify the different types of flora and fauna that might exist in a particular place. Some place names denote sacred places that people should be aware of. Place names can also help us understand the relationships between people in a state or between the states themselves.

Division of Polity: Milad and her Children

The legend of Milad began when the seven Tekiimelab (demi-gods) were searching the land for Temodokl's (one-eyed god) eye. They came upon a woman Dirrabkau who was boiling taro and asked her to cook their fish for their evening meal. With her ingenuity, Dirrabkau cooked the fish and inserted them in the cooked taro, thus making taro fish sandwich. The Tekiimelab took their food and left. Upon finding out the ingenuity of Dirrabkau's taro fish they went back and told her of a great flood which would be coming and instructed her to tell her son, Ngiselacheos, to lash a big bamboo raft in preparation for the flood. When the floods came, she was prepared but, as the water rose her hair caught in a tree and she was drowned. Dirrabkau drowned when the flood came. The Tekiimelab found her body, and they breathed life into her nostrils, at this point she became Milad meaning "was dead".

According to Palauan legend, the goddess Milad gave birth to four children: Imeungs, the oldest son; Olekeok, the second son; Ngerbuns, the third child and the only daughter; and Sureor, the youngest son. After Milad gave birth, she went to the top of a hill called Ometochel and threw four small islands in front of her children as their markers. She threw Ngemolei in front of Imeungs, Ngerutoi in front of Olekeok, Okerduul in front of Ngerbuns, and Ngetmeduch in front of Sureor. These four children of Milad form the four corner posts of Palauan society.

Traditional Village and Identity

Written by Meked Besebes

Traditional landscape of Palau encompasses the traditional village as well as other features that have specific function of serving a purpose in Palau's world view. In this sense the traditional landscape of Palau includes land physical features in which archaeology is unable to determine for lack of tangible evidence. Oral history and ethnographic information can help build the context better and to enlighten the traditional way of life in Palau. A complete stone work village contains a stone path which connects to all stone platforms, docks, as well as other stone features such as resting platforms, bathing pool and other features which are listed later in this paper.

Traditional stonework villages are important to Palauan cultural identity as they physically manifest the ties of community, social status and kinship, and provide a sense of belonging that is "so crucial to every Palauan." Traditional villages are considered to be where the core and souls of Palauans evolved from. Thus, the essential structural aspects of Palauan social and political organization were charted in the mythological prehistoric era of Palau. Place names, names of titles, names mentioned in migration legends, and alliances between individuals or villages from this era remain a central mode of integration today.

A traditional place name is a marker to identify or to locate in detail a specific place. Most have stories associated with each name. Villages which had a previous relationship share places with the same or similar names and there are stories that can explain the connection between the places with the same or similar name. Traditional place names are very significant and extremely valuable to the people associated with them.

The term *kotel* refers to one home village following matrilineal lineage. One's home village is a strong identification and one is a strong member of his or her mother's clan and her village. It can be an insult to say something about one's mother, her clan, or her home village. When a Palauan passes away, he or she must be buried in his or her mother's home place.

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ANCIENT KOROR AND ITS VILLAGES

Koror includes Koror proper and those areas immediately surrounding it. The political unit of Koror includes the small limestone islands known today as the "rock islands" (*ocheall* or rocky place). Despite poor soils and limited supplies of fresh water, villages were established on a number of the hundreds of islands; and the oral histories of Koror and other Palauan districts recount the movement of peoples from and through the rock islands to Koror and throughout Palau.

Village	Poetic	Former Villages (the Rock Islands)
Koror	Erenguul	Cheteet or Ngerengos, Ngermenganged
Ngermid	Chemeliakl	Ngerbodel (Tuangel), Ngerbechedesau
Ngerkesouaol	Melengoes	Ngerielb
Ngerchemai	Meluert	Ocheall island villages
Iebukel	Ekidilas	
Ngerbeched	Tumuk	Desekel, (Ngerengchol)
Ngerkebesang	Musachel	Ermang
Meyuns	None/ new village	

Archaeological data indicates that there were settlements in the rock islands from about 650 A.D. at Uchularois, Ngemelis, to some time in the mid 1600s or possibly as late as the 1700s at Ngerengchol, Ulebsachel.

Archeologists differ over the estimated date by which occupation of the rock islands ceased. Masse, Snyder and Gumerman concluded that the settlements were dated from 1300 to 1400 A.D. Takayama and Osborne have suggested that at least some of the rock island villages were occupied into the 1600s. It is apparent that despite the long period of settlement in the rock islands the people were seeking to relocate, for life on the rock islands was marginal due to both the shortage of drinking water and to the precarious existence of the small reef islands. (What is now Chudel reef off Mecherchar was once the island of Beluucheuar, which was destroyed in a typhoon.)

Information Source: Karen Nero's Dissertation, Ch. 3. p. 18. Making the Balance: The Founding of Koror

PALAUAN MONEY

Udoud

According to legends, some form of Palauan money *(udoud)* may have been in existence in Palauan culture since ancient times. Some researchers believe that Palauan money came from Yap, while others think it is more likely to have come from South East Asia or China. Ornamental beads brought in as recently as the nineteenth century have since been included in the Palauan money system. Nowadays, imitation as well as authentic Palauan money is observed being worn around the neck by some women and children. In the past, only high-ranking women wore Palauan money necklaces, since Palauan money was owned mostly by high-ranking families.

Photo by Palau Visitors Authority

Traditional Palauan money or udoud

Toluk

There is another type of money made of hawksbill turtle shell that is used only by women. This particular valuable is called *toluk* and is used mainly as an exchange for service. It may be accompanied by *udoud* if a particular circumstance requires both. In ancient times, a certain type of seashell *(chesiuch)* was used as money. The toluk eventually replaced this money.

Some of the important events in a person's life or in village functions in which Palauan money was and is still used are in ceremonies or transactions pertaining to birth, marriage, house-building, divorce, adultery, *mur* (elaborate feasts), dance presentations, women's services, penalties, magic, death, inheritance, war and head-hunting, and installation of chiefs. Pictures depicting Palauan money and the legends surrounding it are frequently painted on the rafters of the *bai*.

Photo by William E. Perryclear

Toluk made of hawksbill turtle shell

CANOES

Canoes were a very important part of the culture in Palau. There were four types of regular vessels: sailing canoes, war canoes, cargo canoes, and ocean-going canoes. These canoes were very well built and even heavily decorated, such as the paddling war canoes, which could sometimes reach up to 40ft and could carry up to 30 people.

Canoes can be viewed in several states including Melekeok and Ngchesar.

Photo by William E. Perryclear

Ngchesar war canoe

FOOD

The foods of early Palau were basic and nutritious. They consisted mainly of taro and certain types of fruits and vegetables. For protein, there was an abundance of fish and

other seafood, pigeons and another bird resembling a small chicken (its eggs were eaten, but not the bird). Breadfruit was rare and seldom eaten. Dishes prepared with coconut juice, milk and coconut meat were common.

Food was not only used for nutrition but also a source of pride. Customarily, when a clan sponsors a feast there is more food than can be consumed by the guests. At the end of the feast, the host plans to give food baskets to those who traveled far as sustenance for their journey home. This practice continues today as a good host respects the guests' participation in the celebration.

Photo by Ann Kitalong

Different varieties of taro, a staple in the Palau diet.

Food has always been, and still is, one of the most significant elements in Palauan community events such as marriages, funerals, paying for a house, and every other occasion of importance when people congregate. This is a tradition that goes back to the earliest days of Palauan history.

ROCK PAINTINGS

The southern Rock Islands are considered to be the location of the earliest settlements in Palau. The expanding population later moved north, where agriculture was easier on the flatter more fertile lands of Babeldaob.

On top of the Rock Islands, remains of ancient stone pathways and village sites can be found overgrown with dense jungle. Pathways can be seen about 40ft above the waterline on many of the island cliffs. Some believe these are the eroded remains of previous wave undercuts before the sea level dropped to present levels. Several of the pathways are flat, over 6ft wide and give the impression of being man-made. Most are overgrown and difficult to see, but some can be seen from boats.

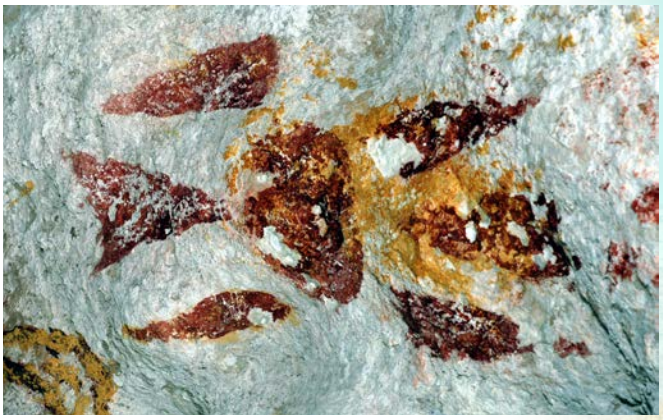


Photo by Kevin Davidson

One of many rock paintings found on Ulong Island.

Caves are often hidden along these paths, with pottery shards or human remains evident. These areas were obviously inhabited by people centuries ago, and cannot be confused with caves where Japanese soldiers fought during WWII. The Japanese caves are along the waterline, some with metal gun shells or pieces of guns evident. Also, almost all Japanese pottery was glazed, while the old Palauan pottery shards are unglazed and primitive.

Hundreds of pictographs can be found on the cave walls and along the pathways of the Rock Islands. The same yellow and red paints are used, although stylistically, every site is different.

On Ulong Island, one of the largest collections of pictographs can be found. The drawings here are of a symbolic design, more impressionistic than others found so far. The designs almost seem to be stenciled onto the rocks.

Another site, called White Cliff, is close to Lighthouse Channel in Koror. One can easily see the red paintings on the pathway from a boat. The pictographs here clearly show human figures, hand prints and canoes, and are of a very different style. At both sites, caves can be found behind the pathways containing pottery shards and some human bones. One of the caves at Ulong has a cooking pit inside it with shell tools and pictographs evident deep inside the cave. The pictures inside are badly eroded due to moisture.

Pictographs have been found on eight different islands and many more may exist hidden behind vegetation. This rock art shows no resemblance to any known rock art in Micronesia and has not been dated. Palauans were only familiar with the rock art at Ulong and explained it as being the work of the god called Orachel. Orachel was practicing his painting on these rocks before going up north to show the Palauans how to decorate their meeting houses with paint.

Ulong Island

The Ulong Complex consists of three major and three minor raised coralline reef islands. Once a single limestone landmass, the three islands are now separated by shallow tidal channels.

The largest island of the complex, Ulong, is a high, rugged landmass composed of layered limestone oriented along a northwest azimuth. On its west side, Ulong has one of the largest of the rock island sand beaches. Otherwise it is bordered by an erosion notch punctuated by small coves and beaches. The beach flat is bounded on the east by a steep cliff face that rises 30-60m and splits into two arms to form a large, sheltered cove in the southeast. The karst terrain contains numerous sinkholes and two marine lakes. Like other rock islands, Ulong is heavily vegetated with coconut palms *(Cocos nucifera)* and several introduced vine species on beach areas and native trees, dominated by *Hydriastele palauensis, Semecarpus venenosus,* and *Cordia subcordata,* more common to the limestone substrate. Animal species frequently observed on the island are the megapode *(Megapodius laperouse senex),* introduced rats (*Rattus* spp.), and the common tree snake *(Dendrelaphis lineolatus).* A tourist structure equipped with a fireplace and seating is located on the beach flat. Signage with information about the stonework village site is located to the south.

Information Source: Dr. Geoffrey Clark, and Dr. Christian Reepmeyer, Australian National University and Jolie Liston, Australian National University in RISL World Heritage Dossier.

Oral history

Palauan traditions recount how Osilek, the rich chief of Ulong, married the beautiful Oreng. Oreng's mother was widowed and indebted to the generous Osilek who fed her. Oreng's mother asked her daughter to marry Osilek as she had no other means to repay his generosity. Oreng respected her mother and consented to marry Osilek although she was truly in love with Mariar of Metukeruikull Village in the nearby Island of Ngeruktabel. Mariar died from a broken heart when he heard that Oreng had married Osilek. When the news of Mariar's death reached Oreng, she travelled to Metukeruikull for the funeral and was found dead embracing Mariar's corpse. In another story, Osilek forced Bieb of Ulong to marry him when she was in love with Matkerumes from Ngeanges Island. Bieb contracted a disfiguring disease, but was cured by Matkerumes with *ditmechei* (ti, *Cordyline terminalis).* When the couple was departing Ulong, Bieb's

mother tearfully followed them into the sea and turned into a clam, whereupon Bieb dove into the water to join her mother. The story warns that those who own a *bieb* (Biib, Palau Fruit Dove, *Ptilinopus pelewensis)* should not eat or bring clams into the house.

The attack on Ulong by warriors from Ngemelis is recorded in the proverb *"ko er a mekemedil a Ulong el dob er a kebesengei"* ("like the war at Ulong, which came in the evening"; Parmentier 1987). After their defeat, the people of Ulong fled to the volcanic island of Ngerekebesang in Koror, where the chief of Ulong had forged a recent alliance. Others from Ulong moved to Ngaremlengui and to Ngeburech village near Melekeok on the island of Babeldaob.

After a number of years, the Ngaremlengui group decided to join those in Ngeburech. Without a sufficiently large money bead to repay their Ngaremlengui hosts for their past hospitality, the immigrants made payment by repaving the stone paths and platforms of Imeong village (Snyder et al. in prep.). After their defeat, the Ulong people traded a famous piece of curved money bead *(bachel)* known as *Kedam* to acquire land and relocate to Babeldaob (Osborne 1966).

In Palau's oral traditions, the demi-god Uodel instructed the women of Ngerkesoaol village to stand on Tuker hill in Oreor (Koror) and wave their ceremonial *telutau* mats toward the west for one month. As a result, the *Antelope* wrecked on Ulong in AD 1783 and Koror became rich and powerful by gaining access to the foreigner's exotic goods and powerful weapons (Nero 1987). *Telutau* mats are associated with the gods and, according to this story, it was Palauans acting at the command of, and through, their local gods that brought the foreigners who played such a decisive role in Koror attaining wealth and status (Nero pers. comm.; see Krämer 1926).

Cultural sites

Ulong Island has the most significant set of cultural remains in the Rock Islands. The island contains four significant sites that span Palauan known rock art in Micronesia and has not been dated. In addition to a spectacular rock art gallery. the Ulong cultural sites include:

- The oldest cultural deposit in the Palau archipelago dating to 3100 years ago.
- An intact stonework village system dating to the last 1000 years. The abandoned stonework village, located on the southwest beach flat and surrounding limestone slopes includes a large defensive wall fronting the beach and trails to stone terraces, walls and platforms in the limestone. Associated with the stonework are thick deposits of shell midden and pottery.
- The survivor camp of the East India Company packet, the Antelope, which was wrecked on the west barrier reef of Palau in AD 1783. The well-preserved remains of the camp and textual records of the encounter are a unique record of initial cultural contact between Pacific Islanders and Europeans.
- A complex of caves and a large eroded overhang marked with a diverse and sophisticated assemblage of red-painted rock art that is unrivalled in Micronesia.

Early human settlement: The oldest cultural site in the Palau archipelago is located in the southwest of the island where subsurface deposits have been dated to span the period from 500 to 3000 years ago (Clark 2005; Clark et al. 2006). Deposits of a similar age have not been located on the volcanic land masses due to island subsidence, the

burial ofc oastal sites beneath eroding upland sediments, and the presence of highly acidic soils that chemically degrade prehistoric remains. Stratigraphy at the Ulong site extends to a depth of 2.5m and holds a unique record of Palauan material culture and lifeways, particularly human use of the marine ecosystem over a 2500 year period.

Stonework village system: Ulong Village contains several stone features, including a large defensive wall, a walk-in well on the beach flat, and several terraces and stone platforms on the slopes and ridges to the south and east. More than 16 stone features were observed in the 2010 survey which followed the substantial investigations of Osborne (1966, 1979) and Masse et al. (1982). The 2010 work recorded more terraces (F-16 to F-18).

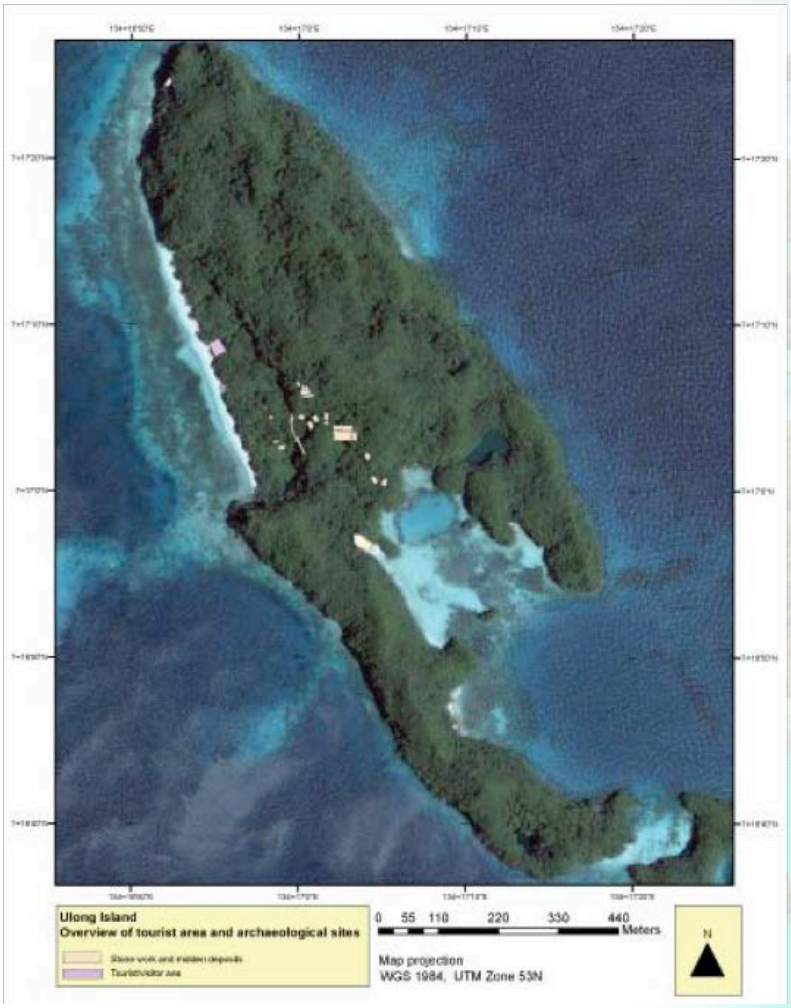
Village features

The main stonework feature is a defensive wall (F-5). The wall, measuring approximately 80m long, 3-4m wide, and up to 1.5-2.5m high, has two entrances. Sections of the dry-stacked feature are well preserved especially in the north and just south of the first entrance. The wall consists of medium to large coralline limestone boulders (maximum boulder size is 80cm x 80cm x 40cm). An 85cm high and 120cm deep step on the wall's interior allowed defenders to guard against attacks from the beach. Recovery of a large quantity of stone tools and ceramics manufactured on the volcanic islands highlights the close relationship between Palau's limestone and volcanic islands. Based on stratigraphic and radiocarbon results the Ulong village stonework dates to 950-550 years ago. Ulong was probably abandoned around AD 1600 as the village and the entire island group were uninhabited at the time of the Antelope shipwreck in AD 1783.

Survivor camp of the packet Antelope: European maritime expansion in the 18th century had a momentous effect on many indigenous Pacific societies. The preservation of sites exemplifying and illustrating the initial contact and interaction between the West and the Pacific are extremely rare. The Antelope survivor camp on Ulong is one such site. In AD 1783, a British East India Company packet, the Antelope, commanded by Captain Henry Wilson, struck the outer barrier reef of Palau several kilometers north of Ulong. The event initiated sustained and significant contact between the people of Palau and the world's colonial powers. For the next 200 years Britian, Spain, Germany, Japan and the United States played a role in Palau's development.

The Antelope's 49 crew members established a camp in a protected cove on Ulong's south side. Palau's oral traditions record this momentous event of first sustained

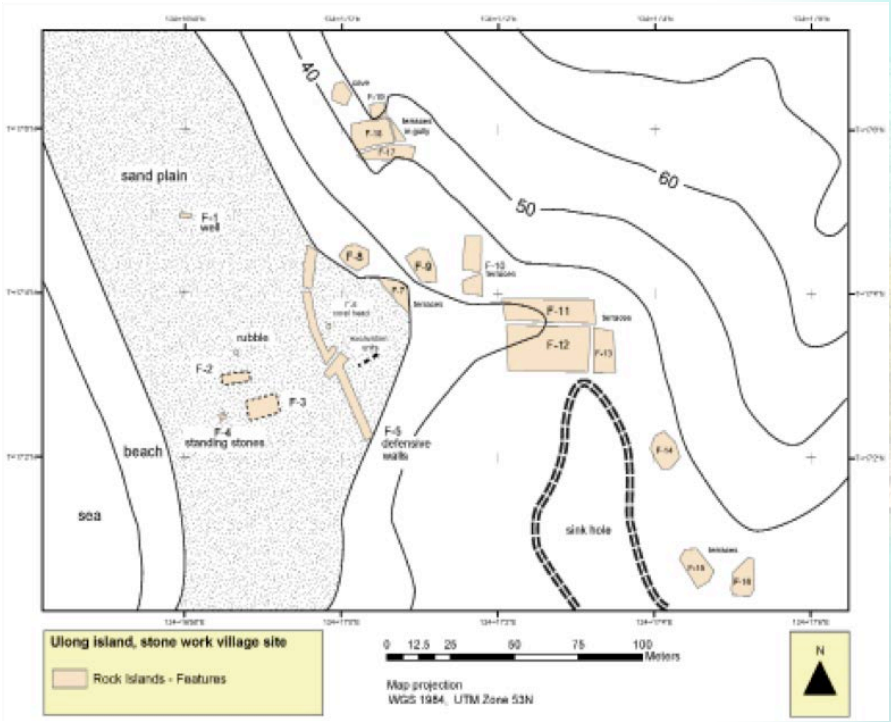
European contact; an event that would lead to the elevation of Koror in Palau's hierarchically structured society. The poet and playwright George Keate (1789) wrote an immensely popular book based upon the crew's experiences entitled *An Account of the Pelew Islands.* A recent archaeological and geophysical study relocated the remains of this camp to provide exceptional documentation of the history of contact between the shipwrecked crew and Palau's chiefs and commoners (Clark and de Biran 2010).



Clark/Reepmeyer – ANU

Ulong Island archaeological sites and tourist facilities

At the time of contact, the two major political entities competing for superiority in Palau were Koror (headed by the Ibedul) and Melekeok (headed by the Reklai). Communication between the Ibedul of Koror and the British-Chinese crew on Ulong was facilitated through a shipwrecked Malaysian who spoke both languages. The Ibedul used the *Antelope's* crew and their weapons to gain an advantage over Melekeok to the north and Peleliu to the south. Koror was hence able to establish itself as the central place in Palau, a position that it maintains today. Important connections were made with the East India Company and Britain through the Ibedul's second son, Lee Boo, who travelled to London with Captain Wilson before dying of small pox in December 1784.



Clark/Reepmeyer – ANU

Ulong stone work village features

The historical significance of Lee Boo's journey to Britain is marked in the landscapes of both countries. In London, there is a Rupack [*Rubak,* "male elder"] Street and Captain Henry Wilson's retirement home in Colyton, currently listed as a British heritage property, is called "Oroolong House" [*Oroolong* = Ulong]. Lee Boo is buried in the churchyard at Rotherhithe, England. His tomb bears an inscription written by George Keate: "Stop, Reader, stop! – let Nature claim a Tear – A Prince

of Mine, Lee Boo, lies bury'd here." Palau displays a statue of Lee Boo on the grounds of the Palau Community College. The statue's plaque reads in part: "While in London, Prince LeeBoo became Palau's de facto ambassador of goodwill to England and Palau's first true scholar." Painted on the nearby *bai* (men's meeting house) is a sequence of pictographs illustrating the arrival of the *Antelope* and subsequent events from a Palauan perspective. There are memorial tablets to British-Palauan relations on the west side of the beach on Ulong, in St. Mary's Church, Rotherhithe, UK and in St.Andrew's Church, Colyton, UK.

Rock art overhang and associated caves: A large overhang on Ulong's northwest coast holds one of the premier painted sites in the Pacific, a dense and spectacular concentration of red rock art. Called – lecheklel Orachel (Orachel's drawings), traditions say that the Ulong Rock art, and the smaller assemblages identified on five other Rock Islands, was made by the culture hero Orachel. He is also known for discovering the secret to making and decorating the wooden *bai* structures. His brush was possibly a quill made from the coconut spathe and paint made from charcoal, squid ink and red pigments. Orachel's final drawing made while he was turning to stone was the spectacular rock art of Ulong.

Photo by Mark Willis

Ulong red-painted rock art

Ulong Island is probably the very first place in Palau that foreigners landed. In 1783, Captain Henry Wilson was shipwrecked on the *Antelope.* He and his crew came to the island and set up camp and started to build another boat. Captain Wilson came to understand the people of Palau and realized that they had seen neither iron nor steel tools. He showed them how to use many tools and gave them new ideas about the outside world. After the completion of his boat, Captain Wilson agreed to take Chief Ibedul's son, Lebuu, to England. He thought that if this young man could be educated in England, he would someday return to his people and be able to educate them. Unfortunately, six months after his arrival in England, Lebuu became ill from small pox and died. He was buried in England in Captain Wilson's family graveyard. Captain Wilson returned several years later to Palau, bringing gifts such as sheep, goats and pigs to the Ibedul. Ulong is a significant cultural and historical site in that it signifies the beginning of the first written history about Palau.

Information Source: Olkeriil, I. 2011. Rock Islands Southern Lagoon as Nominated by Palau for World Heritage Listing

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STONE MONOLITHS

Stone carvings are found all over Palau, mostly on Babeldaob and Koror. Some were used in religious rituals, while the purpose of others is unexplained. Stone pathways, sitting stones and platforms of houses and villages can still be found almost intact around the islands. Stone monoliths and free standing carvings can be seen along the road of Melekeok State. Some of these carvings are ten feet tall.

These stone faces called *Klidm* by locals are found in many different styles. Some have fearsome, aggressive faces with large sunken eyes and fanged mouths. Others are more realistic, with fully formed features and an outline of a head, like the one found in Ngerbodel village, Koror.

None of the stone faces have been dated and it is unclear who made them or for what purpose. Local legends tell of gods or spirits who made them, or that they were people who were turned to stone by gods. The stone type they are made from is not long-lasting and algae growth makes the features disappear over the years

Photo by Ann Kitalong

Dirrangerekesauol or mother and child found in Ngermid, Kororo.

Another carving of interest in Ngermid, Koror, is called Dirrangerekesauol. Local legends say that it represents a mother and child turned to stone, others say it shows a lizard or crocodile, or a stone face with fanged teeth and sunken eyes, and a smaller face carved on its head. Most researchers believe these stories were developed to explain the stone carvings which may have been made by people other than the Palauans.

BAI

Written by Dr. Patrick Tellei, President, Palau Community College

Of all the things that represent Palauan culture, the Men's House, known as the *"bai,"* is the most iconic symbol, and the most often photographed. The most visible are the *Mad el Bai,* which is the east-facing front, and *But el Bai*, the west-facing rear, respectively.

The Palauan *bai* is iconic not just because of its impressive structure, but what it has come to represent over hundreds of years in the eyes of sojourners and explorers who have come to Palau centuries ago up to now. It's also very significant due to the way it

is constructed, how it symbolizes the community, and the way the knowledge of how to build this impressive structure is passed from one generation to the next.

The building of the *bai* requires a holistic knowledge of nature. It requires understanding of seasons, of plants and trees, of shrubs and weeds, soil and its properties, and also of destructive insects and things that infest buildings, as well as construction methods. One is a skill and one is a technique. The tradition requires people that know how to build and others who know the ornamental designs (different specialists).

There are different kinds of *bai.* These are B*ai er a Klobak, Bai er a Cheldebechel, Bai er a Taoch,* and *Bai er a Chelid*. The most important, most significant, most elaborate, and the one that has all the complete parts and ornaments is the *bai er a klobak,* the seat of the council of chiefs of each village, such as Bai Melekeong in Melekok, Bai er a Meketii in Koror, Bai er a Keai in Aimeliik, and Bai er a Ngara Irrai in Airai. The second most important *bai* in the community is for the secondary tier of chiefs, such as Ngaruchob of Melekeok and Ngaracheritem of Koror. These *bai* are called *chosobuulngau el bai.* The third tier of the *bai* is at the village level, such as *Bai er a Oldesibel* in Ngerubesang, Melekeok *Bai er a Ilulk* in Ngeraus, Ngchesar, *Bai er a Tuich* in Ellab, Ngaraard, and *Bai er a Mellabedch* in Ngerusar, Airai.

The remaining *bai* such as *tetib bai* and *bai el beluu* are used by women and all community members for many kinds of functions such as feasts, planning meetings, meetings for fishing expeditions, meetings to plan dances, to welcome guests from other villages, and in contemporary times, meetings to receive leaders of the government to speak to the community. In contemporary communities of Palau, at the state and community level, there are centers built with national funds that exist to serve the purposes of the last tier of *bai,* like the *tetib bai,* such as Ked Center in Airai, Oikull Center in Ngerikiil, Ngarachamayong Cultural Center in Koror, and the community center in Ngerchemai.

Mad el Bai of
Bai er a Klobak in Koror

But el Bai of
Bai er a Klobak in Koror

Photos on page by Patrick Tellei

The Knowledge of Bai Building

The holding of the knowledge of the traditional *bai* building was exclusive and proprietary in traditional Palau. After World War II, the only *bai er a klobak* that was still standing was *Bai er a Ngara Irrai* in Airai, which was built at the turn of the previous century, about 1890. The next *bai* to be built was *Bai er a Ngesechel a Cherechar* in 1968, at the Palau Museum in Koror under the direction of the Palau Museum (now Belau National Museum) authorities. It was built by Ngaratabelik, a men's group from Ngeremlengui. This *bai* was tragically destroyed by fire in 1978. The new *Bai er a Ngesechel a Cherechar* was rebuilt on the same site and completed in 1991 with funds appropriated by the Palau National Congress, Obiil er a Kelulau. In 2013, it was completely renovated by the young men's group Ngar Osichii of Ngerubesang, Melekeok.

About 30 years ago, there were very few left who held this knowledge, and Palauan elders realized that when the current generation of the bearers of the knowledge of how

to build the *bai* died out, the skills would be lost for good. The bearers of knowledge are the people who direct the loggers, builders, carvers and artisans in the construction and decoration of the *bai.* This knowledge was traditionally passed on through the generations (to children or siblings) as part of their inheritance. This process is called *oidel a chas,* meaning passing down knowldge from one generation to another.

The liberation of this thought process led to the building of the Bai Melekeong in about 1983 (the Melekeok council of chiefs' *bai).* It was first one to be built in Melekeok since the last *Bai Melekeong* was dismantled and used for fortifications by a garrison of Japanese soldiers prior to the end of World War II. This was done at the time when people felt that the building of the grand bai had been lost. The completion of *Bai Melekeong* was a kind of renaissance and reassured the community that the knowledge, although scattered among so many different artisans and builders, was not entirely lost. So the building of *Bai Melekeong* served as an impetus to reawaken the tradition of *bai* building.

Traditionally, the people of capital villages, such as Melekeok and Koror, did not build *bai* (or canoes). Befitting their high status, they would order a *bai,* specify the size, and designate the *cheldebechel* who would build the *bai.* In fact it was expected that they "spread the wealth" by paying other villages to carry out the building of these traditional structures. Melekeok could thus order and pay for a *bai.*

Contemporary Bai Building

The building of this *Bai Melekeong* ushered in a new phase of *bai* building. First, the people of Melekeok would now build the *bai* instead of ordering it to be built. Also, instead of traditional bearers of knowledge working in isolation, the young people's groups were allowed to observe so they could absorb the knowledge, sometimes with no words to teach them, just watching and doing. Before long, Before long, *Bai Melekeong* was completed.

The *Bai Melekeong* structure was built next to the main road; it was milled, cut, marked, fit together, and carved with depictions there to allow maximum participation and observation by young and old, local residents and visitors alike, in anticipation of liberating and spreading this knowledge to the maximum number of people. Once it was fit together, a traditional approval feast was held that allowed the opportunity for the chiefs to review their soon-to-be-completed *bai,* making comments or recommendations and giving their final approval. Afterward, it would be dismantled and manually carried a mile to the traditional location where *Bai Melekeong* had stood for centuries, the same site where the Ibedul of Koror, accompanied by Captain Wilson of HMS Antelope, paid a visit in 1783 to the Reklai of Melekeok and the Artingal community. On that spot, the new *bai* was reassembled.

While the *bai* was being assembled, news spread that the young men of Melekeok were building a traditional *bai* using traditional methods. Villages and states around Palau and their councils of chiefs began sending people, both to offer food tributes and, at the same time, to observe the construction and the renaissance being brought forth by the young men of Melekeok. A particular group of chiefs of Aimeliik, called Ngarkeai, paid a visit to Melekeok and were the first group to request the young men of Melekeok to build the chief *bai* in Aimeliik, receiving approval, securing funds, and arranging for the construction. The chiefs of Melekeok graciously agreed to their request to be the next, because the state of Aimeliik, or Ngerbuns (the traditional name of Aimeliik), is the sister of Melekeok, the only female child of mythical Milad. The other two children of Milad were sons, Imeyungs (Ngeremlengui) and Koror.

After the Aimeliik *bai* was successfully built in 1988 on the traditional Ngarkeai chiefs' platform, word further spread that there was a group of young men (Ngaramelangchadof Melekeok) capable of building traditional *bai*. The next request came to build one at Ngarachamayong Cultural Center in central Koror, through the Bilung (chief matriarch), Gloria Gibbons Salii of Koror, the head of *Kerngab* (female counterparts of the chiefs of Koror). She is also the head of Ngarachamayong Women's Group (a group of female elders representing all sixteen states in Palau). After the Bilung had taken the initiative to build the US$2.5 million contemporary cultural center, she realized this complex would not be complete without a *bai e ra klobak.* She ordered the largest traditional council of chiefs' *bai* that exists in Palau today to be built. Since the *bai* would be built in Koror she wanted it to be the largest, widest, longest, grandest and most elaborately decorated *bai* to be built in modern times. Completed in 2007, it consists of ten sleepers called *bad,* a kind of foundation beam. In comparison, the existing *Bai er a Ngesechel a Cherechar* at the National Museum in Koror, *Bai Melekeong* in Melekok, *Bai er a Keai* in Aimeliik, and *Bai er a Ngara Irrai* in Airai all have eight sleepers. Not only that, the material used was a very tough and hard-to-work-with wood called *btaches ked,* which was made possible owing to sophisticated sawmilling equipment available now in Palau.

The ten sleepers (foundation beams) of Bai ra Klobak.

To describe all the ornamentation, depictions and symbolism in the *bai,* we will use as an example those that can be found at the *bai er a Klobak* that was constructed at the Ngarachamayong Cultural Center, and also of *Bai Melekeong.*

Bai Construction Materials

The method of construction is as follows. Each village has a village center where the *bai* is built. The stone piers, upon which the sleepers rest, rise from a stone platform in this village center.. Resting on top of the ten sleepers are two longitudinal *uchutem.* The ends of the *uchutem* are connected across by beams called *kuoku* at both ends of the *bai, mad el bai* (front) and *but el bai* (rear). On top of the *uchutem* rest the *kboub* (walls) and *chad* (posts). *Chad* also means "person" or "man" in Palauan. The four corner posts of the *bai* are called *saus.*

Stone platform at village center with stone piers.

Two longitudinal uchutem beams rest on top of the ten sleepers.

Corner post saus (on left corner) and chad posts resting on top of the longitudinal uchutem beams and the kuoku end beams.

The foundation sleepers rest on top of the stone piers.

Photos on page by Patrick Tellei

At the Ngarachamayong *bai er a klobak* building site, there are twenty piers on the stone platform. The ten sleepers rest on top of these twenty piers. The *uchutem* beam rests on top of the sleepers. The ends of both beams

are connected by *kuoku*. On top of the *uchutem* beams rest walls (k*boub)* connected to posts *(chad).* These chad are located at each side of a door. There are six entrances, so there are twelve chad. There are four corner posts called *saus.*

Ellabed resting on bad and rekoi.

Inside view of BaiMelekeong showing rekoi, ellabed and imuul

On top of the *kboub, chad* and *saus* there are *tenons* (tongues that fit into mortise holes), and all are held together by *orsechokl* that are mortised and fit onto these *tenons* on top of the post. Fitted on top of the post is another beam called *ongrangre*.

The iis (threshold) is framed on either side by doorposts called chad, and both rest on the kuoku beam.

At the front of the *bai,* the *iis* (threshold) is mortised and connects the two chad posts, and both rest on the *kuoku.* The two *saus* are mortised and fitted onto *tenons* and rest on the corner where the *uchutem* and *kuoku* beams meet.They are held in place lengthwise by the *orsechokl* (top plate) and crosswise by a part named *olik* with a lap joint.

The *ellabed* is mortised and fitted via *tenons* to the top of the sleeper beam, where it is held in place by *rekoi,* a piece of wood with a curved-up end to hold a mat in place. It is also traditionally a place of sanctuary. If the *bai* is under attack and a man is afraid for his life, he can jump up to the *rekoi* for shelter there, and his life will be spared. However, by so doing, he irrevocably abdicates his manhood and must wear a skirt and work in the taro patch with the other women for the rest of his life.

Olik on top of ongrangre

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As mentioned, the *rekoi* is mortised to the *ellabed* post, and the end of the *rekoi* rests on the *ongrangre* (primary top plate) and is lashed to it. The *imuul* cross beam is mortised and sits on top of the *ellabed*. The bottom of the rafter sits at the back of the *rekoi* and extends all the way to the ridge on both sides. Both sides of the rafters meet at the middle right on top of the ridge *(buadel)* and form an X. The *buadel* is held in place by the *otekrikr* kingpost, which is mortised and fixed via tenons to the *olik* at the bottom and the *buadel* on top. The bottom of the X is the ridge. At the top of the X made by those two crisscrossing rafters is a piece of wood called *rael* that is defined as the path or way of the spirits.

In order to hold the rafters in place, a rope is wrapped from the bottom of the ridge all the way around a minimum of five times (from the *buadel* ridge over to the *rael* and down around the ridge again). In order to tighten the two parallel pieces of wood further together, another rope is wrapped around them, pulling the top and the bottom closer together; the term for this technique is *cheleas.* This is the same word that is used in the context of the Palauan family adoption tradition. When a couple adopts a child from another family, in order to create a closer relationship, tributes of fish or food are brought to them to further strengthen the ties, the way the rope tightens the rafters together in the *bai.*

There are three beams corresponding to each rafter, equaling the number of sleepers (for ten sleepers there are ten corresponding rafters). The lowest one, the *imuul,* is a

beam mortised and fixed via *tenon* to the top of the *rekoi.* The rafter is lashed to the end of the *imuul* at both sides of the *bai.*

Both sides of this *imuul* beam are where the most significant legends and mythologies are told about each particular village that owns the *bai,* focusing on the exploits of the men, women and leaders of the past. Thus, the stories carved at that level are of that significance: who said what, who won what, etc. Note that although the bottom beam holds all the significant stories of that capital village, they are ranked from east to west in order of importance. The most important ones start on the east beam (and are carved on both sides).

This beam reaches across the *bai* from one side to another. *Imuul* is defined as "going to the other side" – from an engineering standpoint it is balancing the load from one side of the sleeper to the other. From a traditional Palauan standpoint, it is the way by which the whispered counsels and traditional policies, rules and regulations *(kelulau)* travel from one side of the *bai* to the other side. The ten chiefs of the ten village clans within a *klobak* are divided into two opposing sides called *kaucherareu.* These chiefs always sit on opposite sides of the *bai.* This mutual opposition provides checks and balances in decision-making that are good for the community. The odd-numbered clans sit on one side headed by one chief while the even-numbered clans sit on the other side headed by the second chief. This is the heart of Palauan tradition: maintaining a balance. Everything has two sides.

The second beam, which is lashed at the midpoint of the rafters on both sides, is called *omkuuk* which literally means "to spread." This beam holds all the weight of the roof and keeps all of the roof members from crashing into the center of gravity. On both sides of this beam are carved the stories of villages in alliance with the capital village that owns the *bai,* other lesser legends of the community and villages, and spillover from the first *imuul* beam (i.e. whatever major stories could not be accommodated there). *Omkuuk* also has another meaning: "to spread and make widely known." Some lesser-known stories of exploits that find themselves on the *omkuuk,* when told over and over again, will attain more importance and eventually move down to the lower beam.

Next, the highest beam, just below *buadel* (the ridge), is lashed likewise from one rafter to another, and is called *reberball.* This means "to be seated at" (by the spirits). The carvings and depictions on this beam are anecdotes, clichés, old sayings, proverbs, and at times, admonishments.

Photo by Patrick Tellei

God of Construction, Chedechuul.

There are four *delal a duus* (purlins), which literally means "the mother of all purlins" (longitudinal structural parts of the roof). The *delal a duus* is the principal purlin that is tied to the main rafters. The rafters, called *seches,* are tied to the *delal a duus* from the *ongrangre* all the way to the *rael,* the entire length of the *bai.* The *delal a duus* protrudes at both ends of the *bai* and holds the rafters and the *ongiau,* the fascia board that is decorated from the bottom to the top. The *ongiau* is decorated either with *belek* (spirit faces) in Koror or *dellerok* (money birds) in Melekeok. Where the *ongiau* meet at the top, they are decorated with the God of Construction, Chedechuul. It is normally a face with eyes, a nose and a long beard wearing two *chelbucheb* money beads on each ear. The second set of *duus* is tied to the rafters and extends from beyond the *ongrangre* all the way to the *rael.*

The *osekidel,* which is made of bamboo, is tied to the purlin from the lowest *duus* all the way to the *rael* and criss-crossed at the top to form another X. The *osekidel* is where the

thatched roof (hand-woven from coconut fronds) is tied in place; each piece of thatched roof is tied to three *osekidel.* On average, from the bottom to the top of one roof section, measuring five- to six-feet wide, there are 190 pieces of thatch. With fifteen of these sections on each side, on average a *bai* is composed of about seven to eight thousand thatched roof pieces.

The *ongiau* (fascia board) is decorated with spirit faces *(belek)* in Koror.

Once all the thatched roof pieces are tied in place (each bai uses an average of 5,200 thatched roof pieces), it is time to install the uchub, the ridge cap. The word *"uchub"* comes from the Palauan word for compassion, *klechube-chub.* The *uchub* is the top part that covers everything in the *bai* both physically and symbolically, protecting against wrongdoing and preventing water from coming inside. It takes over five hundred leaves to complete this crowning touch.

To install the *uchub,* a sharp piece of wood called *eliil,* usually made of mangrove root, is pushed through from one side of the roof to the other side, crossing in between the *rael* and *buadel*. The *eliil* sticks out on both sides of the roof and is sharpened on both edges to prevent the spirits that hover over the chiefs' *bai* from landing on it because they could get pierced. The *eliil* are installed at about five feet apart the entire length of the *bai* from *mad el bai* (front) to *but el bai* (rear). Two pieces of bamboo called *osarch* are tied at the bottom of the *eliil* on both sides, extending along the entire length of the *bai.* A crown of nipa leaves is then painstakingly mounted on top of the *bai,* inserted under the *osarch* by a man sitting on the ridge cap.

The final part of the *bai* to be completed is *melech,* which in construction terminology means cable end. In Palauan mythology *melech* represents the evil spirit that needs to be driven out of the *bai* once it is completed in a ceremony that is called *osebekel a melech.*

As discussed, there are two facades of a *bai,* east and west. The face called *mad el bai* traditionally and constructively must face east. *Mad el bai* means the "face of the bai". (*mad* = face). It is bordered on both sides by *ongiau,* which are planks starting from the top of *olik,* the heaviest beam, extending from one side of the *bai* to the other.

Bai Motifs and Symbols

The cable end of *mad el bai* is generally divided into six equal horizontal spaces, with the following symbols painted or depicted on them, normally in the following order. People seated in the *bai* need to know all this symbolism by heart.

- *Chelchelebesoi* is one of the most beautifully colored fish in the ocean and is depicted on the *bai* to symbolize beauty, good taste and good life. It represents everything that is good that must come from the *bai* and be extended to the community.

Chelchelebesoi

- *Bechei* is a worm-shaped figure with a human head, human hands and a straight body, but it is depicted with its internal organs visible that contain all symbols of Palauan money. *Bechei* is a symbol of prosperity and frugality, representing the wealth that needs to be collected for the community. There is only one body, one head and two hands, so all the wealth needs to be distributed equally in unison.

Bechei

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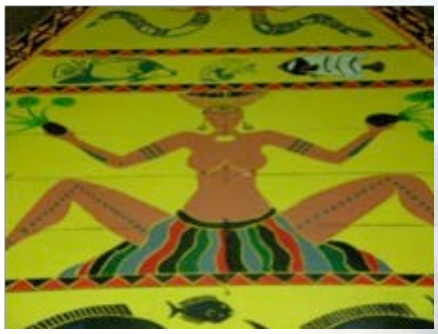
- *Dilukai* is a female figure seated with legs extended and open to display the genital area. There are many legends and stories about *Dilukai*. Some even say that *Bechei* was the brother of *Dilukai,* but she has come to represent fertility, continuity, growth, birth, sustenance and life.

  The display of the female genitals also refers to the customary death settlement of *cheldechduch,* representing the money that is paid to the male members of the wife's side of the family when she is either deceased or a widow. This payment, called *techel otungel,* is owed by the husband's relatives as compensation for the conjugal services performed during the marriage.



Dilukai

- *Mesekuuk* (surgeon fish) are a type of reef fish that, in the face of danger from a predator, congregate together under a leader to form the shape of one big fish that cannot be eaten, chasing the predator away. *Mesekuuk* symbolizes doing things together in unison, having one voice, supporting a decision when it has been made, and getting along.

Surgeon fish or *mesekuuk*

- *Terroi el beluu* is a circular figurine with two human heads, two legs and two arms. One of these figurines is encircled by *belsebasech,* a continuous triangular pattern. This has come to symbolize continuity, each triangle representing a different season for planting, harvesting etc., and showing how the members of the community need to cooperate and work in unison.

The circular figurine, *terroi el beluu*

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- On the lowest plank is *chedeng,* the shark. The sharks are normally depicted on the *bai* facing each other with mouth open and body curved, ready to strike. In the Palauan community these facing sharks show that we may be in unison and try to get along and work together with our women, but one should not mistake that to mean that they can try to run over us: like sharks, we are ready at all times to attack if necessary.

The shark or *chedeng*

  The rest of the *ongiau* plank of the *Bai ra Klobak* in Koror is decorated with *klikmch,* consisting of multiple faces, eyes, noses and ears all the way to the end (in Melekeok this part is decorated with a clam). *Klikmch* is defined as the smiling face. It symbolizes the face of humanity, Koror's willingness to host others, which is why the motto of Koror is *"oureror a ourois er a rechad."* This expression literally means Koror is deeply rooted in people. Koror's willingness to open its arms to migrants from within and outside Palau is a source of its wealth. It has allowed people, ideas, and economic ventures to prosper, adding to Koror's power and wealth. The Koror war canoe is also named after the face *oklikmch.* The last traditional war canoe carved for the Festival of Pacific Arts in 2004, was also named *oklikmch* in a quest to maintain this state motto.

  Ironically, one of the few coincidences in language history is an instance when the Palauan and English words have the same meaning. The west end of the *bai* is called *"but el bai"* which is the rear of the bai (in English "butt"). This western

façade has different legends of great significance to Koror, including those about the relationships between Koror and Peleliu, and between Koror and the English.

These stories and symbols on the outside of the *bai* are for the public; the ones on the inside are only for the eyes of the chiefs.

There are many other symbols used as depictions in the *bai,* as follows:

Chedechuul

- *Chedechuul* is the god of construction, normally placed where the fascia boards meet at the top of the ridge line.
- *Orachel* were the first *bai* builders; legend has it that they marked, assembled and built the original *bai* at the bottom of the ocean and then brought the knowledge to the people of Palau.

Bellek

- *Klidm* is a smiling face that symbolizes strength in people, and has come to represent the people of Koror, who have a motto that they welcome all the citizens of Palau
- *Bellek* is also a face, this time wearing money-bead earrings.

The removable threshold placed at the entrance to the *bai*

- *Iis* is the removable threshold placed at the entrance to the bai; "iis" also means "nose" as it is the center of the face. The *iis* is located under the *olik,* a low roof beam to make the entrance very short in order to force a physical show of deference and obedience from everyone who goes inside, as even proud people have to bend over to step inside and bow down when they enter the *bai.*

Cheldecheduch

- *Cheldecheduch* is a zigzag shape that symbolizes communication; Palau's ancient people believed voices traveled in waves
- *Udoud* is a plus sign in a circle that represents *chelbucheb,* conveying the concepts of a monetary community, wealth and the economy.

Mengidab

- *Olik,* the fruit bat, is also the name of the part of the *bai* that crosses the main entrance, upon which a large figure of *olik* is carved on a very low entrance. The *Olik* is the only animal that holds its head down when it rests, so it symbolizes humility, obedience and deference; if you don't have any of these traits you will be forced to emulate them when you enter since the entrance is low.
- *Mengidab* is a spider usually carved on the *rekoi* plank, representing the legend of Mengidabrutkoel, the mythical figure that taught the people of Palau the first natural childbirth. Before that all children were born by Cesarean section, resulting in a high female mortality rate.

Sechalmalk

- *Sechalmalk* is the rooster, a symbol of announcements of decisions from the *bai* to the community. It also symbolizes the value of starting on time and letting people know what you are going to do, like the rooster waking up and crowing in the morning. In the myth about *bai* building in Ngerchelong "Bai Rulchau," after the seventh crowing of the rooster, the sun came up, and the

Photos on page by Patrick Tellei

builders, who could only work at night, had to leave. Thus, the *bai* remains unfinished even today.

Dellerrok

- *Dellerrok* is the money bird, the symbol of Melekeok that is mythically believed to excrete money from its body.
- *Kim* (clam) is a symbol found in many different forms that illustrates the dualism in Palau, where there are two sides to everything and mutual opposition is central to traditional ways.

Kim

- *Besebeser a Ngerot* is a zigzag motif with leaves on top and a money symbol hanging on the apex of the zigzag. *Ngerot* is the mythical place where father and son went fishing. The father told his son to collect rocks for fishing sinkers, but the son started playing and throwing the rocks. When they reached the beach and the sun rose, they found that the big stones left were money beads. This story illustrates how haste makes waste, and since wealth can depart in no time, one should pay attention.

Besebeser a Ngerot

- *Belsebasech* is a zigzag design normally drawn in two colors, either black and red or black and yellow. It symbolize continuity and is also the border when you want to end a legend "and so it ends."

Belsebasech

- *Mesekuuk* is a symbol of unity and unison (surgeon fish).
- *Chedeng,* the shark, represents strength, fierceness, perseverance and toughness.

Cheldecheduch

- *Kaeb, kabekel, brotong* and *kaberruuch* are the main Palauan canoes: *kaeb* is a fast sailing canoe; *kabekel* is a war canoe*; brotong* is a cargo canoe; and *kaberruuch,* also known as *omuadel,* is a fishing expedition canoe. Usually *kaberruuch* is a retired war canoe that had a poor showing in a war expedition or canoe race. In the old days, when a capital village lost a war canoe race, they would buy the winning canoe and send it to be a fishing canoe so it could never win again.
- *Chad* come in two kinds: *sechal,* which represent man, manhood and things of a manly nature; and *redil,* which represent women, womanhood and things of a feminine nature.

The two *chads*, *sechal* and *redil*

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- *Blai* is a dwelling, the depiction of which reflects family, family life and normalcy.
- *Beluu*, as used in depictions, is a contiguous land mass composed of ocean, mountain, flat land and mangroves
- *Iungs* literally means "islands," including small islets, atoll islands and rock islands. Atoll islands are symbolized by a flat sandbar with coconut trees, and arock island is symbolized by a shape protruding from the ocean and colored green to indicate trees (not coconut palms).
- *Dellomel* can be either *kukau* or *kerrekar. Kukai* is swamp taro that is the mainstay starch food in traditional and contemporary Palauan society. *Kerrekar,* on the other hand, are big trees such as breadfruit and the *ukall* tree used to build canoes, houses and *bai.*

- *Sils,* or the sun, symbolizes heat, living and the universe.
- *Ius,* the crocodile, represents catastrophes or danger from the past or lurking ahead.

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Working with my father (Adelbairureor Ubal Tellei) and young men from Melekeok at Bai Melekeong, c.1983.

Working with my father (Adelbairureor Ubal Tellei) and young men from Melekeok at Bai er a Keai in Aimeliik, 1988.

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Museum Bai of Koror

In 1969, the Belau National Museum tried to revive this unique part of Palauan history by rebuilding a *bai* in the traditional way. It was built in about eight months' time using traditional tools and materials. Master builder Ngiracheliong Ngirasibong was helped by two men's clubs from Ngaremlengui and Ngarchelong. The project was sponsored by the Palau Legislature and the Trust Territory Government. The newly-built *bai* was first damaged by a typhoon and then burned down by unknown persons in October 1979.

For decades after World War II, Koror did not have a *bai* since all had been destroyed. Koror used to have one of the famous *bai* located in Ngermid village. Throughout the years, most important foreigners who visited Palau stayed at this *bai,* including Kubary, McCluer, Wilson and Cheyne, who all had important roles in Palau's history.

In 1990, another *bai* was rebuilt on the same site and can be seen there today. The quality of the decorations and paints used were not as good as those used for the traditional *bai* (which often lasted for decades), and repainting has had to be done already since its construction.

YAPESE STONE MONEY

The Yapese people had been coming to Palau for centuries to carve their unique stone discs out of limestone cliffs before the traders started visiting Micronesia. Exchanging favors with the Palauan chiefs, they were allowed to quarry certain cliffs around Koror and Airai State. Not having any metal tools, the discs were carved with clam shells, stone tools and adzes. Discs were up to four feet in diameter, the maximum size they were able to carry and load on their canoes to bring back to Yap. The size and hardship in carving and bringing it back to Yap determined the value of the piece.

After the trader O'Keefe shipwrecked on Yap in 1871, he decided to stay and bought a Chinese junk, starting operation in 1875. He got the Yapese to work for him and collect copra as payment for transporting their stone money discs from Palau to Yap. He also traded metal tools with them, and the Yapese were then able to make larger stone discs than ever before.

William E. Perryclear

Yapese stone money on Metuker ra Bisech

Carving and transporting the discs by sea was no longer a problem, but hauling the stones from the quarries to the boat was still difficult and lots of pieces broke on the way or rolled into the sea.

Apparently the Yapese used to stop in Ngkeklau on their way back to Yap when they were still bringing the stones by canoe before 1875. In 1994, a Palauan family who were building a house near the beach found fourteen intact pieces of stone money on their property, ranging from eight inches to two feet in diameter, which may have been a storage place for the Yapese. Other stone discs have been dug up in other areas in Palau and a few large, unfinished pieces are still near the original quarry sites.

Like the Palauan money beads, the Yapese discs were exchanged between families during traditional customs and used to purchase land on Yap. Yap has limited limestone ridges, which is why they traveled to Palau to get these discs. The holes in the middle made it easier to carry them down to the canoes.

You can see a huge piece of Yapese stone money on a small Rock Island called Metuker ra Bisech adjacent to Airai State. It was discovered, along with unfinished pieces, metal tools and living and burial sites, by Americans who were in Palau searching for WWII artifacts.

Information Source: Palau- Cultural History 2004. Mandy T. Etpison.

Sources and Additional Reading

The Bureau of Arts & Culture has produced a series of booklets describing different aspects of traditional Palauan culture. These are available for a small price (around $3) from the Belau National Museum. Books, on most subjects described as well as many more, are also available from the Belau National Museum and the Etpison Museum.

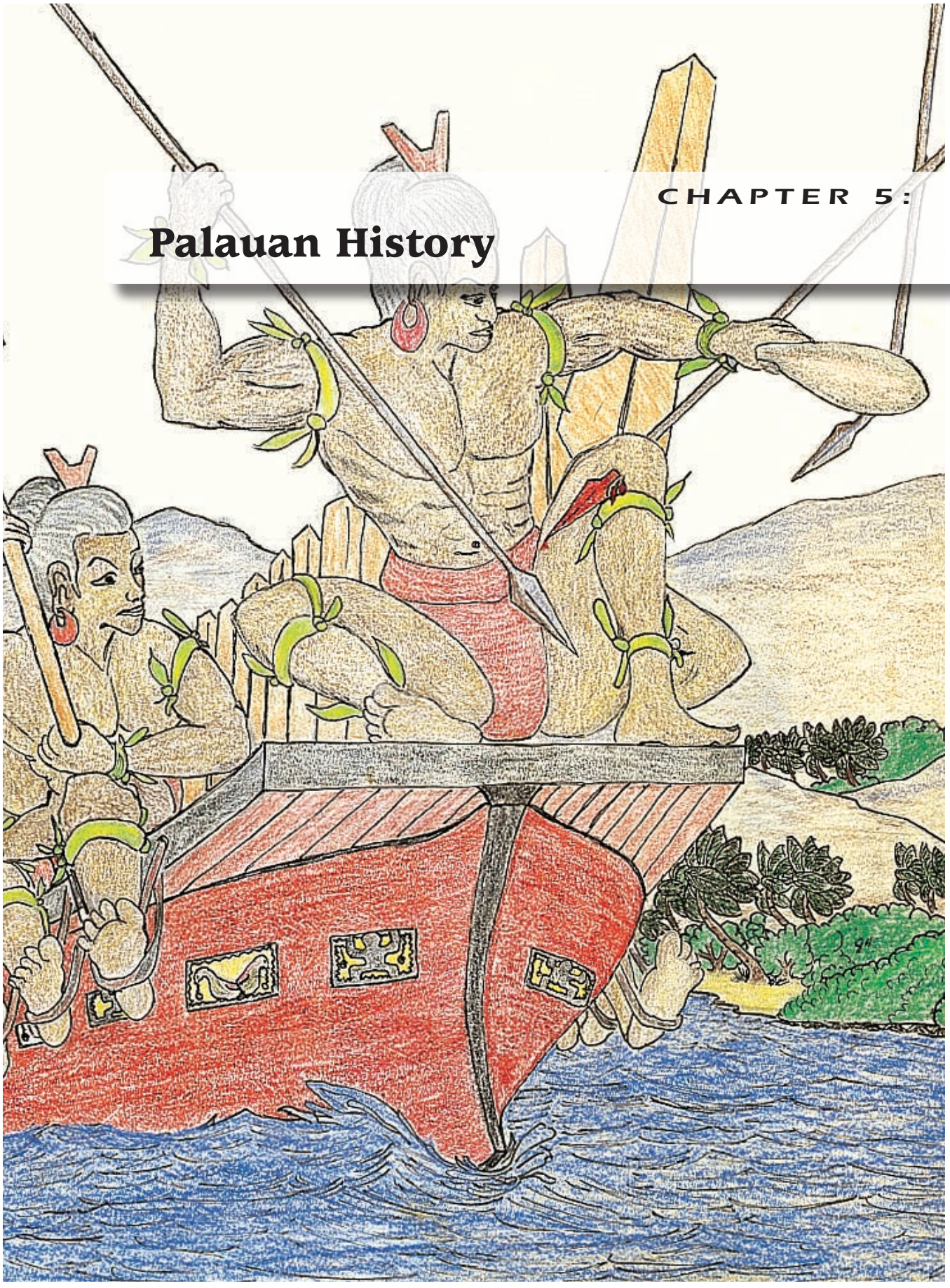
Given the importance of this site to Palauans in terms of their history and culture and the concerns that exist in regards to its future, those visiting the site should not engage in any type of behavior or activity that disturbs the integrity of this site or diminishes the respect that should be accorded to it. Therefore, because of the importance and sensitivity surrounding this and all historical registered sites, the Palau Historic Preservation Office would like to emphasize the following guidelines:

- Remember to take everything you brought to the site with you when you leave.

- Do not remove anything from the site. Although you may not think something is not significant to the site, all pieces make up the whole.
- Remember that many sites include culturally sensitive areas and therefore behavior should always be respectful.
- **19 PNC Chapt. 1 § 181:** It shall be unlawful for any person to take, appropriate, excavate, injure, destroy, or alter any registered historical sites or cultural properties deemed eligible for inclusion on the Palau Register of Historic Places. Any person violating any provision of this Act shall be punished pursuant to all applicable laws. That such cultural, historical, and archaeological properties yield a significant representation in Palau's history and prehistory and are deemed eligible for inclusion in the State or Palau National Register of Historic Places.

CHAPTER 5:

Palauan History



Color Pencil Drawing John Q. Demei

HISTORICAL PERIODS

The history of Palau can be divided into three main sections:

- Pre-contact (before 1783)
- Contact (1783-1888)
- Modern (1888- present)

Pre-Contact Times

- Ancient Rock Island villages, caves, pictographs, traditional village sites and remains of traditional culture.
- Badrulchau is one of the most impressive archaeological sites in Palau. It covers an area of five acres (4 hectares). Pre-historic terraces exist between Ollei and Mengellang villages in Ngerchelong. There are 37 monoliths (large upright stones) set into two major rows. The monoliths were dated back to 90-1165AD. There are many stories about how the monoliths came to be there, eg. Gods constructed the pillars.
- Ulong Island is an old village where you can find pieces of ceramic pottery, shell middens and burial sites as well as pictographs in the caves.

Contact Times

- Ulong Island is also the site where Captain Wilson was shipwrecked in 1783 and where the people of Koror assisted him in building a new ship.

Photo by Palau Visitors Authority

Modern Times

- Consists mainly of remnants of intense battles between the Japanese and Americans during World War II. The southern islands of Peleliu and Angaur are the areas where most artifacts remain. Shipwrecks are concentrated around Malakal Harbor, but found throughout Palau.
- The Hero fighter plane can also be seen adjacent to Ngermediu beach.

Information Source: The Environment, Inc. 1994 Tour Guide Handbook

Contact Times

The first European visitors were Spanish, in 1710 and 1712 and they called the islands Los Palos. In 1783, the wreck of the British ship, *Antelope,* led to the introduction of the chief of Koror's son, Lebuu, to London society.

European ships made a number of later contacts and some mapping of the islands was conducted by the French explorer Duperrey in 1824 and a Russian expedition in 1828. Spain attempted to retain its sovereignty over the region, but it was challenged by the Germans and the British. Finally, the Germans purchased the Carolines from Spain in 1899 and, although its commercial interests in Palau lay in the possibilities of plantations and phosphate, the German colonial administration was responsible for introducing health regulations to control epidemics that had hugely ravaged the populations since first European contact.

Modern Times

Photo by Palau Visitors Authority

At the start of the First World War, Japan took over the Carolines in 1914. As a Japanese colony until World War II, Palau attained a modern infrastructure including harbors, roads, bridges, sewage systems and electricity – along with expansion of the copra industry and phosphate production. Japanese military authority was replaced in 1922 by the civilian South Seas Bureau, and the administrative center of Koror had a population of 25,000 Japanese (four times the local population) in 1935. Then Japan began to build up its military forces in the Pacific, setting up fortifications in the Carolines and making them a closed military area in 1938.

After Japan entered the war, Palau became a base from which to enter the Philippines. Micronesia remained under US military control for two years after the war ended. Palau became part of the US-administered UN Trust Territory of the Pacific Islands (TTPI) in 1947 and was the last of four political entities that emerged from the now defunct TTPI.

A nuclear-free constitution was adopted on January 1, 1981, but this long delayed a mutually acceptable Compact of Free Association (COFA) because it was seen as incompatible with the US perceptions of its defense interests. The compact agreement between Palau and the United States in 1986 gave the islands independence subject to defense being the responsibility of the United States for 50 years. Successive referenda in Palau, however, failed to produce a 75% majority.

In 1987, Palau voted to amend the Constitution to allow approval of the compact by a simple majority. In a subsequent plebiscite, 73% of the votes were cast for the compact, but this was ruled invalid in August 1988 by the Palau Supreme Court. The courts also ruled there were inconsistencies between the compact and Palau's nuclear-

free constitution, which was incompatible with the US defense policy, an impasse which was broken when Palau revised its constitution. Agreements with the Bush Administration in 1989 provided assistance in paying off foreign debt and funds for new development. The Belau people remained citizens of TTPI. On November 9, 1993, a 68% majority voted in favor of the compact. After this vote, Palau achieved self-government on 1 October 1994.

In 1980, President Haruo Remeliik became the first president of the Republic of Palau. President Remiliik had strong anti-nuclear convictions and was thus assassinated in July 1985. Vice-President Alfonso Oiterong became the second president of the Republic of Palau. In 1985, President Lazarus Salii was sworn in as the third president; he died in his home in 1988. In 1988, Vice-President Thomas Remengesau Sr. became the fourth president of the Republic. In 1989, Ngiratkel Etpison became the fifth elected President. President Etpison succeeded in passing the Compact of Free Association through a constitutional referendum. This referendum was held on the condition that Palau and the United States reduce the terms of the COFA from 50 to 15 years and reduce the size of Palauan lands used for U.S. Military purposes. The referendum was to change the majority vote from 75% to the majority vote.

Kuniwo Nakamura was elected in 1992 and signed the Compact of Free Association (COFA) with the United States. Through the COFA, the United States compensated Palau with funding over 15 years for military rights in Palau. Palau received $450 million for the first year. In 2000, Tommy Remengesau Jr. became the seventh president of the Republic. He was known as an environmental champion through his two terms. He initiated the Micronesian Challenge to protect 30% of the nearshore marine environment and 20% of the terrestrial environment. In 2008, Johnson Toribiong became the eighth president of the Republic. President Toribiong established a Shark Sanctuary. In 2012, Tommy Remengesau Jr. became the ninth president of the Republic and was recently awarded the Champion of the Earth. He stated that this award was based upon generations of committed Palauans to protect Palau's unique environment. Currently, he is initiating a Marine Reserve to protect 75% of Palau's Economic Exclusion Zone.

Information Source: Kitalong, A. 2012. A Tour of Palau. Second Edition.

HISTORICAL AND CULTURAL SITES IN THE ROCK ISLANDS

Site Name	Island Location	Other WWII, German, Japan, U.S.	Settlement	Burial Site	Rock Art	Comments
Ngerengchol	Ulebsechel Island		√			Settlement estimated between A.D. 1300-1400. Large population/settlement remains found there suggests the overuse of resources that may have caused the abandonment of the settlement along with constant warfare. (Source: Masse, 1984).
Ngermid Ichum	Ngermid dock	√	√		√	The only rock painting located at a site that still has people residing in the area, near Mechang at Ngermid.

Site Name	Island Location	Other WWII, German, Japan, U.S.	Settle-ment	Burial Site	Rock Art	Comments
Taberrakl Cliffs adjacent to Ngederrak Reef	Ngeruktabel				√	Located on the southeastern coast of the island. Contains the most number of picto-graphs. Many are handprints. Pictographs re-semble some found on Olechukl lars, at Ulong. Pictographs are located on the wall and ceiling of a Cliff Ledge (Source: McKnight 1964; 11-21)
Metukeruikull	Ngeruktabel		√			Remains of a heavily damaged stone platform can be found on the beach. Remains of pottery sherds and eight stone platforms were found there. A small area but evidence suggests that a large population resided there (Source: Masse and Synder, 1982)
Ngeremdiu (Ancient village called Oimaderuul)	Ngeruktabel	√	√			Inhabitants of this settlement were believed to have moved to Melekeok (Source: Osborne). Secharuleong who controlled Melekeok before Reklai, supposedly came from this vilage. Old Japanese Lighthouse foundations and limestone dock remains. The Germans used this same area previously as radio/lighthouse. The trail and dock are still in relatively good shape, but is covered with dense limestone vegetation.
Skogi Japanese Zero	Uchul a Chei	√				A Japanese fighter plane shot down in WWII. Most of the plane remains in tact. Located on the reef area of Uchul a Chei closest towards the island (Kisakes beach).
Ngchus	Ngeruktabel	√	√			The Japanese used to raise Pearl Oysters (Chesiuech). Old buiding foundations and remains of dock are still there.
Burial cave	Chomedokl				√	Ancient burial site. Unfortunately, it is very difficult to find any remains. At one time many bones and skeletons could be found in cave.
Olechukl lars	Ulong		√		√	Second greatest number of pictographs. Ulong island is associated with the legend of Osilek (first rubak of Ulong) and Oreng. The picto-graphs are placed over the back wall and roof of a cave on a limestone cliff that is located at the northwestern end of the island. In a room in the back of the cave, a bowl-like depression lined with bright red earth which, like a similar depression found at Taberrakl, is believed to have been used for mixing paint. (Osborne 1966)
Ngerechong	Ngerechong	√	√			Inhabitants helped Koror's noblemen to avenge Ibedul's death. Building remains are found there possible from the Japanese time.

Most of the sites mentioned above are known sites of historical and cultural importance. Not to mention, several other sites are in the main islands (Oreor, Ngarekebesang and Malakal) of Koror. However, many of the sites are not easily accessible and are not areas open for visitors. Sites that are well-known attractions utilized by tourist and locals are the Japanese Zero and Ngeremdiu beach area and Lighthouse/Todai Trail.

Also it should be noted that with many cultural/historical sites, there is the dilemma of having a vast amount of cultural information about some sites while others have very

little information. Another difficult circumstance is the substance of the cultural information. Despite the fact that studies on ancient settlements in the Rock Islands have been documented, the local traditional importance of sites are only available for a few of those sites while the others are unknown. The essentials about culture and history are on hand for areas such as Ulong and Ngeremdiu. The other sites, however, still need to be further assessed and established by Koror State and the Bureau of Cultural Affairs as registered cultural sites and if suitable visitor attractions. For more information on cultural and historical sites, please contact the Koror State Community & Culutral Affairs or the national government Bureau of Arts & Culture.

Information Source: Koror State Department of Conservation and Law Enforcement

BEST PRACTICE GUIDELINES FOR SITES OF CULTURAL & HISTORICAL SIGNIFICANCE

Given the importance of these sites to Palauans in terms of their history and culture and concerns that exist in regard to its future, those visiting cultural sites should not engage in any type of behavior or activity that disturbs the integrity of the site or diminishes the respect that should be accorded to it.

- Remember to take everything you bring to the site with you when you leave.
- Do not remove anything from the site. Although you may not think something is significant to the site, all pieces make up the whole – i.e. If most tourists remove pottery shards from a site, there will soon be none left.
- Remember that many sites include culturally sensitive areas and therefore behavior should always be respectful.
- Do not allow divers to touch any objects found in or around shipwrecks. In the past, divers have removed artifacts from wrecks, reducing their value as dive sites and diminishing their historical integrity. It is also dangerous to touch anything found in wrecks as there is often live ordinance present which could endanger people's lives.
- When visiting WWII sites, please ask tourists not to touch or climb on airplane remains. Remind them that in most cases a person or several people died at the site and it should be accorded the necessary respect.
- When visiting the *bai* at the Belau National Museum be sure to inquire about fees prior to arrival. When visiting other cultural and historic sites please inquire with the Koror State Department of State and Cultural Affairs at 488-3133 or 488-4457.
- There are registered cultural and historical sites on private property that require prior permission for access from the land owners. Please inquire with the Koror State Department of State and Cultural Affairs to arrange a site visit. Example: Mother and Child Monolith.
- Many states charge entrance fees or charge for photographs to be taken of their cultural and/or historical sites as in some cases, they cover the costs of maintaining the sites. Explain this to your tour group and ensure that they pay the necessary fees.

Sources and Additional Reading:

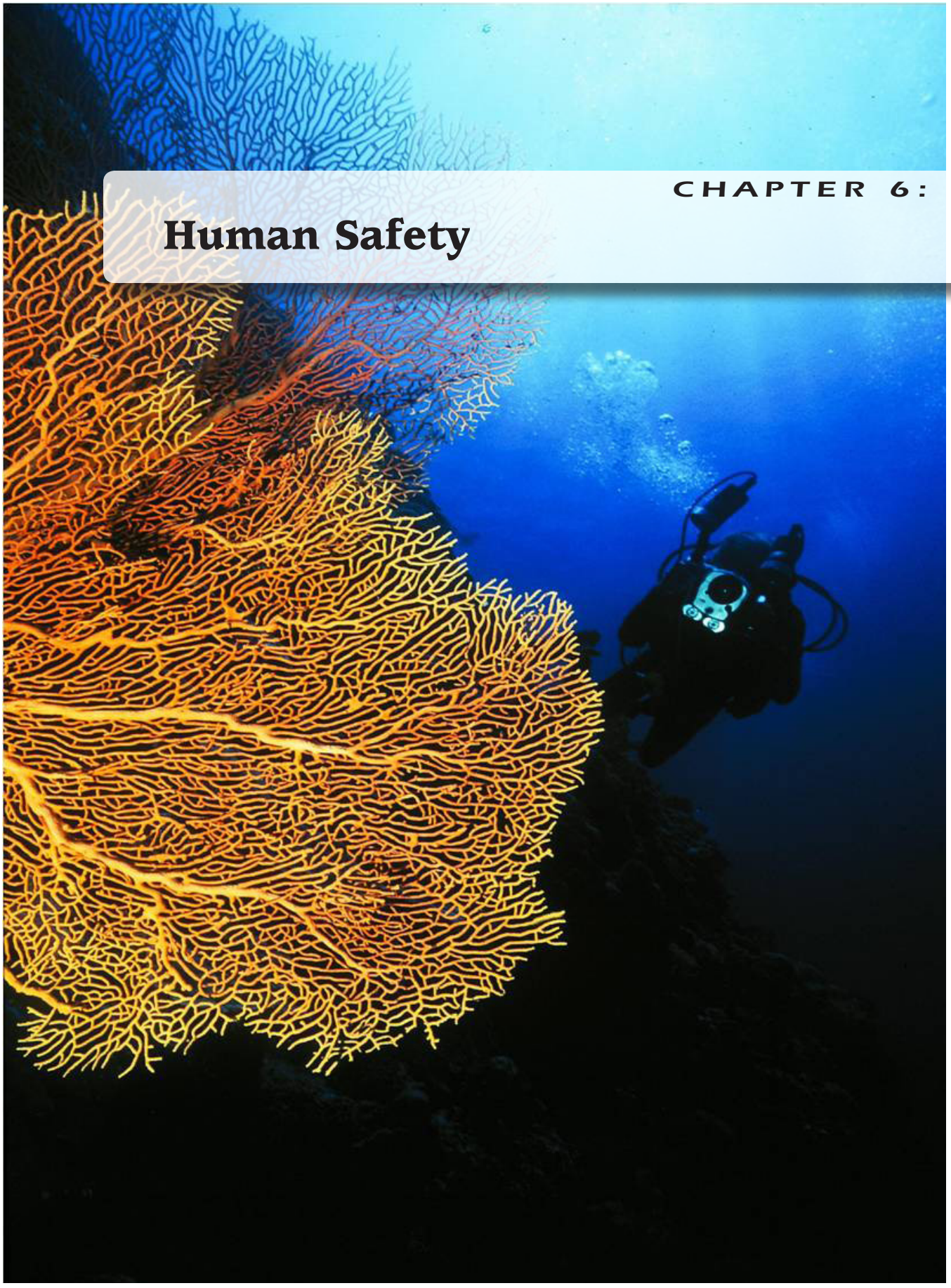
Ballendorf, D. A and King, P. (eds.) 1980. Towards New Directions and Political Self-Actualization. Micronesian Area research Center.

Hezel, F.X, 1983. The First Taint of Civilization : a history of the Caroline and Marshall Islands in the pre-colonial days, 1521-1885. University of Hawai'i Press.

George Keate (1877?) An Account of the Pelew Islands.

CHAPTER 6:

Human Safety



Mandy Etpison

AN OVERVIEW

Traditional Knowledge

Traditional knowledge to all tour guides. Each site has specific types of currents and tide shifts throughout the day and season. A smart guide will check all the proper charts and written information. A smarter guide will also find out local knowledge about tides and currents from fisherfolk who have fished in particular areas for generations.

Human Safety

Prevention is the first rule for safety; avoiding or preventing a problem in the first place begins with you!

1. **Self Serving** – an individual must be properly trained mentally and physically in order to understand the dangers and safety precautions necessary for safe trips. A licensed diver is educated about human physiology in relation to the chemistry and physics of water and gases. A tour guide in Palau should also be trained on environmental conditions and know the tides and currents.

   Know your limits – How far can you swim? – In normal conditions, with the current, against the current, and in a storm? How deep can you free dive? What weight can you lift? EVALUATE YOURSELF!

2. **Serving Others** – in order to serve others, you must first serve yourself and then the additional responsibility required for other people. You must be able to evaluate their ability and limitations through questioning and observing their actions. When is the last time they went diving? Are they assembling their equipment properly? How is their buoyancy in the water? Are they listening to your instructions?

Currents and tidal changes – there are several very strong and not always predictable currents (Peleliu express). Strong tidal changes can also produce additional changes in water movements.

Drug Use – 50% of all dive accidents are alcohol related and 4% are related to recreational drugs. Drug use results in poor judgment and slow reaction.

Shark and Triggerfish – there has been no reported shark attacks on divers. There have been several attacks on spear fishermen, because sharks target the fish caught. Triggerfish have been reported to attack diver's fins and even their face.

Tip: *Don't panic. An arched back, slow movement, and a low tail are indications of an aggressive shark.*

Depth perception – often in very clear water, like a vertical drop-off, it doesn't seem as deep as it is.

New Environments – unfamiliar reefs and animals may cause stress and fear in novice divers, orient divers as best you can on what to expect

Unfamiliar, Misuse of and lack of equipment – 15% of all dive accidents are caused because the diver had no watch! If you have equipment that you do not know how to use it can be a hazard.

Over-equipped – If your hands are not free and you have heavy equipment, it is difficult to hold on and move around.

Tip: *Advise divers against the use of heavy camera equipment when conditions are not optimal*

Information Source: The Environment, Inc. 1994 Tour Guide Handbook

DIVING AILMENTS

This section is designed to act as a source of reference for common problems and injuries that may occur on a typical dive. **ALL DIVE MASTERS AND TOUR GUIDES SHOULD BE CERTIFIED IN FIRST AID AND CPR EACH YEAR!** Training is available at the Palau Red Cross Society. You need to be certified by a qualified instructor in order to practice and administer first aid and CPR properly.

Decompression Illness

Decompression Illness (DCI) is a term which encompasses decompression sickness and arterial gas embolism. This term is often used because the manifestations and management of the two disorders are often identical and because of the difficulty in distinguishing between them.

Decompression illness is caused by the presence of gas bubbles in our bodies. The bubbles may have entered the bloodstream as a result of breath holding or inadequate exhalation on ascent; or trapping of air in the lungs due to asthma, mucus, water inhalation, laryngospasm, cough or cold. On the other hand, the bubbles could be excess nitrogen (or another inert gas), formed in the blood or body tissues as a result of inadequate decompression after a dive. DCI can and does occur on dives that are well within the no-stop limits of various dive tables and on dives conducted in accordance with various dive computers.

The following factors may increase a diver's likelihood of getting decompression illness even if the tables/computers are followed correctly:

- Repetitive diving (especially multi-day repetitive diving)
- Deeper diving (deeper than 80ft/24m)
- Rapid or multiple ascents
- Exercise before, during or after the dive
- Flying after diving
- Dehydration (seasickness, alcohol, diving in the tropics)
- Obesity
- Fatigue, lack of fitness, illness, stress, previous injury or heart defects
- Being cold
- Age – risk may increase with age
- Carbon dioxide excess
- Decompression stop diving
- Breath-holding during ascent
- Lung disease (due to increased risk of pulmonary barotraumas)

NOTE: If symptoms similar to those of decompression illness are present after diving, never exclude decompression illness because of what may appear to be a safe dive according to the tables or computer.

Signs and Symptoms

Although these usually occur within six hours of diving, they may develop 24 to 48 hours after the dive, or even later if there is altitude exposure after prolonged diving. Decompression illness is frequently accompanied by general malaise (feeling unwell) and extreme fatigue.

Although the symptoms of DCI sometimes disappear spontaneously, particularly if oxygen is breathed, medical evaluation and recompression are required to minimize tissue damage and later recurrence of symptoms.

Common Signs and Symptoms of DCI

- Chest, torso or back pain
- Dizziness
- Extreme fatigue
- Headaches
- Malaise
- Nausea
- Numbness/tingling sensations
- Pain/discomfort at or near a joint
- Weakness

Other Signs and Symptoms of DCI

- Blood in stools
- Blotchy skin
- Confusion
- Convulsions
- Coughing
- Death
- Difficulty breathing
- Difficulty passing urine
- Hearing loss
- Impaired consciousness
- Itchy
- Lack of coordination
- Loss of balance
- Loss of bladder/bowel control
- Paralysis
- Personality change
- Rash
- Ringing in ears
- Speech disturbances
- Visual disturbances

FIRST AID AND CPR

The Palau Red Cross Society provides a course for community first aid and safety. Contact information for the Palau Red Cross is as follows:

Palau Red Cross Society
P.O. Box 6043 Koror, Republic of Palau 96940
Tel: (680) 488-5780/5781
Fax: (680) 488-4540
E-mail: Palredcross@Palaunet.com

The Course description and outline are provided below:

Course Description

The main purpose of this course is to help lay responders recognize an emergency and feel more confident in their abilities to act aptly in the event of any emergency situation. Additionally, this course is designed to promote a safe and healthy lifestyle. Upon

completion of this course through a series of demonstrations and tests, one will be able to provide basic care that is necessary for injuries or sudden illnesses in infants, children, and adults.

This course certifies individuals for CPR and First Aid and Safety. It is a 10 to 12 hours course.

This course is divided into three components.

Component I: Adult CPR
Component II: Infant and Child CPR
Component III: First Aid Basics

Course Outline: Community First Aid and Safety

Component I: Adult CPR

Participants in this course will be able to respond to an emergency. They will also be able to recognize an emergency, devise an emergency plan, provide appropriate information, and even demonstrate needed medical skills regarding conscious or unconscious victims.

§I Adult CPR

1. Responding to an Emergency/Emergency Plan
   a. Deciding to act/take action
   b. Obtaining consent
2. Preventing Disease Transmission
3. Moving an Adult
4. Caring for Shock
5. Life-Threatening Emergencies: Checking an unconscious adult/child/infant
6. Life-Threatening Emergencies: Checking a conscious adult/child

§II Adult CPR

1. Adult CPR
   a. Breathing Emergencies: Helping a conscious choking victim
   b. Breathing Emergencies: Helping an unconscious choking adult
2. Breathing Devices
3. Rescue Breathing for an Adult
4. Recognizing a Heart Attack
5. Cardiac Chain of Survival
6. CPR Demonstration
7. Preventing Cardiovascular Disease

Examination for § Adult CPR

Component II: Infant and Child CPR

Participants in this course will be able to respond to a breathing or cardiac emergency in infants and children.

§II Infant and Child CPR

1. Life-Threatening Emergency in Infants and Children
    a. Moving an infant or child
    b. Caring for shock
    c. Checking an unconscious child or infant
    d. Checking a conscious adult/child
2. Breathing Devices
3. Breathing Emergencies
    a. Helping a conscious choking infant
    b. Helping a conscious choking child
    c. Helping an unconscious choking infant
    d. Helping an unconscious choking child
4. Rescue Breathing
    a. Infant
    b. Child
5. CPR Demonstration
    a. Infant and its purpose
    b. Child and its purpose
6. Preventing Emergencies in Infants and Children

Examination for § Infant and Child CPR

Component III: First Aid Basics

Participants in this course will be able to recognize and care for victims of sudden illness and injuries.

§ I First Aid Basics

1. Injuries
    a. Wounds
        i. Controlling bleeding
    b. Burns
2. Injuries to muscles, bones and joints
    a. Immobilizing muscle, bone and joint injuries
3. Injuries to the head, neck and body
4. Sudden Illness

Examination for § First Aid Basics

Information Source: Miriam Chin, Executive Director for Palau Red Cross Society

Hazardous marine animal injuries

Envenomations

Spine Punctures Warning Signs

- Purple or black skin coloration
- Nausea
- Shock
- Respiratory arrest
- Puncture or laceration
- Immediate pain
- Vomiting
- Swelling
- Cardiac arrest

Seasickness

Although the subject of avoiding seasickness may not be vital to proper supervisory technique, it is a common concern among boat divers. It is thought that seasickness involves the vestibular apparatus of the inner ear and that visual/perceptual disorientation is a significant factor in causing the disorder. Based partially on fact and common experience, the following advice may be helpful in avoiding seasickness:

- Divers should avoid eating greasy foods prior to boarding and while aboard the boat.
- If seasickness medication is to be taken, advise divers to always know its effects before using it prior to diving. Be aware that due to significant side effects, transdermal medications (usually applied via a patch behind the ear) are not recommended prior to diving.
- If the decision is made to take a known, acceptable medication for seasickness, divers should be advised to always do so well in advance of departure (often the night before diving). Most medication is ineffective if taken when seasick.
- While underway, divers prone to seasickness should be advised to remain on deck and not to go below unless necessary.
- As visual orientation is thought to be very important in avoiding seasickness, divers should be advised to maintain eye contact with the horizon or other stationary, land-based object.
- All divers should be advised to stay away from areas near exhaust fumes.
- Divers prone to seasickness should be advised to try to stay busy while underway but should not read
- Finally, advise seasick-prone divers to always be prepared to enter the water as soon as possible. Most individuals become seasick not while underway but after the vessel is at anchor. The less time spent on board, the less likely seasickness will occur. Finally, if it should become necessary to vomit, have him do so over the leeward rail. Should the vomiting become persistent, have the diver rest in a cool, shaded area and drink fluids to avoid dehydration.

Information Source: PADI Dive Master Manual

Accident Details Form

Name of Diver (s):

Diver Experience Level:

Details of dive:

Maximum depth

Dive time

Ascent rate

Safety Stop

Gas Used

Dives in Previous 48 hours

Accident Descriptions:

Location

Details

First Aid Administered

Further Treatment Advised

Information Source: Divers Alert Network

DIVE EQUIPMENT

Proper Care and Storage

Taking proper care of your equipment and maintaining it regularly will help prevent serious malfunctions as well as increase the life span of your equipment.

All gear including snorkel, mask, fins, wet suit, SCUBA and underwater equipment needs to be rinsed thoroughly with fresh water at the end of each diving day. The gear then should be stored in a clean, dry area where it can drain and dry properly.

Regulator Care

- Store where it can drain and dry
- Rinse gear thoroughly each day of diving
- Wash with anti-bacterial solution (Nonoxunal 9) to kill bacteria
- Watch for roaches – they will eat the white silicon
- Coil hose – wears out faster if hung
- Spray regulator lightly with silicon every 3-6 months
- Check warranty for replacement parts

Tools

- Adjustable crescent wrench, small Phillips screwdriver, O-ring remover, baggie with 12 extra O-rings and one extra exhaust diaphragm, zip strips, O-ring grease, "jack knife" tool kit

Common Problems

- O-ring is missing, loose or broken
- Hole in mouth piece of regulator
- Flipped diaphragm
- Auto inflator is sticking

Three types of Corrosion

1. Saltwater – green color
2. Rust – reddish-brown
3. Aluminum oxide – white

Recommended Overhaul = once per year

Information Source: 1994 Tour Guide Handbook

Cylinder Care:

Your scuba cylinder has been inspected against the standards of Professional Scuba Inspectors (PSI) and the Compressed Gas Association by a Visual Cylinder Inspector. To keep your cylinder in the best possible condition, follow these recommendations.

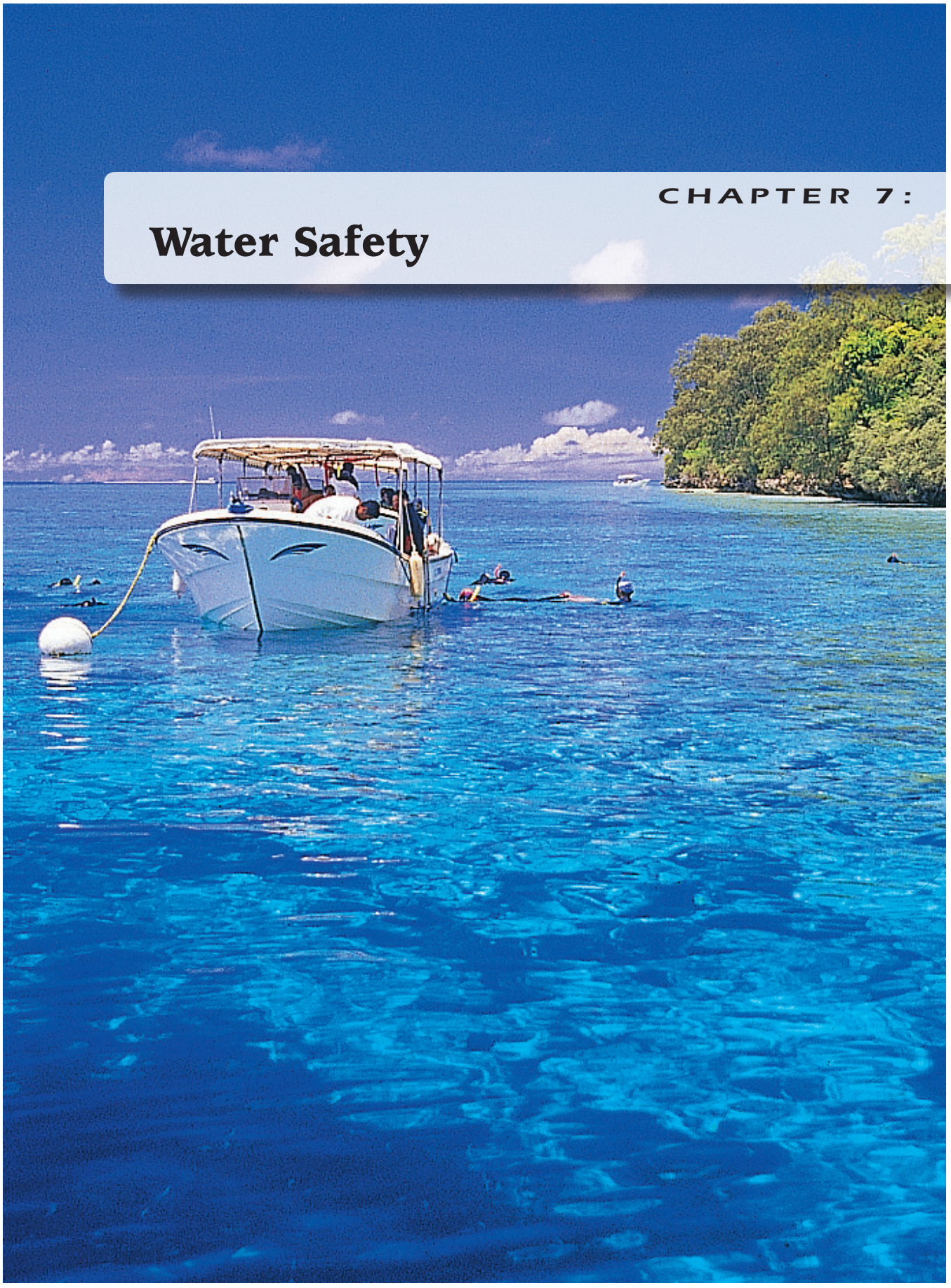
- Keep Moisture Out – Retain 100-300psi within cylinder to assure valve is not inadvertently opened allowing water to be forced though the regulator into the

cylinder. Release a small amount of air from the valve and filter attachment prior to charging the cylinder.

- Storage – Cylinders should be securely stored vertically in a cool, dry place. The cylinder should be clean for storage. Rinse the exterior with freshwater after saltwater exposure. Fully filled cylinders should not be stored for long periods because corrosion is accelerated by the additional oxygen.
- Handling – Scuba cylinders, while resistant to rough handling, can be damaged. Cylinders can be dented if dropped. Cylinder boots are often poor shock absorbers. Valves sometimes open slightly when in transport. Be alert to the sound of escaping air.
- Valve Care – Keep it clean. Tape commonly placed over the valve aperture after the cylinder is filled with air should be removed during long term cylinder storage because the adhesive may become dry and difficult to remove.
- Cylinder boot and backpack – Remove boot, cover, backpack or other dissimilar metal accessories occasionally to clean away salt deposits and inspect for any corrosion.
- Your next inspection depends on a variety of factors. It is recommended that a PSI Cylinder Inspector is consulted.

CHAPTER 7:

Water Safety



William E. Perryclear

NATIONAL GOVERNMENT WATER SAFETY REGULATIONS

(Ministry of Justice Marine Law Enforcement)

All boats must apply for an operating license. The following is a list of the requirements and regulations pertaining to the application for licensing procedure.

- Requirement that all boats covered by this license shall have on board at all times a tool kit for basic engine repair and first aid kit.
  - It is required that the tool kit contain the following: one spark plug wrench, one pair of pliers, two sizes of flat head screwdriver, two sizes of Phillips screwdriver, one adjustable wrench, one full set of replacement spark plugs for one of the engines and at least one replacement fuel filter cartridge for any installed fuel filtration.
  - It is recommended that the first aid kit contain the following: sterile gauze compresses, adhesive tape, band-aids, hydrogen peroxide, burn ointment, sterile eye wash solution, cotton, and "sting stop," meat tenderizer or an equivalent marine sting relief formula.
- Requirement that all boats covered by this license shall have on board at all times properly functioning radio equipment capable of communicating with on-shore radio equipment and facilities, such as a fully functional VHF marine radio.
- Requirement that all boats covered by this license shall have on board at all times a sufficient number of personal floatation devices for all persons being transported. Buoyancy compensators used for SCUBA diving may be counted as a personal floatation device, but children's inflatable toys and buoys shall not be counted as personal floatation devices for the purpose of meeting this requirement. It is recommended that personal floatation devices be of Type I for commercial passenger carrying boats.
- Requirement that all licenses shall allow a sticker or other form of identification and/or certification to be affixed or carried on board all boats by this license when required by the Board.
- Requirement that all boat operator(s) of all boats covered by this license shall, before transporting passengers for hire, obtain an up-to-date weather forecast so that they can be forewarned of major weather disturbances, including, but not limited to, typhoons, tropical storms, etc.
- Requirement that all boats covered by this license operating at night must be equipped with, and use, boat navigation lights.
- Recommendation that all boats covered by this license shall have on board at all times a minimum of three aerial and three hand-held safety flares all of which are within their imprinted service expiration date.
- Restriction that all boats covered by this license shall not transport passengers in numbers exceeding the maximum carrying capacity of the boat as determined by the boat manufacturer and/or the Water Safety Board and whose maximum carrying capacity is listed on the license.

- Restriction that all boat operator(s) for all boats covered by this license shall not consume or be under the influence of intoxicating liquor or narcotic drugs immediately proceeding, or while, operating the boat. For purposes of this restriction, the standards for being under the influence of intoxicating liquor or narcotic drugs shall be the same as those used for 42 PNC 514 (for driving a motor vehicle).

- Restriction that the boat operator(s) for all boats covered by this license shall be over the age of 18 years old, not mentally or physically impaired in any way that might impede or hinder safe operation of a boat, and have over one year of experience operating a boat. Boat operators for boats covered by this license shall be listed on the license application form for approval by the Board. Boat operator(s) approved by the Board shall be listed on the license. Before any boat operator(s) that are not listed on the license may operate a boat covered by this license while transporting passengers, the license shall notify the Board of the additional boat operator(s) and obtain the Board's approval of them.

Additional Requirements and Restrictions for Boats for Hire Carrying SCUBA Divers

- Requirement that all boats covered by this license that are engaged in transporting, guiding and supervising SCUBA divers shall carry at least one Supervising Diver who is a divemaster (or who holds more advanced certification such as assistant instructor or instructor) with certification from a recognized diving organization. Diving certifications recognized by the Board shall be listed and kept on file pursuant to 34 PNC 5203 (e). The maximum in water Supervising Diver/ SCUBA diver customer ratio is one to ten.

- Each group of SCUBA divers engaged in diving shall be led and guided by a Supervising Diver. Use of safety divers to assist divers need not have divemaster certification, but must hold a current diving card from a recognized diving organization and have done at least forty scuba dives. All SCUBA divers must present a diving card from a recognized diving organization or other positive proof of such certification to the licensee or Supervising Diver before diving; provided, however, that this is not required for student divers who are being taught by an instructor certified by a recognized diving organization.

- Requirement that, before each SCUBA dive, the Supervising Diver on any boat covered by this license shall evaluate all dive conditions and make preliminary determination that the dive site is currently safe and suitable for diving. The Supervising Diver shall also determine, before diving, that the dive is suitable for the SCUBA divers in the group that is being guided and supervised, based upon the divers' skill level, training, experience and other factors. The Supervising Diver shall complete a dive site briefing prior to every dive. The briefing shall include dive site description, maximum depth, bottom time, current direction and speed, safety considerations, pick-up point and any special considerations.

- Requirement that the Supervising Diver(s) on any boat covered by this license shall, before diving, insure that each SCUBA diver that is being guided and supervised inspects his/her own SCUBA gear to insure that such gear is in proper working order. Each Supervising Diver shall be equipped with the following gear (in working order) on each dive in addition to his/her basic SCUBA gear: signal float (sausage), signal mirror, octopus regulator, wetsuit or dive skin, watch, dive

tables (need not be carried on dive) and dive computer or timing device. On any night dive the Supervising Diver must also be equipped with a waterproof strobe light and the boat should be equipped with a boat marker light.

- Requirement that all boats covered by this license must fly the recognized red/white dive flag (signifying "diver down") when engaging in diving activities. When not engaged in diving activities the flag must be furled. All boats covered by this license shall also be equipped with safety or current lines (floating polypropylene or similar line) of at least one-hundred feet in length connected to a float(s) in sufficient quantities to be utilized, when deemed necessary, by each diving group on board.
- Requirement that all boats covered by this license shall require all SCUBA divers to dive with an inflatable diving safety sausage. If a SCUBA diver does not possess one, then one shall be made available for rental or purchase from the licensee for the dives with the licensee and every diver shall be instructed in its use before diving.
- Restriction that all Supervising Divers and safety divers for all boats covered by this license shall not consume or be under the influence of intoxicating liquor or narcotic drugs immediately preceding, or while, carrying out their duties and responsibilities of supervising, guiding, and/or watching over divers.
- Review of License Application

Upon receipt of the Application for a license and fee, the Board shall instruct a Water Safety Inspector and/or a Board member to inspect the applicant's boat(s) and/or operations in accordance with 34 PNC 5271. After inspection, the Board shall issue the license upon receipt of a satisfactory inspection report.

BOAT REQUIREMENTS BY NATIONAL LAW THAT EACH GUIDE NEEDS TO CHECK

This is a basic outline of what a guide can check before using a commercial boat for the first time.

The Division of Transportation, Ministry of Commerce and Trade provides training, testing and licensing for all commercial boats in Palau. Every boat that carries tourists, or is a boat-to-hire, must have the following according to National and Koror State Law:

- An up-to-date registration number available upon request
- An up-to-date license for each boat captain available upon request
- Have required, well maintained safety equipment on board at all times including the following: VHF radio, tool kit, first aid kit, oxygen for SCUBA operations, personal flotation devices for all passengers, lights and a fire extinguisher

For updated information or specific questions on national requirements contact the Division of Transportation, Ministry of Commerce and Trade. For updated information or specific questions on State requirements contact Koror State.

***Each tour guide needs to ensure that the skipper and boat meet national standards at all times for their own safety and the safety of their customers.*

Boat Registration

The boat must be registered with the Ministry of Commerce and Trade and Koror State. An up-to-date registration number should be displayed on the boat.

Boater License

All skippers of boats-for-hire or commercial use need to have an up-to-date boaters license.

VHF (Very High Frequency) Marine Radio

Every tour or commercial boat should be equipped with a VHF Radio. All boaters should regularly monitor Channel 16 – the International Emergency Channel and the local emergency channels. Local channels are as follows: Channel 3 or 5 are for Peleliu and Angaur, Channel 7 is for Koror, and Channel 18 is for Northern Babeldaob. Do not use these channels unless there is an emergency.

SAFETY EQUIPMENT

Lights

Lights must be on from sunset to sunrise and during times of restricted visibility (eg. heavy rain) by all boats. Such lights include but are not limited to masthead lights, side-lights, range lights and stern lights. A maximum of five lights and a minimum of three must be running at the required times listed above.

Personal Flotation Device

Every person on board a boat must have one Personal Flotation Device (PFD).

There are four types of PFDs based upon the location, activities and likely time of rescue shown below:

Type I – for off shore cruising, racing and fishing, where rescue may be slow to arrive

Type II – inland cruising, dinghy sailing and dinghy racing, where rescue is likely in a relatively short period of time.

Type III – protected, inland water near shore, where there is a high chance of immediate rescue

Type IV – a throwable devise for an overboard victim or to supplement the buoyancy of a person overboard.

These PFDs must be:

- readily available,
- in good condition,
- properly sized for the passengers,
- used by each passenger during rough weather.

Fire Extinguisher

There are four types of fire extinguishers as shown below:

Type of fire extinguisher	Type of Fire
Type A	Ordinary combustible material
Type B	Gasoline, oil and grease fire
Type C	Electrical fire
Type D	Combustible Metal

There are two sizes of fire extinguishers as shown below:

Size	Foam (gal)	CO_2 (lbs)	Dry chemicals (lbs)	Halon (lbs)
B-I	1-1/4	4	2	2-1/2
B-II	2-1/2	15	10	---

Summary Table of Safety Equipment required by National Law for Each Class Size for boats

Class	Boat	PFD Types I, II or III	PFD Type IV	Fire Extinguisher Type B-II	Whistle*	Bells*	Lights
A	<16	x	1	1			x
1	>16 <26	x	1	1	1		x
2	>26, <40	x	1	2	1	1	x
3	>40, <65	x	1	2	1	1	x

**Only boats with inboard engines require whistles or bells.*

Information Source: Boater Safety Manual. Division of Transportation, Ministry of Commerce and Trade

Boat Maintenance

Boats must be well maintained, with reliable engines and equipment to ensure the safety of its passengers. Several guidelines for proper maintenance are as follows:

- Rinse boat thoroughly with fresh water after a tour
- Bring boat up at least once a month
- Clean algae from bottom which causes resistance and slows down boat – use household chlorox
- Change spark plugs every two to three months
- Tune-up engines every six months
- Lubricate all moving parts – use petroleum-based product (WD-40)
- Check engine for corrosion
- Grease engine with marine grease

Common Problems	Possible Causes
Lower Unit Trouble	Plastic caught on it
Engine Overheating	Plastic or leaves caught on it
Broken Impeller	Hard to fix
Engine Dies	Fuel problem, water in gas, loose hose, clogged filter, water in gear
Engine Won't Start	Clip on ignition, water in gas, electrical problem, battery – scrape terminals with sand paper,piston ring blown

Information Source: The Environment, Inc. 1994 Tour Guide Handbook

PALAU MARINE ADVISORY SYSTEM

The Palau Marine Advisory System is critical for all guides to understand and follow regarding local weather advisories. The following, provided by the National Emergency Management Office, contains all the necessary information as of 2014. Please call the NEMO office for updates.

National Emergency Management Office
Office of the Vice President
Republic of Palau 96940
680-6366/67 • Fax: 680.587.6368
email: palaunemo@gmail.com

A Small Craft Advisory

- A small craft advisory is issued by NEMO when marine conditions outside the reef and areas around Angaur and Kayangel are moderate to relatively rough.
- Traveling to these areas are allowed but caution is advised.
- If you venture out and water conditions are too rough, DO NOT proceed to these areas.
- An advisory is in effect only when the SMALL CRAFT ADVISORY flag is flown.
- The Small Craft Advisory Flag is white with red lettering.
- Flag locations are listed on the back.

A Small Craft Warning

- A small craft warning is issued by NEMO when marine conditions outside the reef and areas around Angaur and Kayangel are extremely rough.
- Traveling to these areas is strictly prohibited.
- Travel within the reef at this time is usually allowed provided NEMO should be contacted first.
- A warning is in effect only when the SMALL CRAFT WARNING flag is flown.
- The Small Craft Warning Flag is red with white lettering.

Flag locations are indicated below:

- Airai (Surangel Marina)
- Angaur
- Kayangel
- Koror State Rangers Marina
- Happy Landing
- M-Dock (Corner of Fish 'N Fins)
- Melekeok
- Ngchesar
- Ollei Port
- Palau Pacific Resort
- Peleliu
- T-Dock
- Ngeremlengui Port (coming soon)

Emergency Contact Numbers

Police..... 911
Fire & Rescue 488-1411
Marine Law..... 488-5206

KOROR STATE WATER SAFETY REGULATIONS

(Koror State Department of Conservation and Law Enforcement) effective as of October 1, 1995

Diving

- Assure the safety of all participants
- Maintain a level of professional competence equal to the standard established by Koror State Government.
- Any boat taking customers out for scuba-diving or snorkeling and deep sea fishing must be equipped with : a first aid kit, a VHF 2-way radio, dive flag/float line and flotation devices (one piece per person aboard). Although not required by law, the DAN Emergency Handbook and an oxygen kit should also be brought on every tour.
- The red/white or blue/white dive flags must be flown when in-water activities are in progress, and all white flags when fishing activities are in progress. At all other times, flags must be rolled or taken down.
- Boats involved in night diving/fishing activities must have adequate boat marker lights above water and an in-water working strobe marker.

- Maximum depth for sports divers is 100ft.
- Required in-water Dive Master: Customer ratio is 1:10
- No spear guns or spear fishing activities shall be allowed when scuba divers are aboard.
- In addition, taking any type of marine life, dead or alive, is strictly prohibited when engaged in scuba diving activities.
- Working as a Dive Master, you must have required training and current certification.
- Boat handlers/safety personnel must have current certification in CPR, training in First Aid and Rescue procedures.
- Divers must present a certification card or positive proof of such certification before they are allowed to dive.
- Extreme caution is required when approaching a dive site with divers in the water.
- All shore divers are required to have a dive float/flag in the water. Shore divers should be informed of the Koror State Conservation laws and regulations.

Dockside Preparation Prior to Departure

Good communication with your passengers with respect to the safety of the dive or snorkel trip and a feeling of trust in the boat operation must be given to the guests prior to departing to the dive site.

- **Greet guests** – help passengers aboard and ensure everyone is given instructions and space for their personal equipment.
- **Roll Call** – require all dive operators to maintain records of passenger information and dive profiles.
- **Welcome aboard introduction** – boat captain should provide comprehensive instructions for the safety and comfort of the passengers.
- **Explain features of the boat** – where everything is located and the proper disposal of waste products.
- **Explain procedures in setting up dive equipment and preparation of dive activities** – explain how you expect divers to handle their gear and their storage.
- **Safety of the voyage**
- **Reviewal of Marine Conservation laws** – in order to dive/fish, all foreigners must have a proper permit.

Management/Evaluation procedures

Management is required to insure that boat crews are properly trained in these procedures and a quarterly review is held. All boat operators are required to have current certification in CPR, life saving procedures, First Aid and any certification held and required at the time of employment.

Injury Assessment and Priority of Evacuations:

The captain has the ultimate responsibility for injury and priority of evaluation determination.

CLASS I: Boat will get underway immediately. This requires assessment of the total situation with consideration for the safety of divers remaining in the water. The captain has the ultimate authority to get underway but must consider the determents of the action. Following are considered as a Class I evacuation case – air embolism, deep laceration with arterial bleeding, respiratory/cardiac arrest, or any life-threatening situation requiring immediate care and requires treatment by shore-based facilities.

CLASS II: Boat will get underway immediately upon diver recall. Captain may elect to use the main engines sounding to alert divers. Following are considered Class II evacuation cases – victim is complaining of chest pain, shortness of breath, paralysis or limb pains. A deep cut or wound without arterial bleeding or any injury requiring treatment at shore-based facilities but not life-threatening.

CLASS III: Boat may or may not get underway according to the availability of shore-based rescue vehicles/personnel. The determining factor of speediness of this evacuation depends on the victim's state of mind and condition. Examples of Class III cases are – small cuts or abrasions, any illness of undetermined origin, and injury that would not necessarily require shore-based treatment. The boat operators are required to complete a full report of any accident and submit it to Koror State Department of Conservation & Law Enforcement as soon as possible or within 24 hours.

Moorings and Anchoring Instructions

Mooring - Each time a boat uses a mooring buoy, the boat operator is responsible for ensuring a proper hook up and inspection. It may be necessary to attach an additional piece of line or pick up line for a vessel that has higher bars. Always report discrepancies of mooring equipment to Koror State Dept. Conservation & Law Enforcement on the day of such finding.

Anchoring – Anchoring in the Rock Islands or anywhere within the State of Koror and/or causing damage to the local environment is illegal. When anchoring is required, please follow these guidelines:

- Be familiar with white sandy holes in the area.
- Using a donforth anchor type only. Lower the anchor into the sand by watching the anchor all the way down to the bottom. Boat captain should keep vessel positioned directly over the sand hole until his anchor reaches the bottom.
- Once the anchor reaches the bottom, the captain/boat operator may back his boat slowly in order to set out line.
- If diving, Dive Master should descend down on the anchor line and check position and security before continuing on the dive.

Emergency Information

Rough weather at sea / crossing the reef

- Close all watertight and weather tight doors, hatches and air ports to prevent taking water aboard.
- Keep bilges dry to prevent loss of stability due to water in bilges.
- Keep passengers seated and evenly distributed. Have passengers put on life preservers.
- If assistance is needed, call over radio or telephone to your respective main office, the local authority (Koror State Rangers ph # 488-2150 or VHF Channel 5 International). If you have a serious emergency call the National Emergency Office (NEMO) and the Bureau of Public Safety.
- Give instructions to passengers concerning leaving the boat, staying together, and listening for instruction.

Man overboard

- Post a lookout person to keep the people overboard in sight at all times.
- Throw a ring buoy/float overboard as close to the person as possible.
- Maneuver the boat to pick up the person in the water.
- If a person is not immediately located notify Local Authority (Koror State Rangers and National Police) and other boat/vessels in vicinity by radio.
- Continue the search until released by Authority.

Fire at Sea

- Cut off air supply to the fire, close hatches, ports, doors, ventilation etc.
- Immediately use portable fire extinguisher at the base of flames for inflammable liquid or grease fires or water for fire of ordinary combustible materials.
- If fire is in the machinery space, shut off fuel supply and ventilations.
- Maneuver boat/vessel to minimize effect of wind and fire.
- If unable to control fire, immediately notify the Fire Department and Koror State Rangers and other boats in the vicinity by radio (VHF Channel 5 International).
- Move passengers away from fire, have them put on life preservers and if necessary, be prepared to abandon boat/ship.

Boat Handling

Collision Rules

Between Power Boats: When two boats are coming at each other head on, each boat driver should steer right (starboard) so that they pass each other on the left. When two

boats are heading generally in the same direction, but on a collision course, the boat on the left yields to the boat on the right.

Between Power Boats and Sail Boats: Generally, it is the duty of the power boat to keep out of the way of sailboats. However, this does not give the sailing boat/vessel the right to hamper the safe passage of a power boat/vessel.

Port Regulations

Power Boats

- It is the duty of any person having control of a power boat to navigate so as to avoid collision or injury to any person or vessel in the same area or disturbed by its wake. The boat must be managed with due care and consideration with regard to the prevailing conditions and the likelihood of other person being present or coming into the area occupied by the boat or its wake. You are responsible for the effects of your wake as you are for the effects of the boat itself.
- No boats or vessels may exceed a speed of five (5) knots when in Malakal Harbor area in Koror State.
- Sixteen (16) is the minimum age required to operate a power boat. A boat operator under this age may do so only if under the supervision of an adult.
- Boat operator must obey orders from Koror State Marine Law Enforcement personnel.
- Every person in a power boat is considered to be in control of the vessel for the purposes of assigning fault or liability for violations of these rules. In the case of a dive boat, all staff would be held responsible for a violation.

Diving Rules

- No power boat may come within 100 yards of a diver's down flag or light. You must not display the divers down flag unless you have divers in the water. The only exception is in a rescue operation.
- Diving is restricted to an area within 100 yards of the divers down flag or light.
- No person may swim or dive in a navigational channel and Malakal Harbor, except a rescue or an authorized operation.

Ski Boats

- There must be two people operating a ski boat. One at the wheel and the other acting as a lookout person and all must wear a life preserver.
- No skiing is allowed within any navigational channel, Malakal harbor, Dive Site or Rock Islands.

Personal Watercraft *(See Koror State Personal Watercraft Regulations)*

- Personal watercraft (PWC) operators are required to wear a life preserver to include passengers.

- Personal watercrafts are not allowed to be operated within any navigational channel, Malakal Harbor and all Rock Islands.
- Personal watercrafts are only allowed in the designated areas. Please check with Koror State Rangers for detailed information.

Fishing Boats

- Stay clear of all fishing boats.
- Look out for the boats which are tailing off beyond the drop off. They often have very long anchor/mooring lines which are often marked with a small buoy.
- Watch for your wake. Many people fish in a very small boat. Not only may your wake disturb them, it may create a danger of capsizing a small boat.
- Trolling fishing boats often use very long lines. If you see a boat trolling, stay very wide from it to avoid getting tangled up with the trolling lines.

Have fun but remember, the life you save may be your own!

KOROR STATE PERSONAL WATERCRAFT REGULATIONS

(K7-139-2003) effective as of May 2003

Section I – Authority

These regulations are promulgated and enforced by the Governor of Koror. They will be effective sixty (60) calendar days after becoming law, and shall have the force and effect of law and bind every person within the state's jurisdiction, except as to personal watercraft being used for governmental purposes, including emergency rescue and environmental and/or scientific research or study (provided such personal watercraft is clearly marked and identifiable as being primarily used for governmental purposes), and to personal watercraft being operated by participants in a professional exhibition or a regatta, race, marine parade, tournament, exhibition or water safety demonstration (provided such event occurs with the Governor's prior, express written permission and pursuant to event rules and regulations also approved by the Governor and enforced by the event's sanctioning body and/or officials). Each ticketed violation hereunder shall carry a One Hundred Dollar ($100) fine and/or ninety (90) days of incarceration.

These regulations are based upon the best available information – a body of knowledge that continues to evolve as more jurisdictions around the world adopt and promulgate similar regulations. Therefore, the Governor reserves the right to modify these regulations when and as he deems wise in light of then-current scientific and/or regulatory findings.

Section II – Background

Personal watercrafts are typically propelled by an inboard, internal combustion engine that drives a water jet. Engines are largely two-stroke; although the four-stroke engine is growing in popularity and use. They generally use a gas-oil mixture that, as with out-

board motorboat two-stroke engines, can deposit significant amounts of harmful and long-lasting pollutants into state waters. They can disrupt our delicate underwater ecosystem and their high-pitched whine can disturb wildlife and individuals nearby. This may ultimately result in fewer tourists pursuing more traditional activities like boating, diving, snorkeling, hiking, camping, bird watching, canoeing and kayaking. It should also be noted that accidents often occur when inexperienced users operate personal watercraft without proper instruction and when experienced users attempt acrobatic maneuvers, sharp turns and/or wave jumping.

Inspired by our concern over the foregoing, our state has chosen to promulgate a system of "water surface use management" to balance the community's safe enjoyment of state waters with the preservation of our delicate underwater ecosystems.

Section III – Definitions

As used in these regulations, unless the context otherwise requires, the following terms and those defined throughout shall have the meanings ascribed to them.

- "Channel" means the deepest part of any waterway (through which the main current flows) or the part of a body of water deep enough for navigation through an area not otherwise suitable for navigation.
- "Idle speed" means the PWC's slowest possible speed (which can in no event cause a noticeable wake or be greater than five (5) knots).
- "Operate(d)" means to be in charge of a PWC while it is under way and not secured.
- "Operator" means the person who is in charge of a PWC being operated.
- "Owner" means a person who claims (or is entitled to) the lawful possession of a PWC by virtue of that person's legal title to (or equitable interest in) a particular PWC.
- "Person" means an individual, corporation, limited liability company, partnership, association, governmental entity or other legal, business or organizational entity.
- "Personal watercraft" and "PWC" means a powered, on-water vessel that is designed to be operated from a sitting, standing or kneeling position on – rather than within – the hull, and is equipped with an internal combustion engine that powers a water jet pump that cannot be disengaged to prevent the vessel from making headway, as typified by, but not limited to, Jet Skis, Sea Doos, Wavejammers, Waverunners, Wetjets, Wet Bikes and Surf Jets.
- "State" means Koror state in the Republic of Palau.
- "State waters" means the twelve (12) nautical miles (1.85 kilometers) of water defined in and determined by Article 1, Section 1 of the state Constitution.
- "Type I Personal Flotation Device" means a non-inflatable device designed to turn an unconscious person in the water from a face down position to a vertical or slightly backward position and to have more than twenty (20) pounds or nine kilograms of buoyancy.

- "Type II Personal Flotation Device" means a non-inflatable device designed to turn an unconscious person in the water from a face down position to a vertical or slightly backward position and to have at least fifteen point five (15.5) pounds or seven kilograms of buoyancy.
- "Type III Personal Floatation Device" means a non-inflatable device designed to keep a conscious person in a vertical or slightly backward position and to have at least fifteen point five (15.5) pounds or seven kilograms of buoyancy.
- "Use(d)" means to operate, navigate or employ.
- "Vessel" means each and every craft capable of being used as a means of transportation on water.

Section IV – General Restrictions

Every PWC must at all times be operated in a reasonable and prudent manner and shall never be operated to chase or harass wildlife or at greater than idle speed within one hundred (100) feet of any shoreline, dock, swimmer, diver, snorkeler or a non-PWC vessel.

No PWC may be modified after-market to increase its speed, thrust or noise emissions. Every PWC must have:

- a properly operational self-circling or lanyard-type engine cutoff switch that, at all times during the PWC's use, is attached to the PWC operator (or the operator's clothing or life preserver);
- a spring-loaded throttle mechanism that, when tripped, automatically and immediately returns the PWC to idle speed; and
- a line and anchor capable of securing a non-operational PWC.

No PWC may be used to tow any individual unless the respective PWC manufacturer's user manual expressly permits same and the PWC has, in addition to the operator, a rear-facing individual passenger to continuously monitor the progress of the person(s) being towed.

Section V – Age Restrictions

Except for in an emergency, no individual under the age of thirteen (13) shall operate a PWC. Nor shall any individual under the age of seven (7) be a passenger on a PWC unless said PWC is, at that time, being operated by that individual's parent or legal guardian. An owner shall not authorize or knowingly permit the owner's PWC to be operated in violation of this section.

Section VI – Time Restrictions

Except for in an emergency, no person shall operate a PWC after seven (7) p.m. or before six (6) a.m.

Section VII – Locale Restrictions

The Governor shall designate buoyed areas in which PWC use is permitted. These areas shall be known as "Water Sport Zones". A PWC shall not be operated outside of a desig-

nated Water Sport Zone unless it is being operated at an idle speed or is headed toward the nearest Water Sport Zone or from one Water Sport Zone to another. When heading from shore to the nearest Water Sport Zone or from one Water Sport Zone to another, an operator must proceed thereto via the best available channel. Notwithstanding anything herein to the contrary, PWC operation, even at idle speed, is prohibited among and within one hundred (100) meters of the Rock Islands, and within any Rock Island bay and the state's commercial port area.

There will initially be four (4) Water Sport Zones. The Governor may designate additional areas as he determines necessary.

Water Sport Zones

The four (4) initial Water Sport Zones will be located at:

- the Koror side of the Renrak waiting house
- the Meyuns old Skozyo sea plane ramp,
- the deep-water lagoon at the northern end of the Llebuchel Channel (between Echang and Uchulangas).
- the T-dock west ramp at Arkemais, and at Station Harbor,

The Water Sport Zones' water surface size and perimeter will be determined by the Governor. The placement of these initial Water Sport Zones has been approved by the Koror State Department of Conservation and Law Enforcement because the locations are, in the Department's estimation, unlikely to be degraded by noise and water pollution (as they are already impacted by human activity), are not in ecologically sensitive areas, have good water circulation (which enables the flushing of any discharged oil and fuel), and are largely open (thus dissipating PWC noise). Further, these areas have established land entry points (i.e., docks), provide deepwater access and have the generally calm waters suitable for PWC operation.

Section VIII – Depth Restrictions

No person shall operate a PWC where the water is less than five (5) feet deep, as determined by an absolutely vertical measurement from the water level downward to the sea floor, unless the PWC is located within a Water Sport Zone or the PWC is proceeding at idle speed to be imminently docked, launched or otherwise secured.

Section IX – Capacity Restrictions

No more than one operator and one individual passenger are permitted on a PWC simultaneously, unless expressly authorized by the PWC manufacturer's user manual. No more than one individual may be towed by a PWC unless expressly authorized by the PWC manufacturer's user manual.

Section X – Safety Equipment Requirements

Every PWC operator, passenger and person being towed by a PWC shall wear a Type I, II or III personal floatation device while on a PWC or in or on the water. Every PWC shall at all times contain a signaling device, paddle, tow strap, and a functioning, waterproof, battery-operated flashlight. In addition, a radio or cellular communication device is strongly recommended.

Section XI – Dealer Restrictions

Any person offering a PWC for sale within the state shall procure and maintain a valid business license from the state and shall provide every PWC buyer with a summary of all laws and regulations governing PWC operation in state waters and shall, on request, provide instruction free-of-charge regarding safe PWC operation. Every such dealer shall require each PWC purchaser to acknowledge in writing that the purchaser has been provided with a summary of all laws and regulations governing PWC operation in state waters and that the purchaser has read and understood them. The dealer must retain each signed form for no less than six (6) months from the respective sale's date. This Section XI shall not apply to private individuals offering for sale no more than one (1) at any given time.

Section XII – Rental Restrictions

Every person offering a PWC for rent within the state shall procure and maintain a valid business license from the state and shall provide every renter with:

- a summary of all laws and regulations governing PWC operation in state waters;
- a Type I, II or III personal flotation device, and all other equipment required herein; and
- instruction free-of-charge regarding the safe operation of PWC (which shall include basic PWC operation and control skills, and distress and emergency protocol).

Every person offering a PWC for rent within the state shall also: (a) procure and maintain no less than Two Hundred and Fifty Thousand Dollars ($250,000) of liability insurance to cover all damage caused by such person and/or any of such person's PWC renter(s) to the environment and/or any third party or personal or real property; (b) require each of such person's PWC renters to acknowledge in writing that such renter has been provided with a summary of all laws and regulations governing PWC operation in state waters and that the renter has read and understood them (and shall retain each signed form for no less than six (6) months from the respective rental date); and not rent – or offer to rent – any PWC to any individual less than eighteen (18) years of age or anyone who is, in the reasonable determination of the individual offering the PWC for rent, under the influence of any drug or alcohol.

Section XIII – Owner Liability

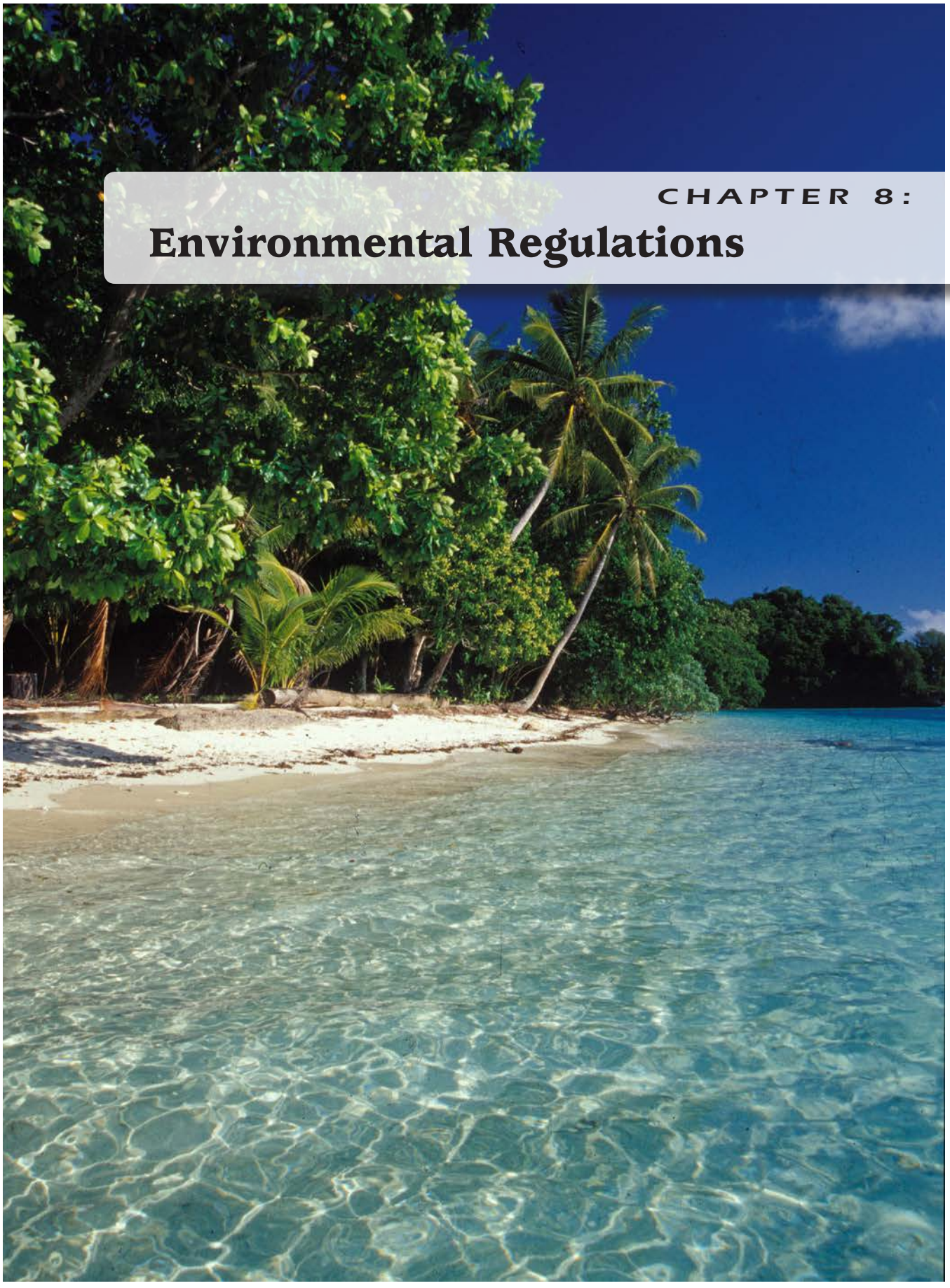
A PWC owner is liable for all injuries caused by the negligent operation of said owner's PWC (excepting persons offering a PWC for commercial rental). It shall be refutably presumed that a PWC is being operated with the owner's knowledge and consent if the PWC is being operated by the owner's son, daughter, spouse, father, mother, brother, sister or other immediate member of the owner's family.

Section XIV – Prospective, 2-Stroke Engine Ban

Commencing on January 1, 2006, 2-stroke engine PWC will be prohibited.

Section XV – Operator Drug and/or Alcohol Use Prohibition

In addition to any other Koror State Public Law or Republic of Palau dictate, no PWC operator may be under the influence of any drug or alcohol.



CHAPTER 8:

Environmental Regulations

Palau Visitors Authority

KOROR STATE ROCK ISLANDS MANAGEMENT

World Heritage Site

In 2012, the Rock Island Southern Lagoon (RISL) was inscribed as a World Heritage Site. The site's geographic center is 134°20'34.48°E, 7°14'48.93°N and covers an area of 1,002 km^2 and includes 445 limestone islands, 52 marine lakes and is surrounded by a lagoon with fringing reefs, patch reefs and shallow water marine areas. The buffer zone is the territorial waters of Koror State excluding an urban area of 164km^2. The RISL natural and cultural features are of outstanding universal value. The 2013 Koror State Management Plan (KSMP) was updated to include a more comprehensive cultural management component to further meet Palau's commitment as a World Heritage Site.

The Rock Islands – Southern Lagoon Area is owned and regulated by the traditional leadership of Koror and the Koror State Government, who have appointed the Koror State Public Lands Authority and the Koror State Planning and Zoning Commission to oversee all land and designate land use and zoning, respectively. The State's Department of Conservation and Law Enforcement is responsible for running the Management Area and enforcing State environmental laws. The Koror State Rangers was first established in 1989 to enforce State curfew laws, and later became the Department of Conservation and Law Enforcement in 1994. In the 21 years that the department has been established, it has, and continues to, work closely with a range of locally based agencies and organizations on management and research activities within the Management Area. This has resulted in the development of State regulations on resource use and activities and designation of protected areas within the Management Area.

National domestic fishing laws also apply to the Management Area and are enforced by national enforcement officers at the Division of Fish and Wildlife. The State cannot currently enforce national laws but is working to remedy this. Additional national regulations that control access to specific areas in the Management Area have been reinforced by State law, and are thus enforced by the Rangers. This includes Palau's first protected area, the Ngerukuid Islands Wildlife Preserve, which was established by the Trust Territory Government in 1956 and the State in 1999; and restrictions on fishing in Ngerumekaol Spawning Area that were established by National Law in 1976 and strengthened by State Law in 1999.

Long before modern conservation laws were developed, Palau's resources were managed by traditional controls, such as *bul* (harvest restriction) and marine tenure. Although traditional marine tenure no longer exists within the management area, traditional controls have been maintained and are the basis of many modern day conservation initiatives. A traditional decree declared by the Ngarameketti Chiefs Council of Koror in 1973, still restricts harvesting of marine and terrestrial resources in the Rock Islands and the surrounding waters in the Management Area.

Modern day conservation initiatives are supported by a range of State laws that regulate general resource use and recreational activities and designate protected areas within the Management Area (see Table 1). The Year 2000 Rock Islands Management and Conservation Act, which regulates recreational activities, provides much of the basis for current management activities in the Management Area.

KOROR STATE ENVIRONMENTAL AND CONSERVATION LAWS

Koror State has a website (www.kororstategov.com) that has all of Koror State Laws that can be accessed and reviewed

Koror State Acts & Regulations relevant to the Management Area

Regulation	Purpose	Reference	Effective
GENERAL RESOURCE USE:			
Permit for Shell Collection	Regulates collection of shells, except for scientific purposes or for food.	MO 46-69	1969
Photo Permit (commercial use)	Regulates commercial photography (still & movies) by non-residents of the State.	MO 50-69	1969
Harvesting restrictions in the Rock Islands, Decree by Ngarameketii, Chief Council of Koror	Prohibits harvest of any marine of terrestrial life by non-residents of the State, & the taking of domestic animals to the Rock Islands.		1973
Littering and Trash Disposal	Prohibits littering and any disposal of trash in the Rock Islands	K2-34-89	1989
Fishing License (commercial)	Regulates commercial harvest of marine resources, & prohibits use of damaging fishing techniques.	K4-68-95	1995
Harvesting & cutting of vegetation in mangroves.	Prohibits harvest of vegetation in mangrove & wetlands below high tide.	K6-110-2000	2000
Sardine harvesting restrictions	Prohibits sale of sardines (mekebud) & restricts fishing or capture of sardines (mekebud, mearu, & teber) for four days before & during full moon.	K6-95-99	1999
Rock Islands Management & Conservation Act	Designates tourist activity areas, & requires that all tourists hold a valid Rock Island User Permit.	K6-113-2000	2000
Economic & non-economic values of coral reef ecosystems	Recognizes the economic & non-economic values present in coral reef ecosystems in Koror State waters, & authorizes the Governor to put in effect rules & regulations to enforce this Act.	K6-121-2001	2001
Rock Islands Management & Conservation Act Amendment	Exempts children five years old or less, & visitors to Dolphin Pacific (only) from requiring a Rock Island User Permit.	K6-126-2001	2001
State Parks-Koror Side Japan Friendship Bridge & Long Island	Designates Koror State Parks in these two areas.	K7-132-2002	2002
Fishing License Amendment (Non-Commercial use)	Prohibits non-Palauan citizens from fishing from land on Koror Island. Fishing license permits fishing from a boat or registered watercraft only.	K7-138-2003	2003
Land Crab Act (rekung el daob, rekug el beab, kesuar)	Prohibits the taking, possession, & sale of live or dead land crabs during certain times, & undersized or berried crabs at any time.	K7-140-2003	2003
Grouper Regulation	Regulates taking of Groupers and provides size regulation	K9-243-2011	2011
Sea Cucumber Act	Permanent Moratorium on all sea cucumbers	K9-247-2011	2011

Regulation	Purpose	Reference	Effective
Permit Increase Act	Amend K8-207-2009	K9-248-2011	2012
Cutting of Trees and Vegetation	To provide penalties for cutting of trees and clearing vegetation	K10-271-2014	2014
BOATING:			
Boat Registration Act	Requires motorboat owners that reside in Koror to register boats to operate within State waters.	K6-99-99	1999
Cruising Yacht Permit (non-commercial)	Requires yacht owners to have permits when anchoring, mooring or docking within Koror State waters, except Malakal Port.	K6-107-2000	2000
Live aboard Vessels	Limits the number of live-aboard vessels operating in KS, bans operation of new vessels, & established permit fees.	K6-124-2001	2001
Prohibit motorboat operation at Kerker ra Kosiil	Prohibits motorboat operation.	K7-130-2002	2002
Jetski & similar motorized personal watercraft	Establishes safety & operational regulations for personal watercraft & designates four water sport zones.	K7-139-2003	2003
PROTECTED AREAS:			
Ngemelis Island Complex- no fishing within one mile	Prohibits fishing within one mile of the island complex.	K6-68-95	1995
Ngkisaol Sardines Sanctuary (mekebud, merau, & teber)	Prohibits fishing or taking of sardines within 100 yards.	K6-95-99	1999
Ngemelis Island Complex-no motorboat operation	No operation of motorboat between island complex.	K6-97-99	1999
Ngerukuid Islands Wildlife Preserve	Prohibits transport of firearms or other weapons capable of killing or capturing birds, animals or marine life, bans transport of domestic animals, burning, cutting, destroying or removing plants.	K6-101-99	1999
Ngerumekaol Spawning Area	Prohibits fishing, killing, trapping or possession of fish at any time.	K6-101-99	1999
Soft coral arch, cemetery reef, & all marine lakes	Prohibits fishing, hunting or taking of any marine flora & fauna.	K6-95-99	1999
Ngerderrak Reef Area moratorium	Prohibits fishing, hunting or taking of any marine flora & fauna.	K6-119-2001	2001
Extension of moratorium – Ngederrak Reef	Extends moratorium until Jan 9, 2005.	K7-133-2002	2002
Permanent Conservation Moratorium – Ngerderrak Reef	Repeals K7-133-2002, to establish a permanent conservation moratorium of Ngederrak Reef	K7-156-2005	2005
Ngerkebesang Conservation Zone	Prohibits fishing, hunting, taking or disturbance of any marine flora & fauna.	K7-136-2002	2002
Ngerbechetei Conservation Area	Tourist activity area requires visitors to obtain permit prior to entry	K9-245-2011	2011
Ngetmeduch Conservation Area	Prohibits fishing, hunting, taking or distrbance of any marine flora and fauna	K9-246-2011	2011
Long Island Conservation Area	Prohibits fishing, hunting, taking or disturbance of any marine flora and fauna. one mile zone	K9-244-2011	2011

Designated Tourist Areas and Regulations

Tourist Areas

- Jellyfish Lake (Ongeimi'l Tketau) on Mecherechar Island
- Bablomekang Island
- Ioulomekang Island
- Beach Areas (Ngermeaus, Ngeanges, Ngchus, Ngchelobel, Ngbusch, Ngeroblobang, Ngeremdiu and Bkul chotuut)
- Ngeremdiu Todai Trail (German Lighthouse)
- Ulong Islands

All other land is reserved for Palau residents. Tourists may access all water areas except Ngkisaol Sardines Sanctuary, Ngerukuid Islands Wildlife Preserve, Ngederrak Reef and all other marine lakes.

Regulations

- Any visitor entering Palau on a tourist visa must have a valid Rock Island permit to use the area. The permit costs $15 and is valid for 15 days. It allows scuba diving, snorkeling, kayaking, boat touring and land activities on designated tourist activity areas.
- Non-Palauan citizens and visitors must have a valid fishing license to take part in any fishing activities. License fee is $20 per month, or $200 per year. It is illegal for non-Palauan citizens to fish from land areas on Koror Island (includes all fringing reefs joined to land areas).

State Fishing Regulations

- No fishing, hunting or disturbance or possession or transport of any firearms of any description, or other weapons, nets, traps, snares or objects or materials capable of killing, or otherwise taking birds, animals or marine life in Ngerukuid Islands Wildlife preserve. Also no entry.
- No fishing all year round, no hunting, disturbance or possession of any fish in Ngerumekaol Spawning Area (Ulong Channel).
- No fishing within one mile of the Ngemelis Island Complex.
- No fishing, hunting or disturbance of sardines within 100 yards of Ngkisaol (Inlet) Sardines sanctuary.
- No selling of sardines *(mekebud, merau, teber)* at any time in Koror State.
- No fishing of sardines *(mekebud, merau, teber)* four days before and during the full moon.
- No fishing, hunting, taking or disturbance of any marine flora and fauna at Soft Coral Arch, Cemetery Reef, any marine lake and Ngerkebesang Conservation Zone.

- No hunting or fishing, no taking, removal, or disturbance of any marine flora and fauna and no entry of motorized watercraft at Ngederrak Reef Area (moratorium until 2005).
- All non-Palauan citizens and tourists must attain a fishing license to partake in recreational fishing activities. Non-Palauan citizens are prohibited from fishing on any kind of land or improvements to land on the Island of Koror, and may only engage in fishing activities from a boat or registered watercraft.
- Licenses are required for all commercial fishing in Koror State Waters.
- In addition to no-take areas, the following fishing methods are prohibited:
  - Spearfishing using a spear or projectile powered by gas or any explosive mechanism;
  - Fishing with the assistance of any explosive substance or any harmful substance or poison;
  - Fishing using any net with mesh smaller than three inches on any side of the hole;
  - Commercial fishing within the reef by foreign licensee or any company with foreign partnership or joint venture;
  - Drag and drift net fishing both inside and outside the reef except for the purpose of bait collection;
  - Fishing using any net that is moved by any vessel;
  - Fishing using any form of mechanically compressed air or other breathing apparatus;
  - Receiving, buying, transporting, storing, using, eating or selling any fish obtained in violation of this law;
  - Fishing for trochus at any time except during the trochus season as mandated by the ROP, unless further restricted by Koror State.

Koror State Land Crab Regulations

The harvesting restrictions listed above also include invertebrates. In addition, the Koror State Land Crab Act prohibits the taking, possession and sale of live or dead land crabs *(rekung el daob, rekung el beab,* and *kesuar)* from midnight on the second day before the day and night of the full moon, and on the day and night of the full moon for a total period of three days around the time of each full moon. The act also prohibits the taking of undersized land crabs, smaller than three inches (largest carapace width) and the taking, possession, sale or exchange of land crabs with eggs (berried) at any time.

Trochus MPAs

Koror Municipal Ordinance No. 48-69 (Amending in its entirety Koror Municipal Ordinance No. 4-57, which covered various other reefs than as named in the 1969 law): This municipal ordinance, effective as of June 16, 1969, set aside the following Koror State reefs as trochus breeding sanctuaries: 1) Uchelbeluu; 2) Ngederrak; 3) Lukes; 4) Udel; 5) Ngermongind; 6) Rebotel. The ordinance provides that unless expressly permitted by the "Mayor of Koror Municipality with the concurrence of the Trust Territory Marine Biologist" the harvesting of trochus in the referenced areas at any time shall be illegal and constitute a misdemeanor offense and provides a monetary penalty for those taking trochus from the sanctuaries or entering the sanctuaries with the intent

of removing trochus there from equal to not more than $25.00 or imprisonment for not more than thirty (30) days, or both.

Shell Collecting

Koror Municipal Ordinance No. 49-69: This municipal ordinance, effective as of December 3, 1969, makes it unlawful for any person to take or collect shells within the waters of Koror State without first obtaining a written permit from the Mayor or his designated representative. The ordinance does not apply to the taking of shells for scientific purposes or for food. The ordinance also deems any violation of the law a misdemeanor and provides a penalty for violators of the law of a fine of not more than $25.00 or imprisonment for not more than thirty (30) days, or both.

Photography & Filming

Koror Municipal Ordinance No. 50-69: This municipal ordinance, effective as of December 3, 1969, prohibits any professional photographer who is not a permanent resident of Koror State from taking photographs or movies in Koror State for commercial purposes unless the person first obtains a $50.00 permit to do so from the Mayor or his designated representative. The ordinance also deems any violation of the law a misdemeanor and provides a penalty for violators of the law of a fine of not more than $25.00 or imprisonment for not more than one month, or both.

Fishing by Residents Only

Decree by Ngarameketii Chiefs Council of Koror dated December 19, 1973: This decree, by the Ngarameketii Chiefs Council of Koror, states that the following restrictions are to be observed from January 1, 1974, until such time as rescinded by additional tribal decree: 1) No person who is not a resident of Koror Municipality may fish, or cut, take away, or hunt any terrestrial or marine life in the rock islands or there surrounding waters, or take away any article of value from within the Koror Municipality; 2) No pets such as cats, dogs or monkeys may be taken to the rock islands nor disposed of there at any time; and 3) All residents of Koror, fishing or picnicking in the Rock Islands shall carefully observe Koror traditional and cultural methods and regulations pertaining to the use of the rock islands and surrounding waters. Any persons violating the decree shall be "punished by the Ngarameketii Chiefs Council of Koror in accordance with traditional and cultural manners." This law has not been officially rescinded in writing by additional tribal decree.

Littering

Koror State Public Law No. K2-34-89: This Koror State Public Law, effective as of May 11, 1989, prohibits littering or depositing of waste material by any person on any land or in any waters or atmosphere owned, controlled by, under the jurisdiction of, or maintained by the State of Koror except in a public dumping ground. This includes a ban on all trucks and other vehicles from allowing soil, sand, coral, rocks, vegetation or other materials to be blown from the vehicle while either moving or stationary. Persons violating the littering prohibition are liable for civil penalties in the amount of $200 per violation and forfeiture of the vehicle (and all related equipment) used in the act. Additionally, the violator shall be guilty of a misdemeanor and punished by incarceration of at least thirty (30) but not to exceed ninety (90) days and a fine of at least fifty dollars ($50.00), but not to exceed one hundred dollars ($100.00), and shall also be

liable for reasonable costs and fees (including clean-up and attorney costs) incurred by Koror State in enforcing the law.

Shipwrecks

Koror State Public Law No. K3-54-92: This Koror State Public Law, effective as of October 20, 1992, provides practices for the proper care, removal and disposal of wrecked, stranded or abandoned ocean going vessels and their contents and places the burden of such practices upon the persons responsible for the wreckage, stranding or abandonment of the vessel or upon the operator or owner thereof. Under the provisions of this Act, the Koror State Marine Rangers are to remove salvageable materials from the wreck, secure the wreck with anchors, oversee the removal of all hazardous substances and the removal or disposal of the wreck if not moved by the owner within one (1) month of its grounding. Notwithstanding the duties of the Rangers set forth, the owners are required to remove the vessels themselves, according to strict requirements set forth in the Act. All costs incurred by the Rangers or the State of Koror in accomplishing the obligations of ship owners shall be jointly and severally paid by the operator and/or owner of the vessel including (without limitation): (a) costs for fuel, oil and other transportation costs; (b) employee costs; (c) costs of all equipment required for removal; (d) costs of hiring experts and special equipment; and (e) costs of all materials used for storage and clean-up. Violators of the Act are liable to pay a fine of no less than $1,000 and no more than $10,000 for each separate offense. Each day of a violation constitutes a separate offense. The House of Traditional Leaders of the State of Koror may waive any provision of the Act.

Port Commission

Koror State Public Law No. K4-64-94: This Koror State Law, effective as of October 12, 1994, establishes a Port Commission consisting of five (5) members that are charged with conducting an annual study and review of the facilities and operation of the Port of Koror, which will evaluate (a) proposals for improvements to, or expansion of, the facilities and operations thereof, and (b) whether or not the Legislature should establish tariffs, maximum rates or charges on tenants of the Port. The Commission is also charged with submitting comments upon any lease or renewal thereof with respect to land leased in the Port area.

Fishing Licenses

Koror State Public Law No. K4-68-95 (which amends in its entirety Koror State Public Law No. K3-42-90, effective as of January 10, 1990, requiring that licenses be required for all commercial fishing in Koror State waters): This Koror State Public Law, effective as of approximately June 13, 1995, requires that licenses be required for all commercial fishing in Koror State waters and that different licenses be obtained for each classification of fishing (i.e. clamming, shelling, lobstering, netting, spearing, trolling, bottom line fishing or long line fishing). Licensees are required to fill out detailed applications and then the Governor (or designee) is to review and evaluate the application and issue a license only when it is determined that the issuance will not unduly deplete, endanger or harm the resources of Koror State. The law also provides the following monthly fees for respective fishing licenses: (a) for spear gun, line or hook (including long line, bottom line, reel casting or trolling, but excluding fishing for lobster, crab or other crustaceans), $25.00; (b) for lobster, land crab or other crustaceans or shellfish, $10.00; (c) for sea cucumber, kelp, seaweed and clams, $10.00; and (d) for

reef fishing with nets, $10.00. For non-commercial fishing by non-Palauan citizens, the annual fee is $100.00, or $10.00 per month, excluding net fishing, which costs $50.00 per month. With respect to fish sales, this law prohibits all persons or entities from purchasing fish unless the seller exhibits to the buyers his/her license, and all buyers are required to provide written numbered receipts to sellers. Both sellers and buyers are required to maintain records of each transaction for official inspection. The following activities, among others, are also prohibited under this law: (1) spear fishing with a spear or projectile powered by compressed gas or by any other explosive mechanism; (2) fishing with the assistance of any explosive substance or any harmful substance or poison; (3) fishing using any net with mesh "smaller than three inches on any side of the hole"; (4) commercial fishing "within the reef by foreign licensee or any company with foreign partnership or joint venture"; (5) drag and drift net fishing both inside and outside the reef except for the purpose of bait collection; (6) fishing using any net that is moved by any vessel; (7) fishing using any form of mechanically compressed air or other breathing apparatus; (8) receiving, buying, transporting, storing, using, eating or selling any fish obtained in violation of this law; (9) fishing of any nature within one mile of the shore line of either Ngemelis or Dmasch Island; (10) fishing for trochus at any time except during the trochus season mandated by the Republic of Palau, unless further restricted by Koror State; and (11) processing trochus in any area except the western pier of T-Dock from the gas station to the tip of the pier, the area of Ice-Box Park between the sewage treatment plant and the end of the road at BMDC, the filled land on the opposite side of the causeway from Ngetmeduch Island, or any other area identified by the Governor. Additionally, any violator shall be guilty of a misdemeanor and may be punished by incarceration not to exceed ninety (90) days and a fine of at least fifty dollars ($50.00), but not to exceed one hundred dollars ($100.00), and/or also be liable for civil penalties in the form of $500.00 for the first violation and $1,000 for each subsequent violation, and the forfeiture to Koror of all fish (or the fair market value thereof) obtained in violation of the Act, and all vehicles, boats, engines, scales, spears, nets, lines, tackle and other equipment used to engage in fishing or receiving, selling, buying, transporting, storing, preparing or using of the fish obtained in violation of the Act. Violators shall also be liable for costs (including reasonable attorney costs) incurred by Koror State in enforcing the law.

Liveaboards

Koror State Public Law No. K6-87-98 (as amended by Koror State Public Law No. K6-124-2001, effective as of approximately November 7, 2001, which, among other things, repealed Koror State Public Law No. K6-111-2000): This Koror State Public Law, effective as of April 2, 1998, placed a ban on the erection, operation or maintenance of a floating hotel in any body of water of the State of Koror. There was also originally established a moratorium upon the operation of new liveaboard dive vessels within Koror State waters which was revised by the 2001 amendment to allow the operation of up to seven (7) liveaboard dive vessels in Koror State waters while banning the operation of any new liveaboard vessels not operating at the time of the 2001 amendment, calling for the promulgation of liveaboard dive boat regulations by the Governor and providing for an annual environmental impact fee to be paid by all operators of such vessels. All liveaboard vessels not "grand fathered" by the 2001 amendment are allowed to transit through Koror State waters for navigation or interstate or foreign commerce, but are only allowed to anchor at Malakal Harbor except during emergency situations or if specifically permitted to anchor elsewhere for scientific or educational research. Annual environmental impact fees to be paid to Koror State for legal liveaboards are set at one thousand dollars ($1,000.00) for vessels with five (5) to ten (10)

cabins and two thousand dollars ($2,000.00) for vessels with eleven (11) to thirty (30) cabins. All such fees are to be used by Koror State to maintain mooring buoys, conservation marker buoys and channel markers, to construct or otherwise create a system at the sea terminal to allow liveaboards to pump sewage and waste water directly into the sewer system or to construct a holding tank system, or to maintain any such system. The Bill also provided the following penalties for violations (including attempt and conspiracy) of its terms: (a) a fine in the amount of $50.00 and a jail term of up to five (5) days, or both, for the first offense; (b) a fine in the amount of $100.00 and a jail term of five (5) days for the second offense; and (c) a fine in the amount of $100.00 and a jail term of ninety (90) days for the third and subsequent offenses. The law also states that any government employee who violates the law by processing an application or issuing a permit in violation of its terms will be charged. Also, the law provides for civil damages against violators and mandates that any citizen of Koror may bring a suit for damages against a violating party and be entitled to fifty percent (50%) of the total damages obtained against a violator at trial. Temporary regulations for legal liveaboards regarding anchorage, mooring, wastewater, oil and petroleum waste and solid waste disposal are also contained in the law. They have since been superseded and replaced by regulations promulgated by the Koror State Governor.

Sardine Protection

Koror State Public Law No. K6-95-99: This Koror State Public Law, effective as of April 28, 1999, prohibits the capture of *mekebud* (Gold Spotted Herring or *Kerklotsichthys quadrimaculatus)*, *merau* (Blue Sprat or *Spratelloides delicatulus)*, and *teber* (Hardthead Silverside or *Atherinomorus lacunosus)* in certain areas and during certain times of the year, to prohibit the taking or disturbance of marine flora and fauna in popular tourist sites and to prohibit the sale of *mekebud.* The law bans the taking, capturing, netting, catching, containment or removal (or any attempt or conspiracy to do the same) of the three species from within one hundred (100) yards of the entrance to the Ngkisaol islands, including the shallow water area within the inlet. The law also bans the taking, capturing, netting, catching, containment or removal (or any attempt or conspiracy to do the same) of the three named fish species during the four days immediately preceding the full moon and on the day and night of the full moon in all the territorial waters of Koror State. Also contained in this law is a total ban on the capture, netting, containment, etc. of any species of flora or fauna, alive or dead, from: Soft Coral Arch, including any area within 100 yards thereof; Cemetery Reef, including any area within 100 yards of any upper edge thereof; any marine lake in Koror, meaning any body of water that is separated from the ocean by rocks, island, land barrier, or which is cut off from the ocean at low tide even if there is a tunnel or cave which links another part of the marine lake to ocean waters; and Ngkisaol Islet. Additionally, the law prohibits the sale of *mekebud* at all times in Koror. Any violator or person who attempts or conspires to violate the law shall be punished by incarceration of three (3) days or a fine of at least one hundred dollars ($100.00) or both for the first offense, incarceration of five (5) days and a fine of one hundred dollars ($100.00) for the second offense, and incarceration of up to ninety (90) days and a fine of at least one hundred dollars ($100.00) for the third and subsequent offenses

No Boats in Ngemelis Complex

Koror State Public Law No. K6-97-99: This Koror State Public Law, effective as of April 28, 1999, provides management procedures for the islands of Ngemelis – the four islands known as Dmasech, Iilblau, Cheleu and Bailechesengel – by diverting motorized

boats from the area in an effort to decrease erosion of the islands, protect fragile coral reefs from damage and maintain water clarity and quality. The law renders it unlawful for any person to operate any motor vessel between or through the referenced islands except for emergency purposes, for purposes of research and monitoring by written permit, for law enforcement or as otherwise permitted by law or permit. Additionally, any violator or person who attempts or conspires to violate the law shall be punished by incarceration of three (3) days or a fine of at least one hundred dollars ($100.00) or both for the first offense, incarceration of five (5) days or a fine of at least one hundred dollars ($100.00) or both for the second offense, and incarceration of up to ninety (90) days or a fine of at least one hundred dollars ($100.00) or both for the third and subsequent offenses.

Registering Boats

Koror State Public Law No. K6-99-99 (which amends and supercedes in its entirety Koror State Public Law No. K2-33-89, effective as of May 11, 1989, regarding boat inspection, registration and licensure in Koror State waters; and as amended by Koror State Public Law No. K6-105-99, which revised the size of the registration number to be displayed on motorboats): This Koror State Public Law, effective as of July 14, 1999, and with a sunset date of ten (10) years thereafter, requires the owners of any class of motorboat to register by January 1 of each year and obtain a registration number for each boat after providing proof of a safety inspection certificate indicating compliance with national governmental regulations. The only owners regulated are those persons who have Koror as a principal place of residence. Motorboats covered are those with outboard engines and those not having outboard engines that are 25 feet or less in length. Owners, after filing the application described in the law and obtaining a registration number are required to affix the number on the forward part of the starboard and port sides of the boat, located as high as possible on such part of the boat as to be easily visible to observers. Prorated annual fees are as follows: $2.50 per year for all boats that have a length less than 25 feet and an engine under 15 horsepower; $5.00 per year for all boats that have a length less than 25 feet and an engine between 15 and 55 horsepower; $7.50 per year for all boats that have a length less than 25 feet and an engine between 56 and 115 horsepower engines; $10.00 per year for all boats that have a length less than 25 feet and an engine between 116 and 175 horsepower; $12.50 per year for all boats that have a length less than 25 feet and an engine between 176 and 235 horsepower; $15.00 per year for all boats that have a length less than 25 feet and an engine between 236 and 305 horsepower; $17.50 per year for all boats that have a length less than 25 feet and an engine between 306 and 399 horsepower; $20.00 per year for all boats that have a length less than 25 feet and an engine between 400 and 599 horsepower; and $22.50 per year for all boats that have a length less than 25 feet and an engine over 600 horsepower, with an additional $2.50 fee for each additional increment of 50 horsepower. Additionally: for boats longer than 25 feet utilizing at least one outboard engine one fee each shall be paid as follows for both the length and horsepower of the engine: (1) fee based on the size of boat, $10.00 per year for boats that are 25-39 (sic) feet in length, $15.00 per year for boats that are 30-39 feet in length, $20.00 per year for boats that are 40-49 (sic) feet in length, $25.00 per year for boats that are 50 feet in length or more, with an additional $2.50 fee for each additional foot exceeding 50 feet. The law contains a presumption that any motorboat being anchored, docked or moored in Koror for a period of ten (10) days is owned by a resident of Koror and must be registered. Additionally, any violator shall be punished by a fine of fifty (50) dollars ($50.00) for the first offense, incarceration of three (3) days and/or a fine of at seventy-five dollars ($75.00) for the second offense, and incar-

ceration of ten (10) days and/or a fine of one hundred dollars ($100.00) for the third offense, each violation to be deemed a separate offense. Fees collected are to pay for monitoring and enforcement of the law, including the purchase of boats, fuel and oil and maintenance and other expenses.

Ngerukewid MPA

Koror State Public Law No. K6-101-99 (as amended by Koror State Public Law No. K6-118-2001, which redesignates the boundaries of the Conservation Area): This Koror State Public Law, effective as of September 20, 1999, creates a sanctuary for the protection and preservation of the Ngerumekaol spawning area and to conserve the Ngerukewid Islands Wildlife Preserve. The act specifically describes the Ngerumekaol Conservation Area and renders it illegal to kill, trap, capture wound, possess, transport, retain or otherwise have under control any fish or part thereof in the defined area. Violators shall be guilty of a misdemeanor an imprisoned for a period not exceeding ninety (90) days or fined not more than fifty dollars ($50.00) or both. The law also specifically describes the Ngerukewid Islands Wildlife Preserve, states that the area must be retained in its "present primitive condition where the natural plant an animal life shall be permitted to develop undisturbed," and prohibits all persons from transporting any firearms of any description or other weapons, nets, traps, snares or objects or materials capable of killing, or otherwise taking birds, animals or marine life or eggs or possessing the same in the Preserve. It also bans persons from transporting domestic birds or animals or allowing such animals under his control to enter the Preserve, lighting or using fire in the Preserve or cutting or destroying plant life in the Preserve or removing plant life therefrom. Additionally, any violator shall be guilty of a misdemeanor punished by a fine of fifty (50) dollars ($50.00) or incarceration up to ninety (90) days or both.

Ngerur Island

Koror State Public Law No. K6-102-99: This Koror State Public Law, effective as of September 20, 1999, rezoned the area commonly known as Ngerur Island from CD (Conservation Zone) to RV (Resort Center Zone). Pursuant to the Koror Zoning law at 31 PNC § 3001 et seq., the only allowed uses under a CD Zone are parks, wilderness or shoreline preserves, flood and erosion prevention activities, and other conservation activities and accessory uses customarily incident to the above uses. The RV Zone allows for hotels, restaurants, nightclubs, bars and similar uses and accessory buildings and uses customarily incident thereto. This zone change occurred to accommodate a proposed luxury hotel resort to be situated on Ngerur.

Docking Fees

Koror State Public Law No. K6-107-00: This Koror State Public Law, effective as of approximately January 3, 2000, requires that owners or operators of cruising yachts (defined as non-commercial pleasure boats that are not required to register under any boat registration act of the Republic of Palau or its states) obtain permits when such yachts anchor, moor or dock within the territorial waters of Koror State, excluding Malakal Harbor. The law sets forth the following monthly permit fees: $10.00 for yachts with an overall length equal to or exceeding 16 feet but less than 23 feet; $20.00 for yachts with an overall length equal to or exceeding 23 feet but less than 40 feet; $40.00 for yachts with an overall length equal to or exceeding 40 feet but less than 65 feet; and $80.00 for yachts with an overall length equal to or exceeding 65 feet. Permits are required

to be available for inspection at all times. Additionally, any violator shall be guilty of a misdemeanor punished by a fine of not more than one hundred dollars ($100.00) or incarceration up to ninety (90) days or both.

Mangrove Protection

Koror State Public Law No. K6-110-00: This Koror State Public Law, effective as of approximately March 29, 2000, prohibits the cutting and/or harvesting of trees and vegetation below the high tide line, in mangroves and within wetlands areas, except those instances in which such measures are taken to maintain or expand existing *mesei* (taro patches) or to create new *mesei* or when the state or national government performs such measures to benefit the public (i.e. for public roads or existing docks, power and sewer lines or sewage treatment centers). Additionally, any violator shall be punished by a fine of one-hundred dollars ($100.00) and/or incarceration of up to three (3) days for the first offense, a fine of one-hundred dollars ($100.00) and/or incarceration of up to ten (10) days for the second offense, and a fine of one-hundred dollars ($100.00) and/or incarceration of up to thirty (30) days for the third offense, each violation to be deemed a separate offense.

Rock Island Management & Conservation Act, 2000

Koror State Public Law No. K6-113-00 (which amends and supersedes in their entirety: Koror State Public Law No. K4-65-94 regarding dive permit legislation; Koror State Public Law No. K5-74-97 , the "Rock Island Use Act" ("RIUA"); Koror State Public Law No. K5-84-97, which established a sunset date for the RIUA; and Koror State Public Law No. K5-89-98, which renamed the RIUA the "Koror Rock Islands Management and Preservation Act"): This Koror State Public Law, effective as of approximately August 31, 2000, and titled the "Year 2000 Rock Islands Management and Conservation Act," consolidates prior laws pertaining to the recreational use of the Rock Islands (defined as all islands, including land and beaches, within the territorial jurisdiction of the State of Koror, but excluding Malakal, Arakebesang, Ngerur Island, Koror mainland and any other small islets or islands joined to Malakal, Arakebesang or Koror mainland by causeway or bridge) in an attempt to manage the Rock Islands and surrounding water resources. The law establishes the following "Tourist Activity Areas": the jellyfish lake on Macharchar Island, including the designated pathway thereupon; the island of Babelomekang; the island of Youlomekang; the beach area of Ngchelobel; the island of Ngeanges; the island of Ngermeaus; the island of Ngchus; Ngeremdiu and the Ngeremdiu Todai Trail (German Lighthouse); the islands of Ulong; the beach area of Ngeroblobang; and Bkulotuut. All portions of the Rock Islands except the Tourist Activity Areas are for the exclusive use of Palaun citizens and resident aliens (defined as any person who is not a Palauan citizen but resides in Palau). Tourists may not enter, visit, stay or remain on any Rock Island or portion thereof if it is not part of the Tourist Activity Area, and all citizens and resident aliens are prohibited from accompanying or transporting any tourist into any non-Tourist Activity Area. Tourist may use the waters of the State of Koror for diving, snorkeling, fishing and other recreational uses. However, tourists using the waters of Koror or visiting the designated tourist areas in the Rock Islands must purchase a Rock Island use permit and must have it in their possession while in the Rock Islands. The Rock Island use permit costs $15.00, is valid for seven (7) days, is nontransferable and must be kept on the person of the tourist at all times. Tourists must also acquire a fishing permit, as required by law. It is unlawful for any boat operator to transport tourists using the waters of Koror for recreational purposes who are not in possession of a Rock Island use permit, however tourists, while

in direct, non-stop transit through the waters of Koror State to a destination outside Koror State boundaries and who do not engage in the referenced activities are exempt. It is also unlawful for any boat operator to transport tourists without a Rock Island use permit to the designated tourist areas in the Rock Islands. Tour operators may be authorized by the Governor to sell permits to their customers after submitted a detailed application to the Governor for such right and privilege. Tour operators must maintain a detailed accounting with respect to permits sold, including the tourist's name and address, the serial number of the permit, the date of issuance and Koror State receipt number. Tour operators shall submit their accounts to the Koror State Finance Office within fifteen days after the end of each quarter, by April 15, July 15, October 15, and January 15. Tour operators are required to inform tourists of the restrictions of this act and must post a notice as specifically set forth in the act. Any attempt by a tour operator to prohibit, refuse or cause delay in allowing the Koror State Finance Office to audit the operator's records shall be a violation under the law; the right and privilege to sell permits may be revoked. The Paramount Chief Ibedul or his designee in the Koror State House of Traditional Leaders may exempt official guests from the requirements of this act in writing, upon application. Upon conviction, violators shall be guilty of a misdemeanor and pay a fine in the amount of $50.00 for the first offense. For the second offense, violators shall pay a fine of $75.00 and may be imprisoned for not more than three (3) days, and for a third or subsequent offense, violators shall pay a fine of $100.00 and shall be imprisoned for not less than three (3) days and not more than ninety (90) days. The law also lists the purposes of the permit fees, and states that not less than fifty percent (50%) of the fees will be applied to the costs of various items, including (among other things) maintenance and protection of dive sites, acquisition and installation of mooring buoys, monitoring purposes and other expenses associated with the protection and preservation of the Rock Islands. The law automatically terminates upon the passage of a Comprehensive Management Act for the Rock Islands.

Ngederrak Reef MPA

Koror State Public Law No. K6-119-2001: This Koror State Public Law, effective as of approximately January 10, 2001, enacts a moratorium upon fishing and taking of any marine flora or fauna on or in the reef area commonly known as "Ngaderrak" and prohibits motorized watercraft from traveling over the referenced reef area for a period of two years from and after the effective date. Any person violating the law can, upon conviction, be fined no less than fifty dollars ($50.00) but no more than one hundred dollars ($100.00) for a first offense and shall also be sentenced for a period of up to ninety (90) days for each offense. Each subsequent offense after the first offense shall be punished with "a greater monetary fine, and/or increased jail offense (sic). No offense shall be deemed a continuing offense and each individual item of flora or fauna taken or disturbed shall be deemed a separate offense that may be punished separately.

Damaging Coral Reefs

Koror State Public Law No. K6-121-2001: This Koror State Public Law, effective as of approximately July 8, 2001, mandates that any party, including all courts of competent jurisdiction, must recognize and include in any consideration, estimation or deliberation by any party regarding the monetary value of any and all unlawful damage to any portion of the coral reef ecosystem located in the waters of the State of Koror, direct use values, indirect use values and non-use values of the portion of the coral reef ecosystem damaged.

Ngederrak Reef MPA

Koror State Public Law No. K6-133-2002: This Koror State Public Law, effective as of approximately July 2002, amends section 2(D) of K6-119-2001 by extending the conservation moratorium for Ngederrak Reef from two to four years.

Ngerkebesang Conservation Zone

Koror State Public Law No. K6-136-2002: This Koror State Public Law, effective as of approximately November 2002. Located to the west of Ngerkebesang Island and the Palau Pacific Resort. The boundaries include all areas below the highest high tide watermark, within the boundary from the breakwater at Ngereksong 100 meters west, and south to Ngerdis point, to the shore at the Palau Pacific Resort. Demarcation markers have defined this area. There will be: No Fishing, capture, remove, touching, or otherwise disturb any form of marine flora or fauna. Marine flora and fauna means all forms of corals, invertebrates, fish and other living organisms of any kind. The Governor of State of Koror may provide written authorization to any person to undertake conservation measures consistent with the provisions of this Act or to remove or deal with any flora or fauna for the purpose of conducting scientific studies or research. The Palau Pacific Resort management shall take all steps reasonable and necessary to inform the guests and visitors of the boundaries and restrictions of the Conservation Zone. It shall be unlawful for any person to fish for, capture, net, take, molest, destroy, alter, move, remove, touch or otherwise disturb any form of marine flora or fauna in the Ngerkebesang Conservation Zone. The prohibitions do not include the removal of litter, trash, debris, or other inorganic objects that may have organisms growing on or in such foreign objects.

Fishing Law (Amendment)

Koror State Public Law No. K6-138-2003: This Koror State Public Law, effective as of approximately May 2003, amends and repeals certain portions of KSPL K4-68-95. Specifically, the new law: Prohibits non-Palauans from fishing in Koror (unless from a boat) and Increases to $200 per year or $20 per month the fee charged to non-Palauans for a non-commercial fishing license. A non-Palauan's net fishing license will be $50 per month.

Personal Watercraft/Jet Ski Regulations

Koror State Public Law No. K6-139-2003: This Koror State Public Law, effective as of approximately May 2003, regulates the operation of "jet skis" and similar motorized watercraft, and authorizes the Governor to promulgate regulations for use and operation of jet skis and other jet boats. It shall be unlawful to operate a jet ski or jet boat on, in, or over any water that is less than ten (10) feet deep. It shall be unlawful to operate any jet ski or jet boat on or in any water over any fringing reef, barrier reef or patch reef unless there is at least ten (10) feet of water over such fringing reef, barrier reef or patch reef. It shall be unlawful for any person operating a jet ski or jet boat to flee from any Koror State law enforcement officer who is enforcing this Act. It shall be unlawful for any person while operating a jet ski or boat to fail to stop or fail to obey the lawful directives of any Koror State law enforcement officer relating to the use or operation of such jet ski or jet boat.

WHAT IS THE NGEDERRAK CONSERVATION AREA?

The Ngederrak Conservation Area is a marine protected area (known as an "MPA") that contains important ecological habitats, including an inner lagoon, sea grass beds, coral reef channels and outer slopes. These habitats host a wide variety of species, including species of cultural and commercial importance.

Where is Ngederrak Conservation Area Located?

PHOTO BY MANDY ETPISON

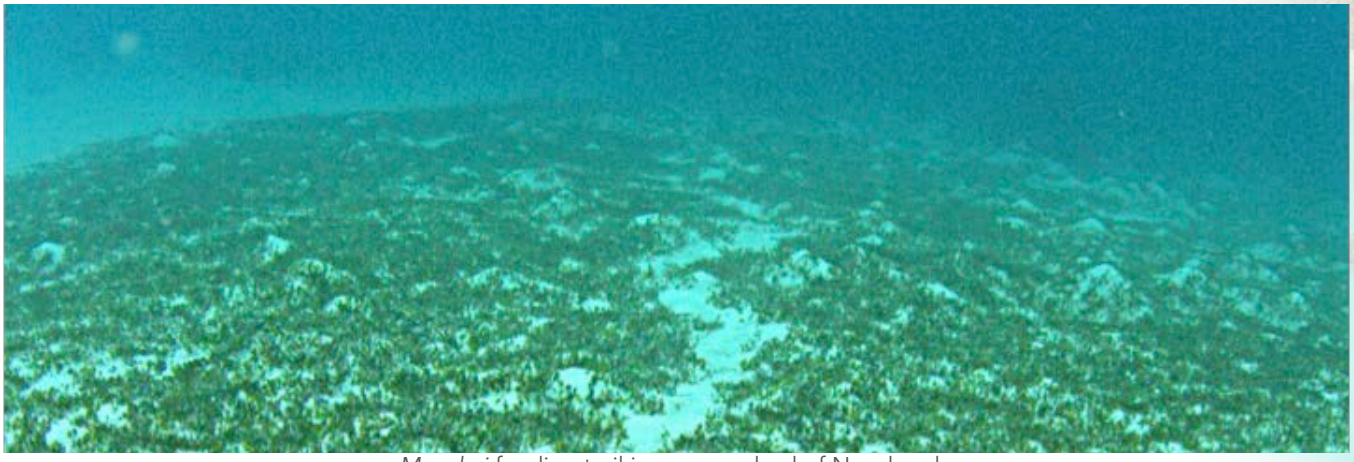
Ngederrak MPA is located to the Southeast of Malakal Harbor in Koror. It is bordered on the West by the Toachel ra Kesebekuu (Lighthouse Channel) and on the east by Toachel ra Ngel, and it is approximately 5.8 square km in size. The area is clearly marked by buoys which are labeled "No Boats."

Why Should we Protect the Ngederrak Conservation Area?

The Ngederrak Conservation Area serves as critical nursery habitat for many types of juvenile reef fish, including species such as Rabbit fish *(Meas)* and Napoleon Wrasse *(Maml)*, which are important local species. It is also home for invertebrates, such as Sea urchin *(Ibuchel)*

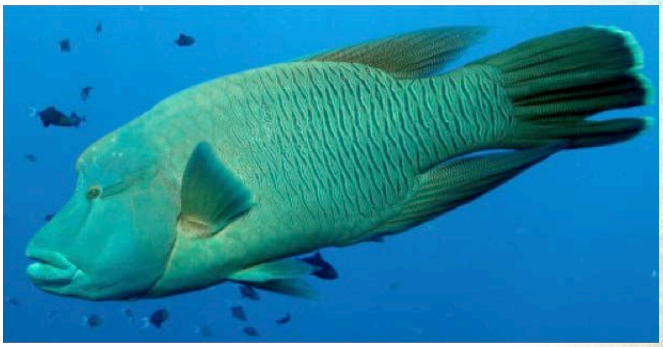
and Sea cucumber *(cheremrum)*. The area also provides important feeding habitat for endangered dugongs *(Mesekiu)*. Protecting this sanctuary will mean juvenile fish can grow and move to other areas outside the conservation area.

Dugong dugon *(mesekui)*



Mesekui feeding trail in seagrass bed of Ngederrak

Green turtle *(melob)* feeding at Ngederrak



Kemedukl or *Maml*

What are the Legal Restrictions for Ngederrak Conservation Area?

In 2001, Koror State enacted legislation making it illegal for anyone to enter the Ngederrak Conservation Area by boat or to remove or disturb any of the plants or animals in the area. Although the legal restrictions were initially put in place for a two-year period based upon local knowledge of the area, they were eventually made permanent

after research by the Coral Reef Research Foundation confirmed the ecological importance of Ngederrak. Under the relevant legislation, anyone convicted of illegally entering the MPA or disturbing, destroying or removing plants or animals in the MPA may be fined a minimum of $250 per offense ($500 for second or repeat offenses) and may also be imprisoned for up to 90 days. Importantly, each individual plant or animal item disturbed or removed from the MPA constitutes a separate offense.

What are the Challenges and Threats to Ngederrak Conservation Area?

There are a number of challenges and threats to Ngederrak, including:

- Poaching *(Mekull el omenged)*
- Ship-groundings *(Mekoi el Bilas)*
- Crown of Thorns Starfish *(Rrusech)*
- Climate Change *(Ngedechel a teletelel a debel ma cheltel a beluulechad)*
- Typhoons *(Ses el yolt)*

What can I do to help protect the Ngederrak Conservation Area?

- Volunteer to take part in community meetings and conservation activities.
- Be a part of the Koror Pride Campaign for Ngederrak Conservation Area.
- There are many things you can do to help ensure that the Ngederrak Conservation Area remains healthy and protected, including:
  - Know your surrounding area and where Ngederrak Conservation area is located.
  - Stay within the *Toachel ra Kesebekuu* and *Toachel ra Ngel* channels.
  - Respect the boundaries; stay within the channels; and report violations.
  - Report violations to the Koror State Rangers at 488-2150

KOROR STATE TOUR GUIDE CERTIFICATION REGULATIONS

ARTICLE 1: GENERAL PROVISIONS

1.1 SHORT TITLE:

These Regulations may be cited as the KSG Tour Guide Certification Regulations.

1.2 AUTHORITY:

These regulations are promulgated pursuant to the authority contained in Koror State Public Law (KSPL) No. K9-263-2013 Section 10, and KSPL K8-207-2009. These regulations shall have the force and effect of law.

1.3 PURPOSE AND APPLICABILITY:

The purpose of these regulations is to ensure that industry best practices are followed that protect the environment and culture and ensure that visitors to Koror have a safe and positive experience.

1.4 FEES & PENALTIES:

Unless otherwise provided for by law or regulations, fees and penalties shall be imposed pursuant to KSPL No. K9-263-2013 and these regulations.

1.5 DEFINITIONS:

"Acting as a Tour Guide" means accompanying, escorting, guiding, supervising or assisting people on a Commercial Tour to tour, see, or visit the Rock Islands, a marine lake or any other location in the waters or on the land of the State of Koror.

"Commercial Tour" means any trip, excursion or tour to the Rock Islands and/or the waters of Koror State or any other area within Koror State, including any land trip or tour and any marine lake trip or tour, performed or offered in exchange for a fee, or offered as part of a package tour, or provided in exchange for any good and valuable consideration.

"CPR" means cardiopulmonary resuscitation.

"Rock Islands" means all islands, including the land, beaches, waters, and marine lakes, within the territorial jurisdiction of Koror State, with the exception of the islands of Koror (Oreor), Malakal, Ngerkebesang, Ngerur Island, and any other small islands or islets joined to them by a causeway or bridge.

"Tourist Guide or Tour Guide" means a person who serves or acts, whether as an employee, contractor or self-employed individual, as a guide, instructor, supervisor, or leader of a Commercial Tour, including persons who serve as scuba diving and snorkeling guides, and including escorts on land tours and trips to marine lakes.

"Waters of Koror State" means all ocean waters from the land of Koror State to twelve nautical miles seaward from the traditional baselines, and also includes any marine lake or landlocked lake.

ARTICLE 2: GENERAL CERTIFICATION REQUIREMENTS

2.1 No person shall act as a Tour Guide on the Rock Islands, marine lake, or any other location in the waters or on the land of the State of Koror unless the person holds a valid tour guide certification card issued by the Department of Conservation and Law Enforcement (DCLE) for Koror State Government.

2.2 An applicant for a Tour Guide Certification Card shall fill out the application form provided by the DCLE and submit all required documentation. Upon determination of eligibility, the date of certification examination shall be scheduled.

2.3 No Tour Guide shall engage in business or do business in Koror State with a company or individual not properly licensed by the Palau National Government and Koror State Government; and registered with Palau Visitors Authority and/or Bureau of Tourism, Ministry of Natural Resources, Environment, and Tourism (MNRET).

2.4 All businesses or other entities which provide Commercial Tours in Koror State shall conspicuously post a notice at their operating site which states that such business or entity employs or uses the services of Tour Guides who have been certified by the Koror State DCLE. Notice shall be provided by Koror State DCLE.

ARTICLE 3: TOUR GUIDE TRAINING

3.1 TOUR GUIDE REQUIREMENT

A) Koror State DCLE shall work with relevant agencies to develop the Koror State Tour Guide Certification Program which shall include at a minimum:

1) Koror State Rock Island Management Regulations
2) Koror State Environmental Laws
3) National Government Environmental and Cultural and Historical Preservation Laws
4) Safety Guidelines for tourists engaged in water or other outdoor activities
   i. National and State Water Safety Laws & Regulations
      a) Boat Requirements
      b) Safety Equipment
      c) Palau Marine Advisory System
      d) Koror State Personal Watercraft Regulations
   ii. Tour Guide shall have a list of the entire tour group in Roman Alphabet, as shown in their passports, before the tour takes place that matches the names on permits on a given tour readily available for the inspection of Rangers.
   iii. Tour Guide shall be trained and certified in CPR and First Aid by Internationally recognized organizations and known by Koror State DCLE.
   iv. Tour Guide shall ensure that means of communication with tour station is continuous and uninterrupted at all times.
   v. Tour Guide shall ensure life jackets or buoyancy compensator devices (BCD) are onboard for each passenger during sea tour operations at all times.
   vi. Tour Guide shall ensure that appropriate safety gears are available and used by customers.
   vii. Tour Guide shall ensure that a tour dive boat is equipped with functional emergency medical oxygen kit and emergency first aid kit at all times.
   viii. Tour Guide shall give briefings before a tour.
   ix. Tour Guide shall ensure full accessibility of the emergency channel/ frequency (Channel 16 or established emergency channel) at all times.
5) Guidelines and "best practices" to minimize impact on the environment from snorkeling, scuba diving and other outdoor activities (details in Tour Guide Manual).
   i. Tour Guide shall give site specific briefings before a site tour.
   ii. Tour Guide shall demonstrate appropriate dive etiquette, e.g. do not touch, handle, or provoke any marine organism; do not alter or deface anything on the reef; do not collect or remove any corals, sea grass, algae, or any other marine organisms.

iii. Tour Guide shall ensure appropriate practice of boat mooring instead of anchoring at applicable sites.
iv. Tour Guide shall ensure maximum diving ratio is eight divers to one tour guide.
v. Tour Guide shall ensure snorkeling ratio is ten snorkelers to one tour guide.
vi. Tour Guide shall ensure gloves are prohibited while diving or snorkeling.
vii. Tour Guide shall ensure that reef hooks are properly placed to minimize environmental impact.
viii. Tour Guide shall ensure that trash is properly disposed. All trash shall be removed upon departure from the site.
ix. Tour Guide shall ensure tourists never stand on, kick or hold coral or other stationary marine life.
x. Tour Guide shall ensure prevention of cross contamination in accordance with established guidelines at designated sites, i.e. do not bring anything but clean snorkel gear into Jellyfish Lake and not to take anything from the lake into the ocean (this includes things that appear dead like seashells, marine or terrestrial rocks, which can house potentially invasive organisms).

6) Code of conduct to minimize impact on cultural, historical, and archaeological sites and place (details in Tour Guide Manual). Tour Guide shall ensure that tourists:
i. Remember to take everything they brought to the site when they leave and not to leave anything.
ii. Do not remove anything from the site. Although tourists may think something is not significant to the site, all pieces make up the whole.
iii. Remember that many sites include culturally sensitive areas and therefore behavior should always be respectful.
iv. Respect every place/site visited.

B) Pass the examination offered for such program

1) A person may choose to take the exam without completion of the Tour Guide Certification Course.

C) All tour Guides shall take an annual "refresher" course in order to remain certified as a Koror State Tour Guide.

1) In order to take the "refresher" course, a tour guide must have:
i. Valid working permit if not a citizen of Palau
ii. Valid CPR and First Aid Certification

ARTICLE 4: TOUR GUIDE CERTIFICATION REQUIREMENTS

4.1 TOUR GUIDE CERTIFICATION EXAMINATION:

A person applying for a Tour Guide Certification shall:
1) Be at least eighteen (18) years of age
2) Be proficient in the Palauan or English language
3) Have a valid working permit as a tour guide from Palau National Government, if not a Palauan citizen

4) Have a valid CPR and First Aid Certification from an entity that is internationally recognized and known by the Koror State DCLE.
5) Tour Guide Certification Examination
    i. An applicant must submit the Tour Guide Certification Examination Application Form to Koror State DCLE with the following:
        a. Two (2) copies of a valid CPR and First Aid certification issued by an internationally recognized CPR and First Aid certifying authority and known by the Koror State DCLE.
        b. Two (2) copies of valid picture I.D.
            - Passport, driver's license, or national I.D. for citizen
            - Passport only for non-citizen
        c. Two (2) copies of tour guide working permit issued by the Palau National Government if non-citizen. Work permit and passport shall have same name on both documents.
    ii. The Koror State DCLE will review **Tour Guide Certification Examination Application Form** to determine eligibility. Examination will be scheduled thereafter.
    iii. An applicant must bring two (2) pencils/pens on the examination day. Any electronic devices (i.e. cellphone and radio) are prohibited in the examination room. Notes or any other types of booklets for reference are not allowed during testing.
    iv. An applicant will be given a maximum of one (1) hour to complete the Koror State Tour Guide Certification Exam.
    v. An applicant must pass an examination under the supervision of the Koror State DCLE covering knowledge of tourist sites, points of the island historical and cultural; marine and terrestrial fragile environment; safety regulations, and general interests in Koror State.
    vi. The passing grade for Koror State Tour Guide Certification Examination is 80%.
    vii. The result for Koror State Tour Guide Certification Examination will be available in ten (10) working days.

4.2 TOUR GUIDE CERTIFICATION CARD:

A) The Tour Guide Certification Card will be issued in ten working days following examination date.

B) The Tour Guide Certification Card components shall be:

1) Full name of an applicant
2) Birthdate of an applicant
3) CPR and First Aid Certification number
4) CPR and First Aid Certification expiration date
5) Tour Guide Certification number
6) Tour Guide Certification issuance date
7) Tour Guide Certification expiration date
8) Seal of Koror State DCLE
9) Signature of Director of Koror State DCLE
10) Recent passport size picture

C) The validation for Tour Guide Certification Card

1) The validation of Tour Guide Certification Card is one (1) year, provided that CPR and First Aid Certification is valid for that period.

D) The Tour Guide Certification Fee

1) The fee for the first Tour Guide Certification Card is $30.00
2) The fee for each annual renewal of tour guide certification is $10.00

E) All fees shall be payable to Koror State Finance Office.

4.3 COMMERCIAL TOURS:

A) All businesses or other entities which provide Commercial tours in Koror State shall conspicuously post a notice at their operating site which states that such business or entity employs or uses the services of Tour Guides who have been certified by the Koror State Tour Guide Certification Program.

1) The notice must be issued by the Koror State DCLE.
   i. The notice components include the following:
      a) Name of the business or an entity
      b) Seal of the Koror State DCLE
      c) Signature of Director of Koror State DCLE
      d) Signature of Koror State Governor or the Governor's designee
2) The notice will be seized from the business or entity operating site by Koror State DCLE if a business or entity violates Article 8 Section 1, 2, 3, and 4.

ARTICLE 5: CPR AND FIRST AID CERTIFICATION REQUIREMENT

5.1 CPR AND FIRST AID CERTIFICATION REQUIREMENT:

A) Any person who wishes to work or act as a tour guide in Koror State must be CPR and First Aid certified by a verifiable and internationally recognized as CPR and First Aid certifying authority such as International Red Cross.

B) All Commercial Tour companies shall submit an up-to date list of all CPR and First Aid certified tour guides to Koror State DCLE throughout the year.

1) An electronic copy shall be sent to rorrangers@palaunet.com by the end of each quarter.
   i. End of the 1st quarter is by the last Monday of March
   ii. End of the 2nd quarter is by the last Monday of June
   iii. End of the 3rd quarter is by the last Monday of September
   iv. End of the 4th quarter is by the last Monday of December

5.2 VERIFIABLE CPR AND FIRST AID AUTHORITY:

A verifiable CPR and First Aid certifying authority can be an NGO, government, or business entity that is capable of training, certifying and issuing CPR and First Aid certification and is internationally recognized and known by Koror State DCLE. The department will maintain an up-to-date list of verifiable CPR and First Aid certifying authorities.

ARTICLE 6: RESOURCES FOR KOROR STATE TOUR GUIDE CERTIFICATION

6.1 KOROR STATE TOUR GUIDE CERTIFICATION PROGRAM MANUAL and BOOKLET

Koror State DCLE has the following resource materials:

- Koror State Government Tour Guide Certification Program Manual
- Koror State Government Tour Guide Booklet

6.2 CPR CERTIFICATION

A person or business entity may seek CPR and First Aid training program from entities that are internationally recognized and known by the Koror State DCLE.

6.3 OTHERS

Additional information on the following topics may be obtained from the Koror State DCLE:

- Terrestrial and Marine Environment
- Traditional and Contemporary Culture
- Palauan History

ARTICLE 7: CERTIFIED TOUR GUIDE ON ALL COMMERCIAL TOURS

7.1 CERTIFIED TOUR GUIDE ON ALL COMMERCIAL TOURS

A) A certified tour guide must be present on all commercial tours in Koror State

1) The certified tour guide shall be proficient in English and/or Palauan languages.
2) Any tour guide conducting a tour without a permit shall be cited on site and immediate return to its tour station may take place if safety of the passengers and the tour is at risk. Any subsequent similar offenses shall result in citation including immediate return to its tour station.
3) All tour guides must be registered under a tour agency.
4) A certified tour guide shall have a valid working permit, if not a citizen of Palau.
5) All tour agencies shall provide an updated list of their certified tour guides to the DCLE.

7.2 PROOF OF POSSESSION

A) A certified tour guide shall carry a valid Tour Guide Certification Card at all times while working or otherwise acting as a tour guide in Koror State.

1) Every tour guide on any tour must be able to produce his/her tour guide certification card upon request of any Koror State Ranger.
2) Any tour guide conducting a tour without a permit shall be cited on site and immediate return to its tour station may take place if safety of the passengers and the tour is at risk. Any subsequent similar offenses shall result in citation including immediate return to its tour station.

ARTICLE 8: PENALTIES

8.1 Any person found to be working as a tour guide in Koror State without a valid and current Tour Guide certification card shall be convicted of a misdemeanor and be sentenced to pay a fine to the Koror State Treasury after conviction:

1. First offense is $100.00
2. Second offense is $250.00
3. Third offense is $500

8.2 Any person or business entity that employs a person as a Tour Guide who does not possess a valid and current Tour Guide Certification as required in Articles 3,4, &5 shall be convicted of a misdemeanor and be sentenced to pay a fine to the Koror State Treasury after conviction:

1. First offense is $100.00
2. Second offense is $250.00
3. Third offense is $500

8.3 Any person or business entity that does not provide an up-to-date list to Koror State Department of Conservation and Law Enforcement of all of its CPR and First Aid certified tour guides as required by Article 5 shall pay a fine to the Koror State Treasury after conviction.

1. First offense is $100.00
2. Second offense is $250.00
3. Third offense is $500.00 and KSG business license of such violator shall be subject to suspension, revocation and/or cancellation as provided in KSPL No. K8-188-2007 (November 21, 2007) and/or its consequent amendments.

8.4 Any person or business entity that conducts a Commercial tour in the land or waters of Koror State without the presence of a Tour Guide who is validly certified under the Koror State Tour Guide Certification Program and who is CPR and First Aid certified shall pay a fine to Koror State Treasury after conviction.

1. First offense is $100.00
2. Second offense is $250.00
3. Third offense is $500.00 and KSG business license of such violator shall be subject to suspension, revocation and/0r cancellation as provided in KSPL No. K8-188-2007 (November 21, 2007) and/or its consequent amendments.

8.5 It shall be unlawful to aid, abet, counsel, command, induce, or procure or cause the commission of violation of Article 3, Article 4, Article 5 or Article 7 of these regulations, which if directly performed by any person would be a violation of Article 3, Article 4, Article 5 or Article 7 of these regulations, and any such person may and shall be punished as a principal. No distinction is made between principals in degrees, and no distinction is made between a principal and what may be referred to as an accessory before the fact.

NATIONAL GOVERNMENT ENVIRONMENTAL LAWS

Restrictions Applicable to Forest and Terrestrial Areas

- No harvesting of vegetation in mangroves and wetlands below high tide.
- No hunting, killing or taking eggs from any birds except *Malk* – Red Jungle Fowl *(Gallus gallus)*, *Uek* – Purple Swamphen *(Porphyrio porphyrio)*, *Aiako* – Greater Sulphur-crested Cockatoo *(Cactua galerita)*, and *Tengadidik*– Collared Kingfisher *(Halcyon chloris)*.
- No dumping of trash; litter must be removed from land and marine areas.
- No taking of any flora or fauna from any Tourism Zones.
- No harvesting of wood products except for approved traditional and/or cultural functions.

Calendar of Closed Seasons

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Groupers *(Tiau, Katuu'tiau, mokas', Ksau'temekai, meteungeril'temekai)*				X	X	X	X	X	X	X		
Rabbitfish *(Meas)*		X	X									
Blacklip Pearl Oyster								X	X	X	X	X
Sea Turtles *(Melob)*, *Ngasech* harvest moratorium	X					X	X	X				X
House Parties, *ocheraol*, and *cheldecheduch*	X				X			X			X	X

PNCA Title 24

Title 24 of the National Code: All laws and regulations in Palau make up the National Code, which comprises, amongst other things, Acts that ensure the protection of resources and environmentally sound development. In addition to the EQPA described above, there are a wide ranging number of Acts under Title 24 of the Palau National Code that are focusing on environmental protection. It includes:

- **Under Division I - Environmental Quality Protection:** Chapter 1 – Environmental Quality Protection Act; Chapter 2 – Trust Territory Environmental Quality Protection Act; Regulations: Earth moving, EIS, air pollution, fresh and marine water quality, solid waste management, wastewater disposal, public water systems, pesticides
- **Under Division II - Wildlife Protection:** Chapter 10 - Endangered Species; Chapter 12 - Protected Sea Life; Chapter 13 - Illegal Methods of Capture; Chapter 14 - Protected Land Life
- **Under Division III – Preserves & Protected Areas:** Chapter 30 – Ngerukeuid Island Wildlife Preserve; Chapter 31 Ngerumkeaol Spawning Area

The Environmental Quality Protection Act – Chapter 1 of Title 24 of the Palau National Code: This Act – enacted in 1983 - is part of the Palau National Code for Environmental Protection, which comprises, amongst other things, Acts that ensure the protection of resources and environmentally sound development. The EQPA is a comprehensive environmental law in Palau, and is the main vehicle through which the government meets its responsibilities. It is very wide reaching requiring that all other policies, regulations and public laws be interpreted and administered in accordance with it. The sections of this Act are divided into four sub-chapters: general provisions; Palau Environmental Quality Protection Board; environmental studies and decisions; and implementation, enforcement and court action.

- **Environmental Quality Protection Act (§§ 101-103)** seeks to provide Palau with a healthy environment and natural resources in order to fulfill social, economic and other requirements of present and future generations.
- **The Environmental Quality Protection Board (§§ 121-130)** is entrusted to regulate earthmoving, marine and freshwater quality, toilet facilities, solid waste management, pesticides, public water supply systems and air pollution control.
- **Environmental Impact Statements (§§ 141-143**)
- **Implementation, Enforcement and Court Action (§§ 161-172)**

Endangered Species Act of 1975 (§§ 1001-1012) seeks to prohibit harvest (possession) and commercial activity (including export) involving those species that are listed as threatened or endangered by the Minister of Resources and Development. This law has never been applied since the Ministry of Resources and Development has never adopted the regulations set forth in the Act (i.e. never announced a list of threatened or endangered species for the Republic of Palau).

Protected Sea Life sets regulations relating to the harvest (possession) and commercial activity (including export) of the following species:

- Turtles (§ 1201)
- Sponges (§ 1211)
- Mother-of-Pearl (§ 1221)
- Dugong (§ 1231)
- Trochus (§§ 1241-1246)

Illegal Methods of Capture outlaws the following methods of harvest for marine species:

- Fishing with explosives, poisons or chemicals (§§ 1301-1305)
- Other prohibitions (§§ 1321-1326)

Protected Land Life prohibits the hunting or killing of any bird and taking of eggs in Palau, except for four species.*

- All Birds (§ 1401) except for *Gallus gallus, Porphyrio porphyrio, Cacatua galerita,* and *Halcyon chloris*

Preserves and Protected Areas creates the following conservation areas:

- Ngerukewid Islands Wildlife Preserve (§§ 3001-3004)
- Ngerumekaol Spawning Area (§§ 3101-3103)

Palau International Coral Reef Center Act of 1998 (§§ 3301-3328) establishes a self-sustaining, non-profit coral reef center and marine park that will provide a forum for coral reef studies, research and education. The Center is designed to assist in improving the management, use, and conservation of Palau's and the world's marine environment, in addition to serving as a tourist attraction.

PNCA Title 27

Foreign Fishing (§§ 101-102) enacts its own fishery zone legislation to manage, conserve and regulate the harvesting of fish throughout their habitat, both within the reef areas of islands and atolls, and in other areas within the jurisdictional competence of the Republic.

- Ministry of Resources and Development (§§ 121-125)
- Fishery zones (§§ 141-147)
- Regulation of foreign fishing (§§ 161-173)
- Enforcement and penalties (§§ 181-190)
- Monitoring of foreign vessels in exclusive economic zone (§§ 201-207)

Marine Protection Act of 1994 (§§ 1201-1211) protects certain marine species and natural resources in order to promote sustainability of the marine commons while preserving the livelihood of the commercial fisherman of Palau.

This Act regulates:

- Groupers
- Humphead Parrotfish
- Napoleon Wrasse
- Rabbitfish
- Rock Lobsters
- Sea Cucumbers
- Mangrove Crabs
- Coconut Crabs
- Giant Clams
- Aquarium fish
- Marine rock, hard corals, and sponges
- Gear restrictions (SCUBA, gill and *kesokes* nets)

The Protected Areas Network (PAN) Act (RPPL 6-39) was passed in 2002. It created a nationwide system to support States' efforts in protecting their natural resources. This support included technical assistance to the states from the national government through the PAN Office. The Act states that the PAN office must work with State Governments to nominate and develop management plans for PAN sites and technical assistance to implement, monitor and evaluate the progress of the implementation of each management plans.

This Act was amended in 2007 through the Act RPPL 7-42, which was also an amendment of the Title 24 of the Palau National Code, Chapter 34. This amendment clarified the intent of the "Protected Area Network Act"; endorsed the "Micronesia Challenge"; provided financing provisions for the Protected Areas Network; and implemented an Environmental Protection Arrival Fee Fund ("Green Fee" - a fee paid by non-residents departing Palau) for the financial sustainability of the Protected Areas Network; and for other related purposes.

This Act and amendment sets out the establishment of a PAN Management Committee to provide technical assistance to the Minister of the Ministry of Natural Resources, Environment and Tourism, specifically to review State nominations and management plans and a PAN Technical Committee to assist the PAN Management Committee in the functioning of the PAN. Please refer to the following website (www.palaupanfund.org)for more information about PAN.

The 2009 Shark Haven Act protects over a hundred species of deep water and reef sharks in Palau's waters. Honduras, the Maldives and the Bahamas have since enacted similar laws and banned shark fishing in their national waters.

Invertebrate Species Regulated by National Law

Palauan name	Common name	Scientific name	Minimum size	Harvesting season	Other restrictions
Cheraprukl, Raikilius, Bleyached, Melech	Rock Lobsters	*Panulirus versicolor, Panulirus penicillatus, Panulirus longipes femorstriga*	6 inches total length of the carapace	Open	No export; no taking of egg-bearing females whatever the length
Emang	Mangrove crab	*Scylla serrata*	6 inches greatest distance across the carapace	Open	No export; no taking of egg-bearing females whatever the length
Ketat	Coconut crab	*Birgus latro*	4 inches greatest distance across width of carapace	Open	No export; no taking of egg-bearing females whatever the length
Oktang Ribkungal, Kism; Melibes, Oruer Duadeb, Duaedeb	Giant clams	*Tridacna gigas, Tridacna squamosa, Tridacna derasa, Tridacna maxima, Tridacna crocea, Hippopus hippopus, Hippopus porcellanus*	No	Open	No export (except cultured specimens)
Semum	Trochus	*Trochus niloticus*	3 inches basal diameter	Designated from year to year by OEK	State Government can designate closed areas during open seasons
Chesiuch	Blacklip pearl oyster	*Pinctada margaritifera*	4 inches diamater across the shell	Closed August thru December	
Bakelungal chedelkelek, Bakelungal cherou, Molech, Badelchelid, Eremrum, Temetamel	Sea cucumbers	*Holithuria nobilis, Hothothuria fuscogilva, Holothuria scabra, Actinopyga mauritiana, Actinopyga miliaris, Thelenota ananas*	No	Open	No export
	Sponges, hard corals, marine rock	*Porifera sp. Scleratinia, Hydrocorallina, Coenothecailia, Stolnifera*	No	Open	No export

Fish Species Regulated by National Law

The National Congress has established a website that contains all national laws since the first Congress. The website is palaulegal.org each law has been scanned and uploaded and available on this website. The table below highlights national laws that Congress has passed as of 2014.

Palauan name	FAO common name	Scientific name	Minimum Size	Harvesting Season	Other restrictions
Meas	Rabbitfish	Siganus fuscensens	No	Closed February 1st to March 31st	Illegal to buy or sell during closed season
Berdebed, Kemedukl	Humphead parrotfish	Bolbometopon muricatum		No Harvest	No export whatever the size.
Ngimer	Humphead wrasse (also known as Napolean Wrasse)	Chelinus undulatus		No Harvest	No export whatever the size.
Aquarium Species (various fish, anemones, jellyfish, sponges, crustaceans, and mollusks)			No	Open	Fishing & export restricted to people in possession of an Aquarium Collecting Permit.

National Regulations for Turtle Harvest and Dugong

Name	Minimum Size	Harvesting Season	Other Restrictions
Green Turtle (Melob)	34 inches carapace length	Closed June thru August & Dec thru Jan.	No taking of eggs, no taking of female while she is on shore.
Hawksbill turtle (Ngasech)	27 inches carapace length.	National Moratorium 2010 to 2015	No taking of eggs, no taking of female while she is on shore. No harvesting of turtles of any size.
Dugong Protection Act		No harvest	Penalities increased to no less than two years imprisonment or payment of a $5,000 fine or both for reckless or intentional injury or killing of a dugong

ENVIRONMENTAL QUALITY & PROTECTION BOARD

What is EQPB?

The EQPB is responsible for protecting and preserving the environment for all its citizens. Any major environmental changes must be reported to their office. The types of environmental changes that EQPB handles affect the tourist industry. EQPB is funded by the EPA. Public participation in all areas of this task including compliance, monitoring, and enforcement is essential.

Major areas of concern:

Water Quality – EQPB regularly tests marine and drinking water quality in all states. Public announcements issued over the radio if drinking water in Koror and/or Airai is not safe. Advise all tourists not to drink water straight from the tap – unless boiled first!

Earthmoving Activity – any construction or other activity which disturbs or alters the surface of the land, a coral reef or bottom of a lagoon, (including but not limited to, excavation, dredging, embankments, and reclamation on a lagoon, land development,

subdivision development, mineral excavation including sand, ocean disposal, and moving, and depositing or storing soil, rock or earth).

- Any activity of this kind requires a permit from EQPB.
- Mooring buoys need a permit.
- Civil penalties can be up to $10,000/day.
- Earthmoving activities can have devastating impacts, short and long term, on water quality as well as ecosystems.

Solid Waste – Solid waste must disposed of in an approved facility.

- Civil penalties for littering/illegal disposal of solid waste – up to $10,000/day.
- If it is your vessel and clients throw trash overboard, you as well as the tourists are responsible for violating Palau Solid Waste Regulations.

Pesticides and Hazardous Materials

- Oil and batteries are extremely damaging to marine environments and should never be disposed of in any of our waters.
  - Dispose of batteries in solid waste disposal facility.
  - Penalties – can be up to $10,000/violation.
- Pesticides and common household cleaning products can also be damaging.
  - Phosphates encourage growth of algae.
  - Surfactants bind to fish gills.
  - Bleach, in high concentrations, kills everything including corals.
  - Use eco-friendly alternatives which can also be less expensive!

Sewage discharge – All point source discharge requires a permit from EQPB.

- All marine vessels with toilet facilities are required to have a Marine Sanitation Device. Enforceable by US Coast Guard.
- Port a Potties can also be used if used appropriately
- Raw sewage is potentially dangerous because of high bacteria doses and disease-causing organisms.
- Penalties – can be up to $10,000/violation.

Other Important Environmental Regulations

- It is illegal to "harass, harm, kill, pursue, collect, or possess any plant/animal that is endangered/threatened. Penalties = $10,000 and/or one year in prison
- It is illegal to take turtles when:
  - they are on shore
  - they have a shell less than 27" (Hawksbill) or 34" (Green)
  - during the months of Dec., Jan., June, July and August
  - Turtle eggs at any time!
  - Penalties = six months/$100
- It is illegal to take sponges. Penalties = six months/$100
- It is illegal to take Black Lip Mother of Pearl Oyster shells which are less than 4" across and any time during August 1 – Dec. 31. Penalties = 6mo/$100

- Trochus: Only Palauan citizens can take! Trochus must be more than 3" across base. Clam meat – export is prohibited.
  - Ngerukewid Islands Preserve: Do not go there at any time without permission from the Chief of Conservation and Entomology! Penalties = 6mo/$50 and All Equipment Will Be Confiscated (including boat).
  - Fishing
    - Illegal commercial fishing including, but not limited to: *temekai, maml, meyas* and *cheraprukl*
    - Illegal fishing while using underwater breathing apparatus other than a snorkel
    - Illegal commercial exportation of including, but not limited too: k*etat, chemang, cheraprukl, maml* and *cheremrum*.
    - Illegal use of gill net with mesh size less than 3" diagonally, use and possession of *kesokes* net with mesh size less than 3" diagonally.
    - Illegal taking of fish for aquarium use without proper permit.

EQPB Recommendations

- Advise tourists not to drink water straight from the tap at any time
- Advise tourists not to take, manipulate, or interfere with any part of Palau's natural environment. They are here as guests and therefore should treat every element of our environment respectfully, as they would entering a friend or neighbor's home.
- BE A GOOD EXAMPLE AS A LAW ABIDING CITIZEN COMMITTED TO PRESERVING THE QUALITY OF OUR ENVIRONMENT. Set a strict behavioral standard for clients. Out of this will come respect and admiration. Tourists will appreciate and be aware of Palau's uniqueness.
- Share your knowledge of environmental regulations in Palau, why they are important, and your personal commitment.
- Report any noticeable changes in the environment immediately.
- Report any violations immediately.
- Public participation in "preserving and protecting the quality of Palau's natural environment" will become especially crucial following implementation of the Compact, due to loss of much U.S. Federal oversight. It will become completely up to the people of Palau to protect the rich, unique, natural beauty, and quality of our home.

MARINE AND FRESH WATER QUALITY REGULATIONS

GENERAL PROVISIONS

2401-11-01 Authority

These regulations are promulgated by the Republic of Palau Environmental Quality Protection Board pursuant to the authority granted it by Title 24 of the Palau National Code. These regulations shall have the force and effect of law and shall be binding on all persons and other entities subject to the jurisdiction of the Republic of Palau. The Board shall apply these regulations to all marine and fresh water bodies in the Republic of Palau.

(Effective May 26, 1996)

2401-11-02 Purpose

It is the purpose of these regulations to:

(A) Identify the uses for which the various waters of the Republic of Palau shall be maintained and protected.

(B) Specify the water quality standards required to maintain the designated uses.

(C) Prescribe regulations necessary for implementing, achieving, and maintaining the specified water quality, and to protect health, welfare and property, and to assure that no pollutants are discharged into these waters without being given the degree of treatment or control necessary to prevent pollution.

(Effective May 26, 1996)

2401-11-03 Policy

It is the policy of the Republic of Palau that:

(A) The maintenance of water quality that will provide for the propagation of aquatic life and for recreation in and on the water is an historical and legitimate right of the people of the Republic of Palau.

(B) The achievement of the water quality goals of the Republic of Palau is in the public interest and should not represent an unreasonable barrier to economic or social development.

(C) Existing water uses and the level of water quality necessary to protect existing uses shall be maintained and protected. No further water quality degradation, which would interfere with or become injurious to these existing uses is allowable. Existing uses are those actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.

(D) Waters whose existing quality is less than the quality specified by these standards shall be improved to comply with these standards.

(E) Waters whose existing quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water shall be maintained and protected unless and until the Board finds, after full opportunity for public participation and intergovernmental coordination, that allowing lower water quality is necessary to accommodate an important economic or social development in the area in which the waters are located. In no event, however, may degradation of water quality interfere with or become injurious to existing uses. Implementation of this policy shall be in accordance with Title 24 of the Palau National Code and the rules and regulations promulgated thereunder. [See also: Sections 2401-11-09(B)(6) and 2401-11-20(C)]

(F) Before any new point source of pollution is allowed to lower the quality of water, the source shall be required to meet and maintain the highest statutory and regulatory requirements. Before a non-point source is allowed to lower the water quality, the source shall establish and use the best, most cost-effective, and reasonable management practices.

(G) To the extent practicable, all new point sources of pollution shall not discharge into near-shore or fresh surface waters.

(H) There shall be no direct or indirect discharge of sewage or other waste into any planned or intended ground or surface source of drinking water.

(I) All sewage and waste shall receive the degree of treatment necessary to protect the beneficial uses of waters of the Republic of Palau before discharge.

(J) In no event shall there be a degradation of water quality which shall cause the water quality to fall below that necessary to protect the uses of the water for the propagation of aquatic life and for recreation in and on the water.

(K) Outstanding national resource waters shall be protected in a pristine state.

(Effective May 26, 1996)

2401-11-04 Definitions

"Board" or "EQPB" means the Republic of Palau Environmental Quality Protection Board or its authorized representative.

"Buffer Zone" shall mean a strip of land in permanent vegetation adjacent to State waters or waters of Palau, designed to intercept pollutants, control erosion and manage other environmental concerns.*

"Chairman" means the Chairman of the Republic of Palau Environmental Quality Protection Board personally or his authorized representative.

"Coastal Waters" means "near-shore waters", "off-shore waters" and those brackish, fresh, and salt waters that are subject to ebb and flow of the tide.

"Dilution Ratio" as used in Section 2401-11-32(A)(6) is the ratio of entrained water to quantity of discharged water at the plume centerline after initial dilution.

"Freshwater Lake" shall mean any body of fresh water that has permanent open water with a surface area that is more than an quarter of an acre, excluding man-made ornamental lakes or ponds and all types of pollution treatment lagoons.*

"Groundwater" means any and all water found beneath the earth whether in confined or unconfined areas.

"High Tide Line" shall mean the line delineating the maximum height reached by the rising tide on a periodic basis, excluding unexpected variations in the high tide line resulting from storm surges. In the absence of actual data, the high tide line shall be determined by the deposit of debris on the shore, other physical markings or characteristics, vegetation lines, tidal gauges or other suitable means.*

"Initial Dilution" means the dilution that the wastewater has achieved with the receiving water at the centerline of the mixing zone as defined in Division I below where the mixture surfaces or the density of the mixture becomes equal to the density of the surrounding receiving water. The "initial dilution" may be calculated by using the procedure in Users Guide and Documentation for Outfall Plume Model D.J. Baumgartner. D.S. Trent and K.V. Byram, Working Paper #80, EPA, Pacific Northwest Water Laboratory May 1971. (Available by writing National Technical Information Service 5285 Port Royal Road, Springfield, Virginia 22151, Order Number NTISPB 204-557)

"License" or "Permit" means any license or permit granted by an agency of the National Government to conduct any activity which may result in any discharge into the waters of the Republic of Palau.

"Licensing or Permitting Agency" means any agency of the National Government to which application is made for a license or permit and which has the authority to issue a license or permit.

"Mangroves" shall mean forested areas where the soils are tidally flooded with seawater or a mixture of fresh water and seawater.*

"Mixing Zone" means a defined area around a point source in which specific water quality criteria may be revised in accordance with Sections 2401-11-30 through 2401-11-36, inclusive of these regulations. A zone of mixing is the volume of water near the point of discharge within which the waste immediately mixes with ocean water due to the momentum of the waste discharge and the difference in density between the waste and the receiving

"Natural" means free of substances or conditions or a combination of both attributable to human activities. (O) "Natural Condition" or "Naturally Occurring" means that state of water quality that would exist at a specified time and place in the absence of human activities.

"Near-Shore Waters" means those salt waters lying within a defined reef area, or those salt waters up to 1,000 feet off-shore where there is no defined reef area.

"Non-Point Source" means any origin from which pollutants emanate in an unconfined and un-channeled manner including but not limited to surface runoff and leachate seeps.

"Off-Shore Waters" means all coastal waters beyond the limit defined for "near-shore" waters.

"Ordinary High Water Mark" shall mean that line upon the shore or bank established by fluctuations of water and indicated by physical characteristics, such as a clear natural line impressed on the bank, destruction of terrestrial vegetation, the presence of litter or debris, or other appropriate means.*

"Outstanding National Resource Waters" means the waters of national spawning grounds, preserves, and waters of exceptional recreational or ecological significance.

"Person" means the Republic of Palau, a state, a political subdivision, a public or private institution, corporation, partnership, joint venture, association, firm or company organized or existing under the Laws of Palau or of any state or country, a lessee or other occupant of property, or any individual, acting singly or as a group.

"Point Source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, vessel or other floating craft from which pollutants are or may be discharged.

"Pollutant" means but is not limited to dredged spoil, solid waste, incinerator residue, sewage garbage, sewage sludge, munitions, chemical waste, biological material, radioactive materials, heat, wrecked or discarded equipment, rock, sand, and industrial, municipal and agricultural waste.

"Pollutant Discharge" means either a point source or non-point source of pollutant discharge.

"Pollutant Discharge Permit" means any Republic of Palau Environmental Quality Protection Board Pollutant Discharge Permit issued pursuant to Sections 2401-11-21 through 2401-11-36, inclusive, of the Republic of Palau Environmental Quality Protection Board Marine and Fresh Water Quality Regulations.

"Stream" shall mean a flowing body of fresh water that persists throughout most of the year, except under conditions of drought, and has a visually-defined bed and bank or "ordinary high water mark."*

"Surface Water" means any water as found on the surface of the earth or under the influence of run off or other water.

"Swamp Forest" shall mean a forest that occurs where soils are flooded most of the year with fresh or slightly brackish water.*

"Undue Hardship" shall mean that the owner of the land has been denied all beneficial uses of the property that includes the buffer zone.*

"Water Quality Certification" means a statement which asserts that a proposed discharge activity will not violate applicable water quality standards.

"Water Quality Standards" means standards established for any and all waters located within the Republic of Palau.

"Wetlands" means those areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include saltwater swamps, freshwater/marshes, and cultivated wetlands. These waters shall be classified as surface water.

(Effective May 26, 1996)
**(Amendment Effective September 15, 1999)*

WATER USE CLASSIFICATION

2401-11-05 Classification of Coastal Water Uses

Coastal waters are classified in accordance with uses to be protected in each class as follows:

(A) Class AA Waters.

(1) The uses to be protected in this class of water are oceanographic research, the support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation and other aesthetic enjoyment.

(2) It is the objective that this class of waters remain as near to their natural state as possible with an absolute minimum of pollution from any source.

(3) To the extent possible, the wilderness character of such areas shall be protected. No point source discharge will be permitted in these waters, nor will destruction of reefs, aquatic habitants or other resources be permitted.

(4) The classification of any water areas as Class AA shall not prelude other uses of such waters compatible with these objectives and in conformance with the standards applicable to them.

(B) Class A Waters.

(1) The uses to be protected in this class of waters are recreational (including fishing, swimming, bathing, and other water contact sports), aesthetic enjoyment, and the support and propagation of aquatic life.

(2) It is the objective that in this class of waters, use for recreational purposes and aesthetic enjoyment shall not be limited in any way.

(3) Class A waters shall be kept clean of any trash, solid materials and oil, and shall not act as receiving waters for any effluent which has not received the highest degree of treatment or control practicable under existing technological and economic conditions and shall be compatible with the standards established for this class.

(C) Class B Waters.

(1) The uses to be protected in this class of waters are small boat harbors, commercial and industrial shipping, bait fishing, compatible recreation, over-water commercial or residential structures for recreational or domestic use*, the support and propagation of aquatic life, and aesthetic enjoyment.

(2) It is the objective for this class of waters that discharge of any pollutant be controlled to the maximum extent possible and that sewage and industrial effluent receive the highest degree of treatment practicable under existing technological and economic conditions, and shall be compatible with the standards established for this class.

(3) The Class B designation should apply only to a limited area next to boat docking facilities. No coastal areas with a coastal mangrove fringe greater than 50 feet in width shall be classified as Class B waters after the effective date of this amendment.*

(4) The rest of the water area in such bay or harbor not falling within the area identified in the previous paragraph shall be Class A unless given some other specific designation.

(Effective May 26, 1996)
**(Amendment Effective May 18, 1998)*

2401-11-19 Toxic Substances

Marine and fresh water standards for toxic substances are set forth in Appendix A to the Marine and Fresh Water Quality Regulations. The Board may amend Appendix A from time to time to add additional substances or modify the standards for particular substances as the Board deems appropriate.

(Effective May 26, 1996)

2401-11-20 General Conditions

(A) All methods of sample collection, preservation, and analysis used to determine compliance with these standards shall be in accordance with those specified in the latest edition of Standard Methods for the Examination of Water and Wastewater, by the American Public Health Association or methods specified by the United States Environmental Protection Agency in 40 CFR Section 136 et. seq., as appropriate. Samples should be collected at approximately equal intervals and under those conditions of tide, rainfall, and time of day when pollution is most likely to be the greatest or at a maximum level.

(B) Whenever water quality standards are exceeded, samples shall be taken at frequent intervals to be determined by the Board according to the severity of the violation.

(C) Whenever natural conditions are of a better quality than an assigned water quality criteria, the natural conditions shall constitute the water quality criteria. [See also: Sections 2401-11-03(E) and 2401-11-09(B)(6)].

(D) Whenever two numeric criteria are in conflict, the more stringent criteria shall constitute the water quality criteria.

(E) Pollutant discharge to either surface or ground waters shall be controlled so as to protect not only the receiving water but also those waters into which the receiving waters may flow.

(Effective May 26, 1996)

IMPLEMENTATION MEASURES

2401-11-21 Approval Required for New or Increased Pollutants

(A) It shall be a violation of these regulations for any person to initiate any project which may represent a new or increased source of pollution, either point source or non-point source, without first obtaining written approval of the EQPB.

(B) It is incumbent upon the person initiating the project to demonstrate to the EQPB that the project will not directly or indirectly impair any beneficial uses of the affected waters.

(C) The EQPB may place conditions of the construction and/or operation of the project as necessary to mitigate or eliminate any adverse water quality impacts associated with the project.

(D) The EQPB may withhold approval for any project until the project has received all necessary permits and clearances or has demonstrated that such clearances will be obtained at the appropriate time.

(Effective May 26, 1996)

2401-11-22 Discharge Permit Required

Any point source of discharge shall be in violation of these regulations unless the discharge operator has received a Pollutant Discharge Permit from the EQPB.

(Effective May 26, 1996)

2401-11-23 Written Approval for Hazardous Substances

It shall be in violation of these regulations for any person to store, dispose of or allow accumulation of any hazardous substance in such a manner that the substance may enter the surface or ground waters of the Republic of Palau without first obtaining written approval of the EQPB. Such substances include, but are not limited to petroleum products, pesticides, radioactive substances, and toxic chemicals. The EQPB may require persons handling hazardous substances to implement measures to reduce the possibility of contaminating the surface or ground waters of the Republic of Palau.

(Effective May 26, 1996)

2401-11-24 Response to Spills

(A) In the event of an accidental spill or discharge of hazardous substances, the responsible person shall immediately notify the EQPB and take all reasonable measures to contain the material so that it will not contaminate the surface or ground waters of the Republic of Palau.

(B) Failure to notify the EQPB within 24 hours and take reasonable mitigation measures shall also constitute a violation of these regulations.

(Effective May 26, 1996)

TRANSITION UNDER COMPACT

2401-11-25 Definitions

Unless specifically indicated otherwise, or unless the context clearly requires a different meaning, for the purposes of Sections 2401-11-25 through 2401-11-29, inclusive:

(A) "NPDES Permit" means any USEPA National Pollutant Discharge Elimination System Permit issued by the USEPA under the authority of the U.S. Federal Water Pollution Control Act Amendments of 1972, 82 Stat. 886, 33 U.S.C. 1251, et seq., as amended by the Clean Water Act of 1977, 91 Stat. 1566, 33 U.S.C. 1251, et seq., and the Water Quality Act of 1987, 101 Stat. 7, 33 U.S.C. 1251, et seq.

(B) "USEPA" means the United States Environmental Protection Agency.

(Effective May 26, 1996)

2401-11-26 Continuation of NPDES Permits

(A) All NPDES Permits, and the terms and conditions thereof, in effect on September 29, 1994 for discharges within the territory of the Republic of Palau shall continue in effect after the implementation of the Compact of Free Association between the Republic of Palau and the United States of America and are hereby adopted as EQPB Pollutant Discharge Permits.

(B) All holders of NPDES Permits and those that discharge pollutants, whether directly or indirectly, whether from point-sources or non-point-sources must continue to abide by the terms and conditions of the NPDES permits (as adopted as EQPB Pollutant Discharge Permits) until they are replaced by a subsequent EQPB Pollutant Discharge Permit.

(Effective May 26, 1996)

2401-11-27 Palau Discharge Permit Application Required

All holders of NPDES Permits and those that discharge pollutants, whether directly or indirectly, whether from point-sources or non-point-sources shall, within 90 days of the implementation of the Compact of Free Association, apply to the EQPB for a new or revised Pollutant Discharge Permit.

(Effective May 26, 1996)

2401-11-28 Continuation of Permitted Conduct

During the time period when such a permit application is pending before the EQPB, the discharges authorized by the NPDES Permit (as adopted as an EQPB Pollutant Discharge Permit) may continue, notwithstanding any expiration date on the permit. Once, however, the EQPB issues a new Pollutant Discharge Permit as a result of the application required by Section 2401-11-27, all authorizations to discharge pollutants under the NPDES Permit (as adopted as an EQPB Pollutant Discharge Permit) shall cease.

(Effective May 26, 1996)

2401-11-29 Compliance With Law Required

Nothing in these regulations shall be construed to allow any person to avoid the requirements of the Environmental Quality Protection Act, and the Regulations promulgated thereunder, including but not limited to the Sections 2401-11-21 and 2401-11-22 of the Marine and Fresh Water Quality Regulations requirement that prior written authorization and appropriate permits be obtained from the EQPB prior to the initiation of any project that may represent a new or increased source of either point-source or non-point source pollution.

(Effective May 26, 1996)

MIXING ZONES

2401-11-30 Applicability and Limits

(A) The water quality standards and criteria set forth in Sections 2401-11-9 through 2401-11-19 may apply within a mixing zone unless specific alternative criteria have been approved by the Board.

(B) Mixing zones will not be granted in lieu of reasonable control measures to reduce point source pollutant discharges but will be granted to compliment the applicable controls.

(Effective May 26, 1996)

2401-11-31 Permit Required

(A) All new point source discharges beginning after December 1, 1990 shall apply for an EQPB Pollutant Discharge Permit. This permit shall be required even if it can be demonstrated that the discharge will meet the applicable water quality standards at the point of discharge.

(B) It shall be a violation of these regulations for any person to commence discharging from a new point or non-point source without first obtaining all required permits.

(Effective May 26, 1996)

(C) All point and non-point discharges subject to the provisions of this Chapter shall comply with the terms, conditions, provisions and management plans for any National, State or traditional conservation area, preserve or other protected area as established by law.*

**(Amendment Effective March 12, 1999)*

2401-11-32 Mixing Zone Application

(A) Any application for a zone of mixing must contain the following:

(1) Evidence that the EQPB Pollutant Discharge Permit has been applied for and will be obtained;

(2) A description of the waste to be discharged including flow rate and pollutant types and quantities;

(3) The location of the discharge and a description of the disposal methods (e.g. outfall size, number and type of diffusers, etc.);

(4) Evidence that the concentration of toxic substances present in the discharge will not violate water quality standards for toxic substances;

(5) Identification of those substances for which the mixing zone is required;

(6) A certification for each substance identified in these regulations that after initial mixing the concentration of the substance will not exceed the applicable water quality standard. The following equation shall be used to calculate concentration after initial dilution:

$$Cf = \frac{C\,c + C\,b\,(D\,x)}{(Dx + 1)}$$

C = Concentration after mixing
fCc = Effluent concentration (instantaneous maximum)
Cb = Background concentration
Dx = Dilution ration

(7) Evidence that the basic water quality standards (Section 2401-11-9 through 2401-11-19, inclusive) will not be violated within the mixing zone;

(8) A proposed schedule of effluent and receiving water monitoring to determine compliance with the proposed mixing zone;

(9) A technical justification why a mixing zone should be permitted; and,

(10) Any other information required by the Board.

(B) The mixing zone shall be defined under those conditions of tide, wind, runoff, density stratification and discharge that would result in the minimum dilution.

(Effective May 26, 1996)

2401-11-33 Existing Discharges

All existing point source discharges must apply to the Board for a mixing zone or demonstrate that one is not required no later than June 1, 1992. The application procedure is identical to the one for new sources.

(Effective May 26, 1996)

2401-11-34 False or Misleading Information Prohibited

It shall be in violation of these standards for any person to knowingly present false or misleading information to the Board in an application for a mixing zone.

(Effective May 26, 1996)

2401-11-35 Mixing Zone Application Review

(A) In reviewing a mixing zone application the Board will consider:

(1) Present and anticipated uses of the water body.

(2) Whether an adequate zone of passage will exist for the movement of aquatic life.

(3) The proximity of other mixing zones.

(4) Whether the granting of a mixing zone is in the public interest.

(B) The Board may request additional information from the applicant that is deemed relevant to the Board's determination.

(Effective May 26, 1996)

2401-11-36 Mixing Zone Certification Determination

(A) The Board may eitherapprove, conditionally approve, or disapprove a mixing zone application after conducting a public hearing on the application. The Board will notify the applicant in writing of its determination. The notification will include, but is not limited to:

(1) The duration of the mixing zone; and,

(2) Any conditions placed upon the Board's approval of the application. Conditions may include, but are not limited to:
   (a) Effluent and receiving water monitoring and reporting requirements;
   (b) A timetable for the reduction or elimination of the discharge; and,
   (c) The parameters for which the mixing zone is being granted and the alternative criteria that will apply within the mixing zone.

(B) If the Board disapproves a mixing zone application, it will notify the applicant, in writing, of the reasons for the disapproval.

(Effective May 26, 1996)

MARINE SANITATION DEVICES

2401-11-37 Definitions

Unless specifically indicated otherwise, or unless the context clearly requires a different meaning, for the purposes of Sections 2401-11-37 and 2401-11-38:

"Discharge" includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping.

"Federal Water Pollution Control Act" means the U.S. Federal Water Pollution Control Act Amendments of 1972, 82 Stat. 886, 33 U.S.C. 1251, et seq., as amended by the Clean Water Act of 1977, 91 Stat. 1566, 33 U.S.C. 1251, et seq., and the Water Quality Act of 1987, 101 Stat. 7, 33 U.S.C. 1251, et seq.

"Marine Sanitation Device" includes any equipment for installation on board a vessel and which is designed to receive, retain, treat, or discharge sewage and any process to treat such sewage.

"Sewage" means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes.

"Vessel" includes every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on any waters of or within the Republic of Palau.

Other terms shall have the Definitions set forth in 40 CFR Section 140.1 and 33 CFR Section 159.3

(Effective May 26, 1996)

2401-11-38 Marine Sanitation Device Requirements

All Marine Sanitation Device requirements in effect within the Republic of Palau on September 29, 1994, as set forth in 33 CFR Part 159 and 40 CFR Part 140 shall continue to be in effect after the implementation of the Compact of Free Association between the Republic of Palau and the United States of America and are hereby adopted by reference and no discharge of sewage pertaining to vessels shall occur within the Republic of Palau in violation of said Marine Sanitation Device Requirements.

(Effective May 26, 1996)

SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC)

2401-11-39 Applicability

Sections 2401-11-39 through 2401-11-41 apply but are not limited to all facilities that, on September 29, 1994, were subject to the SPCC requirements of USEPA. This includes, but is not limited to all bulk petroleum product storage facilities within the Republic of Palau.

(Effective May 26, 1996)

2401-11-40 Definitions

Unless specifically indicated otherwise, or unless the context clearly requires a different meaning, for the purposes of this Section,

"Owner or Operator" means any person owning or operating an on-shore facility or an off-shore facility, and, in the case of an abandoned facility, any person that owned or operated the facility immediately prior to abandonment.

"SPCC Plan" means the Spill Prevention Control and Countermeasure Plan required pursuant to 40 CFR Part 112.

(Effective May 26, 1996)

2401-11-41 SPCC Requirements

(A) The SPCC Plan and oil spill requirements of 40 CFR Parts 110, 111 and 112 are hereby adopted by reference, except that the Board shall have the authority to take any action or impose any requirement that said Parts of the CFR authorize the Administrator to take or impose.

(B) Any person that owns or operates any facility, whether off-shore or on-shore, shall complete, maintain, and, as either necessary or as required by the EQPB, revise the SPCC plan for that facility to the same extent required by 40 CFR Parts 110, 111 and 112.

(Effective May 26, 1996)

WATER USE AREAS: CLASSIFICATION AND ESTABLISHMENT

2401-11-42 Surface Waters

The following classification of water uses shall apply to the following areas:

(A) Babeldaob
- (1) Class AA: All areas not otherwise classified and those coastal waters not having a specific water use classification are considered Class AA Waters.
- (2) Class B: Village Docks

(B) Koror
- (1) Class AA: All areas (not otherwise classified)
- (2) Class A:
  - (a) Meyuns
  - (b) Echang
  - (c) Cholebdechal (Oleblechol)
  - (d) Ngiritang
  - (e) M-Dock (Singhatoba) Point
  - (f) Ngetmeduch
  - (g) Mechang
- (3) Class B:
  - (a) Malakal (Ngemelachel) Harbor
  - (b) M-Dock (Singhatoba) including S.E. of Ngerbeched Shore
  - (c) Kemangel Toachel, excluding T-Dock (Ngerkemais)
  - (d) Metukerademul to E. side of old Japanese Dock (Derromel)

(e) Ngereksong
(f) Nikko (Iwayama) Bay from the Nikko pier to a shoreline boundary approximately 1200 feet N.W. of the Nikko pier and an additional 300 feet of offshore reef flat to the N.W. of the shoreline boundary.*
(g) Waters extending 200 meters from the shoreline of Ngerur Island.**

(C) Peleliu
(1) Class AA: All areas (not otherwise classified)
(2) Class A:
(a) Ngebad to Ngarekeiukel point
(b) Southern side of island
(3) Class B: Akalakul (Elochel) Dock

(D) Angaur
(1) Class AA: All areas (not otherwise classified)
(2) Class A:
(a) Pkulamekaep (Bkulamekaeb) point to Medorm
(b) Beach south of Pkulagelul (Bkulengeluul) point
(c) Beach between Ngedeloch point and Medorm
(3) Class B: Angaur (Ngeaur) Harbor

(E) Sonsorol
Class AA: All areas (not otherwise classified)

(F) Tobi
Class AA: All areas (not otherwise classified)

(G) Merir
Class AA: All areas (not otherwise classified)

(H) Pulo Anna
Class AA: All areas (not otherwise classified)

(Effective May 26, 1996)
**(Amendment Effective May 18, 1998)*
***(Amendment Effective October 6, 2000)*

WATER QUALITY CERTIFICATION

2401-11-44 Permits/Licenses Subject to Certification

(A) Water quality certification must be provided by the Board prior to the issuance of any EQPB Permits or any permits required by Sections 402 and 404 of the United States Clean Water Act (33 U.S.C. Sections 1342 and 1344) and section 10 of the United States Rivers and Harbors Act, approved March 3, 1899, (33 U.S.C. 403).

(B) A Republic of Palau Foreign Investment Board license may also be required in order to receive water quality certification.

(Effective May 26, 1996)

2401-11-45 Scope of Work

The scope of review of applications for certification shall be sufficient to determine that no permit would violate water quality standards or become a source of pollution in the future. Such review shall include an examination of but not limited to the following:

(A) Impact on water quality at the proposed project site;

(B) Impacts on water quality of any or all waters influenced by the project, including groundwater, downstream and upstream waters, tidal influenced water or other fresh, marine, or brackish water influenced by the project as a result of topography, percolation, recharge, currents or other hydrologic and geologic conditions;

(C) Impacts of operation of the project on water quality at site and influenced waters as described in Division B; and

(D) All criteria and standards included in these regulations shall be considered.

(Effective May 26, 1996)

2401-11-46 Approval Criteria

(A) No certification shall be issued in violation of the national policy set forth in Section 2401-11-03 of these regulations.

(B) Certification of projects which are not water dependent shall be denied.

(C) Certification of non-water dependent projects for which there is a viable alternative shall be denied.

(D) Certification is denied if the project will prevent or interfere in the maintenance of applicable water quality standards.

(E) Certification is denied if impacts to water quality can not be made acceptable through conditioning of the certification and/or permit for which certification is sought.

(Effective May 26, 1996)

2401-11-47 Conditioning of the Certification

(A) The Board shall place any conditions on a water quality certification that are necessary to assure the applicant will comply with water quality standards, effluent limitations, and with any applicable Republic of Palau or its State's Laws or Regulations.

(B) Conditions shall include, but are not limited to:

(1) structural and nonstructural mitigation measures;

(2) appropriate effluent treatment systems;

(3) appropriate operations and maintenance plans;

(4) compensation to the fullest extent possible for functional losses to the local ecosystem by the unavoidably lost wetlands; and,

(5) compensation for the loss of certain areas with the permanent preservation of other similar ecosystems.

(Effective May 26, 1996)

2401-11-48 Contents of Certification

A certification made by the Board shall include the following:

(A) The name and address of the applicant;

(B) A statement that the Chairman has either:

(1) Examined the application made by the applicant to the licensing or permitting agency (specifically identifying the number or code affixed to such application) and bases the certification upon an evaluation of the information contained in such application which is relevant to water quality considerations; or,

(2) Examined other information furnished by the applicant sufficient to permit the Chairman to make the statement described in Subdivision 1 above;

(C) A statement that there is a reasonable assurance that the activity will be conducted in a manner which will not violate applicable water quality standards;

(D) A statement of any conditions which the Chairman deems necessary or desirable with respect to the discharge of the activity; and,

(E) Such other information as the Chairman may determine to be appropriate.

(Effective May 26, 1996)

2401-11-49 Standard For Certification

If, after considering the complete application, comments received during the public comment period, the record of any public hearing held pursuant to 24 PNC Section 162 and other information and data as the Chairman deems relevant, should the Chairman determine that there is a reasonable assurance that applicable water quality standards will not be violated and the best practicable methods of control will be applied to a discharge which is the result of any activity including, but not limited to, the construction and operation of facilities, then the Chairman shall so certify.

(Effective May 26, 1996)

2401-11-50 Certification Modification

The Chairman may modify the certification prior to the issuance of any applicable license or permit, after consideration of information presented by the applicant, licensing or permitting agency or other government agencies or interested parties.

(Effective May 26, 1996)

2401-11-51 Contents of Application

(A) An applicant for certification shall submit a complete description of the discharge involved in the activity for which certification is sought, with a request for certification signed by the applicant. Such description shall include the following:

1. The name and address of the applicant;

2. A description of the facility or activity, and of any discharge into the Republic of Palau waters which may result from the conduct of any activity including, but not limited to the construction or operation of the facility, including characteristics of the discharge, and the location or locations at which such discharge may enter waters of the Republic;

3. If applicable, a description of the function and operation of equipment or facilities to control discharges, including specification of the methods of control to be used;

4. The estimated date or dates on which the activity will begin and end the date or dates on which the discharge(s) will take place;

5. If applicable, a description of the methods and means being used or proposed to monitor the quality and characteristics of the discharge and the operation of equipment or facilities employed in the control of the proposed discharges;

(B) The Chairman may require the submission of additional information after a certification application has been filed, and shall insure that, if the certification application is incomplete or otherwise deficient, processing of the application shall not be completed until such time as the applicant has supplied the missing information or otherwise corrected the deficiency. The Chairman shall notify the applicant, in writing, within thirty (30) days of the submission of an application, if an application is incomplete or otherwise deficient. A description of the type of additional information necessary to complete the application or correct the deficiency will be included with such a written notice. Failure to provide additional information or to correct a deficiency shall be sufficient grounds for denial of certification.

(C) The applicant will be informed, in writing, by the Chairman, when a certification application is considered to be complete. The Chairman shall act on a request for certification within a period which shall not exceed three (3) months;

(D) The applicant is required to notify the Board immediately, in writing, of changes which may affect the application and certification process:

(E) Fees shall be made payable to the National Treasury. The Republic and its State governments and agencies are exempt from paying filing fees.

(Effective May 26, 1996)

2401-11-52 Notice and Hearing

(A) The Chairman may, upon request, provide the opportunity for a public hearing(s) to consider the issuance of a water quality certification. A notice shall be published in accordance with 24 PNC Section 162.

(B) The Chairman shall inform the applicant, in writing, that such action has been taken.

(C) All publication costs related to public hearing(s) notification(s) shall be paid by the applicant to the necessary and appropriate newspaper agency(ies) prior to publication date. Failure to do so may result in a delay in the certification process beyond three (3) months.

(Effective May 26, 1996)

2401-11-53 Waiver

If the discharge in question is the result of activities which receive a nationwide permit for the discharge of dredge and fill materials, thereby fulfilling specific conditions of that permit pursuant to 24 PNC Section 162, then the Chairman will determine, on a case-by-case basis, which projects are considered to be minor, with a negligible impact and non-controversial. Certification requirements of this section shall be waived for minor projects which have a negligible impact, and are non-controversial activities within three (3) months of the receipt of a completed application.

(Effective May 26, 1996)

2401-11-54 Effect of New Standards on Permitted Activity

The Board shall review any project or activity wherever:

(A) A license or permit was issued without certification due to the absence of applicable water quality standards;

(B) Water quality standards applicable to the waters into which the licensed or permitted activity may discharge are subsequently established before the activity is completed; and,

(C) The Board determines that such uncertified activity is violating water quality standards.

(Effective May 26, 1996)

ENFORCEMENT

2401-11-55 Enforcement

Any person in violation of any of the provisions of these regulations shall be subject to enforcement and court action under 24 PNC Sections 161 through 172, inclusive.

(Effective May 26, 1996)

MISCELLANEOUS PROVISIONS

2401-11-56 Severability Clause

If any provisions of these regulations or the application of any provision of these regulations to any person or circumstances is held invalid, the application of such provision to other persons or circumstances and the remainder of these regulations shall not be effected thereby.

(Effective May 26, 1996)

2401-11-57 Repealer

The regulations contained herein shall replace the Republic of Palau EQPB Marine and Fresh Water Quality Standards Regulations in effect upon the effective date of these regulations.

(Effective May 26, 1996)

2401-11-58 Protected Areas

All activities subject to the provisions of this Chapter shall comply with the terms, conditions, provisions and management plans for any National, State or traditional conservation area, preserve or other protected area as established by law.*

**(Amendment Effective March 12, 1999)*

Permit Guide

Marine and Freshwater Discharge Permit

The purpose of this permit is to ensure that no pollutants are discharged into the waters of Palau without being given the degree of treatment or control necessary to prevent

pollution or any reduction of water quality. Pollutants covered include dredged spoils (this does not refer to filling of wetlands with dredged materials, which is covered by earth moving regulations and permit and U.S. Army Corps of Engineer permit), solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, and industrial, municipal, and agricultural waste. Any project which may represent a new or increased course of pollution is required to obtain a permit. Examples of discharging facilities are municipal sewage treatment plants, industrial facilities, and commercial facilities. The EQPB office will require conditions on the construction and/or operation of the project to mitigate or eliminate any adverse water quality impacts associated with the project.

ROP water quality rules and regulations establish specific criteria and policy for clean water standards. This includes maximum allowable concentrations of specific pollutants, and where each criteria applies in the waters of Palau.

Information required on the application includes location, method, and flow chart of discharge, a list of pollutants and estimated quantities to be discharged, methods of waste treatment to be employed and waste treatment by product disposal, and evidence that the concentration of toxic substances present in the discharge will not violate water quality standards for toxic substances.

MANAGING BOAT WASTES

This section outlines basic do and don't practice guidelines for managing boat wastes.

Bilge Water

Once in the marine environment, oil and fuels can collect in the bottom sediments and concentrate in marine organisms. These substances often enter the marine environment through bilge pumping, fueling, and improper response to spills.

DO:

- ✓ Fix small leaks that allow oil to drip into the bilge
- ✓ Take extra care when you change your oil
- ✓ Use oil-absorbent pads to capture surface oil. Make sure oil is completely absorbed.
- ✓ Dispose of used pads in trash.
- ✓ Raise the bilge pump automatic float switch enough to keep any oil contaminated bilge water aboard until it can be pumped to a clean container.

DON'T:

- Drain engine oil into the bilge
- Put off repairs to engine and fuel tank leaks
- Disable automatic bilge pumps while doing engine repairs
- Turn on bilge pumps before ensuring that the bilge is clean
- Dispose of used oil except at an approved waste reception facility
- Use dispersants such as dish soaps – they do not remove oil form the water, they only break it down into small, hard to see drops

- Discharge bilge water if there is a sheen to it

Boat and Deck Washing

Every time we wash our decks with soap, we contribute to water pollution. Many soaps contain phosphates which promote the growth of algae which extract oxygen from the water which is essential to fish populations.

DO:

- ✓ Rinse and scrub your boat with a brush after each use; safest cleaning product is good old fashioned "elbow grease"
- ✓ Try to buy alternative products that do not contain phosphates
- ✓ Use non-toxic biodegradable cleaners
- ✓ Use hose nozzles that shut off when released and conserve water and reduce the runoff from boat washing

DON"T:

- Use cleaners that contain ammonia, sodium, chlorinated solvents, petroleum distillates, or lye
- Clean the bottom of your vessel by scrapping or scrubbing it while it is still in the water

Marine Debris

The ocean is not a dump! Marine debris – plastic, nets, fishing lines, six pack rings, styrofoam, etc. – can kill marine life.

DO:

- ✓ Keep all waste on board in proper receptacles. Separate plastics, cans, and glass for recycling. Properly manage your debris so that it will not be blown or washed overboard
- ✓ Avoid expensive boat engine repairs – keep your trash out of the water! Boat engines can be damaged when propellers or cooling water intakes become entangled with nets and other marine debris
- ✓ Choose reusable items rather than disposables

DON'T:

- Discard any garbage overboard
- Discard any plastic over the side

Paints, Varnishes, and Epoxies, etc.

Water-soluble paints are less dangerous. The growth of marine organisms on hulls is a common problem faced by boaters. Many boat paints are designed to slough off and carry away unwanted growth. These same paints can often contain anti-growth toxins, which when leached into the water, can accumulate back to us in the fish that we eat.

DO:

- ✓ Buy only what you need. Mix only what you need. Prepare paints over a drop cloth on land, not on the dock.
- ✓ Use the most environmentally friendly bottom paints available.

- ✓ Scrape and paint your boat away from the water. Plug the scuppers and wipe up any spills or residues.
- ✓ Use drop cloths, pans, contaminated trays, etc. to catch paint scrapings and drippings. Dispose of wastes in the trash. Allow empty paint cans to dry out before throwing them away.
- ✓ Scrub the hull periodically to extend the useful life of the paint.

DON"T:

- Scrub the hull periodically to try to extend the useful life of the paint while in the water.

Used Oil

If improperly managed, used oil is a dangerous pollutant. Just one quart of oil can contaminate 250,000 gallons of water and can injure fish, birds, and other aquatic life.

DO:

- ✓ Store your oil in a clean, air tight container
- ✓ Use oil absorbent products to contain any accidental spills or when you change your oil
- ✓ Bring your uncontaminated used oil to a collection facility or recycling center.

DON"T:

- Mix used oil with solvents, thinner, paint, anti-freeze, fuel or other hazardous substances.

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