



The Rock Islands Southern Lagoon

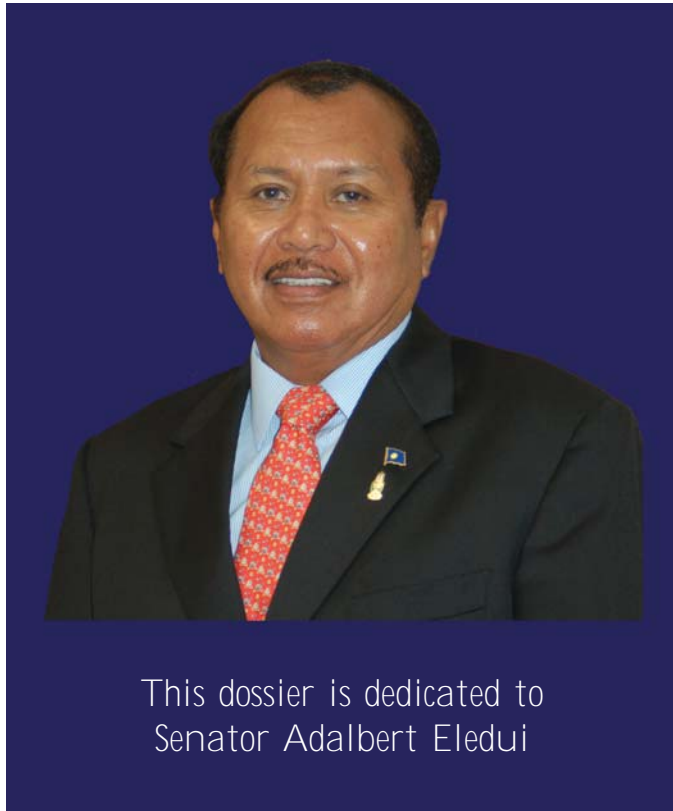
as nominated by

The Republic of Palau

for

Inscription on the World Heritage List

January 2011



This dossier is dedicated to
Senator Adalbert Eledui



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September 24, 2010

Mr. Jung, Young Hun
The World Heritage Centre
United Nations Educational, Scientific and Cultural Organization
7, place de Fontenoy
75352 Paris 07 SP, France

Honorable Masaki Emesiochel
Minister of Education and
Chairman, Palau National Commission for UNESCO

Dear Mr. Jung and Chairman Emesiochel,

It is with great honor that the State of Koror recommends that the Rock Islands Southern Lagoon be nominated as a United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage site. The nomination of this site is one of the goals of the leadership of Koror State and especially my administration.


The well-known biodiversity of the Republic of Palau lies in the marine and terrestrial environment of the Rock Islands, where important habitats for threatened and endangered species are situated. The significant aesthetic and cultural values of the landscape of the Southern Lagoon are integral to the identity of the State and our island nation.

The Rock Islands is a place that has seen increasing levels of protection since 1956 for resource preservation and sustainable use. Most recently Koror State passed public law no. K9-220-2010 to extend the time for the Rock Islands Southern Lagoon Management Plan. The management plan was established to have a comprehensive conservation program for the Southern Lagoon. Becoming a world heritage site will help us better adapt management to address complex challenges and issues that are constantly changing.

Koror State recognizes the significance of the Rock Islands Southern Lagoon as a mixed natural and cultural site. Our nomination onto UNESCO World Heritage List, is part of our continued efforts towards achieving long-term sustainable management and effective conservation of this important area.

Koror State Government fully supports the nomination of the Rock Islands Southern Lagoon to the UNESCO World Heritage list and will work to fully ensure the nomination is successful in the approval process.

Sincerely,



Yositaka Adachi
Governor



My search for the biib and its relatives took me on a journey where numbers melt in the heat and are washed away by pounding rain and where the uniqueness of one individual tells the story of millions.

Michael Parfit, "Islands of the Pacific", National Geographic, in describing his search for the Palau Fruit Dove among Palau's Rock Islands <http://ngm.nationalgeographic.com/ngm/0303/feature5/index.html>

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Executive Summary

State Party

Republic of Palau

State

Koror State

Name of Property

Rock Islands Southern Lagoon (RISL)

Geographical coordinates to the nearest second

Geographic Center: 134°20'34.48"E, 7°14'48.93"N.

Textual description of the boundary of the nominated property

The RISL consists of a 859 square kilometer area and includes 445 limestone islands and 52 marine

lakes surrounded by a lagoon with fringing reefs, patch reefs, and shallow water marine areas.

A4 (or "letter") size map of the nominated property, showing boundaries and buffer zone

See Figure i, next page.

Justification /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. 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 on a



Ngerukewid Islands National Wildlife Preserve. Photo by Patrick Colin.

society living in a marginal environment. The Rock Islands are highly susceptible to climatic change based upon evidence from the transition of the 'Medieval Warm Period' to the 'Little Ice Age' in the first and second millennium AD. Human impact on reef resources and reduced production of resources during the 'Little Ice Age' resulted in abandonment of villages at AD 1650-1750 and migration to nearby bigger islands with more resources.

The RISL bears exceptional testimony to a living cultural tradition. Contemporary Palauans originated from ancestral Rock Island settlements and identify with the aesthetic and cultural values of the RISL. Cave burials and rock art indicate past cultural behavior.

The RISL is one of the most diverse, complex, and breathtakingly beautiful places on earth. Its lagoon is filled with hundreds of gem like "Rock Islands." These limestone islands habitats are diverse and include marine lakes, caves, arches, tunnels, coves, forests, and wetlands, each with unique species. White beaches, mangroves, and fringing reefs surround the islands and patch reefs create an oasis for marine life. The RISL is protected by an expansive barrier reef with deep channels and passes with added richness in biodiversity. The habitat complexity is a refuge for a highly diverse assemblages of organisms.

The RISL's biological and marine habitat diversity ranks as one of the top in the world compared to similarly sized areas.

No other place on earth has this number and variety of marine lakes within a similarly sized area. Five new subspecies of *Mastigias papua* jellyfish described from these lakes suggests that populations of other species will be recognized

as endemics with long evolutionary histories delimited within individual lakes.

The RISL's resilient reefs make it a critical area for the protection of biodiversity. With minimal human impact, the RISL serves 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, 7 species of giant clams, and the endemic nautilus are found in the RISL. The limestone forests and mangroves include all of Palau's endemic birds, mammals, herpetofauna and nearly half of Palau's endemic plants including the critically endangered *Ponapea palauensis*.

The RISL is one of the best managed areas in the world. Thousands of years of customary law combined with current National and State Laws have resulted in effective conservation and protection. The Koror State RISL Management Plan was developed by the Koror community under the guidance of its elected and traditional leaders. Koror State fully supports the establishment of the RISL as World Heritage Site and is committed to keeping the RISL as one of the one of the greatest places on earth.

Criteria under which property is nominated

iii, v, vii, ix, x

Name and contact information of official local agency

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Figure i (Page 6). A4 map of the nominated property, showing boundaries (no buffer zone is proposed)

1. Identification of the Property

1. Identification of the Property

Country

Republic of Palau

State

The Rock Islands Southern Lagoon is wholly within the lands and waters of Koror State.

Name of Property

“Rock Islands Southern Lagoon”.

The Rock Islands Southern Lagoon is named for its gem-like islands of uplifted coralline limestone that are surrounded by sparkling waters and colorful reefs. This document refers to the Rock Islands Southern Lagoon as “the Rock Islands”, “RISL”, or “the Property”.

Geographical Coordinates to the Nearest Second

The approximate geographic center of the RISL is located at 134°20'34.48"E, 7°14'48.93"N.

Maps and Plans Showing the Boundaries of the Nominated Property and Buffer Zones

Topographical Map

Figure 1 shows the RISL property including boundaries, topographical relief, conservation zones, and areas of legal protection.

Location Map Showing the Location of the Property within the State Party

Figure 2a is a map of Palau identifying the RISL and its coordinates.



An aerial view of the Rock Islands. Photo by Ann Kitalong.

2. Description of the Property

2.a1 Description of Natural Heritage

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 7 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.



Islands, reef flats, and marine lakes in the RISL. Photo by Patrick Colin.

In addition to being a source of subsistence and livelihood, the RISL is also a source of national pride and reverence. For millennia, Palauans have used both traditional resource management techniques and, more recently, modern conservation strategies to protect the biodiversity of the RISL while living off of its resources. Palauans remain passionate about maintaining this biodiversity 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 Property has unique characteristics. One of the most well known, yet least visited, complex is the Ngerukewid Islands Wildlife Preserve. This island 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 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 Ngerukewid and 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,



turtles, and manta rays. This has made this area a very important tourist attraction.

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 11.6km of fringing reefs (Yukihira et 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

Distinct island groups

- Ulong Complex
- Ngeruktabel Complex
- Ngerukewid Islands National Wildlife Preserve
- Ngemelis Island Complex
- Mecherchar Complex
- Kmekumer group
- Babelomekang group



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.

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.

Marine Lakes

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 level filled basins, sinkholes, 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



Mastigias papua etpisoni in Jellyfish Lake. Photo by Michael N. Dawson.

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 2m 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 geological features such as caves full of swiftlets (*Aerodramus pelewensis*) and the Polynesian sheath-tailed bat (*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).

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 5 and 25 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 2005a). In a similar context, and one 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.

Coral Reefs

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

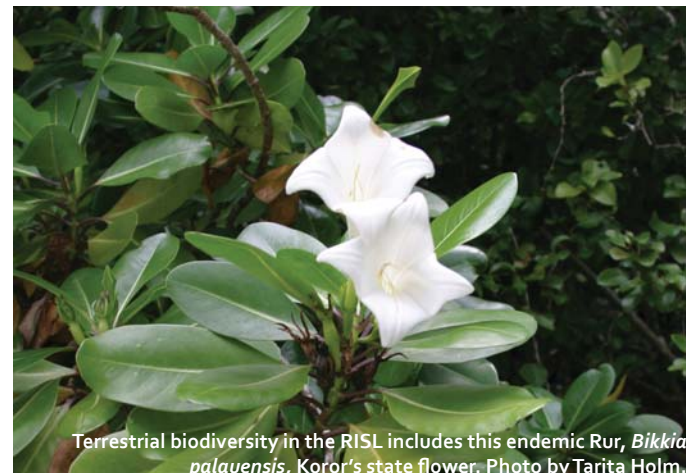


Coral reef. Courtesy PCS.

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, (*Epibulus brevis*) (Carlson et al. 2008), and several sea squirts (*Stolonica limbata*, *Aplidium controversum*, Monniot and Monniot 1996; and *Rhopaalea circula*, Monniot and Monniot 2001).

Terrestrial Habitats

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.



Terrestrial biodiversity in the RISL includes this endemic Rur, *Bikikia palauensis*, Koror's state flower. Photo by Tarita Holm.



Extensive *Turbinaria reniformis* colonies at Ulong Channel. Photo by Paul Collins.

The three main forest types within the Property include the dominate limestone forests, strand forest along back beaches, and mangrove forests adjacent to the marine lakes, coves, and some coastlines.

The Ngemelis Island Complex, Ngerukewid Islands National Wildlife Preserve, and Kmekumer group have sandy beaches that support rare vegetation and nesting sites for endangered species. For example, their beaches have nesting sites for the critically endangered Hawksbill sea turtle, and the beaches and strand habitat support nests of the endangered Micronesian Megapode.

Species Diversity

An important recent terrestrial study shows that island species richness (biodiversity) on islands increases with habitat diversity (Hortal et al. 2009). Similarly, species diversity in the RISL can be expected to be positively related to the wide variety of marine and terrestrial habitats. It follows that the preliminary species data collected thus far in Palau (e.g., Hooper et al. 2002; Fabricius et al. 2007; Ohba et al. 2007; CRRF, unpub.; Palau International Coral Reef Center (PICRC), unpub.; A. Olsen, unpub.) indicate unusually high biodiversity of marine and terrestrial biota for such a small geographic area.

The RISL are home to all of Palau’s threatened megafauna (IUCN Classification of CE, EN, VU, or NT; mammals, large reptiles, large fish, birds). All of Palau’s endemic birds (Holm et al. 2008; Pratt and Etpison 2008), mammals (Wiles et al. 1997; Pratt and Etpison 2008), and confirmed endemic herpetofauna (Crombie and Pregill 1999) reside in the Rock Islands. *Nautilus belauensis*, the second largest nautilus in the world, is endemic to Palau (Jereb 2005) and is commonly found in the deeper outer reefs of the RISL. **Appendix A** is a list of known species as of 2004.

Corals

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 16m in diameter and 6m 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). In 1998, the increased sea surface temperatures associated with the El Niño La Niña Southern Oscillation (ENSO) resulted in extensive coral bleaching. In some locations, 100 percent of the coral colonies bleached; across Palau an average of 48 percent of colonies bleached (Bruno et al. 2001). Studies of Palau's corals looking at recovery from the 1998 bleaching event indicate that the RISL's fringing reefs had the highest coral cover. This suggests that they were less affected by the bleaching than the other regions of Palau (Golbuu, Fabricius et al. 2007; Golbuu, Victor et al. 2007) and potentially more resilient to increasingly more frequent and intense ENSO oscillations that are possibly caused by climate change. The shallow reef tops of the barrier reef in the RISL are another reservoir of bleaching-resistant coral (Colin 2009).

Fish, Sharks, and Rays

Of the more than 1,350 species of fish recorded in Palau, at least 746 occur in the RISL (Winterbottom unpubl.; Maragos et al. 1994). Ngerumekaol Channel alone has 89 recorded species of fish (Amesbury 1991) and is a well known grouper spawning aggregation site. The Ngerukewid Preserve has 150 fish species (Birkeland and Manner 1989). Palau is ranked fifth among the top 10 regions of high reef fish diversity (Allen 2000). Ongoing research continues to discover

new RISL fish species (Winterbottom 2005; Winterbottom, Harold, Murphy 2005; Winterbottom, Iwata, Kozawa 2005).

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.) including resident populations of grey reef, black tip, white tip, and silver tip sharks, bull sharks, tiger sharks, nurse sharks, 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, the 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. Palau's hope that other nations would follow their example was realized in 2010 when the Maldives also became a shark sanctuary.

Every year, more discoveries are made and more is learned about the many habitats within the RISL. For example, German Channel, a famous cleaning station for sharks and manta rays, is now also known to be an important feeding and breeding area for manta rays. Recently, two young mantas were observed and they are believed to have been born during 2010 (Olkeriil, pers. comm. 2010; Etpison, pers. comm. 2010).



Grey Reef Shark. Photo by Paul Collins.



Hawksbill Sea Turtle. Photo by Paul Collins



Emerald Skink. Photo by Eric VanderWerf.

Reptiles and Herpetofauna

The hawksbill sea turtle (*Eretmochelys imbricate*) nests in the Rock Islands. Palau's nesting population is the only one known in Micronesia (Maragos et al. 1994). In 2005 and 2006, 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 may be a resident population in the RISL (Kitalong and Eberdong 2006; Klain and Eberdong 2007). Hawksbill sea turtles are listed by the IUCN as "critically endangered". The endangered green sea turtles (*Chelonia mydas*) is also 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.

Palau's salt water crocodile (*Crocodylus porosus*) is the island nation's only native crocodile (Russello et al. 2006) and Micronesia is the eastern edge of its distribution (Colin 2009). Adult and juvenile salt water crocodile are regularly observed in the RISL (Nash et al. 2008). A 2003 survey of crocodiles estimated the population to be between 500 to 750 non-hatchling individuals (Brazaitis et al. 2003). All of Palau's confirmed endemic herpetofauna are present in the RISL (Crombie and Pregill 1999). Individual Rock Islands or island groups are known

to have endemic exclusive herpetofauna that include the following species: *Platymantis pelewensis*, *Gehyra brevipalmata*, *Gekko* sp. (undescribed), *Lepidodactylus paurolepis*, *Lipinia leptosoma*, *Sphenomorphus scutatus*, *Sphenomorphus* sp. nov. (undescribed), and *Ramphotyphlops acuticaudus*. The endemic frog, *Platymantis pelewensis*, was found during a biotic survey of the RISL's Ngerukewid Preserve (Birkleland et al. 1989).

Mammals

The vulnerable sea cow, *Dugong dugon*, or mesekiu in Palauan, lives in the RISL and is frequently sighted. Palau's dugong population is the most isolated population in the world (Nishiwaki et al. 1979; Nishiwaki and Marsh 1985). Seagrass beds in the Ngederrak Reef Conservation Area are an important feeding ground and refuge for dugongs (Community Centered Conservation 2003). Of the total of 30 dugong sighted during three aerial surveys in 2008, 24 (16 adults and 8 calves) were sighted within the RISL (Kitalong Hillman et al. 2008). Preservation of Palau's dugong population is particularly critical because, due to its isolation, there is less probability that the local populations will become established in other locales (Marsh and Lawler 1998). In 2010, Palau passed legislation establishing all of its waters as a Marine Mammal Sanctuary, prohibiting harvest of marine mammals.

Micronesian megapode Bekai

© Mandy Etpison



There are only two native terrestrial mammals in Palau, both bats. The Marianas flying fox (*Pteropus mariannus pelewensis*) is endemic at the subspecies level to Palau and is commonly found 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*) inhabits cave ceilings in the RISL.

Birds

The Rock Islands are home to all of Palau's endemic, regionally-restricted, and endangered birds. 53 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 White-eye (*Negazosterops 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 testament to the refugia property of the RISL.

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.

Plants

Terrestrial

The RISL contains 55 (42 percent) of Palau's 130 endemic plants and 31 (23 percent) of these plants



Dugongs. Photo by Mandy Etpison.



Dugong feeding trail through seagrass. Photo by Paul Collins

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 Hillman 2008).

Marine

The RISL has at least 119 species and 4 ecads of algae including 57 taxa and the 4 ecads of green algae (Chlorophyta), 16 brown algae (Phaeophyta), 35 red algae (Rhodophyta) and 5 blue green algae (Cynophyta). Omodes Pass within Nikko Bay (formerly Iwayama Bay) has an exceptionally rich algal flora with over 75 species. This pass (340m long, 130m wide and 3-4m deep), representing only a fraction of Palau's marine systems, contains nearly 40% of all algae species (195) collected or recorded (Ohba et al. 2007). A total of 22 algae species were found in the Ngerukewid Islands Wildlife Preserve (Birkeland and Manner 1989). Nine of the 10 seagrass species in Palau are found within the RISL (Ohba et al. 2007).

Exploitation of Natural Heritage

Harvest of Fish

Fishing is a popular activity in the RISL. Having practiced sustainable fishing for millennia, fish forms the core of the Palauan diet (Fitzpatrick and Kataoka 2005). Today the most common methods for fishing are bottom fishing, line fishing, and spear fishing (Matthews 2004). Archaeological data suggests that during occupation of the Rock Island stonework villages in the ancient past dropline fishing, used on squirrelfishes (Holocentridae), snappers (Lutjanidae), emperors (Lethrinidae),



and sea breams (Monotaxidae), changed to more reliable and productive techniques such as netting and basket traps, employed on the parrotfishes (Scaridae), leatherjackets (Aluteridae), porcupinefishes (Diodontidae), and wrasses (Labridae), during occupation of the Rock Island stonework villages (Masse 1989).

Both commercial and non-commercial fishing occurs in the Property, although there is limited fish export from these catches. Harvesting of fish is regulated in the Property. For example, the Ngkisaoi Sardines Sanctuary was established specifically to protect sardines. Additionally, the sale of sardines is banned at all times in Koror and harvesting of sardines is prohibited throughout the Property two days before and on the day of the full moon.

Harvest of Invertebrates

The harvest of invertebrates is regulated by state and national laws. Most invertebrates can be harvested for local consumption, such as the seven giant clam species (*Tridacna* sp., *Hippopus* sp.). Cultured giant clams are commercially exported but there is no export of wild giant clams, sea cucumbers, mangrove and coconut crabs, or lobsters with exceptions for research purposes. The top shell, *Trochus niloticus*, has been harvested for its meat and shell since the 1930s. Harvested trochus shell must have a minimum base diameter of 3 inches. Harvests are usually every 3 years for a one month period in June when the Palau National Congress declares an open season (Palau Marine Protection Act of 1994). Ngederrak Reef is a permanent conservation area where harvesting of all marine life including *Trochus* is banned. However, harvesting is allowed in some areas of the RISL and invertebrates including crustaceans (e.g. crabs and lobsters), mollusks (e.g., clams, trochus, and oysters), sea cucumbers, and sea urchins are still collected from the Property.

Harvest of Turtles

Turtles play a significant role in the traditional Palauan culture and their harvest is legal and regulated. The Palau Marine Protection Act of 1994 placed size and seasonal restrictions on sea turtle harvest, and prohibits harvesting of eggs or nesting females. Hawksbill sea turtles are primarily

harvested for their shells, which are used to make traditional items such as *toluk* (a form of women's money) and non-traditional items such as jewelry, hair accessories, and other items that are bought by both tourists and locals. Adult green turtles are harvested as a food source. Harvesting of turtle eggs, also considered a food source, is illegal although poaching occasionally occurs. There is some support for decreasing turtle exploitation, with the 2004 National Women's Conference advocating a 20-year moratorium on all turtle harvesting. In December 2010, the Palau National Congress declared a 5-year moratorium on the harvest of Hawksbill sea turtles.

Harvest of Birds and Bats

There is commercial and subsistence harvesting of fruit bats in the RISL. Regulations prohibiting the export of fruit bats came into force in 1994 and subsequently reduced hunting pressure. Fruit bat numbers increased in Palau between 1991 and 2005 (Wiles unpubl.). Although most birds in Palau are protected by the Protected Land Life Law, poaching does occur. Micronesian Pigeons (*Ducula oceanica*) are a primary target because they are an important customary food and considered a delicacy. Between 1991 and 2005, the number of Micronesian Pigeons declined in the Rock Islands (VanderWerf 2007).



Netfishing for reef fish. Photo by Ann Kitalong.

A personal tour of wonders in the Rock Islands Southern Lagoon

Ron K. Leidich, an avid naturalist with more than 16 years exploring islands in Palau and the rest of the vast Indo-Pacific basin, highlights some unique features of Palau's Rock Islands.

"I've chosen three sites which highlight the bizarre nature of Palau's geological processes leading to fantastic marine environments the likes of which can be seen no where else on earth," says Leidich.

Oasis Lake (also known as Pincher's Lake (Colin 2009)) is one of the smallest lakes in the RISL, yet its center drops to a depth of 12 meters. Surrounded by tall, castle-like walls, the interior of the lake remains undisturbed, even when typhoon-strength winds are raging outside. Despite the isolated nature of the lake, tidal seawater continuously bathes the corals via a narrow intertidal opening perforating the limestone barrier. Thus coral larva, nutrients, and even fish can be carried through this macroscopic tunnel with each tide into a completely pristine environment. The corals within the lake represent a diverse assemblage of shade tolerant species. Free from physical disturbance, the corals have colonized every square centimeter of available space.

Habitat space is at such a premium

that corals are growing over the top of one another competing in the "high rent district" of this busy coral city. Every night, veteran corals extend and wave their sweeper tentacles armed with stinging cells in the battle for precious space. The multi-colored profusion of *Favites*, *Favia*, *Goniastrea*, *Lobophyllia*, *Porites*, *Pavona* and *Heliofungia* corals provide a spectacular array of diversity, shape, and color. The cathedral-like walls have provided yet another bizarre twist to the coral growth. Left undisturbed, many species of corals have responded by growing into enormous baskets. Normally found as encrusting forms, these baskets have formed alarmingly fragile skeletons, so thin that a diver's light can penetrate the hard skeleton. These exquisitely stunning forms can grow up to the low tide line creating mirrored reflections from the windless surface. This multi-genera assemblage of ancient giants includes *Echinopora*, *Merulina*, *Oxypora*, *Pachyseris*, and *Montipora* baskets. In one exceptionally well protected corner of the lake, *Echinopora* baskets have split into radiating arms standing over two meters tall. The slightest motion of the water causes these leviathans to sway back and forth.

Einstein's Coral Gardens: Many of the marine lakes and coves have delayed and dampened tidal cycles, but nevertheless rise and fall with the tides. The constant tidal flow has a powerful erosive effect on the porous islands, eventually creating sizable tunnels. Leidich refers to this geologic process as "lunar erosion." One particularly grand lake is tidally



A researcher at an entrance to Oasis Lake.



Pachyseris coral baskets in Oasis Lake.



A tunnel leading to Einstein's Garden.

fed by twin tunnels at its northern end. Nutrient rich lagoon waters are funneled in and out of the lake daily, bathing a multi-colored coral garden with the nutrients required to sustain their slow growth. The tall walls of the lake prevent winds and waves from damaging the reef, further protecting the age and beauty of the environment. Overhanging trees growing along vertical walls cover the coral garden in shade, and thus prevent aggressive sun loving species from taking hold. As a result of this specific recipe for coral growth, just a single species of coral dominates this marine habitat. Giant, multi-colored brain corals of the genus *Lobophyllia* carpet the sloping reef walls. Red, green, lavender, pink and gold brains are piled one on top of the other forming an un-replicated marine environment.

Mandarin Fish Cove is an exquisite turquoise inlet that is one of five coves within the protection of the magical Risong Bay. The ancient tunnel system feeding Mandarin Fish Cove has collapsed, leaving a narrow winding entrance just large enough to accommodate two kayaks abreast. The shallow water entrance slips down to a depth of 6 meters in one area and to over 12 meters in the deepest section. The circumference of the bay is surrounded by spiraling walls covered in a lush jungle canopy with hanging mosses

and carnivorous *Nepenthes* pitcher plants. Mandarin Fish Cove is further enhanced by its association with an even deeper land-locked lake, known as Surgeon Fish Lake (also known as Risong Lake (Colin 2009)). The two bodies of water are connected by an artesian connection of siphon tunnels and pores. During extreme outgoing tides, water rushes from Surgeon Fish Lake spilling into Mandarin Fish Cove in a cascading salt water waterfall. The sound of the splashing water can be heard from across the 30 meter wide cove. Incoming tides thus provide a "super-flow" of water and nutrients into Mandarin Fish Cove as a single tide cycle must simultaneously fill both bodies of water. As a result, the narrow entrance leading into the cove is flushed by a river of tidal seawater. Giant pink gorgonian sea fans (*Melithaea* sp.) are bathed in life-giving nutrients in only 1.2 meters of water. The increased nutrient flow has created an outer reef-like environment in what would otherwise be a relatively stagnant pool. Dining on this nutrient soup are schools of Cardinal Fish, surface feeding bait fish and juvenile fusiliers, who in turn feed a host of predators. Baby cuttlefish use the cove as their private nursery practicing their predatory arts before moving on to the bigger prey of the outer reef. Amongst the stunning corals of *Psammacora*, *Hydnophora*, *Porites* and *Anacropora* are the cove's namesake, the multi-colored

Mandarin Fish (*Synchiropus splendidus*), which emerge every afternoon as shadows fall over this secluded marine paradise.



Corals in Einstein's Garden



Synchiropus splendidus



Mandarin Fish Cove from the air

2.a2 Description of Cultural Heritage

Ulong Complex

The Ulong Complex consists of three major and three minor raised coralline reef islands (Table 1). Once a single limestone landmass, the three islands are now separated by shallow tidal channels formed by wave erosion (Figure 3). 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 Common tree snake (*Dendrelaphis lineolatus*). A tourist structure equipped with a fireplace and seating is located on the beach flat along with a toilet block. Signage, now in poor condition, with information about the stonework village site is located to the south.

Oral history

Palauan traditions recount how Osilek, the rich chief of Ulong, married the beautiful Oreng against her will. Oreng was already seeing Mariar from the village of Metukeruikull on nearby Ngeruktabel Island. 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 seeing Matkerumes from Ngeanges Island. Bieb contracted a disfiguring disease, but was cured by Matkerumes with *ditmechei* (ti, *Cordyline terminalis*).

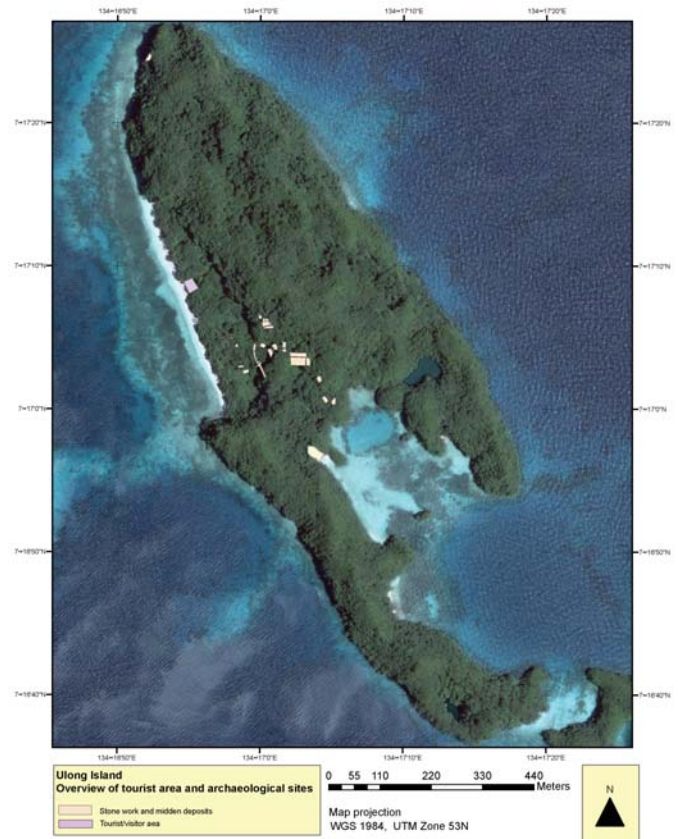


Figure 3. Ulong Island archaeological sites and tourist facilities. Photo Clark/Reepmeyer – ANU

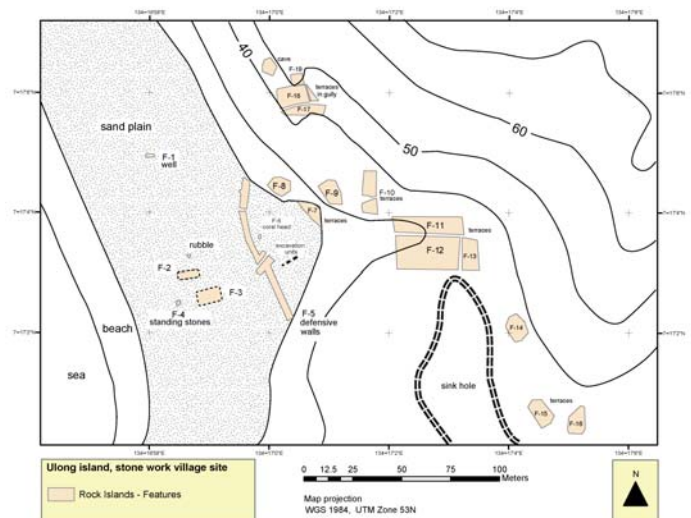


Figure 4. Ulong stone work village features. Clark/Reepmeyer – ANU

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.



Figure 5. Ulong stone work village defensive wall.
Photo Clark/Reepmeyer – ANU

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 1987:288). 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 Imiong 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 1966:403, Figure 120, Frontispiece g).

In Palau’s oral traditions, the demi-god Uodel instructed the women of Ngerkesoaol village to stand on Taker 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 1987:197-198). *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 1926:141-142).

Cultural sites

Ulong Island has the most significant set of cultural remains in the Rock Islands. The island contains four significant sites that span Palau’s historical sequence from human colonization over three thousand years ago to early European contact in the 18th century, 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

Table 1. Islands of the Ulong Complex

Island Complex	Number of islands	Land area (km ²)	Shoreline length (km ²)	Shioya sand (km ²)	Limestone outcrop (km ²)
Ulong Complex	6	1.19	14.49	0.05	0.87



Figure 6. Ulong *Antelope* survivor camp AD 1783.
Courtesy of the National Library of Australia

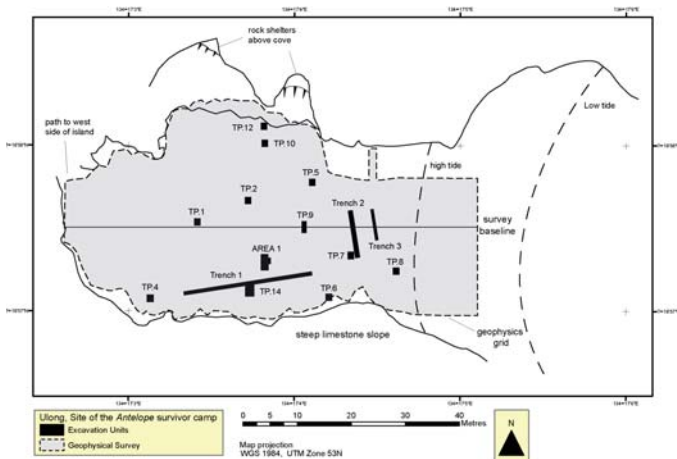


Figure 7. Ulong investigations at the *Antelope* survivor camp.
Clark/Reepmeyer – ANU

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.

1. 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 landmasses due to island subsidence, the burial of coastal 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.

2. 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. The village remains have a dispersed pattern similar to other Rock Island village sites, with occupational deposits divided between a concentrated midden deposit on the beach flat and dispersed stone features lacking dense midden remains in the limestone. Access to terraces, platforms, and sinkholes where taro and other crops were grown in the karst terrain was frequently protected by stone walls crossing trails and gullies. More than 16 stone features (**Figure 4, Appendix B**) were observed in the 2010 survey which followed the substantial investigations of Osborne (1966, 1979) and Masse et al. (1982). 2010 work recorded additional terraces (F-16 to F-18) and a burial cave in a recess of the limestone cliff to the north of the main village. The Ulong stonework village system displays an array of significant stonework features and cultural remains in beach sediments, caves, and sinkholes.

Village features

The main stonework feature is a defensive wall (F-5) (**Figure 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 = 80cm x 80cm x 40cm). An 85cm high and 120cm deep step on the wall's interior allowed defenders to guard against attack from the beach.



Figure 8. Ulong red-painted rock art. Photo Clark/Reepmeyer – ANU



Figure 9. Ulong red-painted rock art in fissure.
Photo Clark/Reepmeyer – ANU

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. To illustrate this, 17kg of pottery was recovered from the upper 60cm of a 1m² unit excavated inside the defensive wall. If only half the amount of pottery in the 1m² excavation is present in the zone of dense village midden (>6400 square meters) then at least 60,000kg of pottery was brought to the Ulong village site from the 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 (**Appendix C**). The early date is also suggested by Ulong's oral traditions which are associated with the period Ngerekebesang was the high-ranking village, thus apparently predating the first Ibedul of Koror who came to power in the 1700s (Nero 1987:125, 126–127).

3. 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

It protected access to the occupied interior and enclosed the village's eastern section. This portion of the village is archaeologically distinguished by a dense concentration of ceramics, midden, and shell tools descending to 60cm below surface. Outside the wall are the remains of stone platforms and an unusual feature composed of four deeply buried limestone blocks that extend 50cm above ground surface and form a 70cm square. The stones appear to be foundation posts for a small structure which could be a stonework village shrine like those found on Babeldaob.

Similar midden deposits are found within and outside of the wall with the latter distinguished by the presence of shallow human burials. Both areas of the beach flat have been subject to archaeological excavation starting in 1966 with Osborne (1979) and more recently by a team from the Australian National University (Clark 2005; Clark et al. 2006).

initiated sustained and significant contact between the people of Palau and the world's colonial powers. For the next 200 years Britain, Spain, Germany, Japan, and the United States played a role in Palau's development.

The *Antelope's* 49 crewmembers established a camp in a protected cove on Ulong's south side (**Figure 6**). 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 on 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; **Figure 7**).

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.

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:



Figure 10. Ulong rock art in cave interior. Photo Clark/Reepmeyer – ANU



Figure 11. Ulong graffiti over rock art. Photo Clark/Reepmeyer – ANU

“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.

4. 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 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 on Ulong.

A detailed analysis of the caves and overhangs on Ulong's north side, has yet to be made, although descriptions of the artwork is found in McKnight (1964), Schmidt (1974), and Osborne (1966, 1979); Masse et al. (1982) considered the site management issues of those pictograph sites associated with tourist visits.

The main area with rock art is an overhang approximately 10m wide, 3m deep, and 4m high, located some 10m above sea level. The overhang is exposed to the northwest and has no floor sediments. The back wall and roof of the cleft are covered with pictographs (**Figure 8**) rock art is also visible in an eroded fissure over the overhang above the main cavern (**Figure 9**) that rises to the top of the cliff face at about 40m above sea level. The overhang is accessible by boat from below and by a very steep path leading from Ulong's central ridge.

The rock art is painted in red ochre and is characterized by finely drawn stylized and diverse motifs. Designs noted by Schmidt (1974) include the four-pointed star, circle within a circle, and stylized fish, faces, and human figures. Comparison with rock art from other parts of the Pacific



Figure 12. Dmasech Island archaeological sites and visitor facilities.

and Southeast Asia does not show any close relationships with the Ulong art. The iconography also differs significantly in style and motifs from the *bai* paintings that probably date to the last 500 years. Archaeological investigations at the early site south of the beach unearthed non-local ironstone artifacts from contexts dated from 3000–2000 years ago. The ironstone had been abraded to obtain iron oxide pigment. Analysis of the rock art pigment indicates this ironstone may have been the pigment source, suggesting that the Ulong rock art has considerable antiquity and is among one of the oldest art sites in the Pacific (Clark 2005).

Connected to the main cavern is a small overhang also containing rock art. North of this small overhang is a cave which, although not appearing to display rock art, holds potentially deep sediments containing prehistoric remains. A second cave to the north has several dispersed and 'hidden' pictographs in small chambers containing floor sediments with

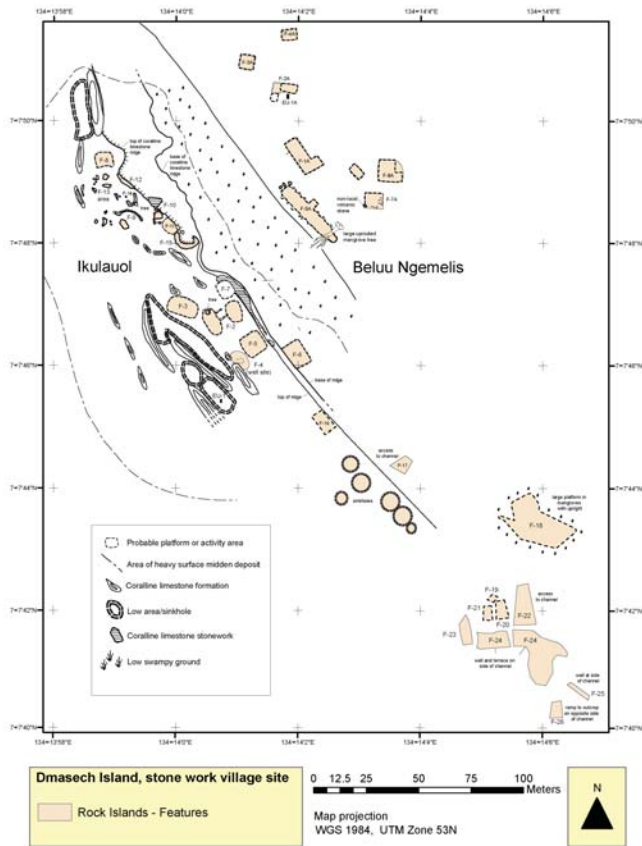


Figure 13. Dmasech stone work features.



Figure 14. Dmasech stone work F-5A. Photo Clark/Reepmeyer – ANU

are narrow jagged ridges of coralline limestone rising above sea level an average of 10-15m. Broad tidal sand flats holding plentiful stocks of marine shell and fish bound the east side of the four largest islands, while the fringing reefs largely surrounding the island group are excellent fishing grounds. The Ngemelis Complex is heavily vegetated with sandy beach flats dominated by coconut trees, *Cocos nucifera* (*lius*) and wax apples (*rebotel*, *Eugenia samarangense*) while ironwood trees, *Casuarina equisetifolia* (*ngas*) and vines and lianas (*Rhaphidophora spathacea* (*oliich*), *Derris trifoliata* (*kemokem*), *Salacia chinensis* (*detimel*) cover the limestone ridges.

The Ngemelis Complex is traditionally linked with the village of Ngerchemai on Oreor and the chiefly title of Obechad. This title is associated with the islands of Ngemelis, Ngerukuid, Ngercheu, Ngedebus, and half of Ngerchong island. In traditional history, Obechad was the No. 2 chief of the Mecherchar-Ngerchong polity and lived on Ngerchong while ruling the Ngerukeuid and Ngemelis Groups (Snyder et al. in prep.).

The islands within the Ngemelis Complex are part of several oral traditions including one of Palau's

potential archaeological significance (Figure 10). Of concern is the large quantity of historic graffiti in the main overhang. The graffiti, consisting of painted/scraped and incised text, has destroyed the prehistoric art in several parts of the complex. Some disturbance may date to WWII use of the island by Japanese military forces. However, there is a significant increase in the amount of destructive graffiti associated with recent tourist visits (Figure 11).

Ngemelis Complex

The Ngemelis Complex is a cluster of eight low-lying Rock Islands at the western edge of the RISL barrier reef system (Figure 12; Table 2). The islands, surrounded by broad beaches of calcareous sand,

Table 2. Islands of the Ngemelis Complex

Island Complex	No. of islands	Land area (km ²)	Shoreline length (km ²)	Shioya sand (km ²)	Limestone outcrop (km ²)
Desomel, Ngis, Belual a Kelat, Dmasech, Uchularois, Lilblau, Cheleu, Bailechesengel	23	1.41	19.52	0.30	0.88

most famous, the discovery of the turtle's egg laying cycle (Palau Community Action Agency 1971). Traditions also relate how Terebkul of Peleliu and Chief Uchermelis of Ngemelis attacked the settlement of Ulong which was oppressing Ngemelis (Osborne 1966:401-403; Nero 1987:195). Uchelmelis and Terebkul painted their red war canoes white so they would be hidden by the sunlight during their sunset attack on Ulong. In one version of the story, the people of Ngemelis moved to the north shore of Babeldaob's Ngeremeduu Bay after the defeat of Ulong because of a severe food shortage (Snyder et al. in prep.). The Ngemelis Complex was later occupied by survivors from the Ngeruangel storm around AD 1700.

Archaeological remains have been recorded on five islands—Ngis, Belual a Kelat, Dmasech, and Uchularois—with only the latter two having received detailed survey and archaeological work. It is likely additional sites are on the unsurveyed islands of Desomel, Lilblau (also spelled Iielblau), Cheleu, and Bailechesengel (Osborne 1966; Masse et al. 1982; Masse 1984).

Dmasech Island

Dmasech Island is 1200m in maximum length and 450m in maximum width. A narrow, 4-8m high, ridge of coralline limestone extends the length of the island. Parts of the island, particularly on the east, consist of low-lying beach that extends up to 250m wide. A small mangrove swamp is present in the southern half of the island, while the northern half contains swampy areas holding small quantities of giant swamp taro (*Cyrtosperma merkusii*).

There are several midden deposits ranging in size from 2500m² to more than 10,000 m² on the eastern beach with marine shell, fish bone, and ceramics down to 80cm in depth. The deposits also contain a variety of shell and stone tools and ornaments, particularly adzes, gouges, scrapers, and shell rings (**Table 3**). The midden deposits are connected to the coralline features to the south by a stonework causeway/walkway (Masse et al. 1982).

These features form a large concentration of more than 24 well-preserved stone platforms, platform-



Figure 15. Dmasech stone work (A) F-18; (B) coral slab and volcanic stones. Photo Clark/Reepmeyer – ANU

like areas, walls, and related stonework in the center of the island (**Figure 13**). The stonework complex is divided by a narrow swampy area into two sections; one section is on the low-lying beach flat to the east of the limestone ridge, and the other section is on top of the limestone ridge. Local tradition calls this area 'Beluu Ngemelis', with signifies it is the central village of the region.

Consisting of well-constructed accumulations of limestone blocks, the platforms on the beach flat

are of variable size and shape. One particularly large and complex platform (**Figures 13-14, F-5A**) is suggestive of a men's house (*bai*), and is a unique structure in the Rock Islands. The nearly level platform is 36.0m long with an average width of 6.0-7.0m, and a maximum height of 1.4m. What distinguishes the platform is a series of small, semi-circular to rectangular extensions protruding from the sides of the larger rectangle. Three pairs of matching extensions are located on both sides of the platform's north section. The purpose of these extensions are not known, their regularity in size and spacing, however, suggests a structural function.

Near Feature 5A is another significant platform (F-7A). The platform displays a large (30cm x 65cm) volcanic boulder cornerstone that had to have been imported from the volcanic islands. It is the only volcanic stone found which may have a structural purpose. A concentration of smaller volcanic rocks was found on a large irregularly shaped platform in the center of the mangrove swamp to the south (F-18, described in detail below).

The section of the stonework village on top of the limestone ridge is a linear cluster of platforms and wall features. The complex continues for about 400m in a north-south direction along the ridgeline. The most prominent feature of the central village complex is a wall (F-15) directly opposite the F-5 platform. The wall, located on a naturally steep semi-circular section of ridgeline, consists of neatly stacked small to medium sized boulders positioned to enhance the ridge's natural defenses. The wall is oriented in a rough semi-circle and has a length of around 13m, a maximum wall height of 2m, a width of 2m, and rises 6.5m above the sandy flat.

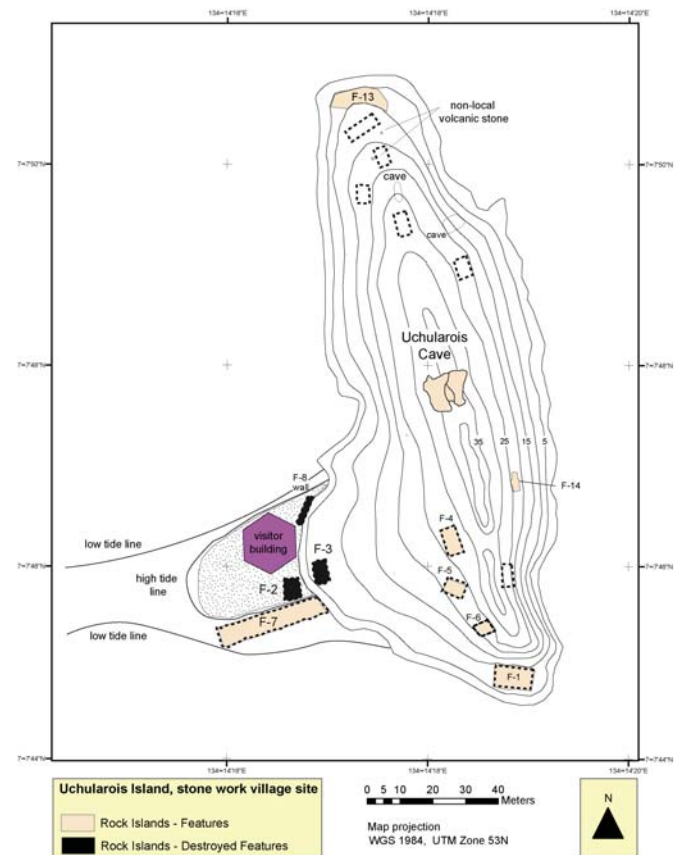


Figure 16. Uchularois Island archaeological sites and tourist facilities. Clark/Reepmeyer – ANU

A second significant feature (F-4) is a modified, 4m in diameter sinkhole, likely a prehistoric well, to the south of the wall (F-15). The well is lined with rounded chunks of limestone and opens to the west. Accumulated in the base of the sinkhole are large quantities of ceramics, shellfish, and shell artifacts.

Further south is one of the most intriguing stonework features. It is an irregularly shaped platform (F-18) constructed of medium-sized

Table 3. Marine shell species used to make Rock Island tools and ornaments

Species	Adze (blades)	Adze (small)	Chisels	Gorgetts	Knives	Ornaments / shell money	Peelers/ scrapers	Spoons
<i>Anadara</i> sp.		X	X		X		X	
<i>Cassis</i> sp.		X	X		X		X	
<i>Conus</i> sp.		X	X	X	X	X	X	X
<i>Cypraea</i> sp.						X		
<i>Pinctada margaritifera</i>							X	
<i>Pinctada</i> sp.						X	X	
<i>Terebra</i> sp.	X			X		X		X
<i>Tridacna</i> sp.	X	X	X	X	X	X	X	X
<i>Trochus</i> sp.						X		

coralline limestone blocks that is situated near the middle of the current mangrove swamp. The low platform is 30.0m long, has a maximum width of 16.5m, and is approximately 0.6m above the swamp deposit (**Figure 15**). Located in the intertidal zone, the feature is surrounded by water at high tide. Large quantities of pottery sherds and many small to mid-sized volcanic rocks are scattered on the platform surface. A limestone upright associated with a concentration of volcanic rocks is on the platform's northeast quadrant (**Figure 15**). The feature's function is unclear but it may be related to activity around the tidal channels to the south of the central village (F-22 to F-25).



Figure 17. Uchularois tourist facility (to be removed). Photo Clark/Reepmeyer – ANU

The features shown in **Figures 13** and **14**, including the large midden deposits to the north, were likely part of a single settlement system. This assumption is supported by the similar ceramic vessels and shell artifact types recovered throughout the area and the walkways/causeways and trails linking the two feature complexes.

Marine shell food remains recovered in the western stonework area of Ikulauol produced a radiocarbon date range of AD 1240-1410. Stonework on the nearby sand flats of Beluu Ngemelis reflects a later occupational horizon dated to AD 1530-1770.

Uchularois Island

Uchularois is located off the southeast tip of Dmasech Island (**Figure 16**). It is connected to Dmasech by a low sandbank (tombola), but has been separated from Dmasech in the recent past. Previous work by Osborne (1966) and Masse et al. (1982) recorded large intertidal midden deposits on the island's west and south sides. Only small eroded remnants of these middens were recorded during the 2010 survey. Degradation of the midden sites is likely a result of storm activity and potentially changes in sea level.

The island is 200m long and has a maximum width of 75m. In contrast to other low lying islands in the Ngemelis Group, Uchularois is a dome-shaped mass of coralline limestone that rises abruptly out of the water. Vegetation is similar to that on Dmasech

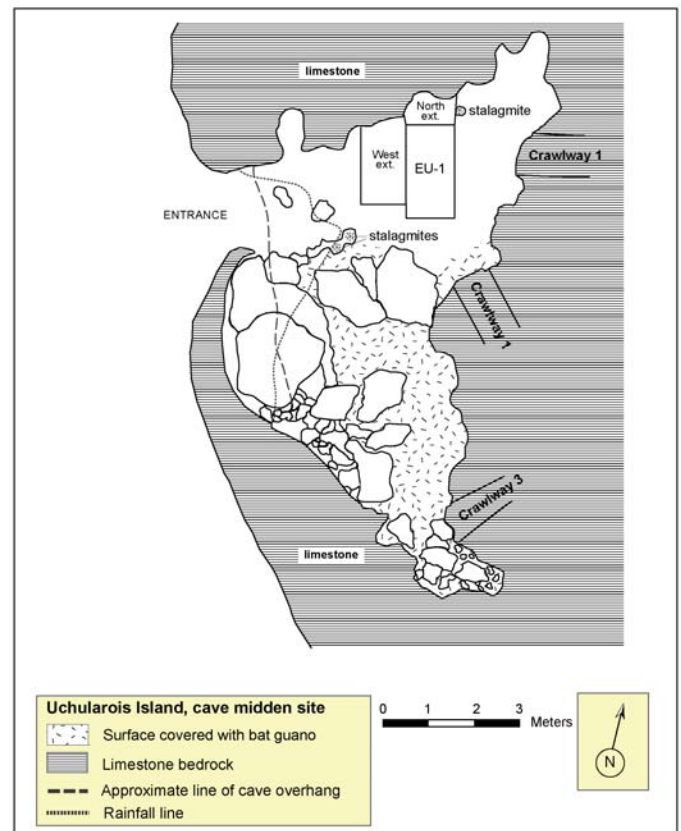


Figure 18. Uchularois Cave and excavations. Clark/Reepmeyer – ANU

Island with coconut tree, *Cocos nucifera* (*lius*), the wax apple tree, *Syzygium samarangense* (*rebotel*) on the beach flat and trees such as the screwpine, *Pandanus tectorius* (*ongor*), *Polyscias grandifolia* (*bungaruau*), *Scaevola taccada* (*korrai*), the ironwood tree, *Casuarina equisetifolia* (*ngas*), the fish poison tree, *Barringtonia asiatica* (*bduul*), and vines on the hill slopes.

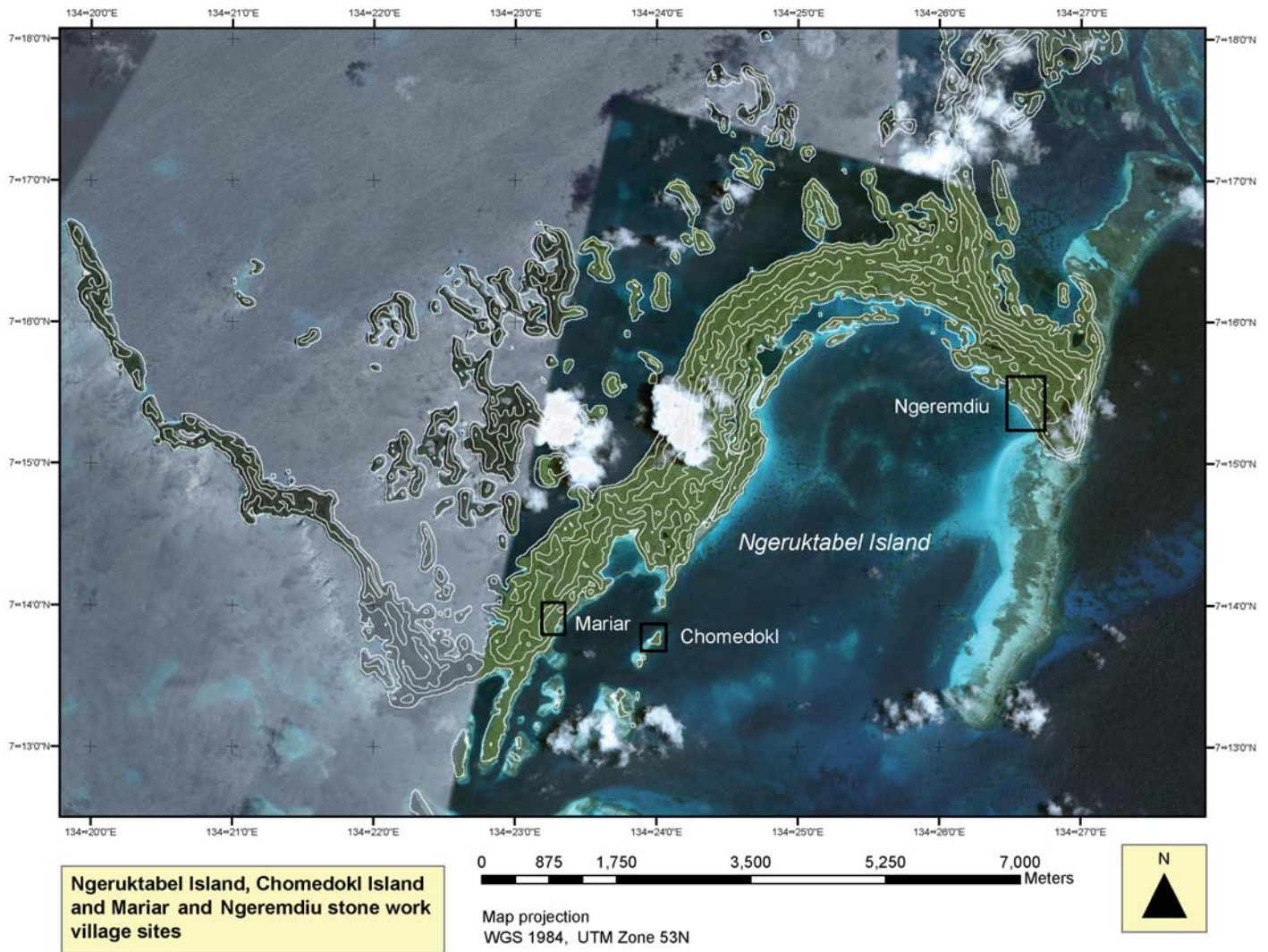


Figure 19. Ngeruktabel Island, Chomedokl Island and Ngeremdiu. Clark/Reepmeyer – ANU

A large two-story, dilapidated, visitor shelter/dormitory is located on the southwest edge of the island on a small raised beach that is approximately 35m long and 1-2m above sea level (Figure 17). The remains of showers, cooking areas, a cistern, and concrete structures associated with the visitor structure are on the beach flat. Masse et al. (1982) noted that construction of these structures in the 1970s had destroyed midden deposits on the beach. The 2010 survey identified further damage to parts of the prehistoric site, with two stone platforms and a stone wall destroyed by modern use. Remnants of one platform (F-3) appear to have been used as a foundation for the water tank.

Several stone features are located on the south side of Uchularois. Most of these are terrace-platforms made to increase the size of natural

ledges and provide level areas for habitation. Oral traditions suggest that some of these stone features represent the home village of Uchermelis, the chief of the Ngemelis Complex. Uchermelis later led a migration from Ngemelis to Ngaremlengui in western Babeldaob and established the houses of Ngeremakiar and Mesebeluau (Parmentier 1987:248).

Seven stone platforms and terraces were recorded on Uchularois in 2010. A prominent prehistoric feature is the remnant of a canoe dock (F-7) directly adjacent to the beach flat. The 33m long and 4m wide dock is currently composed of medium to large coralline limestone boulders that are deeply embedded in intertidal sands. Only the foundation of this substantial structure remains and photographs indicate it was in a similar condition

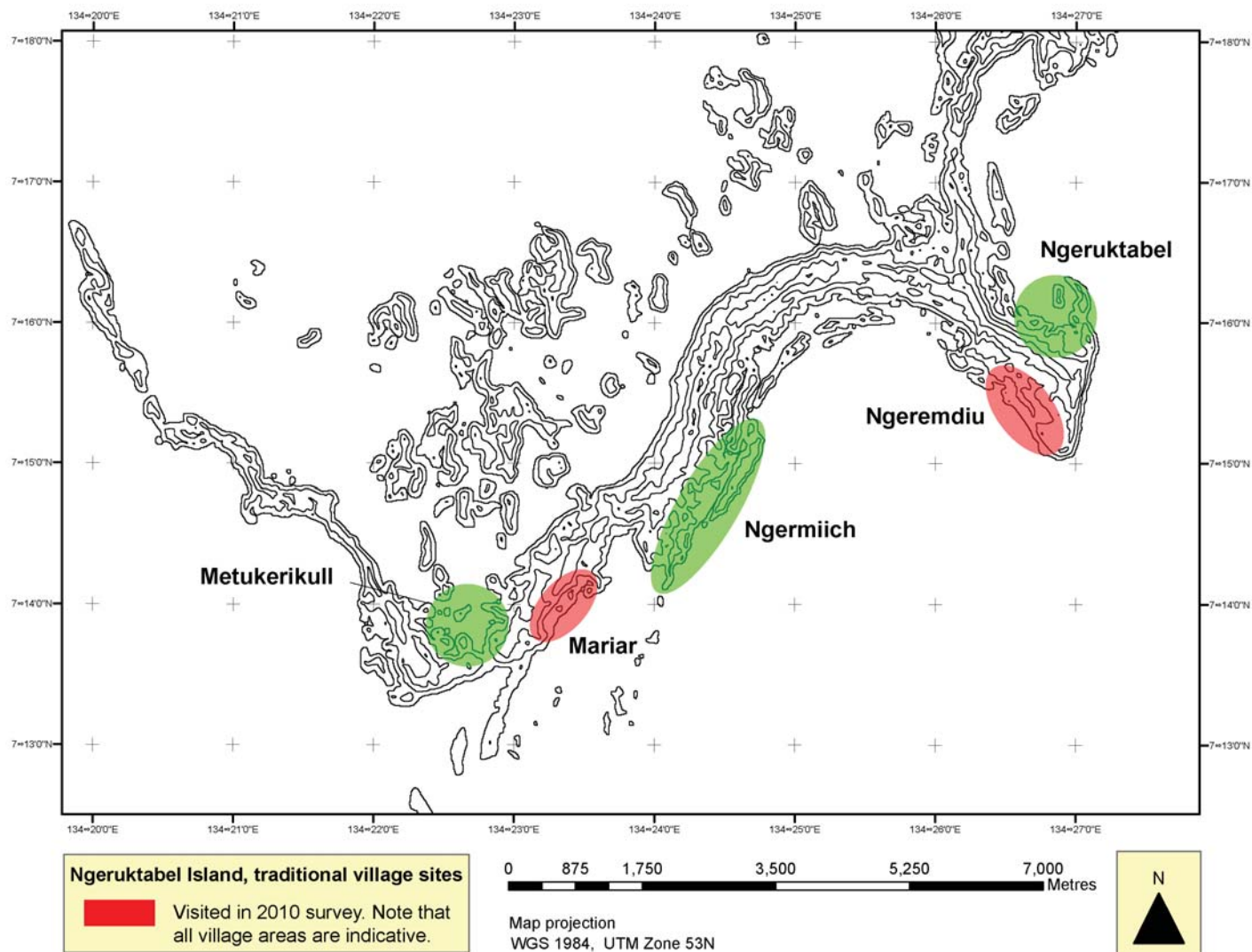


Figure 20. Ngeruktabel Island traditional village sites. Clark/Reepmeyer – ANU

in the early 1980s. Associated with the dock is a platform (F-1) reputed to be that of the chief of Ngemelis. This large feature perches on the lowest raised terrace of Uchularois's southeast edge to overlook the center of the Ngemelis Complex. The 11m long and 7m wide platform is positioned between a limestone outcrop to the south and the cliff face to the north (**Figure 16**).

Uchularois Island received intensive archaeological work by Bruce Masse (1989), who focused on recovering a detailed cultural sequence. Masse investigated a series of inter-connected cave/rock shelters in the center of the island that contain relatively undisturbed subsurface deposits (**Figure 18**). Excavation units were dug in two chambers of the cave complex. The east chamber contained only shallow cultural deposits descending to 30cm

below surface. However, the west chamber had stratified deposits to 130cm below surface with cultural material extending to a depth of 215cm. The surrounding sediment was a fine dust with a high organic content which likely accumulated from wind, termite activity, and the roosting debris of bats. The cave units unearthed a rich and diverse array of cultural remains comprising several thousands of artifacts (pottery, shell, stone, and bone tools/ornaments), along with more than 50,000 food shells and 13kg of animal bones (pig, turtle, dolphin and possibly a pilot whale). Two hearth features dated to AD 1250-1450 overlay sediments with prehistoric remains dated to AD 650-1000 (**Appendix C**).

The Uchularois Cave Complex is significant as the only Palauan site whose cultural remains have

been studied in the detail sufficient to track human impact on the marine ecosystem through time. Uchularois's rich faunal assemblage includes marine shellfish, fish bones, and the scattered remains of prehistorically introduced animals such as the pig (*Sus* spp.) and rat (*Rattus* spp.). Analysis of shellfish and fish bones demonstrated a significant size decrease in taxa in the late-prehistoric period prior to island abandonment. The intertidal coral reef shellfish *Strombus gibberulus* declines in size as do the bony mouth parts of several common lagoon fish (Lethrinidae [*Monotaxis grandoculis*], Diodontidae, and Scaridae) (Carucci 1992).

The detailed faunal analysis indicates that over-harvesting of reef resources was taking place as a result of the permanent occupation of Dmasech-Uchularois during the stonework village phase. The evidence for human impact on the lagoon ecosystem coincides with data showing that Palau had a drier climate when the Rock Island stonework villages were occupied (Sachs et al. 2009). The climate study examined sensitive microbiological, isotopic, and molecular indicators of rainfall in sediments collected from Spooky Lake on Mecherchar. The palaeocores indicate that precipitation decreased in Palau from AD 1450-1650 due to the southward movement of the Pacific inter-tropical convergence zone (ITCZ). The impact of drier conditions on the natural environment, especially inshore fish and shellfish, and pelagic fish stocks is uncertain. Yet, decreasing precipitation is likely to have been a significant factor in the abandonment of the Rock Island stonework villages, whether through primary loss of potable water, or from secondary effects such as a decline in horticultural yields (both in the Rock Islands and on Babeldaob).

Ngeruktabel Island

Ngeruktabel, the largest Rock Island, was formed by the uplift of Miocene-aged reef fronts which preserve as eroded arcuate ridges and segments

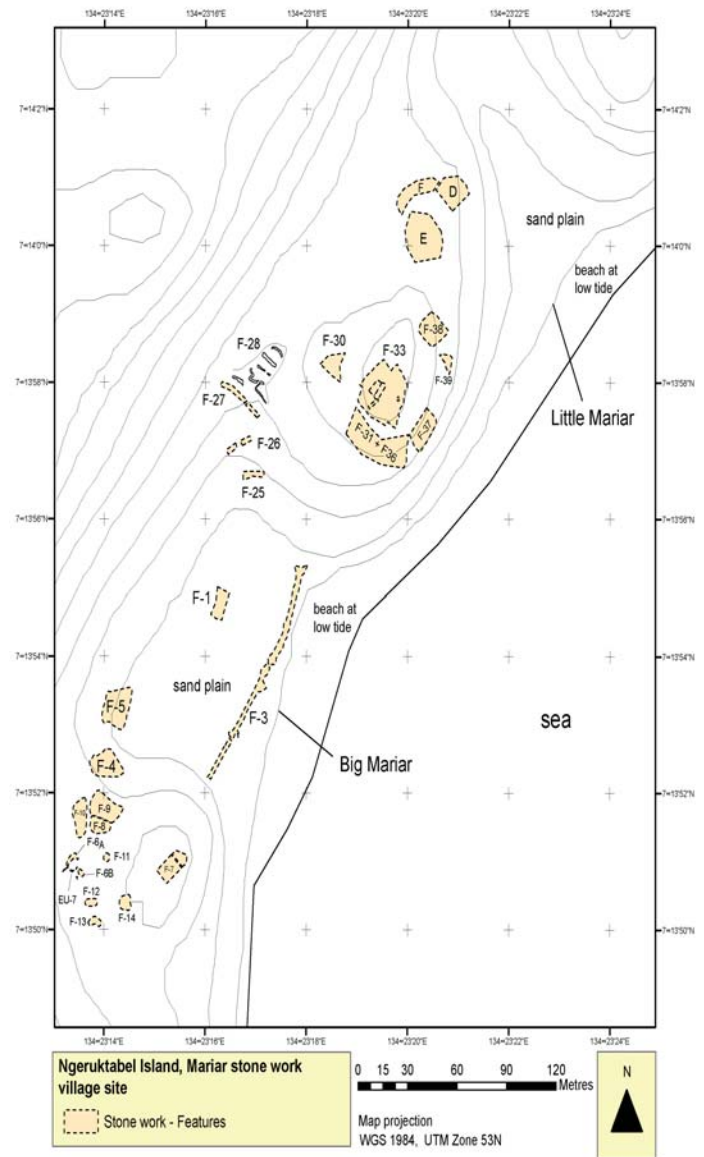


Figure 21. Mariar stone work village. Clark/Reepmeyer – ANU

(Figure 19; Table 4). The uplift resulted in an extremely rugged topography that includes 17 marine lakes and abundant sink holes. The island and associated islets hold a large number of cultural sites identified as the remains of several stonework villages, Yapese stone money quarries, rock art, and a significant complex of WWII structures and remains. Only parts of the island have been intensively archaeologically surveyed, and both tour operators and the local population report

Table 4. Islands of the Ngeruktabel Complex

Island Complex	Number of islands	Land area (km ²)	Shoreline length (km ²)	Shioya sand (km ²)	Limestone outcrop (km ²)
Ngeruktabel Island/islets	156	18.62	91.55	0.05	18.57

many sites that are currently unrecorded. The 2010 survey examined two stonework villages (Mariar and Ngeremdiu), a Yapese stone money site, and a Japanese WWII defensive complex located on the road to Roisngeremdiu. Previous work involved survey of several stonework villages on the main island and sites on nearby islets (Takayama 1979; Masse et al. 1982; Snyder 1985).

Ngeruktabel like other Rock Islands is uninhabited today. Oral history identifies at least five occupied villages in late prehistoric times: Metukeruikull, Mariar, Ngermiich, Ngeremdiu, and Ngeruktabel (Figure 20). The Ngeruktabel population migrated northward to Koror and Babeldaob. Depopulation is recorded as being primarily associated with warfare, although in the case of Ngermiich village, migration is said to have been due to a lack of food. Most of the Ngermiich people moved out suddenly, to Melekeok then to Ngardmau, leaving behind the first chief and his clan. This chief moved his clan to Ngerkebesang and renamed his clan 'Ngermiich' so that the memory of their homeland on Ngeruktabel would not be forgotten (Snyder 1985:288).

Ngeruktabel's foremost oral history concerns the conflict between Koror and the village of Metukeruikull. This warfare had three significant

impacts. First, Metukeruikull was totally abandoned. Second, after the defeat of Metukeruikull, Koror was able to increase its status and position in Palau relative to other villages and districts (*rengeḍ*). Finally, there was a significant decrease in Rock Island occupation as those that assisted Koror against Metukeruikull were given permission to settle in Oreor because of their special relationship with the High Chiefs *Kloteraol* and *Ibedul*.

Oral History - The taking of Metukeruikull

Several versions of the story of the taking of Metukeruikull specify that villages on Ngeruktabel Island, especially Metukeruikull, were oppressing the then minor ranking village of Koror. Other villages that oppressed Koror were Ngermid, Ngerbechedesau, Ngerekebesang, and villages on Ulong (Nero 1987:125-198). An example of Koror's oppression is its being banned from fishing in a large area of the RISL.

In return for being allowed to settle on Koror, the chiefs of the Rock Island settlements of Mecherchar, Ngermeaus, Ngchelobel, Beluuchouar, Ngerchong, Ngercheu, Babelomekang, and Ioulomekang assisted Chief Kloteraol in overcoming Metukeruikull.

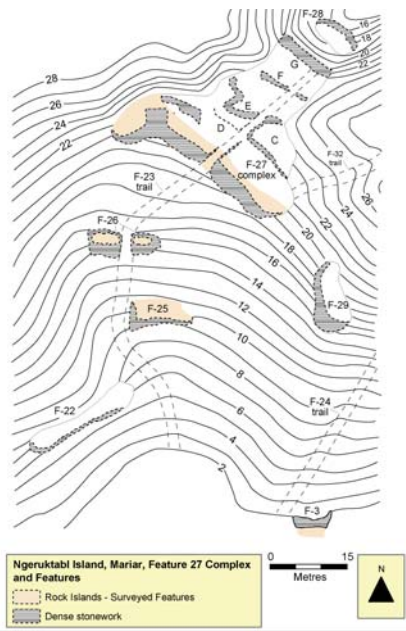


Figure 22. Mariar F-27 complex. Clark/Reepmeyer - ANU

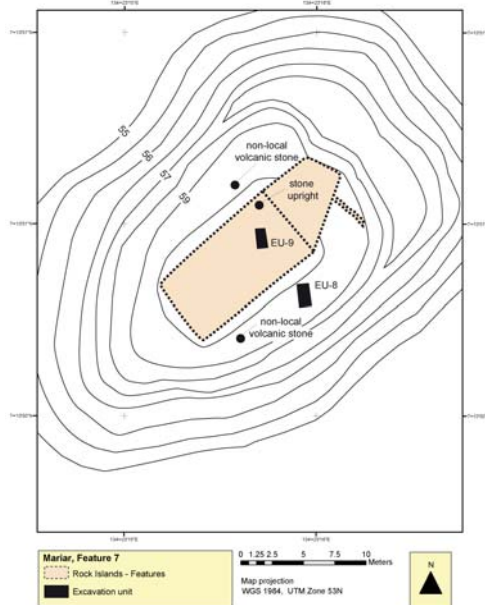


Figure 23. Mariar F-7 platform. Clark/Reepmeyer - ANU

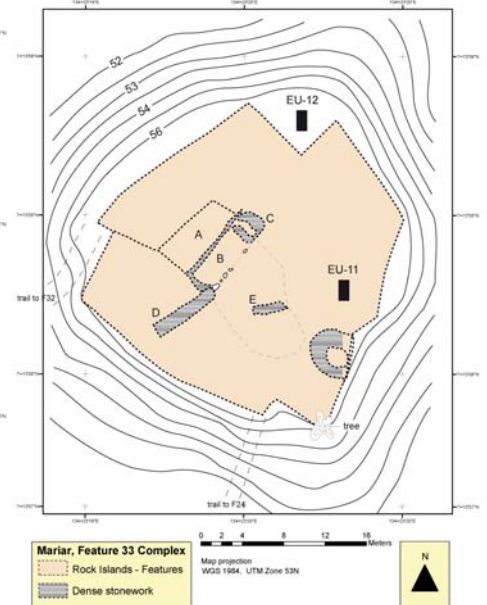


Figure 24. Mariar F-33 complex. Clark/Reepmeyer - ANU



Figure 25. Big Mariar defensive wall in the 1970s. Top photo by Bruce Masse. Bottom, Clark/Reepmeyer – ANU.

Mariar

Mariar is the Palauan name for two adjacent beach flats on the southeast side of Ngeruktabel Island (**Figure 20**). The beaches are located about 150m apart and at low tide there is easy access from one to the other. The larger, southern beach is locally referred to as ‘Big Mariar’ (Klou el Mariar) while the smaller, northern beach is called ‘Little Mariar’ (Kekerei el Mariar). Both beaches, particularly Little Mariar have been recently used as fishing camps and have domestic structures built on them. Vegetation on the beach flats is dominated by coconut, wax apple (*Eugenia samarengense*), and common strand taxa. Several edible species including banana, papaya, and giant swamp taro are also present.

Oral history asserts that at various times Mariar was allied with, and dominated by, Metukeruikull and Ngeruktabel. The inhabitants of Mariar and Metukeruikull left their villages after the war with Koror and settled in Ngermid in Oreor and Oikull in Airai.

Intensive survey of Mariar (Masse et al. 1982; Masse 1984) recorded some 50 archaeological features on the two beach flats and surrounding slopes and ridges (**Figure 21**). Two limestone hilltops overlooking the beach to the south and north of Big Mariar support extensive stone features. On the hilltops are well-preserved terraces made of small-to-medium sized limestone blocks to the south (F-4 to F10) and on the slopes to the north of Big Mariar are two defensive walls (F-26 and F-27 complex (**Figure 22**).

The south hilltop contains a large, well-constructed stone platform that measures 12m by 7m (F-7). Associated with the platform were two volcanic rocks (one has been removed) and a small limestone upright set carefully into a base of packed limestone rubble (**Figure 23**). Feature 7 is notable because sites associated with religious/magical activity were frequently located on high points in the Palauan landscape (Krämer 1917:237-238)

The north hilltop has a large, irregularly shaped area of stonework (F-33 complex) consisting of a well-

The cause of the conflict was the capture and killing of Chief Ibedulrekereel from Koror by the people of Metukeruikull when he was on a fishing expedition in the southern lagoon. The chief’s arm bearing his dugong vertebra (an insignia of high status and power) was cut off and placed in the bottom of woven basket filled with sweet ground taro (*chelbaki*). The basket of taro was sold to the Koror Council of Chiefs who, upon eating the food and finding Chief Ibedulrekereel’s arm, planned a retaliatory attack on Metukeruikull. To accomplish this, high Chief Kloteraol married into Metukeruikull. During the festivities surrounding a ceremonial feast (*mur*) for his new wife, Metukeruikull was easily taken unawares by Koror and its allies. Many of its inhabitants were killed and the village was soon abandoned. The Metukeruikull refugees migrated to Airai and settled at Oikull, which is a contraction of the name Metukeruikull (Nero 1987).

The prominent feature on the Big Mariar beach is a long defensive wall extending the length of the sandy plain. The wall was recorded in the 1980s as being 110m long, 2m wide, and 2m high. Since then, the feature has progressively deteriorated by tree growth damage and stones removed to make fireplaces and provide easier inland access (**Figure 25**). Several rock piles and stone alignments (likely the remains of prehistoric platforms and walls) recorded in the 1980s by Masse et al. (1982) are currently so disturbed they are no longer identifiable as coherent structures. Any potential, associated subsurface cultural deposits may remain intact.

Of concern is the disappearance of the majority of the stone features that were recorded at Little Mariar in the 1980s. The large wall near the front of the beach is entirely destroyed from the combined effects of wave action and tree damage. Large strandline taxa such as *Calophyllum inophyllum* (*btaches*) grew on the wall; when their roots are undermined by storm waves and collapse the stonework is deposited on the steep beach and removed by subsequent wave action. Human activity has also negatively impacted the ancient stonework. In 2010, a wooden shelter stood in the center of the beach. Its associated cooking area was constructed from limestone blocks that were probably taken from one of the prehistoric structures recorded in the 1980s.

Overall, the preservation of stone features on both beach flats was poor compared to the more intact structural remains located on limestone slopes and ridges. With the exception of Ulong, this pattern of variable preservation was also noted at other Rock Islands. At Ulong the preservation of cultural remains on the beach flat has been favored by their distance from the sea and the placement of the visitor area some 200m north of the stonework village.

Ngeremdiu

Ngeremdiu is a stonework village system on the southeast tip of Ngeruktabel Island. The village complex connects two beaches: Oimaderuul and a large cove 250m to the north (**Figure 26**). The beach flats and limestone slopes had been archaeologically

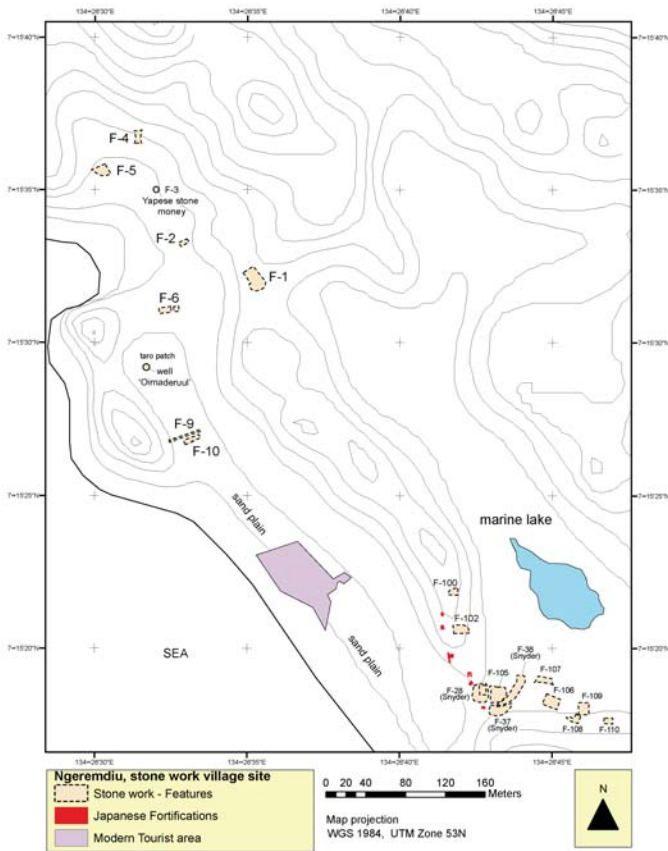


Figure 26. Ngeremdiu stone work and Japanese WWII features. Clark/Reepmeyer – AU



Figure 27. Oimaderuul Beach refurbished stone well. Photo Clark/Reepmeyer – AU

constructed outer wall encompassing an area of 26-28m² (**Figure 24**). Several unusual stone features lie inside this area, including an alignment of limestone boulders (F-33D) and two parallel platforms standing 50-75cm above surface that surround a central oblong depression (F-33A-C). The purpose of these structures is currently unclear. Radiocarbon dates associated with Mariar's features range from AD 1530-1730 on the southern hilltop's platform (F-7) to AD 990-1100 on a midden deposit on the Big Mariar beach (**Appendix C**).



Figure 28. Ngeremdiu Yapese stone money (F-3).
Photo Clark/Reepmeyer – ANU

surveyed (Osborne 1966; Masse et al. 1982; Snyder 1985) prior to the 2010 work when additional prehistoric features were recorded. Currently, the central part of the beach flat has a visitor structure and composting toilet block, with signage for the re-constructed prehistoric well north of Oimaderuul (close to F-9).

Traditional history tells that after the people of Ngeremdiu were attacked by a giant centipede they decided to leave their home and move to Babeldaob. The first chief, Secharuleong, and second chief, Tmekei, split the villagers into two groups. Chief Secharuleong's group migrated to the west coast of Babeldaob, settling near Medorm village in Aimeliik. They established their *bai* at Ngeruudes hill and named it Bai Melekeok. Their god house was named after the village structures on Ngeremdiu. Chief Tmekei led his group to Ngerang on the east coast of Babeldaob and named the village 'Melekeok' after their part of Ngeremdiu village.

Ngeremdiu's stone features are located to the north of the 200m long and up to 75m wide Oimaderuul beach. Oimaderuul has a low density surface scatter of pot sherds and food shells. Substantial stonework is found along a low saddle to the north (Figure 26), and in adjacent limestone terrain including a low saddle south of the beach near the marine lake (Shrimp Lake, 4000m²). It is likely that all the prehistoric features are part of a single dispersed village occupation. Further survey is required,

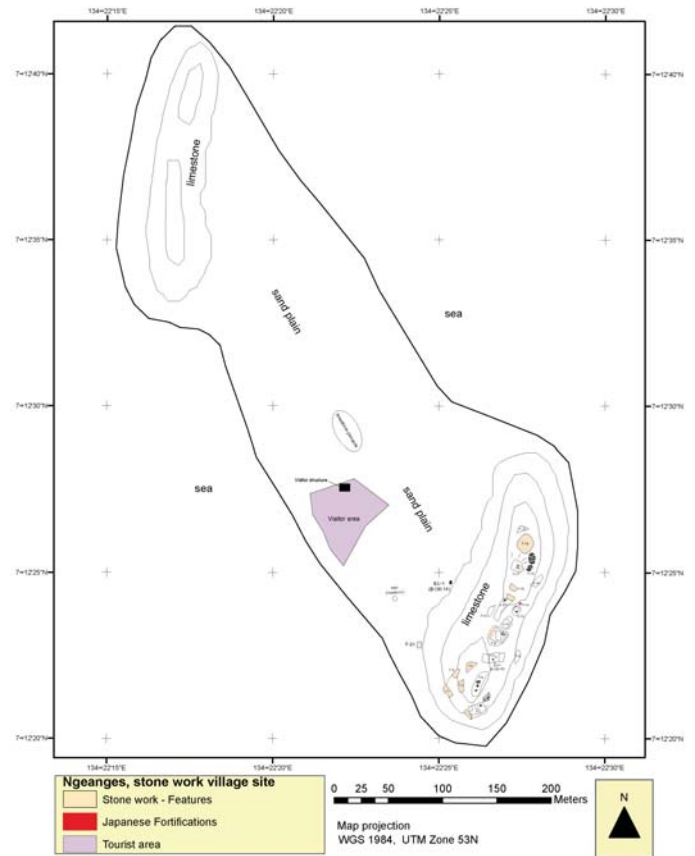


Figure 29. Ngeanges Island archaeological sites and tourist facilities.
Clark/Reepmeyer – ANU

particularly in the north, to identify the extent of prehistoric occupation.

The remnant of a defensive wall (F-9) fronted by a large 16m by 4m stone platform (F-10) lies to the north of Oimaderuul. The wall controls access to a large taro swamp that contains a recently refurbished prehistoric well. The 2010 survey noted probable prehistoric stonework below the well's water table (Figure 27).

Separating Oimaderuul from the northern beach is a low saddle with a defensive stone wall (F-6). Additional stone features to the north and east were also observed. Stone walls and terraces (F-2, F-4, F-5) line the well-preserved path through the limestone off of the northern beach (Figure 26). Also recorded was an unfinished piece of Yapese stone money (F-3) that measures 83cm in diameter and 18cm thick. It is placed upright against a stack of limestone boulders (Figure 28). Overlooking the path and stone walls is a large 23m by 15m stone platform (F-1). It appears that many of the gullies

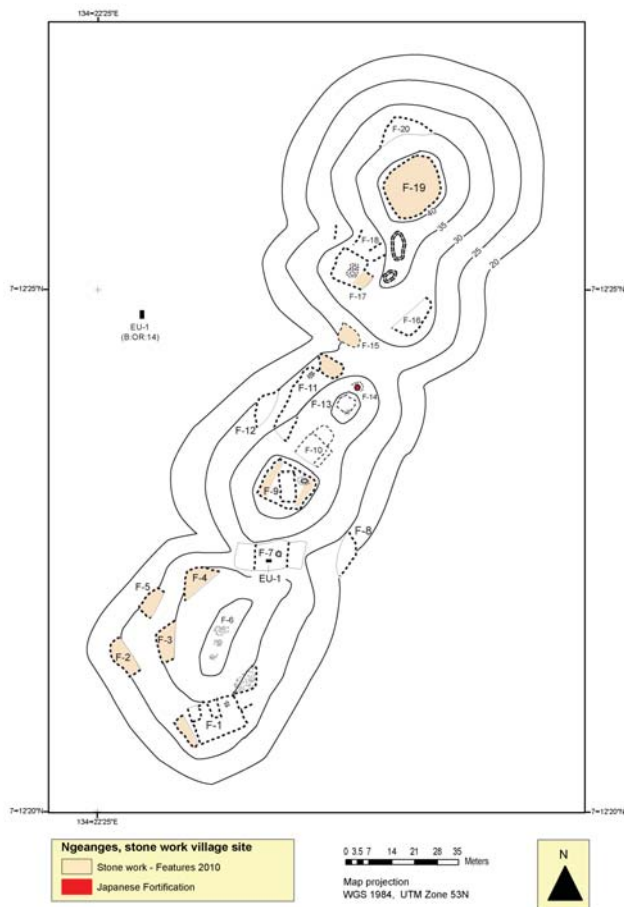


Figure 30. Ngeanges stone work features on southern outcrop. Clark/Reepmeyer – ANU

and limestone ridges north of Oimaderuul contain prehistoric stonework.

An extensive set of stone features recorded by Snyder (1985) as on the ridgeline southeast of Oimaderuul could not be identified in 2010. Several terraces and stone platforms were found only on the south slopes and ridgetops (F-100 to F-105, and F-28, F-37, F-38 in Snyder 1985). These features were disturbed during construction of an extensive WWII Japanese defensive complex, which covers the ridge face overlooking the beach. Defensive positions include foxholes dug into the limestone ridge and circular/sub-circular stone walls that were likely defended gun emplacements. The ridge appears to have been attacked in WWII, and Snyder reported intact shells and bombs littering

the surface. Large stone platforms and walls are present around a sinkhole south of Shrimp Lake. These features were associated with midden material consisting of pottery sherds, shell artifacts, and food shells. No midden deposits were located on the south slope of the marine lake although there is a sparse scatter of traditional pottery sherds. Midden deposits were recorded by Snyder (1985) in several sink holes in the vicinity of the marine lake and in a number of caves/rock shelters. The complex of features in the Ngeremdiu area is a good example of the dispersed prehistoric settlement pattern found in the Rock Islands.

Ngeanges Island

Ngeanges is a small island situated about a 1000m south of Ngeruktabel Island. Roughly 30m high limestone outcrops dominate the north and south ends of the island (Figure 29; Table 5). A limestone pinnacle lies between the two outcrops. These outcrops are connected by a raised beach of Shioya sand. Vegetation is similar to that on Dmasech and Uchularois Islands. Evidence of recent occupation and use of a visitor shelter and long drop toilet, both in poor condition included piles of rubbish and used building materials. The island is known as a cooking place where families can camp to take advantage of seasonal marine resources.

As oral history links Ngeanges with the village of Metukeruikull on Ngeruktabel Island as well as with Mecherchar, it may have altered its affiliation during the course of prehistoric occupation. Stonework on the southern limestone outcrop is reputed to be the house of Aderdei, a chief of Ngeanges. After the war between Koror and Metukeruikull, and the depopulation of Ngeruktabel, Aderdei continued to live on Ngeanges before being induced to relocate to Oikull by the offer of two taro patches (Osborne 1966:437-438).

The beach flat in front of the two limestone outcrops contains substantial prehistoric midden

Table 5. Ngeanges Island

Island Complex	Number of islands	Land area (km ²)	Shoreline length (km ²)	Shioya sand (km ²)	Limestone outcrop (km ²)
Ngeanges	1	0.117	1.67	0.06	0.07

remains that have been partially reworked by land crabs. Other disturbance agents include the effects of WWII bombing and megapode activity. Excavation encountered a midden deposit composed of pottery fragments, shell and stone artifacts, and food shell extending to a depth of 60cm depth (Masse et al. 1982). Radiocarbon dates indicate midden formation and village occupation at AD 1350-1500.

Several stone platforms, terraces, and other features are on the slopes and higher parts of the southern limestone outcrop (Figure 30, F-1 to F-20). As noted at several other prehistoric village sites on coastal flats, stone platforms on the beach were scarce and poorly preserved. There is a possible Yapese stone money quarry (F-17), and similar to Ngeremdiu, there were several Japanese defensive positions mingling with the prehistoric Palauan stonework (F-14, F-16, and F-18). Preservation of stone features in the limestone and the midden



Figure 32. Chomedokl north cave entrance. Photo Clark/Reepmeyer – ANU

deposits on the beach appear to have been affected by WWII bombing/shelling. Several bomb fragments were found in excavation units and a large bomb crater was recorded on the beach flat.

Chomedokl Island

Caves, hollows, benches and solution features are

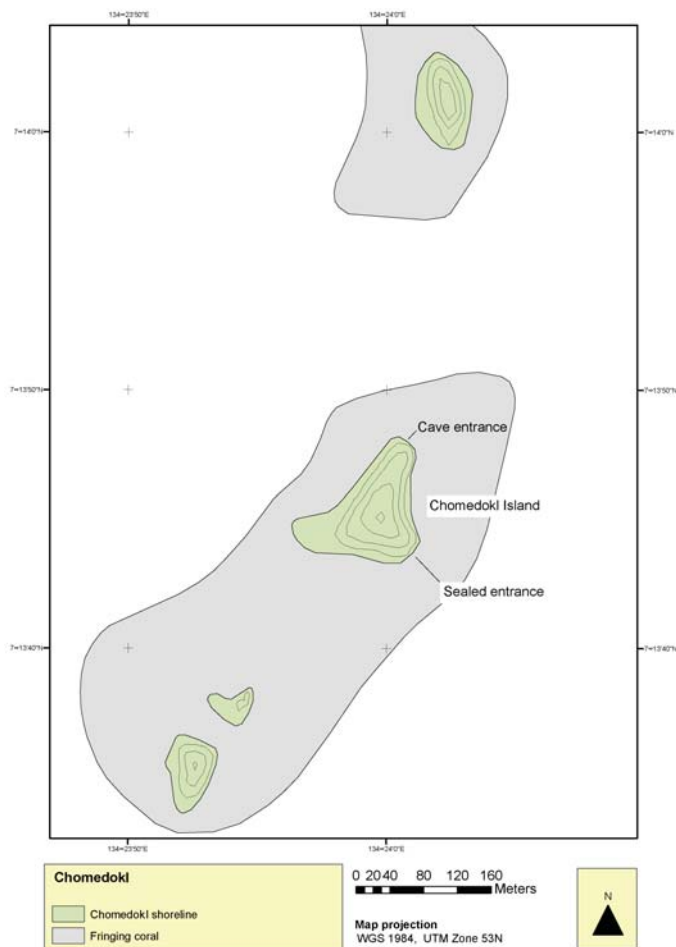


Figure 31. Chomedokl Island burial cave. Clark/Reepmeyer – ANU

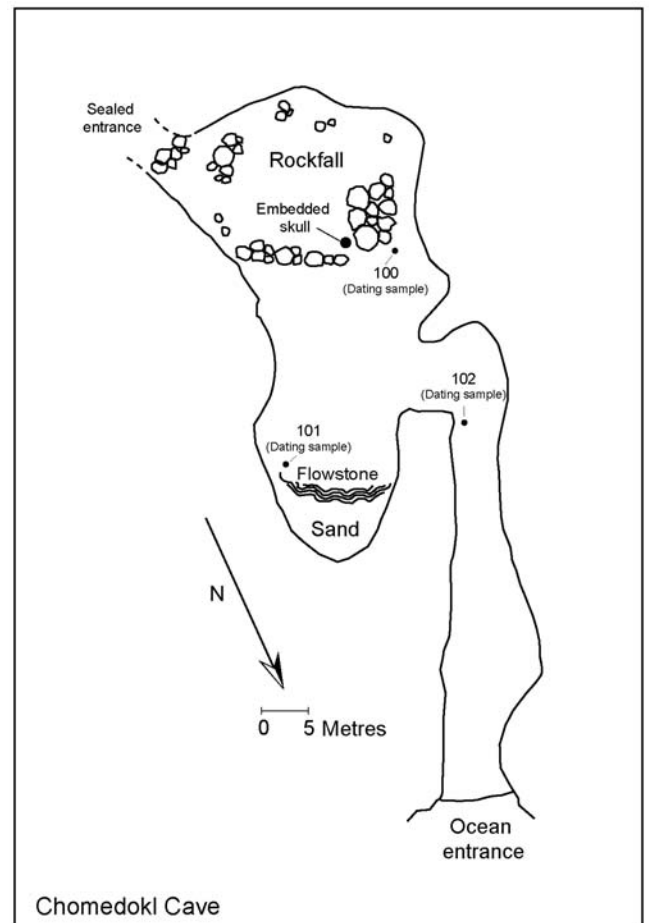


Figure 33. Chomedokl cave plan. Clark/Reepmeyer – ANU

common in Palau's raised limestone islands, and many were used in prehistory for human burial sites. In the Rock Islands, at least 10 burial caves are archaeologically documented with several of these containing the remains of multiple individuals (Fitzpatrick and Nelson 2008; Fitzpatrick et al. 2008). WWII activity and tourist visits have damaged skeletal material and associated artifacts in many of these grave sites. In 2009 and 2010, the large cave on the island of Chomedokl (**Figure 31**) was visited briefly to record GPS points. Berger et al. (2008) conducted a brief survey of Chomedokl's burials. Traditional history records the cave as the burial place for the child of the *Rubak* Reklai (Osborne 1966:436) and skeletal remains from adolescents have been tentatively identified.

The about 8m wide cave entrance in the north of the island is fronted by small islet and a narrow intertidal coral boulder area. A shelf of cemented limestone/beach rubble lies 1-1.5m above the beach base (**Figure 32**). Access to the cave is dependent on tide position and wave strength. The cave's entrance is defined by an approximately 45m long, southwest oriented, high chamber. The surface of

the entrance chamber is covered in limestone rubble and calcareous sediment with occasional large roof fall boulders. The concentrated areas of fragmented human bone lying in the passage were marked during Berger et al's (2008) visit with flag tape attached to thin wire pegs.

The map made by Berger et al. (2008) shows that the main chamber opens out to a large southern chamber about 47m in length and 20m in width (**Figure 33**). The northern end of this latter chamber contains a deposit of sand backed by flowstone, which is likely to have been deposited during the mid-Holocene when sea level was 1.5-1.8m higher than today. The south end of the chamber contains areas of rock fall and skeletal remains including a complete human skull that is cemented into the flowstone. Burial goods found in the cave include a pottery 'plate' and a painted pottery bowl and lid containing stone adzes and shell items (Osborne 196:436, Figure 14). Radiocarbon dates on human bone recovered from the southern chamber and the south end of the entrance passage range from 200 BC to AD 900 indicating that the practice of Rock Island cave burial has a lengthy history.



Tridacna gigas. Photo by Patrick Colin.

“It is a curious fact which derives from countless stories and traditions that in former times the high lime rocks in the south have been settled, but are now uninhabited”

(Krämer 1919:5)

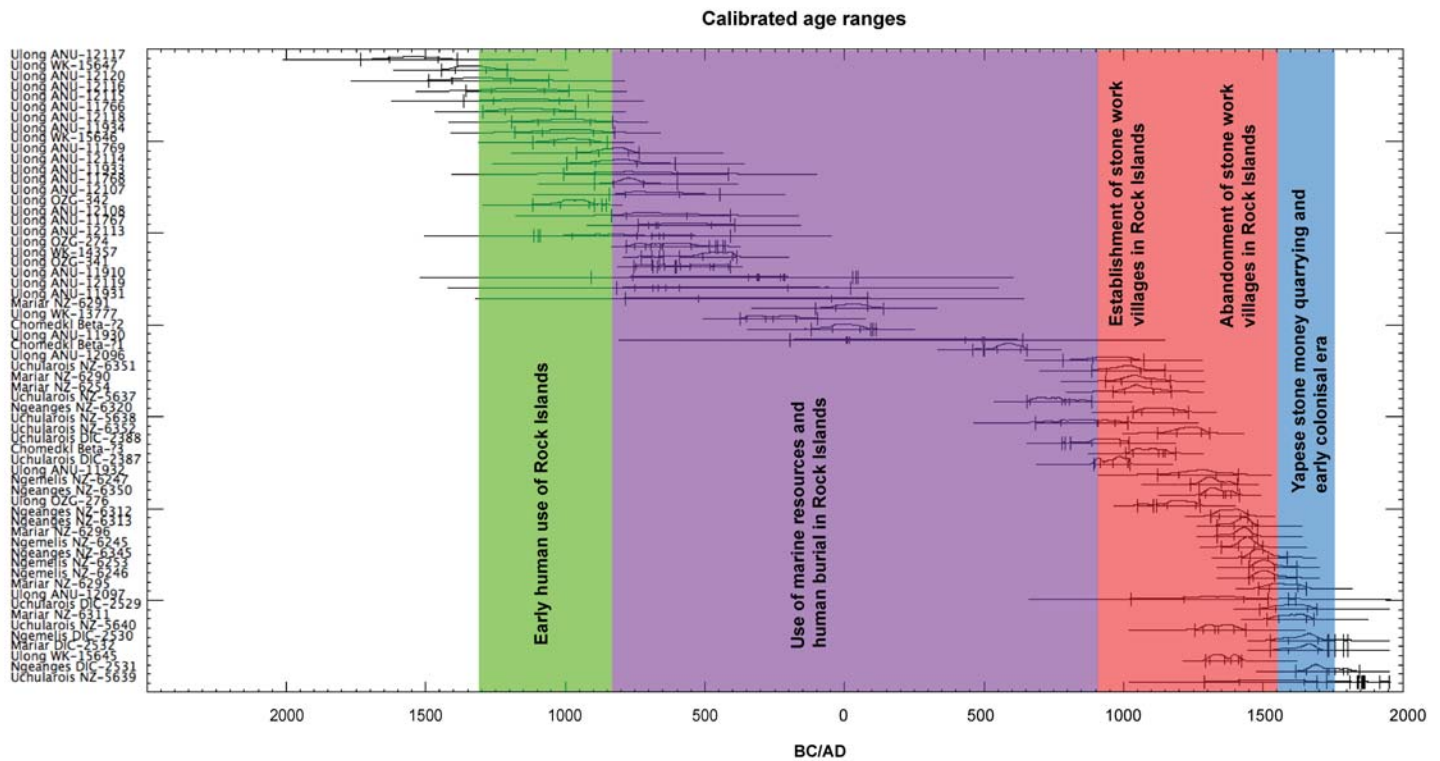
2.b History and Development of the RISL

The first Europeans to visit Palau noted that all of the limestone Rock Islands south of Malakal and north of Peleliu were uninhabited. Palauan people reported, however, that a population numbering in the thousands had lived in the RISL and traces of their abandoned village sites could be found on many islands. Myths frequently place the origin of social groups and the invention of customary practices in the southern part of Palau, known as the ‘lower sea’ or *eou el daob*, an area that also includes the islands of Peleliu and Angaur. The origin stories trace the migration of individuals, families, and entire villages from the Rock Islands to contemporary villages on Babeldaob, Oreor, and Ngerekebesang. The immigrants brought village names, chiefly titles, and community deities from their original village site.

Investigation of Rock Island cultural sites began in the Japanese era with the collection of ceramics and artifacts found in limestone caves. The first systematic survey and excavation of prehistoric sites in Palau was made by Douglas Osborne in 1953-1954 and 1968-1969. Osborne (1966, 1979) recorded Rock Island rock art, ceramics, artifacts, and burial caves. He identified several ancient village sites comprising stonework features (such as walls, platforms, wells, and trails) associated with extensive deposits of marine food remains and he collected the oral traditions associated with the major sites. Osborne’s broad overview of prehistoric remains directed subsequent fieldwork with stonework village sites on Ulebsechel and Ngeruktabel Islands

investigated by Takayama (1979), and several Rock Island village sites extensively researched by staff and PhD students from the Southern Illinois University (SIU) (Masse et al. 1982; Masse 1984).

The SIU team mapped stonework village sites, obtained radiocarbon dates to estimate the age of village occupation and abandonment, and made detailed analyses of recovered fauna and ceramics (Masse 1989; Snyder 1989; Carucci 1992). Of significance was the discovery of a local village settlement pattern within a larger regional settlement system. Within the system a dominant village, headed by a paramount chief, is connected to lower ranked villages to form political districts or federations. The radiometric dates show that Rock Island villages were occupied by at least AD 1200 and abandoned by AD 1650-1750. A decrease in the size of shellfish and fish taxa during the course of Rock Island village occupation indicated overharvesting of locally available marine resources. At the conclusion of the SIU investigations the antiquity of human occupation in Palau was thought to date to 2000 years ago. Subsequent projects on human burials and cultural deposits on the Rock Islands of Chelechol ra Orrak Island and Ulong have lengthened Palauan history to 3000 or more years (Fitzpatrick 2003a,b,c; Clark 2005; Liston 2005), temporally similar to the Neolithic expansion of early ceramic cultures in Island South East Asia and the Western Pacific. A study of Micronesian voyaging conditions suggests that Palau was first settled by people from the southern Philippines-eastern Indonesia area, in contrast to the Mariana Islands who were initially occupied by those from



Graph 1. Rock Island radiocarbon dates and cultural phases. Photo Clark/Reepmeyer – ANU

the middle or northern parts of the Philippines (Callaghan and Fitzpatrick 2008).

The past decade has witnessed a renewal of archaeological work on the Rock Islands. Recent investigations of Rock Island cultural sites examine the role of climate change and overharvesting of marine resources on the abandonment of stonework settlements (Masse et al. 2006; Fitzpatrick and Donaldson 2007; Rintaro and Clark In press). Rock Island calcite deposits were mined by Yapese people who voyaged to Palau to quarry huge stone discs and then returned the discs, used as money, to Yap. Several quarry sites have been investigated to examine how the stone money was extracted and the nature of culture contact between Yap and Palau (Fitzpatrick 2003c). Two stone money quarry sites in Airai State, Uet el Daob ma Uet el Beluu and Chelechol ra Orrak, were placed on the tentative World Heritage list on 28/08/2004 (<http://whc.unesco.org/en/tentativelists/1932/>). Culture contact has also been examined in an investigation of the camp of the surviving crew members of the *Antelope* wreck on Ulong Island where the first contact between Palau and the West took place in AD 1783 (Keate 1789; Clark 2007; Clark and de Biran 2010). Other recent research includes a study of prehistoric

human remains from Chomedokl Island which suggested that early Palauans were insular dwarfs (Berger et al. 2008). This controversial finding has been refuted (Fitzpatrick et al. 2008).

Archaeological and historical data divides the Rock Island culture sequence into five phases each associated with distinct artifactual remains, human behaviors, and set of environmental interactions (**Graph 1**). The rugged terrain and large number of Rock Islands (n=c. 300) has prohibited complete archaeological survey, and many additional Southern Lagoon prehistoric sites, including stonework villages, Yapese money quarries, burial caves, rock art, and early cultural deposits are yet to be documented.

Phase 1: 3100–2700 years ago

Colonization and mobile encampment

The first evidence for human activity in the Rock Islands dates to 3100 years ago on Ulong Island. At this time, sea level was declining after being 1.5–1.8m higher than it is today. Subsidence of the Palau archipelago (estimated at 0.6mm/year) ensured that there were relatively few beaches and landing spots suitable for gaining easy access to the Rock Islands. Ceramic vessels consist of medium-

sized, red-slipped jars made with a mineral temper that was collected from the nearby volcanic islands. Marine resource use focused on the collection of large locally available clams (Tridacnidae) and inshore fish species. Rock Island occupation was short-term and consistent with the presence of mobile camps that skimmed pristine stocks of marine foods from accessible locations.

Phase II: 2700-1000 years ago

Human burials and rock art

Caves and shelters in the Rock Islands were consistently used for human burials for almost 2000 years. The burials are occasionally accompanied by grave goods such as shallow bowls/dishes (grog tempered) decorated with a red slip or paint, shell items such as personal ornaments and pearl shell knives/scrapers, stone adzes, and painted stones. Smaller caves appear to have been used for individual interment while many of the larger caves contain multiple sets of human remains. These latter sites were likely cemeteries for groups who occupied the volcanic islands and had rights to the Rock Islands. Territorial rights are also represented in the placement of highly visible rock art in exposed locations, although some art was, like the human burials, hidden from view in limestone caves. As limestone often rapidly weathers in a tropical climate, many of the Rock Island's art sites have been lost through erosion. The most spectacular remaining site is on Ulong Island where there is a large gallery of red painted art.

Continued use of the Rock Island marine resources is indicated during this phase. However, the lack of evidence for permanent settlements suggests that the technological and social adaptations necessary for occupying harsh limestone landscapes had yet to develop.

Phase III: 1000-350 years ago

Village settlement and intensified use of marine resources

Permanent villages were first established in the Rock Islands about AD 1200. Behind the larger sand plains, trails criss-crossed the rugged limestone environs to connect stone terraces, platforms, and

walls. Settlement location was strongly defensive with high stone walls—some built with an interior foot ledge to allow defenders to hurl projectiles onto attackers—extending across those beaches that provided canoe access. Defensive walls were also strategically placed across trails connecting a village's coastal and interior zones. Large and/or elaborate platforms and stonework consistent with social stratification and site specialization were built on high limestone points and ridges. Traditions record that stone structures on high points were either a chiefly residence, or were the abode of priests. As indicated by substantial midden remains and house platforms, domestic space was generally on sandy beaches. Burials were in sand plains, often in areas with stone structures, although cave burial may also have continued to be practiced. Giant swamp taro (*Cyrtosperma merkusii*) was grown in the swampy ground at the interface between the limestone bedrock and the coastal plain and damp sink holes, while tree crops such as coconut (*Cocos nucifera*) were grown on sandy beaches.

The overwhelming components of prehistoric village deposits are marine shells and pottery fragments. Ceramics, large flanged-rim bowls made with a crushed pottery temper, were produced on the volcanic islands and transported to Rock Island settlements in large quantities. Domestic artifacts were largely fashioned from marine shell. Large clams, collected from the outer reefs, were used to make adzes, pounders, and other utensils. The subsistence economy relied on shellfish and finfish. Food shell mostly derives from small taxa, particularly *Strombus*. The diversity and abundance of fish taxa increases in this phase with the capture of pelagic species such as tuna (Scombridae) and mackerel sharks (Lamnidae). During the course of Rock Island village occupation the size of several subsistence taxa decreases as a result of over-harvesting. With the total Rock Island population estimated to have been between 4000 and 6000 during this temporal phase (Masse et al. 2006), the environmental impact of human occupation on the RISL's terrestrial and marine environments must have been substantial.

Phase IV: 350-100 years ago

Village abandonment and Yapese stone money quarrying

The Rock Islands were depopulated over several centuries with relocation of groups north to the volcanic island of Babeldaob and south to the large platform limestone islands of Peleliu and Angaur. The Rock Island settlements were economically unsustainable in the face of a drying climate, a growing population, and a decline in the abundance of marine foods. The tenuous economic conditions of those occupying the limestone islands are exemplified in their dependence on pottery cooking and storage containers that were only produced on volcanic islands. Abandonment of the Rock Islands had significant socio-political consequences for Palau as village groups were incorporated into larger and more powerful structures, particularly in Koror.

The abandonment of the Rock Islands was followed by significant interaction with Yapese voyagers who were drawn to Palau to quarry the

limestone island's calcite deposits to make stone disk money. Stone money was valued according to its shape, weight, color, and the effort expended in its quarry and transport. In Yap, the large disk money, displayed along the front of stone residential platforms, signaled the status, power and prestige of the individual and clan (Fitzpatrick 2003c). Yapese relations with Palau were influenced by the competition between the rival polities of Koror and Melekeok with Yap's Gagil village linked to Melekeok and Rull associated with Koror (Morgan 1988).

During Phase IV, the RISL's terrestrial and lagoon environments would have experienced some rejuvenation with expansion of indigenous forest on limestone islands and less intensive collection of coral reef species.

Phase V: 230-65 years ago

Colonial era and WWII effects on the Rock Islands

In 1783, the East India packet, the *Antelope* was



Tourists in the RISL. Photo by Ron Leidich.

shipwrecked on Palau's western barrier reef. Upon the crew's return to England, the account of the newly 'discovered' Palauan people (first published in 1788) became, after James Cook's volumes, the most popular voyaging book of the late 18th century. During their stay, the *Antelope's* crew assisted the paramount chief of Koror, the Ibedul, to overcome his enemies on Babeldaob and Peleliu. The favorable relations between the Ibedul and foreigners in subsequent years were detrimental to Koror becoming Palau's central place, albeit under successive colonial administrations (Spain 1885-1889, Germany 1889-1914, Japan 1914-1945, United States 1945-1994).

From a landscape perspective, World War II (in Palau largely restricted to Japanese and U.S. forces) had a huge influence on the Rock Islands. The Japanese military caused impacts resulting from activities of garrisoning troops such as concealing caches of military supplies, establishing defensive positions, and mooring naval and supply ships. Remains from the global conflict include shrapnel fragments, abandoned equipment, unexploded

ordnance, gun emplacements, troop shelters, sunken ships and planes (Bailey 1991). Japanese soldiers built many earth and stone defensive features in Palauan stonework villages and numerous caves and rock shelters were cleared of prehistoric remains or otherwise affected by military activity. The defeat of the Japanese in World War II led to the administration of Palau being transferred to the United States as part of the Trust Territory of the Pacific.

Phase VI: Modern Conservation History

The Ngerukewid Islands Wildlife Preserve was established in 1956, making it Palau's first formally legislated protected area. Palau achieved independence from the United States in 1994, and tourism development became a major economic focus for the country. In response to increasing development pressure and visitor impacts, additional areas within the RISL were protected, culminating in the mandated management of the entire RISL through adoption of a Rock Islands Southern Lagoon Area Management Plan 2004-2008 in 2005. The Plan is currently being revised.



Koror State Department of Conservation and Law Enforcement. Photo courtesy KSDCLE.

3. Justification for Inscription

The Rock Islands Southern Lagoon is proposed for inscription on the World Heritage List as a mixed cultural and natural heritage site under criteria (iii), (v), (vii), (ix) and (x).

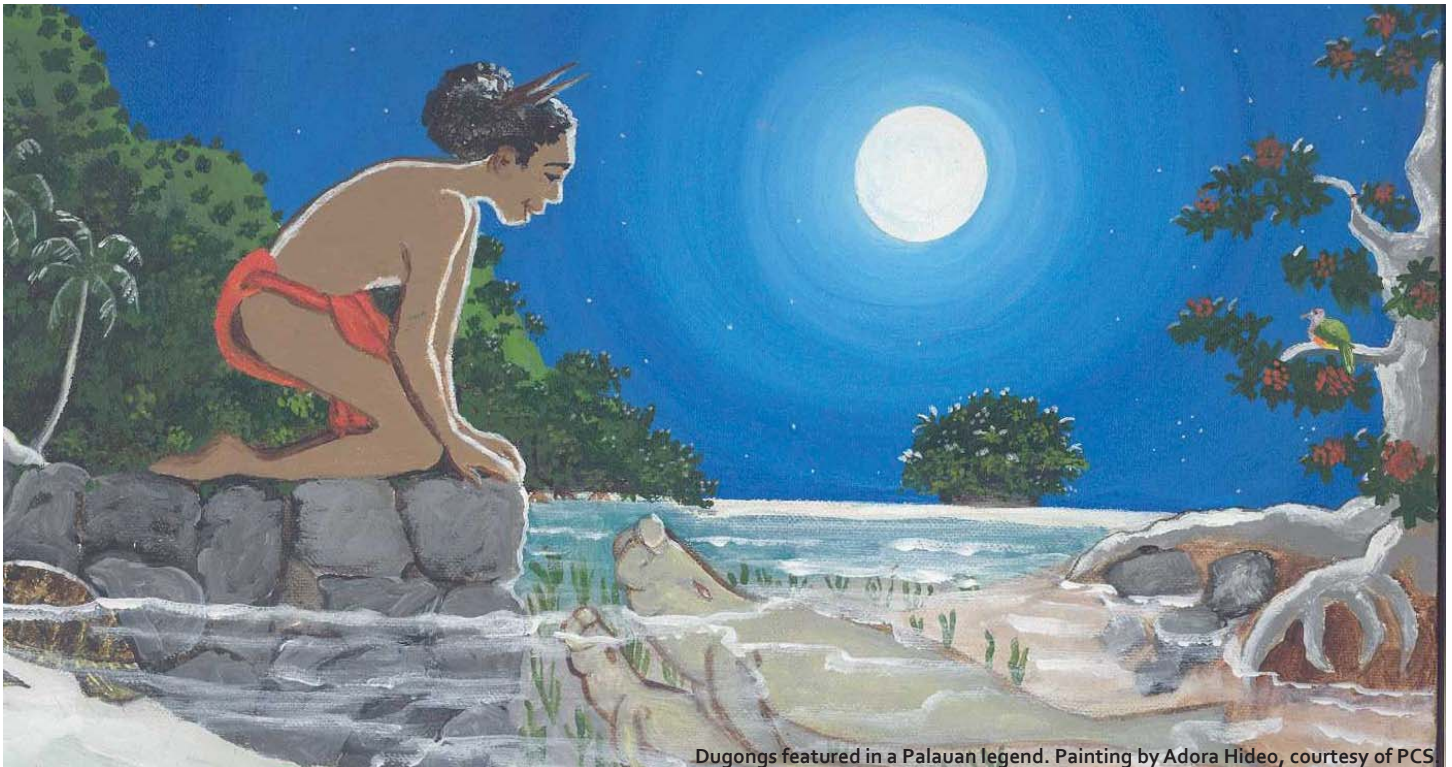
3.a - Criteria Under which Inscription is Proposed

Criterion iii. Bear a unique or at least exceptional testimony to a cultural tradition which is living.

The significant aesthetic and cultural values of the landscape of the Rock Islands Southern Lagoon are integral to the identity of the nation. Within an archipelago continuously inhabited for several millennia, the limestone islands' distinct environmental conditions have sustained a range of

prehistoric and historic sites and evidence for past cultural behavior and environmental adaptations not preserved elsewhere in Palau. The RISL's culturally significant places are recorded in oral history, myths, dances, proverbs, and in the traditional place names of its land- and seascapes. Continuing human use, adaptation to, and reliance on the marine ecosystem is evident in the RISL.

Palau is traditionally divided into a northern volcanic landmass containing the large island of Babeldaob known as the 'upper sea' and a southern group of smaller limestone Rock Islands and adjacent landmasses termed the *eou el daob* or 'lower sea'. Despite very limited supplies of freshwater and arable soil, several substantial stonework villages were established in the Rock Islands. Oral histories



Dugongs featured in a Palauan legend. Painting by Adora Hideo, courtesy of PCS

recount the progressive movement of people from the Rock Islands to other parts of the archipelago. Many Palauans assert that they originate from these ancestral Rock Island settlements, and historical traditions refer to the RISL's ancient burial caves and rock art sites, important site types not found in the remainder of Palau.

The network of stonework villages established in the Rock Islands in the last 1000 years was entirely uninhabited at the time of first substantial European contact in AD 1783. Traditions report that at least 13 village settlements once existed in the RISL, with several of these settlements verified by archaeologists. Oral traditions record extensive migration to and from the Rock Islands and many Palauans acknowledge derivation from the islands of the 'lower sea'. These origin stories are central to the identity of the people of Palau and are represented in the migration histories of villages that date to 'the time of the ancestors' (*Er a Rechuodel*). Traditional history mentions the Rock Island settlement's marginal subsistence conditions and refers to both voluntary and forced relocation of the population to larger volcanic islands where staples could be grown in abundance. Political autonomy, an important factor in the decision to occupy the Rock Islands, was balanced, and eventually outweighed, by the harsh environmental conditions which severely

limited the sustainability of human settlements, particularly when combined with endemic inter-group conflict.

The high limestone Rock Islands of the Palau Archipelago are of Miocene to Pleistocene age and are located in one of the most ecologically diverse coral-reef systems in the Indo-Pacific. The RISL contains an exceptional record of human interaction with the marine environment extending back 3000 years. Knowledge of the lagoon ecosystem continues today, particularly of species behavior related to the capture and collection of vital marine foods. The historical significance of the RISL's marine resources is illustrated, for example, by the traditional stories about the cause of warfare between Koror village on Oreor Island and Metukeruikull village on Ngeruktabel.

Criterion v. Be an outstanding example of traditional human land and sea use which is representative of human interaction with the environment especially when it has become vulnerable under the impact of irreversible change.

The Rock Islands are an outstanding example of human interaction with a precarious environment.



The stunning Rock Islands. Photo by Patrick Colin.



Nudibranch. Photo by Paul Collins.

The islands of PELEW, when viewed from the sea, exhibited high rugged land, well covered with wood. The interior part was in many places mountainous, but the vallies were extensive and beautiful, spreading before the eye many delicious prospects.

George Keate, 1788



Palau Flycatcher. Photo by Eric VanderWerf.



Spadefish. Photo by Paul Collins.

The abandonment of the Rock Islands in the 2nd millennium AD is an exceptional example of the consequences of population growth and climate change to a human society living in a marginal environment.

The Rock Islands consist of small raised karst landmasses with only sparse pockets of sand plains and suitable gardening soil. This terrestrial environment is highly susceptible to climatic fluctuations. Recurrent droughts limit the production of starchy crops in sink holes and on sand plains, while access to potable water is dependent on a high and consistent level of precipitation to the freshwater aquifer (the Ghyben-Herzberg lens). In addition, El Niño/La Niña events disrupt marine organisms, especially the most common subsistence taxa, through increased variability in tidal range, sea temperatures, and nutrient concentration.

Currently Palau, in the wet equatorial zone, averages 3,700mm of annual rainfall. However, large-scale variation in precipitation is documented in Palau's palaeoclimate record with a wetter period at AD 950-1250, known as the 'Medieval Warm Period' (MWP), and an increasingly drier climate which peaked around AD 1650, referred to as the 'Little Ice Age' (LIA). During the transition from the MWP to the LIA, the decrease in precipitation was accompanied by increased frequencies of El Niño Southern Oscillation (ENSO) events. ENSO events result in fluctuations in the Walker Circulation, movement of the Inter-Tropical Convergence Zone (ITCZ), and increased sea-surface temperatures.

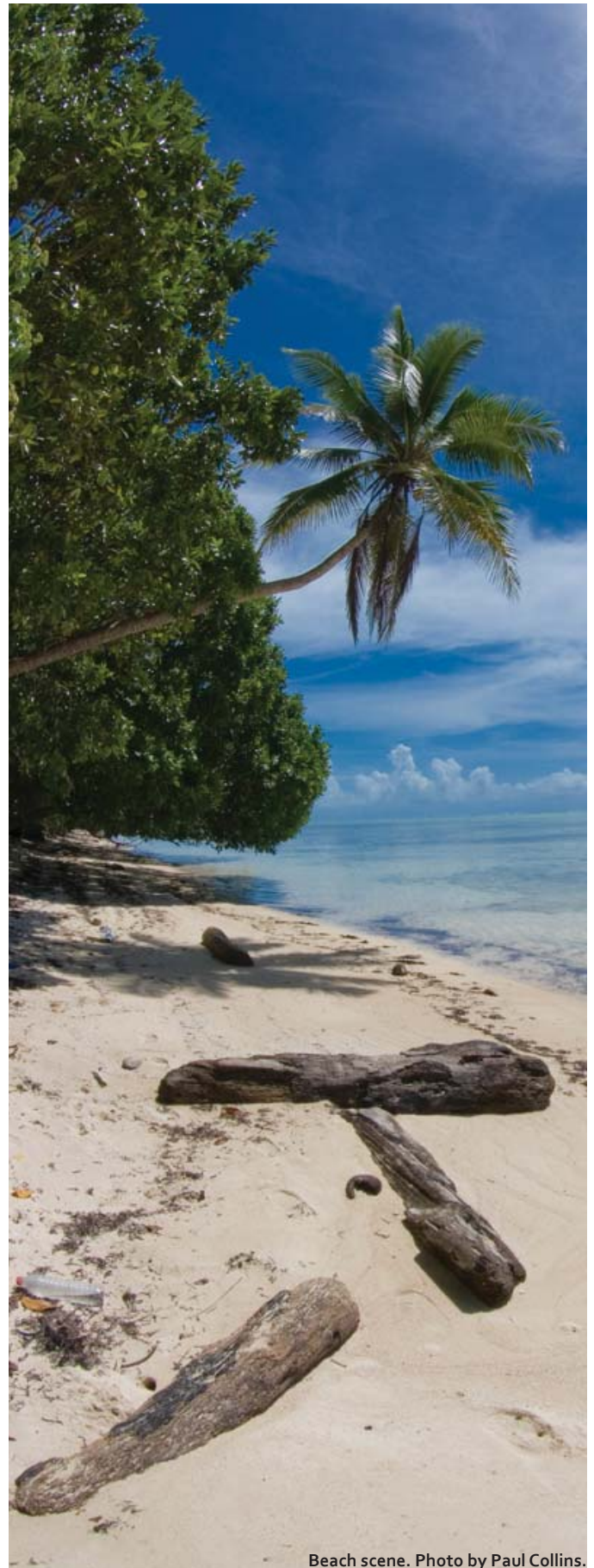
By AD 1250, at the end of the MWP, archaeological evidence shows intensification of human use in the RISL. At this time, permanent settlements were first established in the Rock Islands as a result of a growing population and an increasing frequency of warfare on the main volcanic island of Babeldaob. The large and dispersed stonework settlements on many islands in the Rock Islands are defined by stone architecture. Locally available coral limestone cobbles and boulders were carefully stacked to construct house and sitting platforms, walls,

pathways, docks, and wells. Domestic village space is associated with rich midden deposits composed of ceramic sherds, marine shell, and finfish remains, in addition to tools and ornaments made of stone, bone, and shell.

Stonework village radiocarbon dates and historic records indicate that Rock Island settlements were uninhabited by about AD 1700. During the period when these villages were being deserted, palaeocores show an unpredictable and dry climate. Also potentially related to the abandonment is the overharvesting of local marine resources witnessed by the smaller size of marine shellfish and finfish remains through time. The archaeological record correlates well with traditional Palauan explanations referring to resource deprivation and warfare as the cause of settlement extinction in the Rock Islands.

Criterion vii. Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance

Hundreds of lush green islands lie within the pristine blue waters of the Rock Islands Southern Lagoon. The breathtaking beauty of this seascape and landscape creates an instant sensation of wonder for all who view its splendor. The diverse and complex marine and terrestrial habitats offer every hue and color of the rainbow, providing a sense of timelessness and inspiration that words and images cannot fully express. Ancient legends and chants, old and new songs, poetry, and countless films, documentaries, videos, television programs, books, photographs, murals, and posters have tried to capture the wonder of the Rock Islands from the air, land, and sea. *This Living Reef* (1974) by photographer Douglas Faulkner was one of the first attempts to capture the beauty of the RISL. The RISL was featured in the 1995 Academy Award-nominated IMAX film *The Living Sea*, in a 1998 episode of the Public Broadcasting Service series *The Living Edens*, the 2008 IMAX film *Planet Blue*, and most recently, its migrating golden jellyfish in Jellyfish Lake were featured in an episode of the 2010 National Geographic series *Migrations*.



Beach scene. Photo by Paul Collins.

The emerald islands of the RISL have a full representation of raised limestone islands, from high cliffs to flat platforms to the iconic mushroom shapes. The islands' gentle contours and various shapes fill the mind with images of peaceful demigods resting in a tranquil lagoon of antiquity. The famous Jellyfish Lake offers a mesmerizing experience of the phenomena of millions of golden jellyfish pulsating around you, each lost in its own liquid waltz (Kitalong Hillman 2000). The RISL has a higher density of marine lakes compared to any other place on earth of similar area. The colorful and diverse coral gardens, steep drop-offs and channels with strong exhilarating currents and large feeding and spawning aggregations of fish and sharks, tranquil coves and lakes, and the rare encounter with a turtle, crocodile, or dugong provide an ecosystem of rare natural phenomena and beauty and the experience of a dream come true.

Criterion ix: to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.

The marine lakes within the Rock Islands Southern Lagoon are an outstanding example of significant ongoing ecological and biological processes in the evolution of marine ecosystems and communities of plants and animals. Marine lakes have the physical appearance of islands—i.e., they are bodies of one habitat (seawater) entirely surrounded by another (land). As other islands, therefore, marine lakes may be to the ocean what oceanic islands are to the land (Dawson et al. 2009): simpler microcosm[s] of the seemingly infinite complexity of continental and oceanic biogeography with the necessary replications in natural experiments by which evolutionary hypotheses can be tested (MacArthur and Wilson 1967).

Since 1995, extensive scientific research has been conducted to examine whether the marine lakes might have the same significance in marine



Mastigias papua etpisoni. Photo by Patrick Colin.



Endemic *Nautilus belauensis*. Photo by Patrick Colin.



Astrosarkus idipi, described from Palau. Photo by Patrick Colin.



Subsistence fishing. Photo courtesy PCS.



Students hug Finny the Shark during outreach visits. Photo courtesy PCS

biology that oceanic and coastal islands have in terrestrial biology (e.g., Whittaker and Fernández-Palacios 2007; Losos and Ricklefs 2010). These investigations include biotic surveys in 14 lakes, population genetic characterization of three species, documentation of morphological and behavioral variation, establishment of long-term monitoring of physical dynamics in 15 lakes, and long-term monitoring of coupled-biophysical variation between two to five lakes. Although only a portion of this work is published to date, there is a strong inference that marine lakes are effectively the Galapagos of the seas, providing unparalleled opportunities to study the ecology and evolution of marine taxa (Dawson et al. 2009).

Populations of marine lake organisms are endemic to single lakes (e.g., Dawson and Hamner 2005; Gotoh et al. 2009; Dawson unpubl.) with each

population morphologically distinct (Dawson 2005 a,b). Endemic lake populations also show behavioral adaptations to lake-specific selective forces (Hamner and Hauri 1981; Dawson and Hamner 2003). Genetic analyses of marine lake jellyfish are the first published data showing consistency between patterns of evolution in marine taxa with patterns of evolution in terrestrial taxa on oceanic islands (Dawson and Hamner 2005), a pattern that is also evident in the evolution of size, antipredatory phenotypes, and in the assembly of communities (Dawson et al. unpubl.). Five new subspecies of *Mastigias* (Scyphozoa: Rhizostomeae: Mastigiidae) have evolved from marine lakes within the RISL (Dawson 2005a). Further understanding of the evolution of these systems depends upon their conservation in a pristine state and the avoidance of threats such as invasive species that have devastated the endemic biota of terrestrial oceanic islands.

Criterion x: to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The RISL ecosystem includes numerous and diverse habitats and functional groups from decomposers to producers to apex predators within a relatively small area. Barrier reefs, fringing reefs, patch reefs, reef holes, reef channels, the shallow and deep lagoon, marine lakes, beaches, seagrass beds, mangroves, littoral forests, and limestone forests are all habitats found within the RISL. These habitats are healthy and intact, and there is effective *in situ* conservation to protect and preserve the biological communities. A diverse assemblage of biota are found within each habitat including Palau's endangered megafauna (dugongs, crocodiles, birds, hawksbill and green sea turtles), and hundreds of species of fish, coral, and other invertebrates and algae.

Each of the RISL's 52 marine lakes is unique, with a diverse selection of habitats and communities

that have evolved over time. Biotic surveys of 14 marine lakes documented 311 marine invertebrate species (sponges, molluscs, echinoderms, sea squirts, and jellyfish), of which 131 (43%) are previously unknown species that are likely new to science (CRRF unpub. 2010). Species composition segregates according to the unique physical features of each lake, with species overlap among lakes with similar characteristics. As such, the RISL lakes represent a complete continuum from the most isolated lakes to those most connected to the lagoon. Given the number of lakes yet to be comprehensively surveyed there is a high probability of more new discoveries of species found nowhere else on earth. The limited access and effective management of the lakes ensures *in situ* conservation and preservation of these outstanding natural habitats.

Ten of the newly described or named species of invertebrates from Palau's marine lakes have not yet been found in the surrounding lagoon. These include a sea anemone (*Entacmaea medusivora*, Fautin and Fitt 1991) found in five of the stratified lakes and a sponge (*Haliscara cerebrum*, Berquist and Kelly 2004) found in three of the stratified lakes. Four different ascidian species, or sea squirts, have been described from a variety of lakes (*Eudistoma inauratum* and *Pyura styeliformis*, Monniot and Monniot 2001; *Didemnum mekeald* and *E. partitum*, Monniot and Monniot 2008) and four have only been found in a single lake each (*Ecteinascidia remanea*, Monniot and Monniot 2001; *D. lacustre*, *D. abu*, and *Lissoclinum tumidum*, Monniot and Monniot 2008). With future data analysis, species descriptions, and collections the degree of endemism in the marine lakes of the Rock Islands Southern Lagoon will become more apparent.

Ngerumekaol Channel and Denges Pass within the RISL are healthy and protected fish spawning aggregations that include a variety of fish species (Johannes 1981, 2000; Kitalong and Oiterong 1992; Johannes et al. 1999; Colin 2009). Intensive multi-species coral spawning occurs in Nikko Bay and Lighthouse Channel within the RISL (Penland et al. 2004). These healthy and robust populations of

spawning fish and coral species contribute to the preservation of key ecological processes that are critical for the overall health of the reef. In many of the world's coral reef ecosystems, pollution, dynamite fishing, overharvesting, and dredging of reef habitat has disturbed and stressed these key ecological processes, decreasing their resilience and making them more vulnerable to future disturbance. The reefs of the RISL remain nearly pristine and, as such, are an important area for conservation of global marine biodiversity.

Moreover, these intact coral reef systems, and their corresponding ecological processes, aid in the reef system's resiliency to the impacts of climate change. During the 1998 ENSO event, worldwide coral bleaching occurred, including in Palau. Within the RISL 90 percent of *Acropora* coral bleached, of which more than half recovered (Bruno et al. 2001). Corals fringing the rock islands had a lower percentage of bleaching and mortality compared to other more exposed reef habitats, perhaps due to the shade provided by those islands (Golbuu, Victor et al. 2007). These unaffected coral populations may have played a critical role in Palau's reef recovery by providing some of the coral larvae as recruits for more impacted areas.

All of Palau's known endemic birds, mammals, and herpetofauna are located in the RISL. An estimated 42 percent of Palau's 130 endemic plants have been recorded in and vouchers collected from the RISL (Costion et al. 2009; Kitalong et al. 2009). The RISL includes the IUCN endangered *Cycas micronesica*, the endangered palm, *Hydriastele palauensis* and the critically endangered endemic *Ponapea palauensis*, found only within the RISL. The Ngerukewid Islands Wildlife Preserve within the RISL is the second oldest preserve in the Pacific and one of the least disturbed and most pristine terrestrial ecosystems in Micronesia (Birkeland and Manner 1989). Two decades ago, this complex was free of all six of Palau's introduced mammals—shrews, mice, and rats (Wiles and Conroy 1990). Effective management of this closed island complex has likely kept it free of introduced species.





Statement of Outstanding Universal Value

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.

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. 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 have tried 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.

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, 7 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.

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 and critical habitats. Traditionally, Palauans have conserved and protected these rare and valuable resources for thousands of years. The Ngerukewid Islands Wildlife Preserve established more 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 World Heritage Site and is committed to keeping the RISL as one of the last great places on earth.

3c. Comparative Analysis

Comparative Analysis – Cultural Heritage Sites

The unique values of prehistoric sites in the Rock Islands were compared to other relevant World Heritage properties by concentrating on two thematic elements represented in the cultural landscape of the Rock Islands:

- Human adaptation to a precarious environment and subsequent abandonment of the landscape resulting from climate change and over exploitation of the marine ecosystem.
- The cultural landscape is central to national identity as articulated in traditional history, island place names, and the migration-origin stories of the Palauan people.

Cultural landscapes in the Republic of Palau

The islands of Palau were probably occupied around 3500-3000 years ago by a Neolithic migration out of Island Southeast Asia (Clark 2005). Analysis of sediment cores on Babeldaob indicate vegetation disturbance, including a marked decline of forest taxa (Welch 2002; Athens and Ward 2005) and the occurrence of giant swamp taro (*Cyrtosperma merkusii*), that could represent earlier human arrival in Palau 4500-4000 years ago (Athens and Ward 2001, 2005). These vegetation changes may reflect, however, natural events as palaeoclimate data shows an increased frequency of ENSO events at this time (Gagan et al. 2004).

Human impact on Palau's environment increased from 3100 to 2000 years ago indicating continued prehistoric occupation after colonization (Athens and Ward 2001). On the main volcanic island of Babeldaob human settlement expanded into upland areas, and in the Rock Islands there is evidence for the collection of marine foods and use of limestone caves for human burial (Fitzpatrick 2003a,b,c; Liston 2009). Around 2000 years ago the volcanic

islands experienced major erosion with sediments from upland zones deposited downslope onto the coastal flats. Sediment movement is linked to the construction of substantial earthworks in Babeldaob's upland areas (Liston 2009) and the expansion of horticulture. During this time, the Rock Islands were used intermittently, but the presence of multiple cave interments suggests that local groups were marking territorial areas in the RISL through burial practice.

The transition from constructed earthworks in upland locations to stone village constructions in both lowland and upland parts of Babeldaob took place between AD 700-1200 (Wickler 2002; Liston 2009). The cause of the significant change to the community settlement pattern is unclear, with potential factors including an increasing frequency of warfare and the possibility that interior gardening soils had been depleted of nutrients.

Stonework villages in the 2nd millennium AD were frequently located in areas near the lagoon behind a thick border of coastal mangrove, which provided canoe shelter and guarded villages against attack from the sea. The marshy ground at the interface between the mangrove forest and the volcanic sediments was used to grow swamp taro (*Cyrtosperma merkusii*) with cultivation of dry and wet types of taro on adjacent hill sides and in areas supplied with freshwater. In the Rock Islands stonework villages were not established until AD 1000-1250 after there had been a phase of resource intensification in the volcanic islands. Intensification of crop production is associated with the benign climate conditions of the 'Medieval Warm Period' (MWP).

During the MWP, human populations moved out of the volcanic islands, and established for the first

time, permanent stonework villages on limestone islands in the RISL. Major disruption to the Rock Island stonework village system occurred around AD 1500-1650 with complete abandonment of the limestone islands by AD 1700-1750, and migration of the Rock Island population to islands north and south. Palauans continued to use the RISL's marine resources, and Yapese voyagers came to the limestone islands to quarry disks of calcite stone money, but the Rock Islands were never again inhabited permanently (Snyder and Butler 1990; Masse et al. 2006).

Human adaptation to a precarious environment and abandonment of the landscape resulting from climate change and over exploitation of the marine ecosystem.

1. Climate change

The terrestrial environments of the Rock Islands are highly susceptible to climatic fluctuation. Long-term human occupation demands stable supplies of food and freshwater. Recurrent droughts affect the growth of starchy crops and supplies of potable water are dependent on high levels of precipitation to continuously recharge the freshwater aquifer (Ghyben-Herzberg lens). Recent studies on marine lake sediments in the Rock Islands indicate that the transition from the MWP to the LIA was associated with an increase in the frequency of

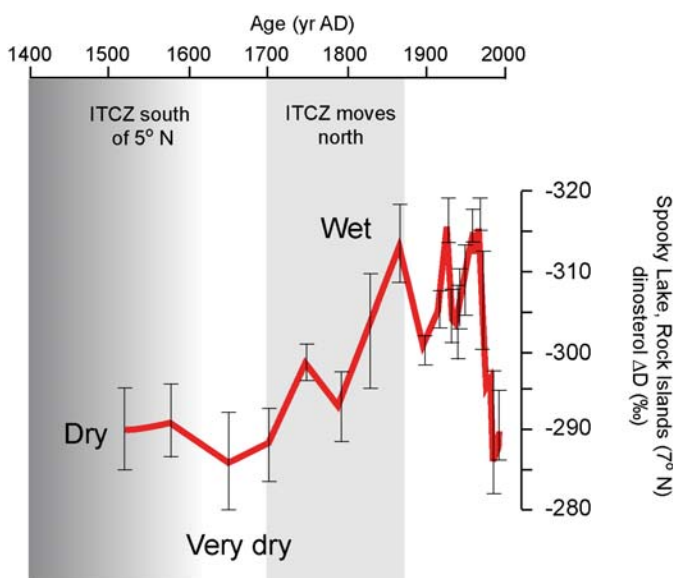


Figure 34. Climate change during the occupation of the Rock Islands. From Sachs et al. 2009.

ENSO events (Sachs et al. 2009). The increased variability in tidal range, sea temperatures, and nutrient concentration during El Niño/La Niña events disrupt marine systems, particularly the common subsistence taxa collected by people. Following fluctuations in the climate starting around AD 1000, the Rock Islands experienced an increasing frequency of dry weather during the LIA (Sachs et al. 2009). Precipitation levels began to fall around AD 1400 and reached their lowest ebb around AD 1650 (Figure 34).

Several World Heritage sites are inscribed under Criterion V of the operational guidelines that has the survival of a population in a harsh environment as a major theme (Fowler 2003). These include Uluru-Kata Tjuta National Park (Australia), Pyrénées-Mont Perdu (France/Spain), Portovenere, Cinque Terre, and the Islands Palmaria, Tino, and Tinetto (Italy), Ouadi Qadisha (the Holy Valley), the Forest of the Cedars of God (Horsh Arz el-Rab) (Lebanon), Sukur Cultural Landscape (Nigeria) and Ivvavik/Vuntut/Herschel Island (Canada).

The vulnerability of prehistoric societies to periods of dramatic climate change such as from the climatic optimum in the Medieval Warm Period (MWP) to the Little Ice Age (LIA) in World Heritage is included within the concept of: landscape abandonment because of irreversible environmental change. An appropriate example is the World Heritage Mapungubwe Cultural Landscape in South Africa. The relict landscape was caused by increasing droughts during the LIA in the 14th century, which limited the agricultural capacity of the land to sustain a large population. The direct consequence of climate change in Mapungubwe was the large-scale migration of people into neighbouring regions which supported the rise of substantial political entities, particularly that of the World Heritage site of Great Zimbabwe (Zimbabwe). Similarly, in Palau climate change depressed the subsistence capacity of the Rock Island population to a point where social fragmentation and migration resulted in a relict island landscape.

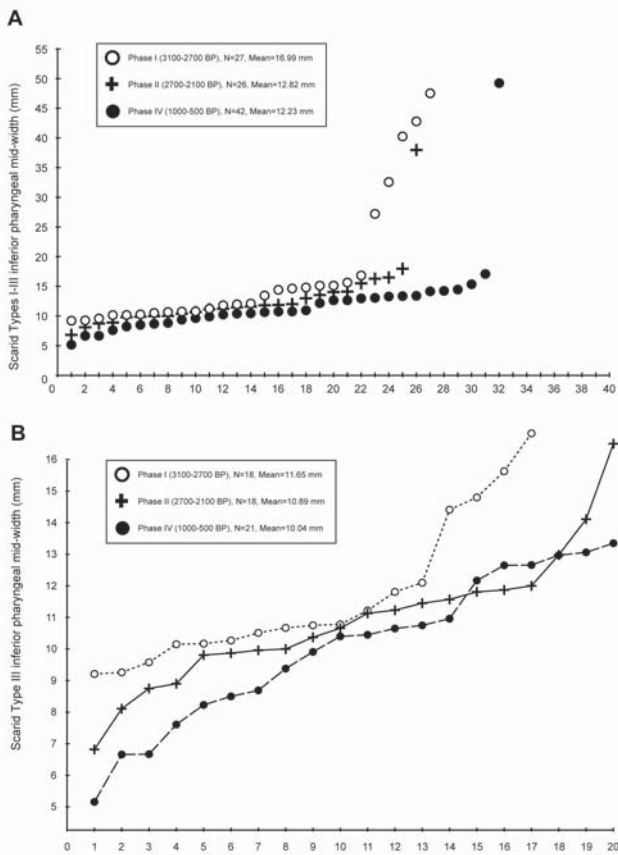


Figure 35. Size decrease in Scarids (parrotfish) in the Rock Islands. From Masse et al. 2006

2. Human impact on the marine ecosystem

The Rock Island's cultural sequence is a three millennia long record of human adaptation to an environmentally depauperate landscape. In this, cultural sites in the Rock Islands can be compared to several other World Heritage sites, such as the 2000-year human sequence of the St Kilda Archipelago in the north of Scotland where the small population inhabiting a marginal environment was similarly reliant on a combination of wild foods (fish and sea birds) and small-scale agricultural production for its survival. The production of starchy root crops was very limited in the Rock Islands compared to the rich food resources of the RISL. As a result subsistence was particularly focused on the extraction of marine resources to supply dietary and material culture needs. The importance of marine resources to Rock Island settlements is seen in traditions about the cause of conflict between Koror and Metukeruikull. The people of Metukeruikull on Ngeruktabel Island forbade the people of Koror entry to their rich fishing grounds, and they killed the chief of Koror (Ibedul) who they found while on

a fishing expedition (Nero 1987:130); an event that precipitated warfare and island depopulation.

Human influence on the marine ecosystem of Palau is well documented compared with impact on the terrestrial habitat through the construction of village sites and clearance of island vegetation. It is unclear when major disturbances to the Rock Island's native vegetation occurred because palaeoenvironmental studies have focused on the volcanic island of Babeldaob, but it is likely that native vegetation clearance was extensive in prehistory.

The ethnographic and archaeological record of marine use demonstrates that Palauans have been collecting and using a wide variety of marine resources sourced from coral reef environments for at least 3100 years.

Marine subsistence taxa taken include:

- Mollusks (*Strombus gibberulus*, *Tridacna* sp., *Hippopus hippopus*, *Trochus niloticus*, *Lambis* sp., *Conus* sp., *Nerita* sp.)
- Bony and cartilaginous fishes (Labridae, Scaridae, Diodontidae, Monacanthidae, Lutjanidae, Lethrinidae, Holocentridae, Elasmobranchii)
- Turtles (e.g., *Chelonia mydas*, *Eretmochelys imbricata*)
- Sea urchins (*Tripneustes gratilla*)
- Lobsters (*Panulirus pencillatus*, *Panulirus versicolor*)
- Crabs (*Scylla serrata*, *Portunus pelagicus*, *Heterocarpus* spp., *Geryon* sp.)
- Saltwater crocodiles (*Crocodylus porosus*)
- Dugongs (*Dugong dugon*)

The absence of volcanic stone in the Rock Islands resulted in the widespread use of shell to make domestic and ceremonial items. Prehistoric shell artifacts found in the Rock Islands include adze blades made in *Tridacna* sp. and *Terebra* sp., knives, chisels, scrapers, and small adzes in *Tridacna* sp., *Conus* sp., *Anadara* sp., *Cassis* sp., spoons and gorgets in *Tridacna* sp., *Conus* sp., *Terebra* sp., peelers/scrapers in *Pinctada margaritifera*, and ornaments/shell money in *Pinctada* sp., *Tridacna* sp., *Trochus* sp., *Conus* sp., *Terebra* sp., and *Cypraea* sp.

Human occupation has had negative effects on the biota of many islands in the Pacific and elsewhere (e.g., Hawaiian Islands, Fiji, New Zealand, Mauritius, Caribbean Islands). When combined with climatic factors such as ecosystem changes can have consequences that are catastrophic for human societies. The Rapa Nui National Park (Chile) World Heritage site is an example of these calamitous consequences. Scientific research on the prehistoric use of Palau's coral reefs has focused on the Rock Islands due to the exceptional preservation conditions of the limestone sediments. Two archaeological sites have fish and shellfish remains which chart human use of marine resources over 3000 years. Midden assemblages from several other sites date to the last 1000 years when stonework villages briefly flourished in the Rock Island prior to the extinction of the village system.

At Uchularois Cave, adjacent to the island of Dmasech, the fish and shellfish remains provide firm evidence for the decline of marine species as a result of human collection practices during the occupation of stonework villages. This is represented by a significant increase in taxa abundance (parrotfishes, Scaridae; leatherjackets, Aluteridae; porcupinefishes, Diodontidae; wrasses, Labridae) concurrent with a decrease in overall fish taxa diversity. The size decrease in the mouth parts of the two most abundant fish species, the large-eyed bream (*Monotaxis grandoculis*) and parrotfish (*Scarus* sp.), indicates that human predation was affecting fish size (Masse et al. 2006). At the Ulong site the size decrease in parrotfish remains shows that the targeting of inshore taxa was impacting the local marine environment over a long period (**Figure 35**). During the stonework village occupation the abundance of fish species taken increased massively, but in contrast to the Uchularois Cave record the diversity of taxa taken also increased at Ulong with pelagic species of fish and shark captured. Taxa diversity reflects the capture strategies and range of marine environments fished indicating that a range of techniques (angling, netting, trapping, spearing, poisoning) and a wide variety of habitats were exploited by stonework village populations (Masse 1984, 1989; Masse et al. 2006; Clark 2005; Rintaro and Clark in press).

The record of shellfish collection from the Rock Islands evidences similar significant change with the depletion of local stocks of meat yielding clams (Tridacnidae) when people first used the Rock Islands 3100 years ago. With the loss through predation of the easily accessible large clams prehistoric people employed an opportunistic collection strategy focused on the collection of a smaller sized but increasingly diverse group of molluscs. The most abundant species in the Uchularois Cave deposit were *Strombus gibberulus*, *Strombus luhuanus*, and *Nerita* spp. Analysis of these remains demonstrated a significant decline in the size of *Strombus gibberulus* pointing to over-harvesting of the species. This species is an excellent indicator of human marine resource use as it is a common inhabitant of intertidal sandy substrates, and protected sand and seagrass flats that are present throughout the RISL.

The important findings from Uchularois Cave are outlined by Masse et al. (2006) below:

“These data, when coupled with the previously discussed analyses of fish remains, offer powerful evidence that portions of the marine inshore environment experienced considerable stress seemingly coincident with the stonework village occupation of the Rock Islands. The Rock Islands shell assemblage may exhibit proof of predation pressure from a growing human population, a natural shift in the local environment, changing climatic conditions, or most likely a combination of these factors. Increasing human predation is a logical component of each of the scenarios. In the early period, fewer people ate fewer crabs and other marine invertebrates. In the later period, more people foraged for food and would have a greater likelihood of finding and consuming molluscs and crabs. With fewer crabs in the local ecosystem mollusc populations would endure fewer attacks. The decrease in shell size late in time indicates that human foragers “overharvested”.

Stonework villages in the Rock Islands were underpinned by the collection of lagoon and coral reef resources. Increase in the size of the human

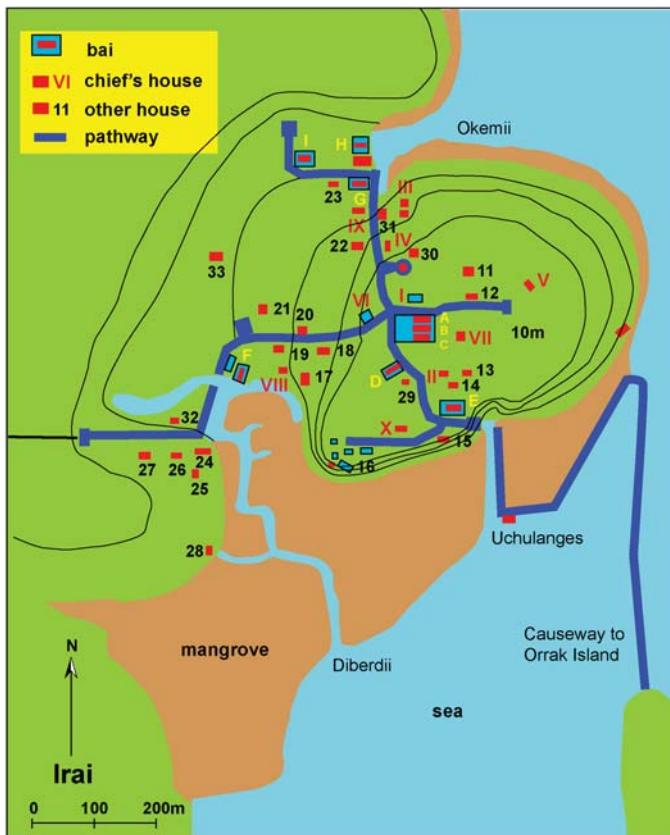


Figure 36. Irai stone work village plan. Clark/Reepmeyer – ANU

population in the Rock Islands placed greater pressure on the marine ecosystem as witnessed by the larger number of fish taken over time and the increasing diversity of marine taxa taken relative to earlier phases. The decline in terrestrial productivity and limited amount of potable water during the LIA made it impossible to sustain permanent occupation, especially when combined with a high frequency of warfare.

3. *Adaptation to a precarious environment* *Comparison with stonework villages on the volcanic islands of Palau*

Stonework villages in the Rock Islands differ substantially from those located on volcanic landscapes in their architecture, spatial layout, and the subsistence/resource strategies of their inhabitants. The differences represent a set of unique human adaptations to the marginal environmental conditions of the Rock Islands.

Stonework villages on the volcanic islands were part of a settlement system consisting of a regional system and a village sphere system (Masse et al.

1982). In the regional system there was a distinct center of socio-political power and authority with a series of lower-ranked villages subordinate to the center. The regional systems (polities) and central places at European contact in the late 18th century correspond roughly with the modern state-system of the Republic of Palau.

On the volcanic islands, stonework villages were usually situated several hundred meters from the shoreline on hill slopes or ridges ranging from 10m to 75m above sea level behind a thick band of coastal mangrove (Snyder and Butler 1990). Small freshwater streams flowing into the valley bottoms were used for community water supply and pond field taro cultivation.

Stonework village features include stone docks, pathways, sitting platforms, walls, burial platforms, meeting house platforms, standing stones, bathing areas, and wells. **Figure 36** shows the layout of Airai Village as recorded in the 19th century, which has features typical of many stonework villages on Babeldaob. The village is organized around a central structure (bai) that is the nucleus of administrative power. The bai is the symbolic expression of the village and the absence of a center post and interior supports symbolizes the unity of the village (Wickler et al. 2005). Associated with the central structure are the houses of high ranking clans/chiefs. Pathways and causeways radiate out from the central area to stone landing docks, gardening areas, and other dwellings. Alongside the paths are house and burial structures and associated activity areas (Morgan 1988). Canoe docks are connected to the sea by tidal channels that are maintained by cutting the dense mangrove forest. Stone uprights, anthropomorphic and natural, are dispersed throughout the village area and are often associated with special function structures such as the bai.

Figure 37 outlines the ground-plan of a stonework village in the Rock Islands based on the Mariar stonework remains on Ngeruktabel Island. The differences between the two sets of stone village remains are outlined below. In summary, the differences indicate that the subsistence economy of the Rock Islands was highly specialized on marine

prescribed ground-plan, as on volcanic islands, but were located according to the constraints of the unpredictable and rugged topography of limestone landscape.

Stone architecture: The stonework remains in the Rock Islands are less formal, smaller in scale, and less diverse than village remains on volcanic islands. Small-to-medium sized terraces and low platforms comprise the majority of stone features in limestone environments and there are relatively few bathing areas, wells, burial areas, stone uprights, canoe docks, or foundations of large community structures such as bai.

Subsistence: Marine food remains are abundant at stonework village sites in the Rock Islands. Starch crops can only be grown in swampy back beach areas and sinkholes in the interior of the limestone environment. Potable water is scarce in the Rock Islands where rainwater percolates through the porous limestone and emerges in small springs and brackish lenses beneath sand plain sediments. While staples grown on volcanic islands could be traded/exchanged to alleviate shortfalls, the stability of the Rock Island subsistence system was limited by the small amount of freshwater and the dependence on wild foods collected from the marine ecosystem.

The cultural landscape is central to national identity as articulated in traditional history, island place names, and the migration-origin stories of the Palauan people.

The exceptional aesthetic qualities of the Rock Islands are matched by the outstanding cultural significance that the islands have for Palauan people. Comparable landscapes that have associated symbolic, cultural, historical, and religious value include Tongariro National Park (New Zealand), Papahānaumokuākea (United States of America), Rapa Nui National Park (Chile), Kakadu National Park (Australia), and Chief Roi Mata's domain (Vanuatu).

Many Paluans believe that they originate from ancestral settlements in the Rock Islands and subsequently moved to Babeldaob. The Rock Islands were formed when the giant Chuab, who created the first village social structure, was burnt. In

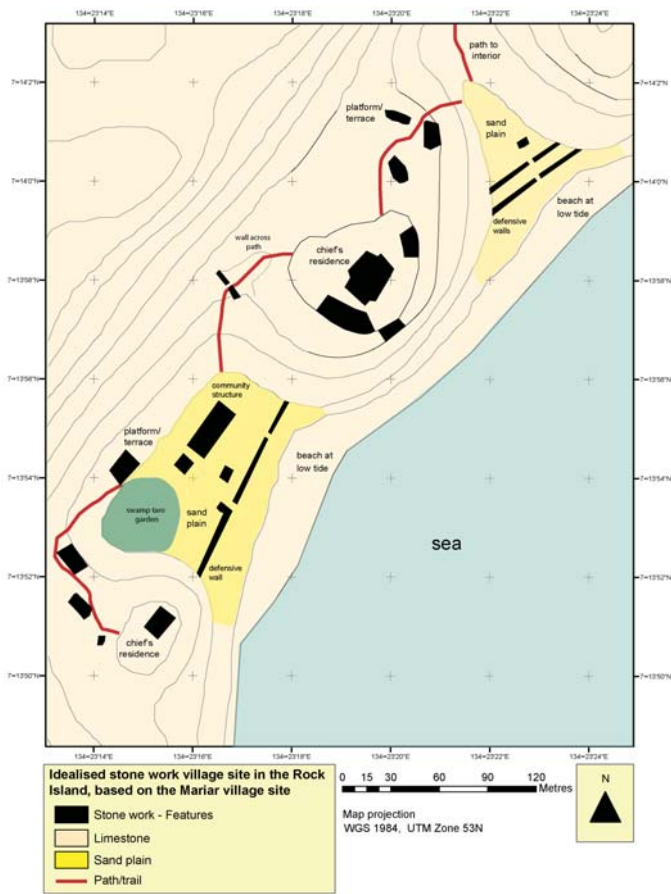


Figure 37. Rock Islands stone work village plan. Clark/Reepmeyer – ANU

foods, while the architectural remains indicate that village social structure was less hierarchical than village systems on volcanic islands.

Defense: Villages located on sand plains in the Rock Islands were exposed to attack from the sea. To counter this threat, defensive walls were built across the seaward side of beach flats. Protective walls guarding trails and paths restricted access to taro gardens in sinkholes and houses/activity areas at higher elevations. On Babeldaob Island the construction of defensive walls was unnecessary as a thick border of coastal mangrove protected stonework villages from seaborne attack.

Central place: On volcanic islands high-status structures were grouped together to form a central place, but on limestone islands chiefly architecture was dispersed with structures built on sand plains, limestone ridge tops, headlands, and interior locations. In general, house platforms and terraces were not organized according to a culturally

falling, Chuab separated Angaur from Peleliu and the giant's body formed all the other islands of the Palau archipelago. Chuab's sibling, Dililebuu, lived on Angaur and named parts of the Rock Islands as she traveled north (e.g., Chesemiich, Iilmalk, Ngebusech in southeast Mecherechar, and Mariar on Ngeruktabel, Nero 1987).

Traditional place names also mention specific cultural sites in the Rock Islands rather than natural landmarks including burial caves, rock art sites, fishing camps, taro gardens, stone money quarries, and ancient village areas. Several sites like the burial cave on Chomedokl Island and rock art site on Ulong Island (Chelechol ra Ulong) are likely to date back 2000 or more years evidencing an ongoing connection between contemporary Palauans and significant ancestral sites. The establishment of permanent stonework villages from AD 1250-1650/1750 is recalled through the retention of place names originating in abandoned village sites. Migrating groups transferred these old place names to their new village sites. Examples include the association of stonework structures on Uchularois Island with the High Chief Uchermelis ('high chief of the Ngemelis Complex'), the transfer of place names from Ngermiich village on Ngeruktabel to Ngerkebesang Island after village relocation, and the retention of stonework village place names at the abandoned village of Metukeruikull (e.g., Bai era Iechell and Iillebai) on Ngeruktabel Island. Relations between the Rock Island villages and with other parts of Palau are remembered in well-known stories including those about Oreng and Osilek on Ulong Island, the defeat of Ulong by Uchelmelis and Terebkul from Peleliu, and the conflict between Koror and the village of Metukeruikull.

The migration history of Palauans is recorded in traditions about the demise of stonework villages like those on Ulong Island and Ngeruktabel Island. After their defeat at the hands of Ngemelis and Peleliu the people of Ulong Island fled to volcanic Ngerkebesang, where the chief of Ulong had forged an alliance. Other Ulong groups split up, some going to the Babeldaob village of Ngeburech near Melekeok, and others to Ngaremlengui. After

a number of years, the Ngaremlengui refugees from Ulong decided to join those at Ngeburech. The large limestone island of Ngeruktabel was depopulated due to warfare with Koror while several Rock Island villages which had assisted Koror were allowed to relocate to Oreor. Both events left tangible remains of their migration in the form of stone remains at former village sites in the Rock Islands and new stone structures on Babeldaob. For instance, because they did not have a sufficiently large money bead to repay their Ngaremlengui hosts for their hospitality, the people of Ulong made payment by repaving the stone paths and platforms of Imeong village prior to leaving for Ngeburech.

An historical connection with ancestral sites in the Rock Islands is also preserved in the retention of chiefly titles brought from the Rock Islands to other parts of Palau. The people of Ngerchemai Village on Oreor used to live in Rock Island villages. After assisting Koror to defeat its enemies in the Rock Islands they were allowed to settle and garden on the fertile volcanic island. The Ngerchemai chiefs kept their former titles preserving the geography of the ancient political structure of the Rock Islands (**Figure 38**). Contemporary cultural activities focusing on the Rock Islands/Southern Lagoon revolve around small-scale fishing and shell fishing, the collection of medicinal and food plants specific to the limestone islands, and hunting coconut crabs and fruit bats. At Oimaderuul Beach on Ngeruktabel Island a stone-lined well has been recently refurbished and swamp taro (*Cyrtosperma chamissonis*) planted in the ancient garden of Ngeremdiu Village. The signage for the site reflects the cultural and natural significance of the Rock Islands to the Palauan people: **“Here remains a symbol of our ancestors’ friendship with nature and neighbours. Not only known for its beauty but also its traditional history and rich culture.”**

Comparative Analysis – Natural Heritage Sites
The Rock Islands Southern Lagoon, while relatively small and found outside of the Coral Triangle, has extremely high diversity within its boundaries. The property is unique as it combines features that are represented in several inscribed sites, such as the

rock island landscape and marine lakes presented in Ha Long Bay, Vietnam, and the diversity of marine habitats found in the Great Barrier Reef of Australia, Lagoons of New Caledonia, Tubbataha Reef in the Philippines, and East Rennell in Solomon Islands. In one visit to the RISL, it is possible to see many species and habitats that are only found collectively at other World Heritage sites, including rock islands, marine lakes, fringing reefs, barrier reefs, patch reef, sand flats, mangroves, seagrass beds, and deep water lagoons, as well as unique marine organisms such as sea turtles, dugongs, manta rays, several species of shark, and endemic terrestrial fauna. Among World Heritage sites with comparable natural heritage features, the RISL and Papahānaumokuākea are the only mixed sites.

As demonstrated in **Table 6**, which is adapted from Table 2 in the IUCN Technical Evaluation of the Lagoons of New Caledonia (IUCN 2008), the RISL of Koror has the highest number of marine lakes among comparable marine sites and among the highest number of fish and corals per unit area. Fish and coral surveys referenced in Table 6 summarized the number of species found in all of Palau, and were not analyzed for the RISL alone when they were prepared. Preliminary data indicate that the numbers of fish and corals in the RISL may be higher than listed in **Table 6**. There may be at least 1,000 species of fish in the RISL (P. Colin, pers. comm.).

Similar areas of karstic islands and marine lakes are found in Vietnam's Ha Long Bay, in the Raja Ampat region of West Papua, and in the Berau region of East Kalimantan in Indonesia. The latter has only four marine lakes within a marine protected area of 11,655km².

Ha Long Bay, only part of which is a World Heritage Site, has 47 marine lakes (S. Patris, pers. comm. 2011) in its World Heritage Site, an area of 150,000ha (WHC Nomination Documentation 2000). Only one marine lake is known to have *Mastigias* jellyfish present, likely the lagoon form thus not a unique subspecies, and even then, only seasonally (Cerrano et al. 2006). The RISL has 52 marine lakes in an area of 85,900ha.

The RISL is comparable to the Ha Long Bay World Heritage Site. The striking difference between the two is the absence of a barrier reef in Vietnam and an extensive barrier reef system in Palau. Within an area of 150,000ha Ha Long Bay contains 400 species of fish while the RISL, with an area of 85,900ha, contains 746 species of fish. Ha Long Bay has a resident fishing community population of 1,600 while the RISL has no resident population. Tourism in Ha Long Bay, with over 1.7 million visitors in 2002, has had major negative impacts on the ecosystem through tourist development and activities (WCMC 2008). The RISL has controlled tourism activity with the maximum number of documented visitors reaching 80,000 in 2007.

In Raja Ampat, there are more than 40 marine lakes in over 50,000km². Recently, marine scientists from the Coral Reef Research Foundation (CRRF) visited 13 of the marine lakes in the central Raja Ampat islands, including Gam and Mansuar. They noted that, compared to Palau's marine lakes, physical diversity was low suggesting less overall diversity in lake types. Most lakes were shallow and well connected to the lagoon, many, appearing to be true marine lakes from satellite photos, were actually coves, and, despite extensive survey, only one meromictic lake (containing no jellyfish) was encountered. Marine lakes also occur in Raja Ampat's northwest (the Wayag Island group) and southeast (Misool Island), and likely on Waigeo Island, however, their numbers are unknown. Within Raja Ampat, the *Mastigias* sp. jellyfish has been identified in only one marine lake thus far (<http://www.misoolecoresort.com/newsAugust2007.html>; Dawson et al. 2009).

Koror State law closes all but one of the RISL's marine lakes to recreational human use in order to deter detrimental human activities, such as fishing and aquaculture development, in them. Thus Palau's marine lakes, still in their pristine condition, remain a natural laboratory for studying evolution. In stark contrast, there is aquaculture development in at least one marine lake in Ha Long Bay (Cerrano et al. 2006) and logging around the perimeter of at least two marine lakes in Raja Ampat (CRRF, pers. comm.).

Table 6. Comparative Analysis of the RISL and other comparable World Heritage Sites

UNESCO World Heritage Property	Total Area (ha)	WH Criteria	Marine Lakes	Bird Species	Fish Species	Coral Species
Rock Islands Southern Lagoon, Palau (Proposed) <small>^{1,2,3,4, 14}</small>	85,900 (94% marine)	iii,v,vii,ix,x	52	56	746	385
Ha Long Bay, Vietnam ^{1,5,15}	150,000 (Percent marine N/A)	i,iii	47	200	400	232
East Rennell, Solomon Islands ^{1,6}	37,000 plus marine	ix	1	43	759 (island Complex)	300 (island Complex)
Lagoons of New Caledonia, France ^{1,6,*}	1,574,300 (100% marine)	vii,viii,ix,x	0	105	1695	510
Great Barrier Reef, Australia ^{1,6,*}	34,870,000 (95% marine)	vii,viii,ix,x	0	242	1500	400
Tubbataha Reef, Phillipines ^{1,6}	33,200 (99% marine)	vii,ix,x	0	46	441	396
Shark Bay, Western Australia ^{1,6,7,8,*}	2,197,300 (70% marine)	vii,viii,ix,x	0	230	323	95
Belize Barrier Reef, Belize ^{1,6,*}	96,300 (50% marine)	vii,ix,x	0	187	500	100
Cocos National Park, Costa Rica ^{1,6,*}	199,970 (97% marine)	ix, x	0	87	300	32
Phoenix Islands, Kiribati ^{1,9,*}	40,825,000 (Percent marine N/A)	vii, ix	0	44	500	200
Galapagos Islands, Ecuador ^{1,6,*}	14,066,514 (95% marine)	vii,viii,ix,x	0	57	460	120
Sian Ka'an, Mexico ^{1,6,*}	528,000 (23% marine)	vii,x	0	339	175	83
Coiba National Park, Panama ^{1,6,10,*}	270,125 (50% marine)	ix,x	0	147	760	58
Aldabra Atoll, Seychelles ^{1,6,11,*}	35,000 (41% marine)	vii,ix,x	0	65	287	210
Soctora, Yemen ^{1,6, 12,*}	410,460 (32% marine)	x	0	192	730	283
Papahānaumokuākea, USA ^{1,13,*}	36,207,499 (99% marine)	iii,vi,viii,ix,x	0	68	258	57

1. Coral Reef Research Foundation 2010

2. Pratt and Etpison 2008

3. Winterbottom 2004

4. Maragos 1994

5. United Nations Environment Programme, World Heritage Monitoring Centre 2008

6. IUCN Technical Evaluation: The Lagoons of New Caledonia: Reef diversity and associated ecosystems (France)_id no.1115

7. Data obtained from Shark Bay Information site at: <http://www.sharkbay.org>

8. Data obtained from UNESCO World Heritage List nomination dossier for Shark Bay, Australia

9. Data obtained from UNESCO World Heritage List nomination dossier for the Phoenix Islands, Kiribati

10. Data obtained from UNESCO World Heritage List brief description of Coriba National Park

11. Data obtained from UNESCO World Heritage List brief description of Aldabra Atoll, Seychelles

12. Data obtained from UNESCO World Heritage List brief description of Soctora, Yemen

13. Data obtained from UNESCO World Heritage List nomination dossier for Papahānaumokuākea, USA

14. Michael N. Dawson, personal communication, 2010

15. Sharon Patris, personal communication, 2011

* Based on the definition of a lake as "small bodies of seawater entirely surrounded by land" (Dawson and Hamner 2005), no marine lakes were identified for these sites.

2010). While Ha Long Bay and Raja Ampat boast abundant marine lakes in large areas, the RISL, in its area of 859km², has the highest density, most diverse collection, and best documented marine lakes (e.g., Hamner and Hauri 1981; Hamner 1982; Hamner et al. 1982; Hamner and Hamner 1998; Dawson and Hamner 2003; Dawson and Hamner 2005; Dawson 2005a; Martin et al. 2005; Patris et al. 2010).

The size of the Rock Islands Southern Lagoon area of Koror State is smaller (85,900ha) than the Great Barrier Reef (34,870,000ha) but its marine species richness is comparable. The Property has some of the most diverse marine environments packed into a relatively small area (Golbuu 2000).

Other World Heritage-listed properties such as Aldabra, East Rennell, and Henderson Islands are raised atolls. Of all these sites only East Rennell has a brackish water lake. This lake, the largest body of enclosed water in the insular Pacific, had far fewer endemic species than the lakes in the RISL (Hamilton-Smith 2007).

The Rock Islands Southern Lagoon is considered one of the most diverse and intact coral reef areas in Palau and in Micronesia. Overfishing of selected customary fish and invertebrate species is a concern within the RISL, but fish and invertebrate populations are still in good condition. The population of Palau is relatively small (ca. 20,000), therefore anthropogenic pressure on harvesting of marine resources is probably lower than other existing marine sites on the World Heritage List. Moreover, since the relatively small RISL is owned and managed by a single State Government, its management has fewer constraints compared to the Great Barrier Reef and the Lagoons of New Caledonia. Furthermore, a recent study by Wolanski and De'ath (2005) indicates that the health of the Great Barrier Reef has been negatively impacted by land-use which has resulted in the input of nutrients and fine sediment. Mining in New Caledonia is a threat to the lagoons, and has resulted in the introduction of terrigenous materials to the coral reef (Fernandez et al. 2006).

3.d Authenticity and/or Integrity

Cultural Sites

The network of Rock Island village remains dating to AD 1200-1650 consist of stonework architecture and subsurface deposits that are substantially intact. The village sites are integral to Palau's traditional history and comprise a significant archive of cultural and scientific information that details the delicate relationship between people and the climate-ecosystem in a marginal environment. The excellent preservation conditions on limestone islands have maintained a range of sites not found elsewhere in the archipelago, including human burial sites, rock art, stone money quarries, and cultural deposits dating back 3000 years.

Several factors have impacted parts of prehistoric sites, but the majority of Rock Islands, particularly those south of Malakal, are relatively pristine not having experienced modern residential or commercial development. The islands today are typically visited only for short periods by both Palauans and tourists. The nearby volcanic islands function as the population and visitor hubs for these Rock Island excursions. Those islands which have well-known natural attractions (Jellyfish Lake on Mecherchar) or are associated with internationally known dive sites (Ulong Channel, Blue Hole) are likely to have higher visitor numbers and potentially greater impacts on their cultural sites.

Major barriers to future development of the limestone islands are the scarcity of drinking water, the small number of locations suitable for construction and infrastructure projects, and Koror State's comprehensive management plan which controls the number of tourists or visitors entering the RISL and their activities. The Koror State Legislature has zoned all of the Rock Islands as a "Conservation" Zone (Koror State Public Law No. K6-100B-99). More recently, the passage of Koror State Public Law No. K9-222-2010 prohibits any permanent construction or development in the Rock Islands (other than tourist related

Table 7. Chiefly titles and associated islands.

Chiefly title	Rank	Islands
Iechaderchemai	1st	Mecherechar, Ngchelobel, Ngorblobang, Ngermeaus, Ngeruktabel (Mariar, Ngchus, Ngermiich)
Obechad	2nd	Ngerchong (half), Ngemelis, Ngerukeuid, Ngercheu, Ngedebus
Ucherchouar	3rd	Beluuchouar, Metukercheuas (southern Mecherchar)
Eriu	4th	Ngerchong (half), Babelomekang, Eoulomekang

facilities). Any change to the existing Southern Lagoon management has the potential to increase development in the Rock Islands either through island-specific commercial projects or by the creeping penetration of modernity from populated areas adjacent to the proposed Property boundary.

Since the end of WWII, sparse intervention at Rock Island sites includes infrequent placement of information signage, construction of low-impact visitor structures, and occasional vegetation clearance at several accessible locations. Archaeological investigations have removed artifacts and food remains from sites on Ngeruktabel, Ngeanges, Dmasech, Uchularois, and Ulong. Excavation units were infilled and the cultural materials are curated at the Belau National Museum (BNM), Southern Illinois University (SIU), and Australian National University (ANU). Tourist operators report that, while most prehistoric Rock Island sites have not been deliberately targeted for their remains, two site types—burial caves/chambers and Yapese stone money quarries—have occasionally been looted. Residents and tourists have removed intact traditional pottery vessels and shell artifacts from burial caves and pieces of stone money from Yapese quarry sites. Anecdotal sources indicate that some souveniring of historic WWII items occurs in the RISL. Sensitive burial caves and fragile rock art sites were visited by tourists in the past, but this practice has been discouraged by Koror State and Koror’s traditional chiefs. There is currently no commercial market for prehistoric items such as the adzes, shell ornaments, and traditional pottery that are commonly found in the Rock Islands.

Cultural Sites: Authenticity

The relict landscape of stonework villages in the Rock Islands is a highly authentic example of an extinct settlement system. As demonstrated by historical, traditional, and archaeological records, the Rock Island stonework structures and settlements date to the pre-European era. An early survey map of Palau made in 1792 by Captain John McCluer did not report any villages in the RISL, and in 1783 the crew of the *Antelope* noted that only one Rock Island was settled. Described as lying between Ulong and Peleliu, the island is most likely Ngercheu (Carp Island), but could be an island in the Ngemelis Complex, which traditions say was occupied by survivors from Ngeruangel atoll around AD 1700. Radiocarbon dating of stonework villages shows widespread occupation after AD 1000 with declining human settlement and final island abandonment around AD 1650-1750.

Traditional history substantiates the authenticity of a unique prehistoric settlement pattern made up of individual stonework villages that were ranked within a larger regional system and headed by a high-status village led by the paramount chief. The structure of this ancient socio-political pattern was preserved during the migration of the Rock Island residents to the volcanic islands. For example, when the inhabitants of the Rock Island village of Ngerchemai were allowed to settle on Oreor in exchange for their assistance in helping Koror to overcome Ngeruktabel Island, the Ngerchemai chiefs kept their titles and relative rank (**Table 7; Figure 38**).

The regional system was hierarchical with lower ranked villages owing tribute and allegiance to the paramount village (*Klou el beluu*). Demands from the

head village for food, artifacts, women, and weapons from subject villages were a constant source of inter-group friction. The defensive aspect of Rock Island villages can be seen in the strategic placement of stone walls across beaches and trails leading to inhabited areas, the difficulty in accessing platforms and terraces deliberately positioned high up in the karstic terrain, and the frequency of observation points on high ridges and peaks. These structures highlight the presence of endemic conflict. The formation of ranked multi-village units in the Rock Islands allowed communities to make full use of the widespread marine resources within the RISL and to defend their settlements when attacked by another district polity (*renge*).

The socio-political arrangement of the stonework village system clearly illustrates the environmental and cultural tensions faced by people living in a marginal environment. The political hierarchy of villages bound the communities together so that the subsistence and defensive needs of dispersed communities could be met. Episodes of water and food shortage as a result of drought, the over-harvesting of natural foods, population increase, warfare, and mounting tribute demands, however, produced instability in the regional system eventually resulting in high rates of migration out of the Rock Islands.

In addition to the stonework villages on Ulong, Ngemelis, Ngeruktabel, Ngeanges, and Mecherechar, significant Rock Islands sites with a high degree of authenticity include a major rock art complex and an AD 1783 culture contact site on Ulong Island, prehistoric burial caves, and Yapese stone money quarries.

Cultural Sites: Integrity

A variety of human and natural factors have influenced the integrity of prehistoric sites in the Rock Islands over different time scales. Comparison of detailed site survey records made in the 1980s by the SIU investigations (Masse et al. 1982; Masse 1984) with information collected by ANU archaeologists in 2010 for this World Heritage nomination dossier provides an almost three-decade long dataset about the major factors affecting site integrity in the Rock Islands. Overall, prehistoric sites on sand plains, where coastal erosion and human activity have been greatest, display less integrity than cultural sites located in the rugged limestone terrain that lie out of reach of the sea and which are less visited by people.

Specific factors resulting in negative impacts to the sites include tree growth and collapse, microbiological and organic activity, megapode nests, land crabs, wave action, tourist-visitor facilities, vandalism, short-term recreational use, and WWII defensive features. Prominent results of the impacts are the loss of structural integrity of the stonework features and the mixing and deflation of stratified cultural deposits.

Tree growth and collapse

Large tropical trees and shrubs generally have a life-span of less than 100 years. The roots of common coastal species such as *Calophyllum inophyllum* (btaches), *Barringtonia asiatica* (bdουλ), and *Artocarpus mariannensis* (chebiei) infiltrate stonework structures and soft sediments containing prehistoric deposits. Growth of the infiltrating tree leads to structure displacement and deterioration. Over several hundred years the cycle of tree growth, death, and collapse displaces large amounts of prehistoric material that is held in the root mass.

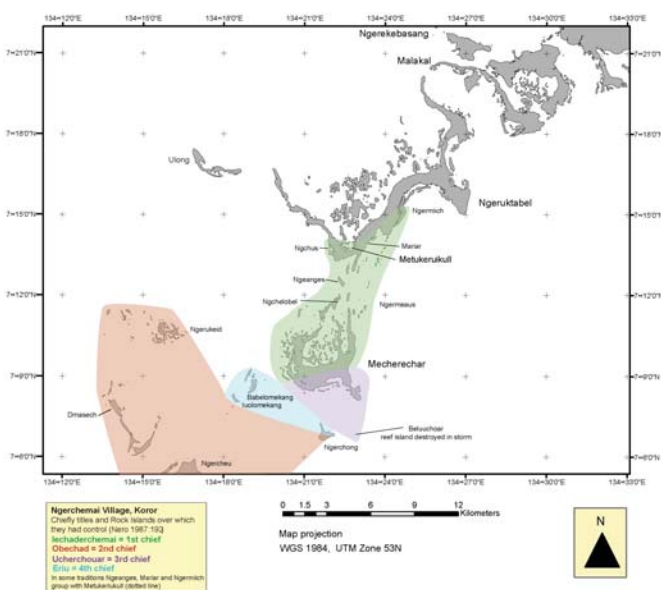


Figure 38. Ancient Rock Island titles and islands. Clark/Reepmeyer – ANU

Microbiological and organic activity

Rock art on sheltered or exposed limestone is subject to biodeterioration due to bacteria, fungi, algae, and lichens. These organisms alter the composition of the substrate and chemically erode both it and the prehistoric art. The organic humic acids formed during the breakdown of vegetation chemically erode calcium carbonate. Organic acids are produced in shallow subsurface contexts containing large amounts of late prehistoric marine shellfish remains. Over time these acids can dissolve substantial parts of these shellfish assemblages.

Megapode nests

The Micronesian megapode (*Megapodius laperouse senex*) is commonly found on several Rock Islands nesting on sand plains that contain prehistoric deposits. The megapode builds large mound nests of sand and forest litter that use heat generated by the decomposing vegetation to incubate their eggs. Nest mounds can reach large dimensions (mean size=6.2m x 7.3m x 1.1m) and incorporate a substantial number of prehistoric artifacts (Wiles and Conry 2001).

Land crabs

Land crabs commonly burrow through moist sand plain sediments, especially in the Rock Islands where there is no resident human population to control their number. The actions of these crabs over long periods redistribute smaller cultural remains through the sediment column.

Wave action

Wave action on sea and coastal prehistoric sites causes degradation to humanly constructed structures and the displacement or removal of cultural and natural deposits. The effects of wave action have been enhanced in Palau as the archipelago is subsiding at a reasonable rate (0.6mm/year). Past and present wave surges (higher than average tides), changing sea levels, and tropical storms have negatively impacted prehistoric sites. Wave wash during severe storms typically follows the interface between the island bedrock substrate and the sand plain and can redeposit prehistoric remains. Located close to the sea, traditional stone features related to canoeing or fishing—stone docks, piers, resting platforms,

and canoe houses—are at heightened risk from the destructive effects of wave action.

The combination of island subsidence and rising sea levels from global warming has the potential to destroy many significant Rock Island cultural properties. Those sites most at threat should be monitored, and investigated if inundation appears likely to ensure their valuable data is not lost.

Visitor facilities

Visitor facilities are often located adjacent to prehistoric remains, particularly stonework villages, due to the limited availability (past and present) of suitable shoreline access points. Some historically constructed shelters and amenity facilities have disturbed or destroyed traditional features by incorporating stones from or disassembling the ancient stonework. Construction often results in uncovering midden deposits and prehistoric human remains (Masse et al. 1982).

Fossicking, vandalism and graffiti

Most prehistoric sites show evidence of visitors causing some damage through fossicking or vandalism. Subsurface cultural deposits and stonework features have not apparently been deliberately targeted but artifacts have been removed from limestone caves and Yapese stone money sites.

Short-term camps/visits

The Rock Islands are extensively visited for fishing and recreation by Palauans and tourists. The building of short-term, temporary fireplaces and other camp structures commonly makes use of stone found in nearby traditional features and the digging of toilets, rubbish pits, and post holes has displaced sediments with prehistoric materials.

WWII Japanese defenses

During, and prior to, World War II there was substantial Japanese activity in the Rock Islands, especially on Ngeruktabel Island, in the form of offensive gun positions, roads, temporary and permanent shelters, lookout positions, lighthouses, and defensive bunkers and earth positions. Although Japanese construction created an important historical

landscape representing the major global conflict of the 20th century, it also impacted the integrity of several prehistoric sites.

Natural Heritage: Integrity

The RISL includes a healthy and diverse terrestrial ecosystem that includes limestone forests, strand forests, mangroves, and hundreds of species of terrestrial flora and fauna. All of Palau's endemic bird species are found with the RISL as well as the critically endangered *Ponapea* palm. Limited access due to steep, often vertical, slopes and rugged terrain has resulted in the RISL's limestone forests being one of the least disturbed forests in the Pacific. Impacts to the RISL's terrestrial ecosystems are reduced by strict regulations on the harvesting of trees (only for cultural and traditional purposes) and permit requirements for collection of terrestrial specimens. Marine habitats and organisms are well represented and other than loss during ENSO events, there have been no other antropogenically-influenced habitat losses in the RISL.

The complete closure of the Ngerukewid Island Wildlife Preserve maintains the integrity of its natural ecosystems. Coral reefs in the RISL have showed more rapid recovery after intense bleaching events in 1998 than other areas in Palau (Golbuu, Fabricius et al. 2007). This indicates that the system has retained its natural resilience despite human use.

The Property operates under the Rock Islands Southern Lagoon Area Management Plan 2004-2008, which is currently being revised. Koror State has committed to regular revisions to maintain its resources and be able to respond to new threats.

The RISL is considered one of the underwater wonders of the world. Ninety percent of dive sites in Palau are in the RISL of Koror. Visitors to Palau have grown from over 50,000 in 2000 to over 70,000 in 2009. As detailed in Section 5.h, these tourists visit a multiple of destinations in the RISL. The current management strategy limits visitors to a small number of delineated areas within the RISL. This enables the management team to effectively monitor and adapt management activities.



Figure 39. Dmasech Island megapode nest in archaeological site. Photo Clark/Reepmeyer – ANU



Figure 40. Little Mariar effect of tree collapse on stone wall feature. Photo Clark/Reepmeyer – ANU

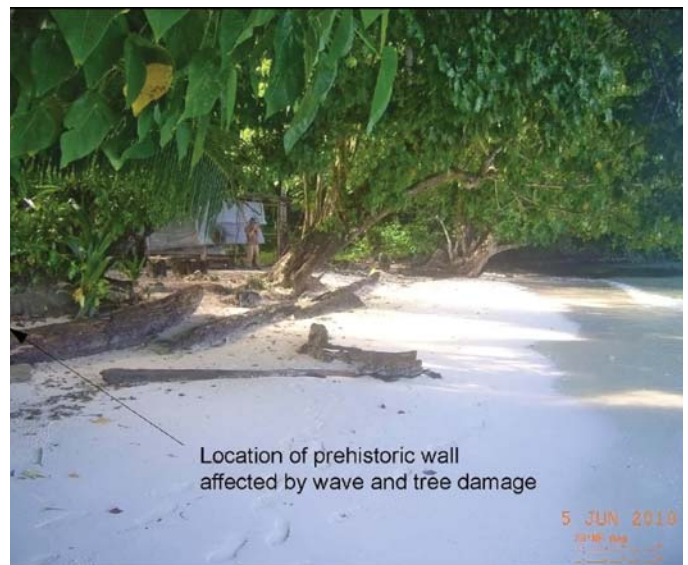


Figure 41. Little Mariar wave impact on prehistoric stone wall. Photo Clark/Reepmeyer – ANU

4a. State of Conservation

The RISL is well managed to keep its cultural and natural heritage in a near pristine state. The RISL is managed according to the Rock Islands Southern Lagoon Area Management Plan 2004-2008, first passed in 2005 and currently under review. Several factors contribute to the RISL's superb conservation state:

1. A comprehensive Management Plan that is certified by law and which has community support;
2. Strict regulatory protection at the national, state, and traditional levels that prohibit or limit taking of key species;
3. No permanent inhabitants and only short-term visitors;
4. The knowledge that RISL tourism is key to Palau's economy.

Present state of Cultural Heritage Conservation

The 2010 survey examined several archaeological sites in the Rock Islands, adding to the initial survey data collected in 2009. The sites visited include stonework villages, Yapese stone money quarries, a burial cave, and a rock art site. A variety of human and natural factors has influenced the preservation of Rock Island prehistoric sites. Specific examples of these impacts as recorded in field survey are summarized below.

Many prehistoric sites in the RISL have yet to be documented. A complete inventory of cultural sites is a priority for the Rock Islands. The 2010 survey showed that the overall preservation of prehistoric sites was generally lower on the sand plains, where coastal erosion and human activity have been the greatest, compared to sites and features in limestone terrain that lie out of reach of the sea and are less visited.

Dmasech and Uchularois

On Dmasech Island the stonework village features display substantial variation in their preservation. Stone features on the eastern beach flat are poorly preserved compared to stone features on the ridgeline. Exceptions are the large F-5A and F-18 features at Beluu Ngemelis (**Figure 13**).

There were several megapode mounds containing archaeological remains of pottery and food shell on the sand plain east of the limestone ridge (**Figure 39**). The depth to which megapodes have disturbed the subsurface cultural deposits is not known.

Several stone features and midden remains on the beach flat of Uchularois Island were removed during the construction of the tourist/visitor structure in the 1970s and 1980s. Extensive deposits of marine shell and pottery recorded around the base of Uchularois in the 1950s (Osborne 1966) had almost entirely disappeared by wave action in 2010 with only a few water-rolled pot sherds present in the intertidal zone.

Ngeruktabel

An extensive set of stone features on the ridgeline southeast of Oimaderuul recorded by Snyder (1985) could not be located or identified in 2010. The only features encountered were several terraces and stone platforms on the south slopes and ridge tops. These features appeared to have been disturbed by the extensive Japanese WWII defensive positions covering the ridge overlooking the beach. The intermingling of Japanese and Palauan stone features can be separated into appropriate time periods when the structures are clearly of WWII vintage as with many circular or 'C-shaped' features roofed with corrugated iron. What is less evident



Figure 42. Ulong Island graffiti on rock art.
Photo Clark/Reepmeyer – ANU

is whether Japanese activity substantially modified parts of prehistoric sites by using ancient stonework to construct defenses. In the 1980s, human remains were found in a toilet block excavation on Oimaderuul Beach. Megapode mounds have disturbed prehistoric deposits on the sand plain as have land crabs in moist back beach areas.

The preservation of stone structures on both Mariar beach flats is poor compared to the structural remains located on limestone slopes and ridges. The defensive stone wall on Big Mariar beach has been impacted by tree growth and decay which has collapsed sections of the wall and reduced its height.



Figure 43. Ulong Island rock art covered by algae mat.
Photo Clark/Reepmeyer – ANU

In the 1980s sections of the wall were measured at almost 2m high, but in 2010 the maximum height was only 1.1-1.2m. Stones from the defensive wall have been used by recent visitors taken to make cooking hearths. On Little Mariar beach, two parallel defensive walls were recorded on the sand plain in the 1980s. The landward defensive wall had completely disappeared in 2010 as had most of the accompanying recorded stone platforms and other features. The second defensive wall on the beach berm in front of the steeply shelving beach has almost completely disappeared due to wave erosion and tree damage (Figure 40). When the roots of the large strandline taxa (e.g., *Calophyllum inophyllum*, btaches) growing on the wall become undermined by storm waves the trees collapse depositing the displaced stone on the steep beach where they are removed by wave action (Figure 41). A kitchen-cooking area in the temporary camp structure recorded in 2010 appears to be made from stones collected from nearby prehistoric features.

Ulong

The prehistoric sites on Ulong Island are generally well preserved. The main feature of the stonework village, the defensive stone wall, has substantially intact sections in the north and just south of the first entrance. Much of the cultural deposit on the beach flat remains intact due to the distance from the sea and the location of the visitor area some 200m north of the stonework village site. However, humic acids have eroded shellfish remains from

the surface and upper levels of the site. Nearby megapode mounds contain archaeological pottery and food shell from the village site. The depth to which megapodes have disturbed the subsurface cultural deposit is unknown.

The major rock art site on Ulong Island is partly destroyed by graffiti. Incised or painted directly onto the prehistoric red-painted art, the graffiti consists mainly of the names and dates of visitors (**Figure 42**). According to local informants, the cultural significance of the art site is not always recognized by visitors and tour guides. Continued unrestricted access is likely to result in further degradation to this significant rock art site. Rock art in a cave on Ulong Island has been partially covered by a moist mat of algae (**Figure 43**).

Ngeanges

Archaeological features on Ngeanges Island have been impacted by recent human activities and affected by WWII bombing/shelling. On the beach flat are recent occupational remains including a poorly preserved visitor's shelter and long drop toilet and piles of rubbish and used building materials. A possible Yapese stone money quarry and stonework features on the southern limestone outcrop appear to be mixed with Japanese defensive positions. Several bomb fragments were found in excavation units and

a large bomb crater was recorded on the beach flat. Dense midden deposits around the base of Ngeanges' limestone outcrops are partially disturbed by land crab activity. Shallow, wide rubbish pits excavated into the beach sediments have displaced prehistoric remains.

Present State of Conservation – Natural Heritage Habitat trends

Coastal habitats in Palau, including within the RISL have been mapped (Idip et al. 2007; Collins, pers. comm. (see box “A visit with a visiting researcher”). Individual zones were mapped at a scale of 1:80,000. Baseline maps indicate the square area across six classes:

1. Algae
2. Coral
3. Sand
4. Carbonate
5. Seagrass
6. Mud

Total values for reefs and mangroves for Koror State (**Table 8**) were analyzed by Yukihiro et al. (2007) using information from Maragos et al. (1994). Additional data is required to exclude the inhabited sections of Koror State that are not proposed for inscription under the World Heritage Convention. The Palau Conservation Society (PCS

Table 8. Area of mangrove and reef in Koror State*

State	Mangrove	Fringing reef	Lagoon and passes			Barrier Reefs		Reef Holes	Islands
	km ²	km ²	km ²	km	# patch reefs	km ²	Km	#	#
Koror	1.6	19.2	500.0	112.8	683	100.0	86.4	100	491

* Additional research is needed to determine values for the RISL alone.

Table 9. Substrate percent cover at Ngemelis Island Complex

Location and Depth	Percent Cover									
	Hard Coral	Rock	Soft Coral	Sponge	Fleshy	Seaweed	Sand	Silt/Clay	Other	Bleached Coral
Rubble Big Drop Off 30ft	25.00	15.88	17.65	27.57	10.66	0.59	0.07	1.69	0.07	0.07
Big Drop Off 50ft	25.91	15.00	22.05	22.95	9.20	0.91	0.00	2.27	0.11	0.34
Blue Corner SE 30ft	42.75	24.75	12.50	14.08	2.25	0.42	0.08	1.58	0.08	1.50
Blue Corner SE 50ft	34.20	14.89	17.84	17.73	4.32	2.27	0.00	1.59	0.23	6.93
Blue Hole North 30ft	36.75	38.00	10.83	10.00	2.83	0.00	0.00	1.08	0.50	0.00
Blue Hole North 50ft	32.08	18.44	15.52	15.00	15.83	0.42	0.00	2.19	0.21	0.31
Turtle Corner 30ft	40.58	30.33	12.42	12.25	1.00	0.33	0.00	2.08	0.25	0.67
Turtle Corner 50ft	33.27	20.58	21.92	18.17	1.63	0.67	0.10	2.50	0.10	1.06
Virgin Hole 30ft	36.03	30.59	12.28	18.24	0.59	0.15	0.07	1.47	0.29	0.22
Virgin Hole 50ft	37.73	22.16	13.30	19.89	3.18	0.45	0.00	1.93	0.00	1.36



Ngemelis Island Complex. Photo by Patrick Colin.

2003) conducted a baseline survey of the Ngemelis Complex's outer reef, recording the percent cover of substrate in ten categories (**Table 9**).

The Palau Automated Land and Resource Information System (PALARIS) maintains IKONOS imagery, limited LIDAR imagery, and other satellite imagery. With additional analysis, trends in terrestrial land cover can be estimated. Much of the Rock Island forest was stressed during a severe drought associated with the 1998 ENSO event. Permanent monitoring sites for the forest is needed to determine loss or changes in biodiversity during extreme climate events.

Species trends

Coral

Across all reef types, coral cover declined from 50 to 70 percent in 1992 (Maragos et al. 1994; Maragos and Cook 1995) to 14 to 23 percent in 2001. Compared to other sites in Palau, fringing and barrier reefs in the RISL had higher coral cover (37 to 41 percent) than all other sites (Golbuu,

Victor et al. 2007). Corals in the RISL appear to be recovering more quickly from the 1998 bleaching event than other areas in Palau.

Compared to other sites in Palau, increase in coral cover between 2001 and 2004 was greatest on fringing reefs in the RISL. Coral recruitment rates between 2001 and 2004 had a mean of $8.1 + 0.4$ recruits/m², the highest recruitment rate of sites surveyed in Palau (Golbuu, Victor et al. 2007).

Fish, Sharks, and Marine Invertebrates

Fishermen's perceptions and limited data show that some populations of customary fish species continue to decline (Matthews 2004). Long-term monitoring at the Ngerumekaol Conservation Area, a spawning aggregation site for groupers, shows that fish populations are stable compared with other non-protected spawning sites in Palau. Current monitoring at different sites in the RISL indicates that selected fish populations at the monitoring sites are stable (Marino et al. 2008). Winterbottom (2004, unpub.) produced a list of fish species in

the RISL. The Palau Conservation Society (PCS 2003) surveyed certain species of fish, sharks, and invertebrates at two different depths on the fringing reefs of the Ngemelis Complex (**Table 10**). Closed marine protected areas that were established in hopes of helping fish populations to rebound show positive signs of increasing fish abundance but the spillover effects have yet to be demonstrated (PICRC unpub). There is evidence of poaching in closed sites (Matthews 2004).

Reptiles

The Palau Conservation Society (PCS 2003) surveyed sea turtles on the Ngemelis Complex fringing reef (**Table 10**). There is local concern about turtle harvesting and socioeconomic studies indicate that turtle populations are declining, that their average size is decreasing, and that there is less successful nesting than in the past (PCS 2002). In 2003, a major national education campaign targeted sea turtle conservation. A current “Turtle Friendly Campaign” recognizes shops and restaurants that pledge to refrain from selling turtle products. The commercial establishments display stickers promoting their turtle-free status. In December 2010, Palau’s National Congress passed legislation placing a 5-year moratorium on harvesting of Hawksbill sea turtles.

A 2003 survey of crocodiles estimated the population to be 500 to 750 non-hatchling individuals (Brazaitis et al. 2003). A national management plan was developed for the protection and management of crocodiles and their habitat that includes the RISL.

Mammals

In a September 2007 survey, 24 dugongs (16 adults and 8 calves) were spotted around and in the RISL (Kitalong Hillman et al. 2008). During 2009-2010, three dugong were found dead in the RISL, presumably incidental deaths due to illegal fishing practices. Dugongs have played an important cultural role in Palauan society. In the past they were hunted for their meat and bones, used in ceremonies, used to indicate status, and to make jewelry. However, in a 2003 survey a large

Table 10. Range of average number of fish and turtles per transect at Ngemelis Island Complex

Species	#/transect at 30ft	#/transect at 50ft
Bluefin trevally	0.9 - 2.6	1.2 - 2.5
Humphead wrasse	0.3 - 0.7	0.25 - 0.7
Humpback Snapper	1.0 - 32.0	1.0 - 10.0
Complexers (8 sp.)	0.2 - 1.45	0.2 - 1.6
Bignosed Surgeonfish	6.5 - 13.0	5.0 - 8.0
Moorish Idol	3.8 - 11.0	2.0 - 6.0
Bumphead Parrotfish	0.1 - 7.0	0.9 - 4.0
Sharks (3 sp)	0.05 - 0.55	0 - 1.3
<i>Tridacna crocea</i>	0.1 - 1.5	0 - 0.26
<i>T. squamosa</i> & <i>T. maxima</i>	0 - 2.6	0 - 0.35
Green Sea Turtles	0.15 - 0.3	0.15 - 0.7
Hawksbill Sea Turtles	0.1 - 0.4	0.1 - 0.3

majority of respondents indicated that the cultural significance of the dugong is diminishing, which may be leading to decreased dugong hunting. Poaching remains a problem, although harming a dugong is severely punished with a fine of US\$10,000 for the first offense. Private, community, and non-profit groups worked together to promote 2010 as the Year of the Dugong. Education and research activities continue to as part of an ongoing campaign to protect dugongs.

Fruit bat populations appeared to have increased significantly between 1991 and 2005 (Wiles unpub.).

Birds

VanderWerf (2007) reported declines for most birds surveyed in the RISL between 1991 and 2005 (**Table 11**). Number of birds observed and birds-per-station were recorded. One notable exception was the Nicobar Pigeon, which had a significant increase in the RISL, despite global declines elsewhere. One postulate for the overall decline is that most birds in Palau rely on forest habitat. The 1998 ENSO event and severe drought caused defoliation and stress to many of the Rock Island’s trees. Although the vegetation has recovered, it is possible that bird populations have not recovered to the baseline numbers. In 2010 the President of Palau signed a Presidential Proclamation mandating



Nicobar pigeon Laib

© Mandy Etison

Table 11. Trends in bird populations, RISL compared to Palau as a whole (1991 to 2005)

Species	Average #Birds/ Station		Trend (1991 to 2005)	
	2005	1991	RISL	Palau
Micronesian Megapode	0.09	0.2	↓	NC
Brown Noddy	0.48	6.06	↓	↓
Black Noddy	1.79	8.5	↓	↓
Palau Fruit Dove	2.7	8.24	↓	↓
Micronesian Pigeon	1.06	3.26	↓	↓
Collared Kingfisher	0.31	0.37	↓	NC
Rusty-capped Kingfisher	0.04	0.26	↓	NC
Cicadabird	0.19	0.28	↓	NC
Palau Flycatcher	0.96	2.57	↓	NC
Palau Fantail	0.39	1.08	↓	NC
Palau Bush Warbler	1.09	3.32	↓	NC
Micronesian Starling	1.65	4.21	↓	↓
Caroline Islands White Eye	1.3	3.89	↓	↓
Dusky White Eye	1.41	3.87	↓	↓
Giant White Eye	0.49	1.48	↓	NC
Bridled Tern	0.15	0.033	↑	NC
Nicobar Pigeon	1	0.61	↑	↑
White-tailed Tropicbird	0.62	0.59	NC	NC
Black-naped Tern	0.42	0.44	NC	NC
Palau Swiftlet	1.06	1.28	NC	NC
Morningbird	0.28	0.31	NC	↓
Micronesian Honeyeater	0.96	1.2	NC	↑

↑ Increase; ↓ Decrease; NC No change

national bird monitoring. The Belau National Museum will carry out yearly surveys, including in the RISL, and produce a yearly State of the Birds report. Two introduced birds, the Sulfur-crested Cockatoo and Eclectus Parrot declined between 1991 and 2005 (VanderWerf 2007). Most birds are protected by National Law, although poaching of Micronesian Pigeons does occur. Poaching of the pigeon is likely less frequent in the RISL, due to the expense of obtaining a boat and fuel to reach the Rock Islands.

Plants

The critically endangered endemic *Ponapea palauensis* is only known in three sites of which two are within the Property. Twenty DNA samples were taken from the plants at these sites (Lewis et al. 2008). The plants appear to be threatened by invasive species. In 2008, there was considerable damage to the leaves of *P. palauensis* in one site within the RISL presumably by the introduced Sulfur-crested Cockatoo. In 2009 further damage was observed including insect damage (Kitalong, pers comm. 2010).



Juvenile fish within seagrass bed. Photo by Ann Kitalong.

4b. Factors affecting the Property



Divers. Photo by Paul Collins.



Fishing boats. Photo by Ron Leidich.

Development pressures

Cultural and environmental heritage is of paramount importance to the Republic of Palau, as is continued economic diversification and the development of sustainable tourism. Under the Rock Islands Southern Lagoon Area Management Plan 2004-2008, Koror State is responsible for the resource base of tourism in the Rock Islands. At the national level, the Ministry of Natural Resources, Environment, and Tourism has oversight over resource management.

In recent years Palau's tourist numbers have quadrupled from a little over 20,000 to more than 80,000. In 2007 tourists were largely from Asia (Taiwan 33%, Japan 33%, Korea 16%) with far fewer from the U.S. (7%), Micronesia-Guam (3%), and the Philippines (2%). The average length of visitor stay was 4.1 days. The major attraction is diving and snorkeling in the RISL with the Rock Islands regularly ranked in the top three dive destinations in the world. To help manage the high volume of visitors, Legislation (K8-180-2007) was passed in 2007 for a 'Rock Island Use Fee' of US\$25 for tourists using the Rock Islands and US\$35 for tourists visiting Ongeim'l Tketau (Jellyfish Lake).

The majority of dive-focused tourists do not visit any archaeological sites. Tour operators do lead some groups to the Rock Island's World War II sites and the more easily accessible stonework villages. Hence, to date, tourism has had a minor impact on the RISL's cultural remains. The 2008 Tourism Action Plan for Palau states that: "*Terrestrial habitats are highly culturally significant but largely unexplored by tourism.*" Increasing tourist interest in these cultural sites is expected in the future, and updates to the Management Plan will address cultural sites.

There is, with one exception, no development in the proposed Property. Dolphins Pacific is a dolphin education and research facility located on the northeast side of Ngeruktabel Island. Recently, small cell sites powered by solar panels have been installed on higher elevations in the Rock Islands to provide wider communications coverage. These have not had an adverse affect on prehistoric sites. The Management Plan strongly discourages any development, commercial or non-commercial, in the Rock Islands.

Because the RISL is zoned a conservation area it is largely undeveloped and has seen very little direct impact from infrastructure, construction or development activities. There are small visitor infrastructures, such as picnic structures and composting toilet facilities on designated rock islands to support visitors but they do not endanger the value of the property. The potential designation of RISL as a World Heritage site will reinforce this current zoning and ensure that no major infrastructure development will be undertaken that will affect the RISL's outstanding biodiversity features.

Environmental pressures

Environmental pressures are expected to impact cultural sites in the Rock Islands, particularly the long-term effects of archipelago subsidence and sea level rise through global warming. Indigenous and introduced plants and animals can have adverse effects on cultural properties in the Rock Islands. In the short term, these impacts can be classed as relatively minor. Over longer intervals tree growth, death, and collapse can degrade the integrity of prehistoric sites, especially stonework village remains.

Climate change is an important factor in the Rock Islands. Reduced precipitation during the Little Ice Age contributed to island abandonment and the creation of a relict landscape of stonework villages. The forecast trend toward a warmer and wetter climate would likely lead to higher rates of erosion on the Rock Island. Rock art sites and human remains in burial caves are potentially at risk from increased water flows. Future sea level

rise has implications for those Rock Island cultural sites that are close to the sea. Several stonework features and prehistoric deposits have been removed by wave action in the last 30 years and loss of the Rock Islands' cultural resources that are located on beaches and sand plains is likely to continue with anticipated sea level rise.

The fragile ecosystems of the marine lakes are susceptible to climate change (Dawson et al. 2001; Martin et al. 2005) and threatened by non-native species introductions (Patris et al. 2010), collectively classifying them as vulnerable habitats of significant biological diversity.

The impact of climate change poses a challenge to the RISL. As previously discussed, the 1998 ENSO event caused a decline in *Mastigias* medusa in Jellyfish Lake (Dawson 2000) as well as widespread coral bleaching in the RISL patch reef systems with less impact on the fringing reefs which are shaded by Rock Island forests (Bruno et al. 2001; Golbuu, Victor et al. 2007). Furthermore, much of the coral reef system has recovered following the bleaching event. Therefore, while within the RISL impact of climate change cannot be avoided, management of human induced threats such as overfishing and habitat degradation can enable more rapid recovery following natural disturbances.

There is rising concern regarding the potential impact of motorized boats, particularly the pollution that may result from leaks of oil and fuel. There has been no evidence to show that there is indeed an impact, however, and research into this area is needed. Koror State Government has moved to outlaw two-stroke jet ski engines and only to allow four-stroke engines. Sewage pollution may be a potential concern on the northern part of the property closer to Koror Island, the population and commerce center. Currently, the sewage system is a ponding system with no treatments. There may be a potential for raw sewage to affect a small part of the property but it will not degrade the overall value. Although Palau's commercial port is not within the RISL area, its proximity means there is potential for oil spills that may affect the property. However, to date there have not been any major oil spills within

the RISL. Any shipping company that operates in Palau is required by the Environmental Quality Protection Board (EQPB) to submit a contingency oil spill response plan for approval that will be implemented in the case of an oil spill.

Crown-of-thorn starfish (COTS) outbreaks have been a concern within the RISL. This phenomenon was documented as early as the 1970s. It is unknown how the COTS outbreaks occurred; however, data from elsewhere support the theory that COTS outbreaks may be related to nutrient inputs. Currently, COTS outbreaks have been limited to a small area within the RISL that has allowed for successful controlled intervention. Tour operators and Koror State Government have collaborated in the past to control the outbreaks by removing COTS from the affected areas.

Introduced and invasive species pose a threat to the biological and economic value of the Property's resources. Although relatively few species have become established in the RISL, invasive species have the potential to alter the natural structure and balance of the RISL's marine and land ecosystem if they are not carefully controlled.

Ponapea palauensis is threatened by the introduced Sulfur-crested Cockatoo, which feeds on it (Costion et al. 2009). A 2003 report (Space et al. 2003) provides an extensive list of invasive species throughout Palau, including the nominated area. The authors suggest eradication strategies for some species in the RISL such as *Chromolaena odorata*, *Clerodendrum quadriloculare*, *Stachytarpheta cayennensis* and *Timonius timon*. Some islands have populations of cats, rats, monitor lizards and monkeys that disrupt the natural ecosystems. There has been discovery of an invasive sea anemone (*Aiptasia* sp.) in Ongeim'l Tketau. There may be other invasive species within the RISL that have yet to be documented.

Laws exist to curb the spread of invasive species. It is illegal to transport potential invasive species in the RISL such as the Macaque monkey (*Macaca fascicularis*). In the Management Plan, Koror State

addresses its goals for preventing the establishment and spread of new marine or terrestrial species and for the eradication and control of existing invasive species through awareness campaigns, research, and monitoring activities.

Natural disasters and preparedness

The main natural disasters to be considered a risk for the RISL are tropical storms, tsunamis, and forest fire. During ENSO events, like that of 1997-1998, the Rock Island's limestone forest and sand plain vegetation dries out and is vulnerable to human and natural fires. The direct impact of forest fires on prehistoric cultural sites is minimal as stonework and sub-surface cultural remains would not be significantly affected. However, cohort death of forest trees due to fire damage can result in substantial site disturbance from sediment displaced in falling tree roots. Typhoons and tropical storms occur from June through November and are accompanied by high winds, substantial precipitation, and large wave surges. This rough weather can damage reefs and prehistoric sites through tree fall and sand plain removal.

The Palau National Tsunami Capacity Assessment report which evaluates the capacity of Palau to receive, communicate, and effectively respond to tsunami warnings is currently under review. Cultural sites first recorded in the 1980s have not been noticeably affected by tsunami damage and the Rock Islands are resilient overall to natural disasters.

Because Palau is outside the typhoon belt, there has been very limited incidence of major typhoons that have affected the whole archipelago. While natural disasters cannot be stopped, effective management of coral reefs by ensuring key ecological processes are preserved will allow for rapid coral reef recovery. Current management approaches such as setting up marine protected areas and identifying resilient areas will ensure that these key reef processes are maintained and therefore when natural disasters occur, coral reef systems within the RISL will bounce back.

Visitor/tourism pressure

The Rock Island's cultural sites are known to many

Palauans and the limestone island landscape is associated with oral traditions, myths, proverbs, and place names that are integral to the history and culture of the indigenous people. The local population uses the Rock Islands for recreational picnics and celebrations, short stays during fishing and diving expeditions, hunting of coconut crabs and fruit bats, collection of medicinal and economic plants, and other traditional activities that preserve a connection with ancestral locations. Collectively local use has had a minor impact on the majority of the Rock Island cultural sites as use is concentrated on those sand plains/beaches that are accessible by boat and have Koror State managed visitor facilities. Wharf/pier facilities for boat mooring have generally not been constructed as motor boats are moored in the intertidal zone or drawn onto sandy beaches.

Several sand plain/beach areas that do not have visitor facilities hold prehistoric remains of stonework villages that can suffer damage from the construction of informal camp structures and amenities.

The RISL is the tourism destination for Palau. There are approximately 75,000 visitors to Palau each year and over 80 percent of them visit the RISL area. The Management Plan has identified certain Rock Islands and reef areas as tourist areas to minimize

impact on the RISL. The management plan identifies uses according to six zones. In addition to active management of the RISL, Palau is trying to diversify tourist attractions and activity to spread the tourist pressure to other islands so that RISL does not suffer degradation from tourist-related activities.

Number of inhabitants within the Property

There are no permanent inhabitants within the Property. Most visitors are day users, with infrequent camping and overnight use at limited sites.

Specific site threats and their effect on cultural sites in the Rock Islands are listed in **Table 12**, which shows that cultural sites located on sand plain/beach environments are most at risk from human and natural factors. Cultural sites located in limestone karst are often very well-preserved because they require significantly more effort to access and are out of reach of the sea.

Burial caves and rock art sites are fragile, culturally sensitive, and important scientific sites that are at heightened risk from human activity such as foot traffic, fossicking, and graffiti. Access to these sites will be managed by Koror State as unregulated visits will result in substantial negative site impacts.

Table 12. Site threats and their impact on Rock Island cultural sites.

Disturbance factor	Stonework feature - sand plain	Stonework feature - limestone	Stonework midden - sand plain	Stonework burial - sand plain	Canoe infrastructure - sand plain	Colonization sites - sand plain	Burial cave - limestone	Rock art - limestone	Yapese quarry - limestone	Western contact - sand plain	WWII sites - marine/terrestrial
Tree growth	X	X	X	X	X	X	O	O	X	X	O
Land crabs	X	O	X	O	O	X	O	O	O	X	O
Megapode	X	O	X	O	X	O	O	O	O	X	O
Microbiological	O	O	O	O	O	O	X	X	O	O	X
Forest fire	O	O	O	O	O	O	O	O	O	O	O
Tropical storm	X	O	X	X	X	X	X	O	O	X	X
Tsunami	X	O	X	X	X	O	O	O	O	X	X
Climate change	X	O	X	X	X	O	X	X	O	X	X
Visit facilities	X	O	X	X	X	O	O	O	O	O	O
Foot traffic	X	O	X	O	O	O	X	O	X	O	X
Fossicking	O	O	O	O	O	O	X	X	X	X	X
Graffiti	O	O	O	O	O	O	O	X	O	O	O
Factor total	8	1	8	5	6	3	5	4	3	7	6

5. Protection and Management

5.a Ownership

Property ownership in Palau is quite different than property ownership in a strict western context. Most property is not owned by individuals. Communal land ownership is more common with much of the communal land being owned by clans. As is the case of the Rock Islands Southern Lagoon area, this property has historically belonged to the clans of Koror and has been held in stewardship and guarded for the good of all by the Chiefs of Koror State. More recently, the question of ownership has been addressed by both the National and Koror State constitutions, and a number of court cases.

Ownership of the resources of the sea and the reef are governed by the constitution of the Republic of Palau and the Koror State constitution. The States own all living and non-living resources from the land to twelve nautical miles seaward, and the National Government owns all living and non-living resources beyond the territory of the States.

Article I, section 2 of the constitution of the Republic of Palau (effective January 1, 1981) states, “Each state shall have exclusive ownership of all living and non-living resources, except highly migratory fish, from the land to twelve (12) nautical miles seaward from the traditional baselines; provided, however, that traditional fishing rights and practices shall not be impaired.”

This section was amended in the Palau General Election of November 4, 2008, to read as follows: “Each state shall have exclusive ownership of all living and non-living resources, except highly migratory fish, within the twelve (12) nautical mile territorial sea; provided, however, that traditional fishing rights and practices shall not be impaired.”

The Koror State constitution, approved in October of 1983, provides,

“The State of Koror shall have exclusive ownership of all living and non-living resources of the seabed, subsoil, water column, insular shelves and air space from the land to twelve (12) nautical miles seaward from the traditional baseline, as provided in the Constitution of the Republic of Palau.”

In a court case that was ultimately resolved on appeal, the traditional chiefs asked the court to clarify issues relating to the ownership and control of areas below the ordinary high water mark (House of Traditional Leaders et al., vs. Koror State Government et al., Civil Appeal No. 09-004, “Opinion” of February 10, 2010). The Appellate Court affirmed the decision of the Trial Court, and affirmed that Koror State Government holds title to all lands below the ordinary high water mark, and that Koror State Government holds Koror State public lands in trust, and that Koror State Government has the authority and power to administer public lands below the ordinary high water mark.

This case was preceded by an earlier holding, also affirmed on appeal, that the Koror State Public Lands Authority holds title to public lands (such as the “Rock Islands”) above the ordinary high water mark (House of Traditional Leaders et al., vs. Koror State Government et al., Civil Appeal Nos. 06-070 and 06-075. Judgement and Decision dated December 17, 2008).

As of this date, none of the islands in the RISL have been awarded to any individual, lineage, or clan, so that none of the Rock Islands in the RISL are being developed for private interests.

5.b Protective designation

The Koror State Legislature has zoned all of the RISL as a “Conservation Zone” (Koror State Public Law No. K6-100B-99), and more recently, Koror State Public Law No. K9-222-2010 prohibits any permanent construction or development in the Rock Islands (other than tourist-related facilities).

Modern day conservation initiatives are supported by a range of State laws that regulate general resource use and recreational activities, and that designate protected areas within the property



Manta rays in German Channel. Photo by Mandy Etpison.

(See **Appendix D** for a Detailed List of Laws and Regulations affecting the RISL of Koror). Activity in the RISL of Koror is governed by the Rock Islands Southern Lagoon Area Management Plan 2004-2008 (**Appendix E**) and the Comprehensive Management Act.

The overall goals of the Management Plan are to provide for the sustainable use of natural and cultural heritage resources of the property. The Management Plan has four objectives:

1. Maintaining biodiversity;
2. Preserving traditional, cultural and recreational uses;
3. Providing for sustainable subsistence and commercial fishing; and
4. Providing for high-quality tourism and recreational activities that do not degrade the environment.

Use of the area must be environmentally sustainable, culturally compatible, and provide benefits to the people of Koror and Palau.

The Koror State Government has appointed the Koror State Public Lands Authority (KSPLA) and the Koror State Planning and Zoning Commission (KSPZC) to oversee all land and designate land use and zoning, respectively. The Koror State’s Department of Conservation and Law Enforcement is responsible for administering the RISL according



German Channel, looking north. Photo by Mandy Etpison.



Koror State Governor Yositaka Adachi (seated left) and Peleliu State Governor Kangichi Uchau (seated right) sign a MOU to jointly manage German Channel. Photo courtesy of KSDCLE.

to the Management Plan and enforcing State environmental laws. They are supported by the National Division of Fish and Wildlife Protection that enforces national laws.

The Koror State Ranger program was established in 1989 to enforce curfew laws. In 1994 it became the Department of Conservation and Law Enforcement. Since the Department has been in existence, it has worked closely with the National Government as well as other locally-based agencies and organizations on management and research activities within the RISL area of Koror State. This has resulted in the development of State regulations on resource use and activities and designation of six protected areas within the Property.

On January 25, 2011, the State Legislature passed Koror State Public Law No. K9-233-2011 to mandate yearly certification for all marine tour guides operating in the RISL, and to mandate the presence of a certified tour guide on all commercial tours. The law also provided financial provisions for regular marine tour guide training programs.

In January 2011, the governors of Koror State and neighboring Peleliu State signed a Memorandum of Understanding (MOU) to jointly manage and

protect German Channel, a popular dive site and important feeding and breeding area for manta rays. The shared state borders fall within the channel.

National domestic fishing laws (**Appendix G**) also apply to the Property and are enforced by national enforcement officers at the Division of Fish and Wildlife Protection. Moreover, Koror State has joint patrols with the Division of Fish and Wildlife. Additional national regulations that control access to specific areas in the Property have been reinforced by State Law, and are thus enforced by the Rangers. This includes Palau's first protected area, the Ngerukewid Islands Wildlife Preserve, which was established by the Trust Territory Government in 1956 and Koror 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.

5.c Means of implementing protective measures
Traditional Management

Long before modern conservation laws were developed, Palau's resources were managed by traditional cultural controls, such as marine tenure and *bul*. One of the most frequent and effective of such methods, *bul* is a temporary restriction or moratorium on certain activities. *Buls* are put into

effect when called for by village chiefs (Marino 2007), typically at times of natural or human threat. In order to notify the community that a *bul* is in place, woven coconut fronds are placed on trees or poles at village entrances.

The Rock Islands Southern Lagoon Management Plan 2004-2008 (**Figure 44**) includes Management Objective 3.3.2 (Traditional Values): Preserve the traditional, cultural, and recreational values of the Management Area for the people of Koror and Palau.

In addition to the prehistoric sites in the RISL, historical sites, especially those which fall under the Palau Lagoon Monument legislation such as sunken Japanese and American ships and planes destroyed during the WWII, are protected. Other historical sites include ruins of a military base built during the German occupation of Palau, WWII artifacts, and the remains of Japanese fortifications.

Zoning

There is a detailed zoning plan for the RISL, included in the Management Plan. Zones were developed based on guiding principles:

- Some biophysical features/elements are more sensitive than others and require different management approaches.
- Certain activities, while acceptable individually, are mutually incompatible or cause cumulative effects and are best confined to distinctly different areas.
- Even where uses are compatible, designation of a zone helps to establish the management priorities for that particular area.
- It is desirable to concentrate facility development in certain relatively small and clearly defined areas, to minimize the area of environmental disturbance, and the costs of services, such as toilets, rubbish bins, and picnic facilities.

Six zoning areas were created within the RISL to guide usage in the property: General Use Zones, Subsistence/Recreational Fishery Zones, Tourism Zones, Conservation Zones, Preservation Zones and Special Management Areas. Certain restrictions apply to all zones (**Table 13**).

Table 13. Restrictions applicable to all RISL zones

- Prohibition of any new mining and dredging activities
- No entry by foreign yachts and boats, except in designated channels/routes, without a cruising permit from Koror State
- No entry to foreign commercial fishing vessels and other large vessels such as large luxury boats, commercial cruise liners, cargo and military ships (excluding registered live aboard boats), except in designated channels/routes
- Harvesting restrictions (seasons, size limits and methods) designated in National and State Laws
- No removal of cultural and historical artifacts
- No damage allowed to any portion of the coral reef ecosystem (eg. via anchoring, resource harvesting or ship grounding)
- No harvest of timber, except for cultural purposes with permit from Koror State
- Dumping of trash is prohibited; all litter must be removed from land and marine areas
- Use of personal water craft (jet skis) is restricted to designated water sport zones
- Tourists require a valid Rock Island Permit for recreational activities in any zone
- Only approved structures/facilities in support of flood and erosion prevention, conservation activities, and visitor use as defined in the Koror State "CD" conservation zone can be built on the Rock Islands,
- No domestic animals (cats, dogs, monkeys) may be brought to the rock islands

- General Use Zones were created to enable the sustainable use of the Property and enable unrestricted access for all Palau residents and restricted access for visitors holding Rock Island Permits and includes all land areas not included in other zones and all marine areas not included in other zones.
- Subsistence/Recreational Fishery Zones enable sustainable subsistence and recreational



Harvesting giant clams. Photo by Ann Kitalong.

harvesting adjacent to conservation and wildlife preservation zones. No commercial harvesting is permitted and restrictions are placed on recreational and subsistence harvesting methods and times.

- Tourist Zones promote low impact ecologically friendly tourism activities. No harvesting is permitted in these areas. Due to safety and congestion concerns conflicting activities have been separated into dive/snorkel zones, snorkel zones, and personal watercraft zones.
- Conservation Zones prioritize conservation of the RISL's cultural and biological attributes. Harvesting is prohibited although areas are open for local recreational use and tourism (with a certified tour-guide).
- Preservation Zones provide the highest level of protection for biophysical attributes and/or cultural heritage. No harvesting is permitted and access is prohibited.

- Special Management Zones were created to enable the continuation of existing activities that are economically valuable to Koror State but need special attention because of their actual or potential impacts on the RISL.

Numerous state laws restrict activities in the RISL. For instance, Recently passed Koror State law K9-229-2010 prohibits the taking and introduction of new flora and fauna into the Ngemelis Island complex. This protection extends one mile from the shoreline of the island within the complex, when measured from the shoreline at the lowest tide (**Appendix D**).

Enforcement

The Koror State Rangers are the primary enforcers of the laws and regulations protecting the flora, fauna, and environments of the RISL. The Koror State Rangers conduct regular patrols during which they monitor activity occurring at tourist and local sites in the Rock Islands. The Koror State Rangers also conduct joint patrols with the National Rangers from the Division of Fish and Wildlife Protection.

National laws and protections

Palau's Constitution requires the National Government to take positive actions to maintain a beautiful, healthful, and resourceful natural environment (Article VI). Numerous statutes and regulations have been adopted to carry out this mandate, and some of these deal directly with biodiversity and sustainable use of biological resources. Others, although not directly dealing with these issues, have significant impacts on cultural and environmental resources and sustainability.

Palau currently lacks a comprehensive statutory and regulatory conservation and preservation framework but has adopted a number of statutes dealing directly with biodiversity and use of heritage resources, as described below.

Title 19 'Cultural Resources': Properties which are deemed to be culturally, historically, or archaeologically significant are eligible for protection under Title 19 'Cultural Resources' of the Republic of Palau's National Code.



A snorkeler seen from an unusual perspective. Photo by Ron Leidich.

Historical and Cultural Preservation Act (Title 19, Chapter 1): The purpose of this act was to establish a comprehensive historical and cultural preservation program (formerly called the “Division of Cultural Affairs”, now designated as the “Bureau of Cultural Affairs”). This agency’s primary responsibilities, among others, include:

1. Maintaining the Palau Register of Historic Places which lists the nation’s significant tangible cultural properties;
2. Developing a nationwide survey to identify documents and gather information on actual or potential historical sites;
3. Preparing, reviewing, and revising a national historical and cultural preservation plan; and
4. Serving as a depository for research materials generated or recovered through historical or cultural preservation projects.

Control over historical and cultural property on public lands is defined through **§134 of Title 19**.

“The National Government reserves to itself the exclusive right and privilege of ownership and control over historical and tangible cultural property located on lands or under waters owned or controlled by the National Government. Each state reserves to itself the exclusive right and privilege of ownership and control over historical sites and tangible cultural property located on lands or under waters owned or controlled by the state. [...] The National Government shall retain the right to, and control over, all historical sites and tangible cultural property located on land leased to others. In all cases where such a site or property is leased or conveyed, it shall be subject, by covenant or otherwise, to such rights of access, public visitation, and other conditions or restrictions of operation, maintenance, restoration, and repair as the Division may prescribe to accomplish the purpose of historical and cultural preservation.”

Individual states in Palau may enact their own legislation. Koror State currently has legislation

dedicated toward helping to preserve structures, landmarks, buildings, and other objects of outstanding historical, archaeological, or cultural significance.

In case of the development of a property, **Title 19, Subchapter IV §151 - §157** states that:

- a. a survey and review has to be conducted to assess impacts of projects affecting historical sites,
- b. findings of historical sites or tangible cultural property must be recorded to the state division,
- c. appropriate action, like recording, preservation of salvage must be conducted,
- d. penalties are instated for violations of the provisions.

In addition to the existing laws listed above, there are permitting processes and related legislation that offer a means to review and prevent potential impacts to these sites. These include the following:

Treatment and Disposition of Human Remains and Burial Furnishings: Created to preserve and protect the historical and cultural resources of Palau and to prevent the undue disturbance and removal of human remains and associated burial furnishings or artifacts. Scholars who conduct research activities in Palau and wish to analyze and/or transport human remains or artifacts outside of the country collected during archaeological excavation must also sign the Agreement for the Disposition of Human Remains in the Republic of Palau and Agreement for Curation of Artifacts, when appropriate.

Historic Clearance Permit: Any activities that require land earthmoving, alteration, or demolition must apply for a Historic Clearance Permit to ensure that cultural properties are not adversely affected.

Palau Lagoon Monument: Under Title 19, specific legislation was passed for the protection of underwater archaeological and historical tangible remains. As stated in **Chapter 3:**

§302. All ships, other vessels and aircraft, and any and all parts and contents thereof,

which formerly belonged to or were part of the armed forces or commercial fleet of Spain, Germany, Japan, the United States or any other nation, which were sunk to or otherwise deposited on the bottom of the Palau Lagoon and its territorial waters, subject to applicable salvage laws, shall be and hereby are set apart as monuments which shall be collectively called the “Palau Lagoon Monument.”

§304. All persons who dive to or by any other means seek and obtain access to the



Branching coral. Photo by Ron Leidich.



Two species of cardinalfish. Photo by Ron Leidich.

aforsaid ships, [...] for the purpose of examination or the gathering of objects there from, shall first obtain a permit therefore form the President or his duly authorized representatives. The President is authorized to issue such permits to those persons whom he deems qualified to conduct such examination or gathering, subject to such rules and regulations as he may prescribe.

§306. Any person who, without the permission of the President, removes, appropriates, damages, or destroys the aforsaid ships [...] or who violates any rule or regulation issued pursuant to this chapter, shall, upon conviction, be fined not more than \$1000, imprisoned for a period of not more than six months, or both.

Palau National Register: There are currently 36 stonework village and other archaeological sites located in the RISL area listed on the Palau National Register. Registered sites are protected under Title 19. SubChapter IV of Title 19 describes the violations and penalties associated with damaging tangible cultural property:

(a) it shall be unlawful for any person, natural or corporate, to take, appropriate, excavate, injure, destroy, or alter any tangible cultural property listed on, or determined to be eligible for, the Palau Register of Historic Places.

(b) Any person who violates this section shall be fined not more than \$1,000 for each separate offense. If the violator directly or indirectly has caused the loss of, or damage to, registered historical sites or tangible cultural property, the violator shall be fined an additional amount determined by the court to be equivalent to the value of the lost or damaged tangible cultural property.

Title 24 Palau National Code Annotated (24 PNCA) (The Environmental Quality Protection Act): The Republic of Palau has a substantive environmental policy expressing intent and resolve to protect and enhance the natural environment as a means to safeguard the human environment. The purpose of this act was to establish general

standards for environmental review by the Republic of Palau Environmental Quality Protection Board (EQPB). The overall goal is to ensure protection of the environment while making an effort to promote sustainable economic development. The EQPB is responsible for the protection and conservation of the environment.

EQPB regulations are divided into eight sections:

1. Earthmoving;
2. Marine and Freshwater Quality;
3. Toilet Facilities;
4. Solid Waste Management;
5. Pesticides;
6. Public Water Supply Systems;
7. Environmental Impact Statements; and
8. Air Pollution Control.

Impacts on endangered species and their habitats and historic properties are required to be considered by an Environmental Impact Assessment or an Environmental Impact Statement for large scale earth moving projects.

Regulations listing threatened and endangered species are under development. Consideration of impacts on ecosystems and on proposed endangered or threatened species is generally required under Environmental Impact Statement Regulations, Chapter 240 1-6, and Earth Moving Regulations, Chapter 240 I-I, adopted by the Environmental Quality Protection Board, but the effectiveness of these requirements is undermined by the lack of a formal listing of endangered and threatened species.

Palau's **Endangered Species Act** prohibits any person from taking, engaging in commercial activity with, possessing, or exporting any endangered or threatened species of plant or animal. The Endangered Species Act was adopted in 1975, but a list of endangered and threatened species has not yet been adopted into regulation. (Kitalong and Kitalong 2007).

Except for four species, all birds in Palau are protected under **24 PNCA § 1401 (Protected Land Life Act)**. The maximum penalty for violation of this section is \$100 and/or six months imprisonment.

Under the statutes establishing the Ngerukewid Islands Wildlife Preserve, the area is to be maintained in a primitive condition, and it is illegal to take or possess weapons, traps, snares, or objects capable of killing or otherwise taking birds, animals, or marine life in the preserve. Possession of birds, animals, marine life or eggs is also prohibited, and transporting or allowing domestic animals or birds into the area is also prohibited, as is lighting of fires or cutting or removing any plant life. There are no civil enforcement provisions however, and the maximum criminal penalties are a \$50 fine and imprisonment for six months, combined with forfeiture of gear (including boats).

Foreign fishing within Palau's 200 mile extended fishery zone is limited by statute under **27 PNCA §§ 101-207**. Foreign fishing is generally prohibited in Palau's territorial sea or internal waters (waters up to three miles from the baseline, encompassing the RISL).

Domestic fishing has statutory limitations under the **Marine Protection Act, 27 PNCA §§ 1201-1211**. These statutory provisions limit the take, sale, purchase, and export of many species and include closed seasons for grouper and rabbit fish, and minimum sizes for parrotfish, wrasse, crabs, and lobster. Gear restrictions such as a prohibition on fishing with SCUBA gear and minimum and prohibitions on certain types and sizes of nets are also included. The Marine Protection Act also restricts the taking of aquarium fish, requires labeling of exports, and authorizes additional regulations to protect certain species from over harvesting (e.g., 27 PNCA §§1205-1207). Violations of the Marine Protection Act are subject to both civil and criminal enforcement. Criminal penalties vary by the type of violation but generally carry minimum penalties of US\$250 to \$500 for first offenses and maximum terms of imprisonment of six months to two years. Civil penalties of up to US\$200,000 per violation may be imposed for violations committed as part of a commercial operation or enterprise.

In 2006, the Palau National Congress passed a total ban on the harvesting of vulnerable Bumphead

Parrotfish, *Bolbometopon muricatum*, and endangered Humphead Wrasse, *Cheilinus undulatus* (SB 7-64). This law was reaffirmed in 2010 by a Presidential veto of a new bill that would have opened a fishing season for these species.

Existing Plans Related to Municipality and Region in which the Proposed Property is Located

The comprehensive "Rock Islands Southern Lagoon Area Management Plan 2004-2008" governs the entire RISL. The Management Plan was adopted by the Koror State Legislature and Governor in 2005. It has been re-authorized while a review is being undertaken.

Property Management Plan or other Management System

The process of developing a management plan for the natural environment of the RISL was long and comprehensive as evidenced in the timeline below. As previously detailed the RISL was historically managed by traditional controls. Although traditional marine tenure no longer exists within the RISL, traditional controls have been maintained and are the basis of many modern day conservation initiatives. For example, 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 Property. Over the years increased tourism and harvesting activity made it apparent that additional laws and programs to enforce the laws were needed and a series of laws and initiatives were created to do so.

The first step towards comprehensive management occurred in 1989, when the Koror State Ranger program began. This was followed by the creation of the Koror State Department of Conservation and Law Enforcement (KSDCLE) in 1994. This further led to the development of State regulations on general resource use, recreational activities, and the designation of protected areas within the RISL.

Since the KSDCLE was established, it has worked closely with a range of locally-based agencies and organizations on management and research activities within the Property. A Rock Islands Use

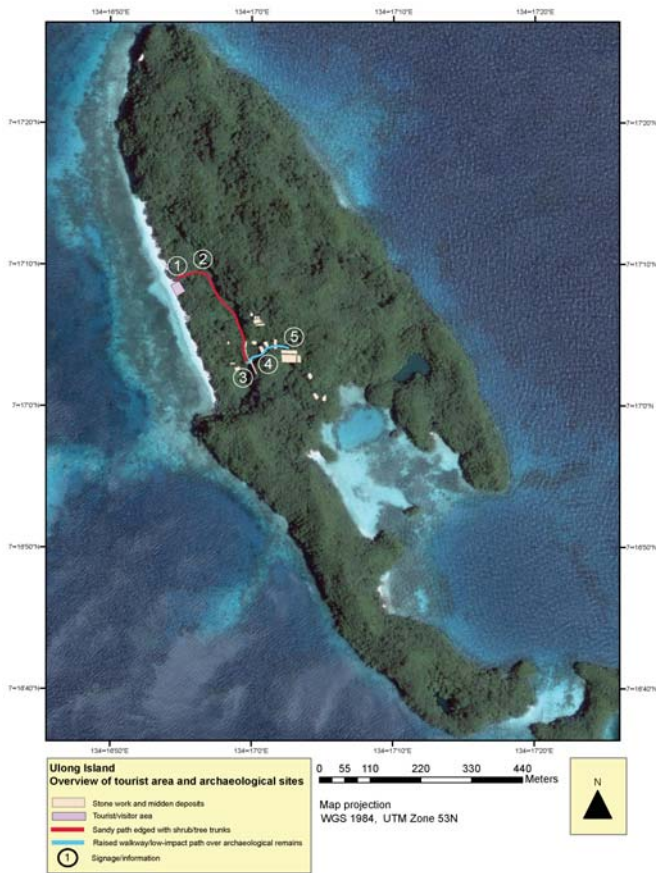


Figure 45. Ulong Island cultural site management plan.
Photo Clark/Reepmeyer – ANU



Figure 46. Ulong Island existing cultural site signage.
Photo Clark/Reepmeyer – ANU

The proposed management plan (**Table 14**) for stonework village sites presented here comprises two objectives:

1. To nurture and sustain Palauan culture by preserving and maintaining the landscapes, artifacts and oral traditions associated with stonework village sites in the RISL; and
2. To strengthen and enhance the cultural aspect of Koror State’s RISL visitor experience.

Examples of proposed actions that would be included in a management plan incorporating the components outlined above are given for the stonework village site on Ulong Island and located at Dmasech Island-Uchularois Island.

Ulong Island stonework village

Visitor arrival: Boat access is toward the middle of the western beach where the visitor facilities are located. The access point is 200m northwest of the stonework village remains and is a natural starting point for a visitor’s trail to the prehistoric site (**Figure 45**).

Proposed Management: Maintain current arrangement.

Facilities: Visitor facilities on Ulong Island consist of an open structure roofed in corrugated iron. Benches and two cooking areas are under the roof and a double toilet block is behind the main structure. Benches and tables lie seaward of the

Act (RIUA) regulating tourist activities in the Rock Islands was passed in 1997. Planning for community facilitation and eventual development of a formalized management plan for the natural environment began three years later. Reflecting Palauan traditions of reaching consensus on important decisions, the Management Plan was created through a comprehensive two-year process that engaged stakeholders at every level. The Management Plan is currently being revised to be in effect from 2011 through 2015.

Proposed cultural sites management plan

Currently there is little to assist visitors in understanding and appreciating Rock Island cultural sites. There is minimal signage and few trails at cultural properties. The majority of tour guides are inadequately trained in historic properties. Whether volume-based or niche-based tourism strategies are adopted by Palau, it is appropriate to develop a management program that protects traditional and historic sites in the RISL from current and future threats.

Table 14. Proposed Cultural Site Management Plan

Objective 1: Nurture and sustain Palauan culture by preserving and maintaining the landscapes, artifacts and oral traditions associated with the Rock Island Stonework Village sites in the RISL.	
Actions	Responsible Agency
1. Develop protocols for maintaining and rehabilitating stonework village sites and features.	KSPLA, BAC
2. Identify village sites that are in critical need of care or rehabilitation	KSPLA
3. Provide infrastructure to care for and monitor identified areas	KSPLA
4. Limit access as necessary to certain identified sites	Koror State Rangers
5. Develop stonework village maps	BAC
6. Collect, document and develop educational materials on the stonework villages	Koror State, BAC, PVA
7. Support stewardship and environmental efforts that are currently in place	Koror State

Objective 2: Strengthen and enhance the cultural aspect of Koror State's RISL visitor experience.		
Actions	Responsible Agency	Comments
8. Develop and implement training in the culture heritage of the Rock Islands to be provided for tour guides and the Koror State Rangers so that tourists/visitors can properly understand the historical and scientific significance of cultural sites and the laws regarding their preservation.	Koror State, Bureau of Arts and Culture	<p>Training in culture heritage can be conducted through the existing expertise in the Bureau of Arts and Culture which is responsible for:</p> <p><i>"Palau Registry of Historic Places. Establish and maintain a 'Palau Registry of Historic Places', nominate and register potentially eligible sites to the Registry, maintain the Bureau's reference library, and conduct reviews of projects relating to the restoration and development of Registered Sites."</i></p> <p><i>"Archaeology, survey and inventory. Implement applicable parts of Title 19 of the Palau National Code, and of the United States National Historic Preservation Act; safeguard and document historic and cultural properties in Palau; and conduct historical clearance review processing."</i></p>
9. Locate visitor arrival points and facilities away from the immediate environs of a cultural site to minimize site degradation from rubbish dumping, foot traffic, and the construction and maintenance of tourist structures.	Koror State	
10. Connect visitor arrival points to cultural sites with paths and trails that limit human impact on the prehistoric landscape and which direct foot traffic to representative physical remains that are sufficiently robust to withstand tourist visits.	Koror State	
11. Develop interpretive and other signage in the Palauan and English languages to educate and inform visitors about the site and appropriate behavior within the site.	Koror State, Palau Visitors Authority, Bureau of Arts and Culture	<p>Place signage and maps (in appropriate materials to withstand tropical conditions) at strategic points on the path/trail to inform visitors about the cultural significance of prehistoric remains and the legal status of cultural sites in Palau. For example, the relevant part of the Koror State Management Plan states that:</p> <p><i>"The removal of any cultural and historical artifacts is prohibited in all zones of the managed area"</i></p>



Figure 47. Ulong Island example of existing foot path to cultural site.
Photo Clark/Reepmeyer – ANU

roofed structure and the area can comfortably support 30–50 tourists a day. The site is maintained by the Koror State Rangers who run the pioneering Beach Boys program which seeks to help the disadvantaged youngsters of the Koror community and to provide them with opportunities to better themselves. Rangers and Beach Boys regularly clean the visitor site by removing rubbish, servicing toilet facilities, and monitoring the effects of tourist-visitor visits.

Proposed Management: Maintain current arrangement.

Signage – path entry: There are currently signs attached to the main building and on large strandline trees that ask tourists not to cut or burn trees/vegetation, touch corals, handle marine life nor feed sharks. They also state that any rubbish is to be returned to Koror and disposed of properly. Behind the main building, and south of the toilet block, at the start of the trail to the stonework site are two signs mounted on metal supports (**Figure 46**). One sign with text in English, Palauan, and Japanese warns visitors not to relocate or remove any objects from the prehistoric site. This sign is badly damaged and only partially legible. The second sign has text in Palauan explaining the archaeological investigations and significance of the site: that in addition to the stonework village remains there are cultural remains dating to the earliest phase of Palauan history. This sign is covered by a film of green plant/algae material caused by water entering the sign's frame.

Proposed Management: Additional signage



Figure 48. Dmasech Island cultural site management plan.
Photo Clark/Reepmeyer – ANU

is required. On arrival at the visitor structure signage giving information about the cultural site and a map showing the path and position of the prehistoric remains is required (see **Figure 45**, Point 1). At the start of the path a sign should be erected that informs visitors that Palau's cultural heritage is a precious resource, that objects from prehistoric sites are not to be relocated or removed, and that interference with cultural sites is subject to legal penalties (**Figure 45**, Point 2). Signage text would ideally be in several languages (e.g., Palauan, English, Chinese, Japanese).

Pathway: The path to the stonework site follows the contact between the sand plain and the rubble-edged limestone slope of the island (**Figure 45**). Vegetation along the path has been periodically cleared as have trees and scrub around the large defensive wall so that the aspects of the stonework and site layout can be seen. The foot path goes over midden remains and there are several prehistoric

entrances in the wall that are partially filled with wall rubble. Inside the wall the ground surface is covered with numerous small fragments of limestone rubble and midden remains (marine shellfish and pottery). There is a dense surface scatter of shell tools and one tourist operator has hidden tools inside stonework so that the artifacts would not be fossicked. There is a faint trail into the limestone, but it has not been cleared of vegetation, marked, or cleared of slope debris.

Proposed Management: The current path from the visitor structure to the defensive wall is to be outlined and built up with 10-15cm of sand and edged with the limbs and trunks of shrubs/trees cut during path clearance (**Figure 45**, red line; **Figure 47**). A 3-5m area bordering the defensive wall and cleared of vegetation is required so that the entire structure and construction details can be seen. The entrance to the pathway is to be marked by a small structure equipped with signage that provides general information about stonework villages and their abandonment (**Figure 45**, Point 2). A raised wooden walkway over the entrance way and across the interior of the site would reduce damage to the site's surface material remains and architectural features such as the raised foot bank and buried coral head near the main entrance (**Figure 45**, blue line). A short section of trail up the limestone slope to several stonework features could be delineated by clearing vegetation and debris and installing trail markers.

Signage - site interpretation: There is no signage at the stonework village. This limits visitor understanding and makes it difficult to appreciate the cultural significance of the prehistoric remains.

Proposed Management: Signage in addition to that placed at the start of the trail to be located at Points 3, 4 and 5 (**Figure 45**). Point 3 is the main entrance to the defended part of the stonework village and there are intact sections of wall to the north, and large limestone foundation blocks to the south. Signage could outline the defensive aspect of the site and describe the material remains visible on the ground surface, particularly the marine food remains that point to over exploitation of the

local environment. Inside the wall, signage information could include the traditional history of the site and migration sequence of the Ulong people. The oldest prehistoric site dating to 3000 years ago is within the wall area and the use of the Rock Island's marine resources at this time could be reported. At Point 5 on the limestone slopes, signage outlining the broader stonework village system that extends into the harsh interior of the Rock Islands could be mentioned to emphasize the marginal environmental conditions experienced in prehistoric Rock Island villages.

Dmasech Island-Uchularois Island stonework village

Compared to Ulong Island the stonework village remains on Dmasech Island-Uchularois Island are more complicated. Not only do the remains extend over two islands but the site components illustrate different aspects of the village system (**Figure 48**). On Uchularois Island the stonework remains are located on elevated terraces which oral traditions record as the chiefly structures of the Paramount Chief Uchelmelis. The stone structures on nearby Dmasech Island are distributed along a low ridge of limestone in the central part of the island; a location which appears to be chosen for community security. Access to Dmasech Island-Uchularois Island is prohibited for tourists. Restricted visitor access is allowed.

Visitor arrival: There are beaches with visitor access on the north, and east-central side of Dmasech Island. A tombola connects Dmasech Island to Uchularois Island where there is a derelict visitor structure and amenities. Access to the cultural sites from the east-central beach is recommended.

Proposed Management: Maintain current arrangement with visitor arrival at Point 1 (**Figure 48**).

Facilities: On Uchularois Island there is a visitor-dormitory structure dating to the 1970-1980s (now in disrepair) on the small sand plain on the southwest of the island (**Figure 17**). Amenities such as a water tank, toilets, showers, and cooking facilities were placed around the structure and on



Ponapea palauensis. Photo by Ann Kitalong.

the terrace above. These facilities are no longer used as there is another visitor area a short distance to the west on Dmasech Island. Visitor facilities on Dmasech Island's east-central beach consist of a large corrugated roofed and walled structure. Surrounding the structure are tables, benches, cooking areas, a toilet block, and refuse areas. The site is regularly maintained by the Koror State Rangers and participants in the Beach Boys program.

Proposed Management: Removal of the visitor structure and amenities on Uchularois Island to be undertaken (Figure 48, Point 2). The site returned to its natural state so that the remains of the prehistoric stonework village system that spanned the two islands can be connected by a single pathway.

Signage - path entry: There is currently no signage giving information about the cultural sites on Uchularois and Dmasech Islands. There are currently signs attached to the main building and on large strandline trees that ask tourists not to cut or burn trees/vegetation, touch corals, handle marine life nor feed sharks. They also state that any rubbish is to be returned to Koror and disposed of properly.

Proposed Management: Signs placed at Point

1 (Figure 48) to introduce the stonework village system and provide a map showing the trail position in relation to the two islands. At the start of the path position another sign informing visitors that Palau's cultural heritage is a precious resource, that objects from prehistoric sites are not to be relocated or removed, and that interference with cultural sites is subject to legal penalties (Figure 48, Point 1). Signage text would ideally be in several languages (e.g., Palauan, English).

Pathway: There is currently no pathway connecting the two sets of prehistoric remains.

Proposed Management: A path built up with 10-15cm of sand and edged with the limbs and trunks of shrubs/trees cut during path clearance (Figure 48, red line) to extend westward on Dmasech Island from Point 1 to Point 6 (Figure 48) and on Uchularois Island from Point 2 eastward to the path end. The tombola linking the two islands is swept by waves and eroded during high tides and storms, and a track on it is not required. A raised walkway may be necessary to cross a low lying section of sand edging the limestone ridge between Point 4 and Point 6.

The section of sand can be wet and boggy at high tide. The path in the limestone terrain between Point 5 and Point 6 on Dmasech Island and east from Point 2 on Uchularois Island is to be cleared of vegetation and the trail clearly marked. On Uchularois Island there are some steep sections of limestone that may require modification to allow safe access.

Signage - site interpretation: There is no signage at either of the stonework village sites which limits visitor understanding of the sites and an appreciation of the cultural significance of the prehistoric remains.

Proposed Management: Additional signage to that placed at the start of the trail to be placed at Point 3 on Uchularois Island and Points 4, 5 and 6 on Dmasech Island (**Figure 48**). Point 3 is the small sand plain at the base of Uchularois Island which is to have existing structures cleared from it. Signage at Point 3 could mention that in traditional history the island was the residence of Uchermelis, the high chief of the Ngemelis Group, who defeated the people from the stonework village on Ulong Island causing island abandonment. Text might also draw attention to the large foundations of a canoe dock or breakwater in the intertidal zone and describe the platform and physical remains at the path terminus. Also of note is the significance of faunal remains from Uchularois Cave which show a decrease in size over time indicating over-harvesting of marine resources during the stonework village phase.

At Point 4 a large rubble foundation on the sand plain is likely the remains of a community structure (bai); one of the few present in the Rock Islands. Signage text could explain the continuing significance of bai to Palauan society. A low lying strip of sand east of the limestone ridge at Point 5 provides a vantage point to observe the stone structures and ridge modification including terraces, walls and platforms. On the ridge signage at a prehistoric well site (**Figure 48**, Point 6) could emphasize the difficulties faced

by the inhabitants in obtaining sufficient potable water and the importance of fresh water wells as seen from the density of marine shellfish and pottery remains surrounding the well.

5.f - Sources and levels of finance

Koror State Department of Conservation and Law Enforcement (KSDLE) receives an annual budget from the Koror State Government. During the 2010 budget year, KSDLE was allocated a budget of over US\$900,000 to pay for staff and implement the following additional programs:

- Compliance Program- a capacity and training program for Koror State Rangers.
- Rock Islands Facelift Program - a program focused on maintaining the tourist areas within the RISL, which includes funding for the Beach Boys (described in section 5.j), construction and maintenance of visitor amenities, and the marine lakes monitoring program.
- Marine Tour Guide Certificate Training Program - a capacity building program designed to develop a standard for tour guides in the marine recreation industry. In 2011 participation in this program by all marine tour guides operating in Koror State waters was mandated by law.

An additional US\$100,000 in special projects was committed to the Management Area in 2010. Supplemental support in the form of financial and technical assistance comes from a variety of local, regional and international organizations. The 2010 budget details current and ongoing programs in the RISL and is available in **Appendix H**.

5.g - Sources of expertise and training on conservation and management techniques

In addition to its competent and dedicated staff, Koror State collaborates with experts from a number of National Agencies, and international, regional, and local non-governmental organizations and agencies to implement activities, source expertise, and identify and implement best practices. Some organizations that partner with Koror State on conservation activities are below.

National Government Agencies

- The Bureau of Marine Resources is the main government agency responsible for development and management of Palau's marine resources. This bureau recommends and reviews national regulations and legislations and monitors marine species populations in Palau's waters .
- The Bureau of Agriculture partners in assessing and mitigating against the effects of invasive species and its Division of Forestry work on terrestrial issues.
- The Bureau of Public Safety is the main Bureau charged with enforcing national laws. As such they have enforcement jurisdiction over all areas of Palau.
- The Office of the Palau Automated Land and Resource Information Systems (PALARIS) is the local apex for GIS technology. PALARIS has assisted Koror State with geo-mapping the RISL. They also are an active partner with mapping coral reef monitoring sites.

Local Community-Based and Semi-Government Agencies

- The Palau International Coral Reef Center (PICRC) is a Palauan semi-governmental agency. PICRC conducts research, provides public and professional education about the ecological, economic, and cultural importance

of coral reefs through trainings, workshops, and conferences. They conduct bi-annual coral reef monitoring in the RISL. www.picrc.org

- The Palau Visitors Authority is a semi-autonomous entity working to support and encourage the development and marketing of tourism as one of the primary economic sectors of the Republic. They are one of the main agencies promoting the RISL area as a pristine tourist destination. www.visit-palau.com
- Palau Community College (PCC) offers programs in Environmental Marine Science Education, Environmental Education, and Tourism and Hospitality. <http://www.palau.edu/>
- The Belau National Museum is a semi-governmental organization whose mission is to stimulate interest in culture and the arts by undertaking marketing, effective research, documentation, collection and presentation of culture, artifacts, natural history, and the development of activities. The museum is mandated to conduct National Bird Monitoring. www.belaunationalmuseum.org
- The Environmental Quality Protection Board (EQPB) is a semi-governmental organization responsible for preserving and protecting the environment in Palau. They issue permits for activities that involve earthmoving and other activities that could potentially impact the



Employees from a Rock Island Tour Company pose with their marine tour guide certificates after conclusion of the 2007 course. Photo courtesy of KSDCLE.

environment.

- Palau Conservation Society (PCS) is a non-profit organization whose mission is to “to work with the community to preserve the nation’s unique natural environment and perpetuate its conservation ethic for the economic and social benefit of present and future generations and for the enjoyment and education of all.” www.palau-pcs.org
- The Belau Tourism Association (BTA) is a consortium of local tour operators and representatives from various tourism sector businesses.
- The Coral Reef Research Foundation (CRRF) is a local non-profit organization focused on increasing knowledge of coral reefs and other tropical marine environments through basic and applied marine research, with special emphasis on species diversity work, collection for biomedical screening, environmental monitoring, reef fish spawning biology, and innovative development of new techniques for marine research work. They collect data within the RISL. Of note is their long-term data series on the marine lakes. www.coralreefresearchfoundation.org

International Organizations

- The Nature Conservancy (TNC) provides expertise on coral reef conservation, management of protected areas and community participation on managing the RISL. They conducted a midterm evaluation of the 2004-2008 Management Plan and conducted planning processes for revisions of the Management Plan. <http://www.nature.org/wherewework/asiapacific/micronesia/work/palau.html>

5.h - Visitor Facilities and Statistics

The majority of Palau’s 80,000 annual visitors visit the RISL. During the years from 2006-2009, an average of 84 percent of visitors to Palau obtained permits to visit the RISL (**Figure 49**).

As detailed in section Section 5.c, there are numerous areas throughout the RISL of Koror State. Tourist areas often have benches, shaded

shelters, charcoal grills, and composting toilets. Koror State works with tour operators to promote environmentally friendly tourism, and offers a marine tour guide course and certification. The first marine tour guide courses were held in 2007. A January 2011 law mandated marine tour guide training and certification.

There are numerous tour operators offering services to tourists who want to visit the natural areas of the RISL of Koror State. Tourists can choose between the many group tours or arrange charter trips. While diving is the predominant pastime for tourists to the RISL, there are many other activities available such as snorkeling, kayaking, stand up paddling, boat and fishing tours. Koror has an abundance of lodging options for visitors to the RISL, from small budget hotels and motels to large luxury hotels. Camping is permitted in certain areas in the RISL of Koror State, but permits are required. The majority of tourists spend the day in the RISL and return to the town of Koror to spend the night, but some participate in overnight kayaking and camping tours in the RISL. There are also live aboard vessels anchored at designated sites with the RISL.

5.i - Policies and programs related to the presentation and promotion of the property

While the Koror State Department of Conservation and Law Enforcement (KSDL), does not receive funding specifically dedicated to promoting the RISL, they are heavily engaged in their community and promote and protect the property through their work. The presence of Koror State Rangers at events occurring in or adjacent to the RISL helps ensure that the events are conducted in an environmentally responsible fashion.

Much of the international promotion of Palau as a tourism destination is accomplished by the Palau Visitors Authority (PVA). While the PVA’s marketing efforts focus on all of Palau, the Rock Islands are an integral component to PVA’s marketing campaign. Images of the Ngerukewid Islands Wildlife Preserve frequently serve as a photographic backdrop in marketing materials. In addition to marketing Palau to tourists, an important component of PVA’s work is to generate

support for tourism within Palau by raising awareness among the local population about tourism and its impact on the nation.

Through the promotion of research and activity in community engagement and education, PICRC is an ardent promoter of the RISL area of Koror State. Although PICRC is focused on the entire nation of Palau, the RISL area of Koror State is a critical focal point of their work. In addition to coral reef monitoring activities within the RISL, some of their most important work is with Palauan youth. Throughout the year, the PICRC staff visit classrooms and teach children about their environment, including the RISL and stress the importance of protecting it. PICRC offers summer programs, including a week long camp and an aquarium overnight experience, that allow youth to develop a richer understanding of the biodiversity in the RISL.

Other agencies in Palau also provide promotional and educational information about places within the RISL. For example, CRRF produced an information sheet on Ongeim'l Tketau which explains its history and how to behave in and around the lake in order to maintain and preserve it.

5.j - Staffing levels

The mission of the KSDCLE is to work with the public to build community support and trust, to preserve peace and maintain order, and to develop and implement a comprehensive management plan for the RISL. The staff members of the KSDCLE are dedicated to the protection and preservation of the Rock Islands Southern Lagoon. **Table 15** shows the overall staffing structure and numbers for the department, which is managed by a Director and also includes the following programs and positions:

- The Ranger Program includes Senior Rangers, Patrol Captains, Rangers, and Conservation Rangers. This department includes trained, ranked and uniformed rangers who maintain law and order, as well as preserve the unique natural resources of the State.
- The Rock Island Face Lift Program (Beach Boys) program trains at-risk youth to maintain tourist areas in the RISL, provides critical job opportunities and encourages environmental stewardship.
- The Coastal Resources Management Officer focuses on the development and implementation of the Management Plan and related programs. In January 2011 this position was vacant.

Figure 49. Comparison between the number of RISL permits issued and the number of visitors to Palau (PVA 2010; Koror State 2010)

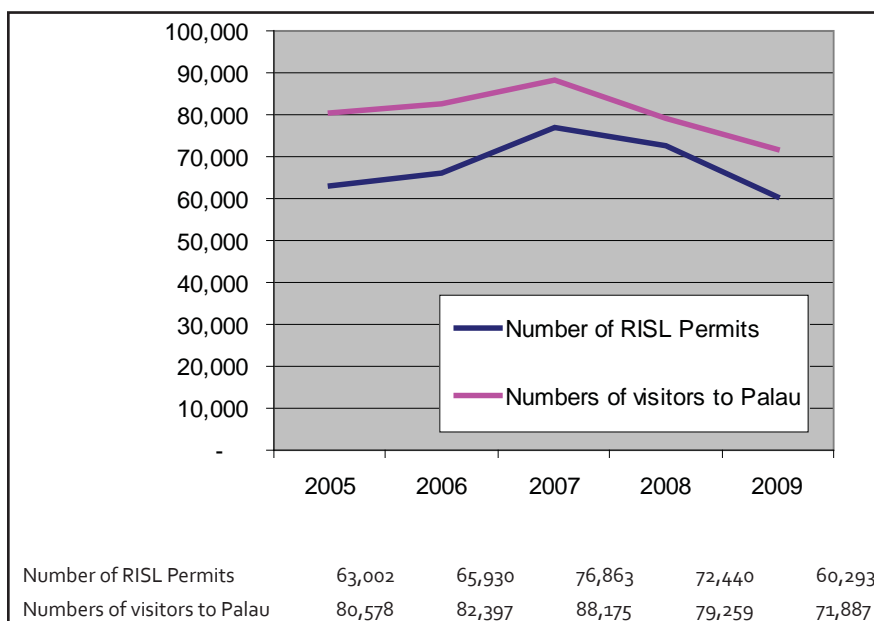


Table 15: Department of Conservation and Law Enforcement Staff

Title	#
Director	1
Secretary	1
Rangers	23
Conservation Rangers	2
Beach Boys	15
Rock Islands Development/PR Officer	1
Quality Control Officer	1
Marine Education/Coastal Management Assistant (Taiwan ICDF Volunteer)	1
Office Assistant	1
Security Guards	5
Boat Mechanic	1
TOTAL	52

A visit with a visiting researcher

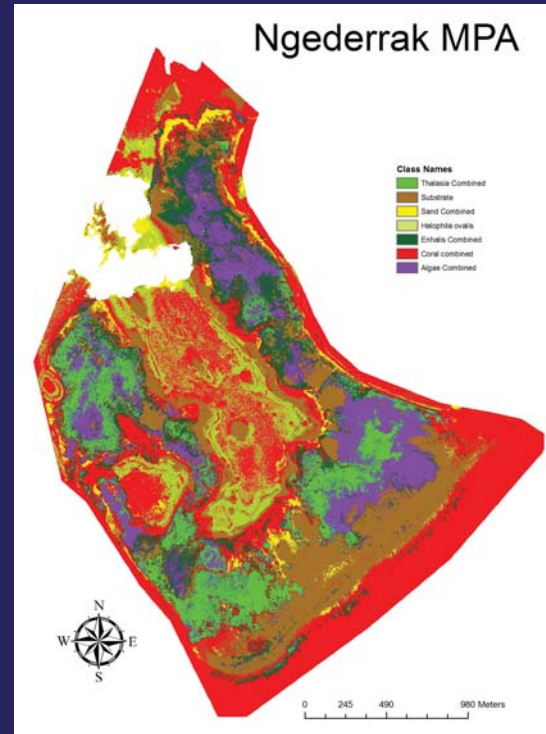
The Rock Islands are a popular location for local and international researchers. Their contributions contribute to a better understanding of the RISL, improving management and monitoring.

Paul Collins, a Graduate Student from the United Kingdom, discussed his 2009 research on Ngederrak Reef.

" My recent survey aimed to map the benthic habitat types for the entire Ngederrak Reef Marine Protected Area (MPA; fully within the RISL) using very high resolution satellite imagery in combination with LIDAR data, differential GPS and extensive ground truthing. The ground truthing required me to visit over 300 individual locations and classify the habitat type (i.e., coral, sand, substrate, *Halophila ovalis*, etc.) and to document the habitat through photography. The 300+ sites each now have highly accurate GPS location data which allows them to be revisited in the future, essentially making them permanent monitoring sites. This will allow Koror State to establish any changes that may occur on the reef and to direct any future monitoring and research. The results of the monitoring and the habitat map produced will serve as a baseline from which future changes to habitat type can be monitored as well as enable examination of the changes that may have occurred over the past 10 years by comparing the new imagery with past imagery for the same area."



An aerial view of Ngederrak Reef.



Photos by Paul Collins.

6. Monitoring

The Rock Islands Southern Lagoon is proposed for inclusion on the World Heritage list based on its cultural sites of importance, unique and thriving biodiversity, and excellent conservation status and management. This monitoring plan is based partially on that in the Management Plan and partially on the information presented in this nomination dossier.

6.a Key Indicators for measuring state of conservation

See **Table 16**.

6.b Administrative arrangements for monitoring property

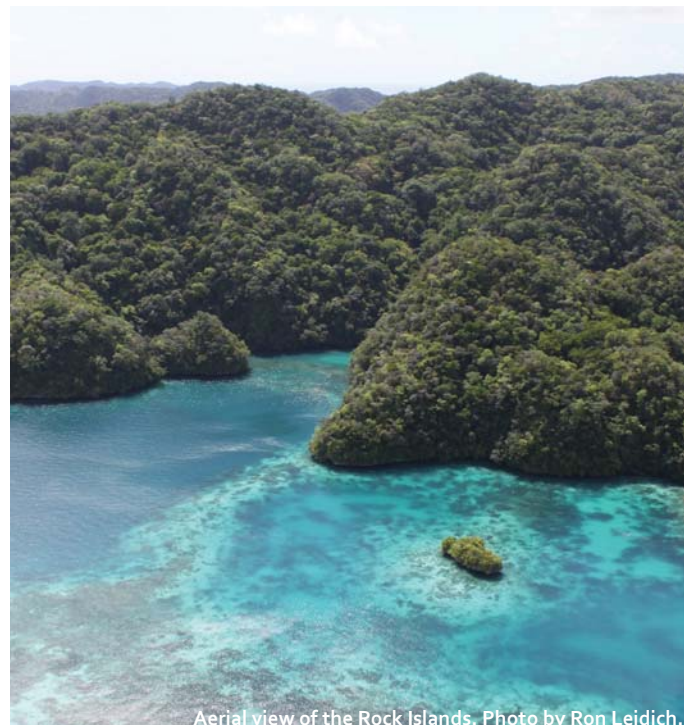
Koror State has ultimate responsibility for maintaining the RISL and monitoring it. Monitoring is conducted through the Koror State Ranger program and through national partnerships which are detailed below.

- PALARIS maintains spatial records, including current satellite imagery.
- Palau International Coral Reef Center (PICRC) conducts the National Coral Reef Monitoring Program for Palau. The RISL is a part of the area that is monitored.
- The nongovernment Coral Reef Research Foundation (CRRF) monitors Palau's marine lakes and conducts research on coral reefs in the RISL.
- The Ministry of Natural Resources, Environment, and Tourism includes the Division of Forestry and Bureau of Marine Resources, both of which have national mandates to monitor forest health and marine resources (such as sea turtles).
- The Belau National Museum is mandated by Presidential Proclamation to monitor birds and produce a yearly "State of the Birds" Report.

- The Palau Environmental Quality Protection Board (EQPB) conducts water quality monitoring.
- The Division of Cultural Affairs under the Ministry of Community and Cultural Affairs is mandated with maintaining information on cultural sites and artifacts.

6.c Results of previous reporting exercises

There have been numerous publications describing aspects of the natural environment of the RISL of Koror State. The following list of references includes relevant previous research studies and monitoring activities in the Property, including published scientific articles, management plans, reports, maps and pamphlets. Although the list is focused on reports detailing the state of conservation within the RISL of Koror State, it also includes surveys and reports with a broader scope if they also include the Property.



Aerial view of the Rock Islands. Photo by Ron Leidich.

Table 16. Key Indicators for measuring state of conservation

Indicator	Periodicity	Location of records
<i>Biophysical Status</i>		
Coastal habitat coverage (km ²)	Ground truthing/spot checks annual	PALARIS, PICRC
Forest cover (km ²)	Ground truthing/spot checks annual	PALARIS
Marine lake species (list of species)	Annual	CRRF
Marine lake species (# jellyfish / area)	Annual	CRRF
Extent invasive species in marine lakes (# species / area)	Annual	CRRF
Reef substrate/Benthic community structure (% cover)	Annual	PICRC
Coral recruitment (#/area)	Annual	PICRC
Fish species (# species / area)	Annual	PICRC
Fish abundance (# / area)	Annual	PICRC
Sea turtles (# / area)	Annual	PICRC
Sea turtle nesting sites (# sites)	Every five years	MNRET
Crocodiles (#)	Every five years	Koror State
Dugong (#)	Every five years	Koror State
Fruit Bats (# / station)	Annual	BNM
Birds (# / station)	Annual	BNM
Plants (# <i>Ponapea</i>)	Annual	MNRET
Water quality (turbidity, nutrients)	Annual	EQPB
<i>Cultural Site Integrity</i>		
# / % sites documented / inventoried	Annual	Koror State / BAC
Presence / absence of documented removable artifacts	Annual	Koror State / BAC
% sites restored	Annual	Koror State / BAC
% sites with documented visitor damage	Annual	Koror State
% sensitive sites with restricted access	Annual	Koror State
<i>Socioeconomic Status</i>		
Perception of resource (% categorization)	Every five years	Koror State
Resource use patterns	Every five years	Koror State
% Buy-In	Every five years	Koror State
Household income distribution by source	Annual	Office of Statistics
# Visitors	Monthly	Koror State
<i>Threats</i>		
Invasive species (presence/absence, #)	Annual	Koror State
Visitor impacts	Annual	Koror State
<i>Management Effectiveness</i>		
Level of funding	Annual	Koror State
# Staff / # empty staff positions	Annual	Koror State
# citations	Annual	Koror State
Presence / absence authorized management plan	Annual	Koror State

6.c Results of previous reporting exercises - List of references

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7. Documentation

Photograph, Image Inventory and other Audiovisual Materials Authorization Table							
Id. No	Format	Caption/Description	Date	Photographer	Copyright owner (if different than photographer)	Contact Details of Copyright Owner	Non-exclusive cession of rights
Photograph 1	JPEG	Rock Islands Southern Lagoon	2010	Mandy Etpison		etpison@palaunet.com	1
Photograph 2	JPEG	Ngerukewid Islands National Wildlife Preserve	2010	Patrick L. Colin / Coral Reef Research Foundation		crrf@palaunet.com	2
Photograph 3	JPEG	An aerial view of the Rock Islands	2010	Ann Kitalong / The Environment, Inc (TEI) .		kitalong@palaunet.com	YES
Figure 1	JPEG	MAP of RISL - Descriptive	2011	Koror State Department of Conservation and Law Enforcement (KSDCLE)		coastalmgmt@kororstate.org	YES
Figure 2a	JPEG	Map of RISL - Coordinates	2011	KSDCLE		coastalmgmt@kororstate.org	YES
Figure 2b	JPEG	Map of NE corner of RISL	2011	KSDCLE		coastalmgmt@kororstate.org	YES
Photograph 4	JPEG	Islands, reef flats, and marine habitats in RISL	2009	Patrick L. Colin		crrf@palaunet.com	2
Photograph 5	JPEG	Marine Biodiversity	2009	Kevin Davidson		pcs@palaunet.com	4
Photograph 6	JPEG	Ongeim l'Tketau (Jellyfish Lake)	2008	Patrick L. Colin		crrf@palaunet.com	2
Photograph 7	JPEG	<i>Mastigias papua etpisoni</i>	2008	Patrick L. Colin		crrf@palaunet.com	2
Photograph 8	JPEG	Coral reef	2010	Palau Conservation Society (PCS)		pcs@palaunet.com	4
Photograph 9	JPEG	Terrestrial biodiversity	2010	Tarita Holm		tarita_holm@yahoo.com	5
Photograph 10	JPEG	Extensive <i>Turbinaria reniformis</i> colonies at Ulong Island	2009	Paul Collins		paul@absolutediving.co.uk	6
Photograph 11	JPEG	Grey Reef Shark	2009	Paul Collins		paul@absolutediving.co.uk	6
Photograph 12	JPEG	Hawksbill Sea Turtle	2009	Paul Collins		paul@absolutediving.co.uk	6
Photograph 13	JPEG	Emerald Skink	2010	Eric VanderWerf		pcs@palaunet.com	4
Photograph 14	JPEG	Micronesian megapode	2010	Mandy Etpison		etpison@palaunet.com	1
Photograph 15	JPEG	Dugongs	2010	Mandy Etpison		etpison@palaunet.com	1
Photograph 16	JPEG	Dugong feeding trail	2009	Paul Collins		paul@absolutediving.co.uk	6
Photograph 17	JPEG	Palau Fruit bat	2009	Mandy Etpison		etpison@palaunet.com	1
Photograph 18	JPEG	Land Snail		PCS		pcs@palaunet.com	4
Photograph 19	JPEG	<i>Hydriastele palauensis</i>	2010	Ann Kitalong		kitalong@palaunet.com	YES
Photograph 20	JPEG	Netfishing for reef fish	2010	Ann Kitalong		kitalong@palaunet.com	YES
Photograph 21	JPEG	A researcher at an entrance to Oasis Lake	2010	Ron Leidich/ Planet Blue Sea Kayak Tours		Planetblue@palaunet.com	10
Photograph 22	JPEG	<i>Pachyseris</i> coral baskets	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 23	JPEG	A tunnel leading to Einstein's Garden	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 24	JPEG	Corals in Einstein's Garden	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 25	JPEG	<i>Synchiropus splendidus</i>	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 26	JPEG	Mandarin Fish Cove from the air	2010	Ron Leidich		Planetblue@palaunet.com	10
Figure 3 - Aerial Map	JPEG	Ulong Island archaeological sites and tourist facilities.	2010	Geoffrey Clark & Christian Reepmeyer/ Australia National University (ANU)		geoffrey.clark@anu.edu.au	7
Figure 4	JPEG	Ulong stonework village features.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 5 - Photo	JPEG	Ulong stonework village defensive wall.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7

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Figure 6 - Drawing	JPEG	Ulong Antelope survivor camp AD 1783.	1788	Keate 1789: facing p.127	National Library of Australia	National Library of Australia (61-02-6262-1421)	8
Figure 7 - Map	JPEG	Ulong investigations at the Antelope survivor camp.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 8 - Photo	JPEG	Ulong red-painted rock art.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 9 - Photo	JPEG	Ulong red-painted rock art in fissure.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 10 - Photo	JPEG	Ulong rock art in cave interior.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 11 - Photo	JPEG	Ulong graffiti over rock art.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 12 - Aerial Map	JPEG	Dmasech Island archaeological sites and tourist facilities.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 13 - Map	JPEG	Dmasech stonework features.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 14 - Photo	JPEG	Dmasech stonework F-5A.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 15 - Photo	JPEG	Dmasech stonework (A) F-18; (B) coral slab and volcanic stones.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 16 - Map	JPEG	Uchularois Island archaeological sites and tourist facilities.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 17 - Photo	JPEG	Uchularois tourist facility (to be removed).	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 18 - Map	JPEG	Uchularois Cave and excavations.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 19 - Aerial Map	JPEG	Ngeruktabel Island, Chomedokl Island and Ngeremdiu.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 20 - Map	JPEG	Ngeruktabel Island traditional village sites.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 21 - Map	JPEG	Mariar stonework village.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 22 - Map	JPEG	Mariar F-27 complex.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 23 - Map	JPEG	Mariar F-7 platform.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 24 - Map	JPEG	Mariar F-33 complex.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 25 - Photo	JPEG	Big Mariar defensive wall in the 1970s.	1979 (Top) 2010	Bruce Masse (Top) Clark & Reepmeyer (Bottom)		wbmasse@lanl.gov geoffrey.clark@anu.edu.au	9 7
Figure 26 - Map	JPEG	Ngeremdiu stonework and Japanese WWII features.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 27 - Photo	JPEG	Oimaderuul Beach refurbished stone well.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 28 - Photo	JPEG	Ngeremdiu Yapese stone money (F-3).	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 29 - Map	JPEG	Ngeanges Island archaeological sites and tourist facilities.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 30 - Map	JPEG	Ngeanges stonework features on southern outcrop	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 31 - Map	JPEG	Chomedokl Island burial cave.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 32 - Photo	JPEG	Chomedokl north cave entrance.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 33 - Map	JPEG	Chomedokl cave plan.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Photograph 27	JPEG	<i>Tridacna gigas</i>		Patrick L. Colin		crrf@palaunet.com	2
Graph 1	JPEG	Rock Island radiocarbon dates and cultural phases.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Photograph 28	JPEG	<i>Tourists in the RISL</i>	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 29	JPEG	KSDCLE	2010	KSDCLE		coastalmgmt@kororstate.org	3
Painting 1	Scan	Dugongs in legends	2010	Adora Hideo	PCS	pcs@palaunet.com	4
Photograph 30	JPEG	The stunning Rock Islands	2010	Patrick L. Colin		crrf@palaunet.com	2
Photograph 31	JPEG	Nudibranch	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 32	JPEG	Palau Flycatcher	2005	E. VanderWerf	PCS	pcs@palaunet.com	4
Photograph 33	JPEG	Spadefish	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 34	JPEG	Beach Scene	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 35	JPEG	<i>Mastigas papua etpisoni</i>	2010	Patrick L. Colin		crrf@palaunet.com	2
Photograph 36	JPEG	Endemic <i>Nautilus belauensis</i>	2010	Patrick L. Colin		crrf@palaunet.com	2
Photograph 37	JPEG	<i>Astrosarkus idipi</i>	2010	Patrick L. Colin		crrf@palaunet.com	2
Photograph 38	JPEG	Subsistence fishing	2006	PCS		pcs@palaunet.com	4

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Photograph 39	JPEG	Koror State Ranger in the field	2010	PCS		pcs@palaunet.com	4
Photograph 40	JPEG	Rock Islands and Dugong	2010	Mandy Etpison		etpison@palaunet.com	1
Figure 34 - Figure	JPEG	Climate change during the occupation of the Rock Islands.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 35 - Figure	JPEG	Size decrease in Scarids (parrotfish) in the Rock Islands.	2010	Masse et al. 2006		wbmasse@lanl.gov	9
Figure 36 - Map	JPEG	Irai stone work village plan.	2010	Clark & Reepmeyer; after Krämer		geoffrey.clark@anu.edu.au	7
Figure 37 - Map	JPEG	Rock Islands stonework village plan.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 38 - Map	JPEG	Ancient Rock Island titles and islands.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 39 -Photo	JPEG	Dmasech Island megapode nest in archaeological site.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 40 - Photo	JPEG	Little Mariar effect of tree collapse on stone wall feature.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 41 - Photo	JPEG	Little Mariar wave impact on prehistoric stone wall.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 42 - Photo	JPEG	Ulong Island graffiti on rock art.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 43 - Photo	JPEG	Ulong Island rock art covered by algae mat.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Photograph 41	JPEG	Ngemelis Island Complex	2010	Patrick L. Colin		crrf@palaunet.com	2
Photograph 42	JPEG	Nicobar pigeon Laib	2010	Mandy Etpison		etpison@palaunet.com	1
Photograph 43	JPEG	Juvenile fish within seagrass bed	2009	Ann Kitalong		kitalong@palaunet.com	YES
Photograph 44	JPEG	Divers	2010	Paul Collins	PCS	paul@absolutediving.co.uk	6
Photograph 45	JPEG	Fishing Boats	2010	Ron Leidich		Planetblue@palaunet.com	10
Figure 44 - Map	JPEG	Rock Islands/Southern Lagoon management zones.	2010	Clark & Reepmeyer on KSDCLE base map		geoffrey.clark@anu.edu.au	7
Photograph 46	JPEG	Manta Rays in German Channel	2010	Mandy Etpison		etpison@palaunet.com	1
Photograph 47	JPEG	German Channel, looking north	2009	Mandy Etpison		etpison@palaunet.com	1
Photograph 48	JPEG	Koror-Peleliu MOU	2011	KSDCLE	KSDCLE	coastalmgmt@kororstate.org	YES
Photograph 49	JPEG	Harvesting Giant Clams	2009	Ann Kitalong/		kitalong@palaunet.com	YES
Photograph 50	JPEG	Unusual perspective of a snorkeler	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 51	JPEG	Branching coral	2010	Ron Leidich		Planetblue@palaunet.com	10
Photograph 52	JPEG	Cardinalfish	2010	Ron Leidich		Planetblue@palaunet.com	10
Figure 45 – Aerial Map	JPEG	Ulong Island cultural site management plan.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Figure 46 - Photo	JPEG	Ulong Island existing cultural site signage.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 47 - Photo	JPEG	Ulong Island example of existing foot path to cultural site.	2010	Geoffrey Clark		geoffrey.clark@anu.edu.au	7
Figure 48 – Aerial Map	JPEG	Dmasech Island cultural site management plan.	2010	Clark & Reepmeyer		geoffrey.clark@anu.edu.au	7
Photograph 53	JPEG	<i>Ponapea palauensis</i>	2009	Ann Kitalong		kitalong@palaunet.com	YES
Photograph 54	JPEG	Marine tour guide certification	2007	KSDCLE	KSDCLE	coastalmgmt@kororstate.org	YES
Figure 49 – Graph	Excel graphic	RISL Use Permits versus Palau visitor arrivals	2010	N/A		N/A	
Photograph 55	JPEG	An aerial view of Ngederrak Reef	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 56	JPEG	MPA Habitat map	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 57	JPEG	Ngederrak Reef	2010	Paul Collins		paul@absolutediving.co.uk	6
Photograph 58	JPEG	An aerial view of the Rock Islands		Ron Leidich		Planetblue@palaunet.com	10

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7.b Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plans relevant to the property

As described in previous sections there are many traditional, state and national laws protecting the Rock Islands Southern Lagoon of Koror State as well as dedicated plans focusing on the management of the property. The following documents are provided as appendices to the application.

Appendix D. National and State Regulations applicable to the Rock Islands Southern Lagoon

Appendix E. Rock Islands Southern Lagoon Management Plan 2004-2008 (Three volumes)

Appendix F. Koror-Peleliu German Channel MOU

Appendix G. National Fishing Laws

7.c Form and date of most recent records or inventory of property

Recent records include results from a wide variety of research studies. Original findings are retained by the research agency. Primary agencies with information about the RISL are listed in Section 6c.

7.d Address where inventory, records and archives are held

Koror State Government

P.O. Box 116

Koror, Palau 96940

Tel: (680) 488-8738/4001

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E-mail: coastalmgnt@kororstate.org

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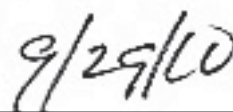
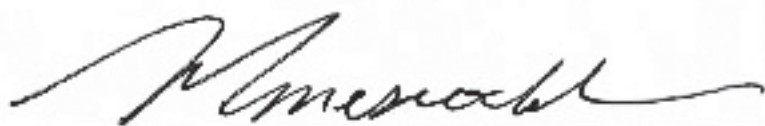
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9. Signature on behalf of the State Party



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The Rock Islands Southern Lagoon Republic of Palau



Photo by Michael N. Dawson.

Ongasireng



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