

2012

**STATE
OF
PALAU'S
BIRDS**



Belau National Museum

His signature is the beauty of things

~ Robinson Jeffers



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Bridled Tern
Bedebedechaki
Sterna anaethetus

State of Palau's Birds 2012

3rd Annual Report of the National Program for Monitoring Forest and Coastal Birds



Natural History Section



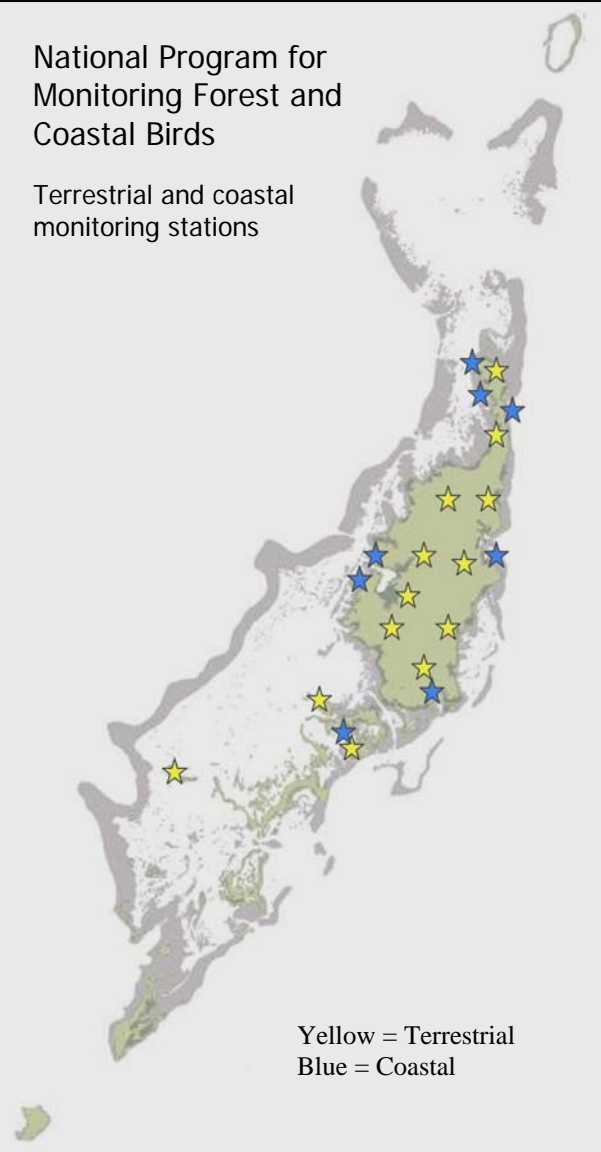
Belau National Museum

Introduction: The Importance of Palau's Birds and Biodiversity

From sea to land, from land to sea; And heave round earth, a living chain of interwoven agency ~ *Goethe's Faust*

National Program for Monitoring Forest and Coastal Birds

Terrestrial and coastal monitoring stations



Growth of the National Program

Bird diversity is an important indicator of overall biodiversity. The National Program for Monitoring Forest and Coastal Birds provides an infrastructure for monitoring bird diversity throughout Palau. In 2012, the national program added four new sites to its network of bird monitoring stations, which now numbers 21 stations. The new stations are located in forest habitats at Ollei, Ngerkebesang and Ulong and a coastal habitat at Ngarchelong. On the map at left, active forest stations are indicated by yellow stars and active coastal stations by blue stars. Fourteen of the 21 stations are located in protected terrestrial or marine conservation areas while the others are placed in unprotected areas to serve as references for monitoring protected areas. Additional stations are planned for central Babeldaob (Koksai), Peleliu, Angaur and Kayangel in the near future.

Stations at Protected Conservation Areas

Ngarchelong - Ollei	State park
Ngaraard - Choll	State beach
Ngaraard - Ngerchokl	PAN terrestrial site
Ngardmau - Waterfall Trail	Eco-Theme Park
Ngiwal - Ngemai	Marine protected area
Ngaremlengui - Ngermeskang	PAN terrestrial site (Bird Sanctuary)
Ngaremlengui - Bkulengriil	Marine protected area
Melekeok - Lake Ngardok	PAN terrestrial site (RAMSAR wetland)
Ngatpang - Pier	Marine protected area
Aimeliik - Ngerderar	Watershed conservation area
Airai - Ngerikiil	IWRM watershed conservation area
Koror - Ngerkebesang	Private nature reserve
Koror - Ngermalk	State park and conservation area
Koror - Ulong Island	World Heritage Site

Introduction: The Importance of Palau's Birds and Biodiversity



Ancient rock art at Long Island Park



Community Awareness - Birdwatching at Long Island Park

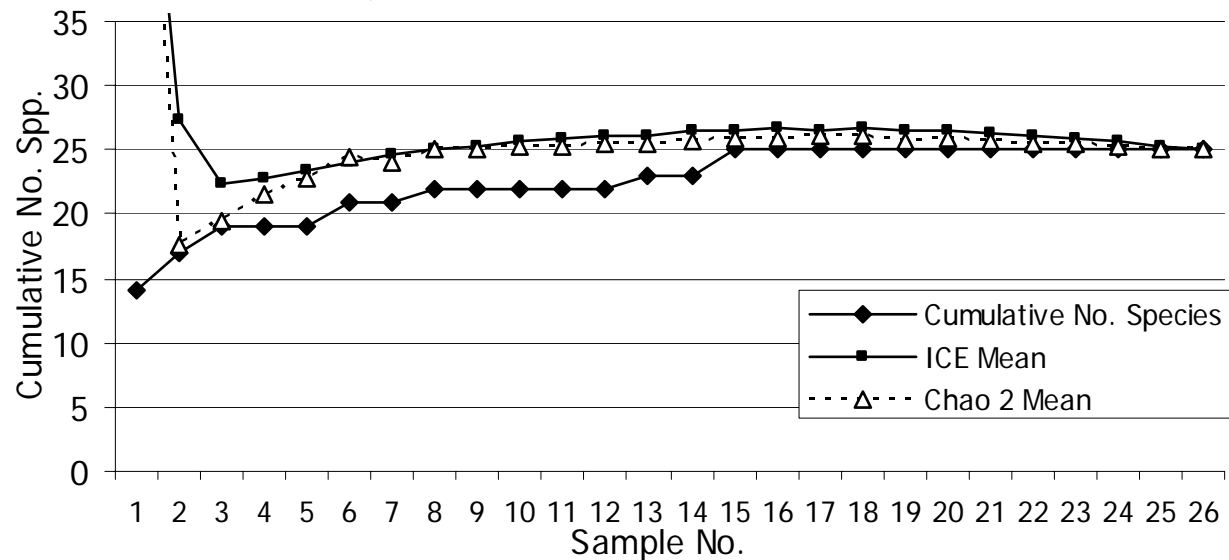
Long Island Park and Conservation Area is an official monitoring station for the National Program for Monitoring Forest and Coastal Birds and an excellent, accessible venue for promoting community awareness of the importance of birds. In November 2012, Belau National Museum in partnership with Koror State Government launched a community birdwatching activity at the park on the first Saturday of every month. Local residents and tourists can mingle with professional ornithologists and conservationists to observe and learn about the rich diversity of forest and coastal birds found in the park. The park is open to the public from dawn until dusk and features other natural, cultural and recreational attractions in addition to birdwatching.

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Ngerikiil IWRM Project

As a participant in the UNDP Palau Integrated Water Resource Management (IWRM) initiative, Belau National Museum through the National Program for Monitoring Forest and Coastal Birds provides monitoring data for the Ngerikiil Watershed, which is the source of municipal water for the people of Koror and Airai States. Bird monitoring data is gathered from the upper Ngerikiil River Basin; Lower Ngerikiil River Basin and Ngerimel Reservoir. The chief environmental indicator is bird species richness. Ngerikiil watershed system is relatively rich in terms of bird species diversity with 25 resident species of forest-dependent birds. The chart below summarizes the bird species richness data collected as of 2012, with standard statistical estimators of bird diversity; the Incidence-based Coverage Estimator (ICE) and the Chao 2 biodiversity estimator. The values of both statistics indicate that the species richness estimate of 25 species is reliable at the 95% confidence level.

**Species Accumulation Curve: Resident Forest-Dependent Birds
Ngerikiil IWRM Watershed (2007 - 2012)**



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Bird Diversity of the Upper and Lower Ngerikiil Watershed and Ngerimel Reservoir

Bird Species Richness of the Ngerikiil Watershed System

Bird Species	Upper Basin	Lower Basin	Ngerimel
Palau Fruit-Dove	X	X	X
Micronesian Starling	X	X	X
Palau Flycatcher	X	X	X
Palau Bush-Warbler	X	X	X
Palau Swiftlet	X	X	X
Morningbird	X	X	X
Dusky White-eye	X	X	X
Micronesian Honeyeater	X	X	X
Palau Ground-Dove	X		
White-breasted Woodswallow	X		
White-tailed Tropicbird	X	X	
Cicadabird	X	X	X
Citrine White-eye	X		
Collared Kingfisher	X	X	X
Micronesian Kingfisher	X		X
Palau Fantail	X	X	X
Micronesian Imperial-Pigeon	X		
Black Noddy	X	X	X
Nicobar Pigeon	X	X	
Buff-banded Rail	X	X	
Palau Owl	X		
White Tern	X	X	X
Slaty-legged Crake		X	
Rufous Night-Heron		X	
Purple Swamphen		X	
Total No. Species	22	19	14

The species richness table (left) for Ngerikiil shows that different sectors of the watershed system support different arrays of bird species. Rare species such as the Palau Ground-Dove, White-breasted Woodswallow, Micronesian Imperial-Pigeon and Palau Owl occur only in the undisturbed upper river basin. The lower basin supports several bird species that are associated with the agricultural areas and aquaculture ponds that are located in the lower basin including the Slaty-legged Crake, Rufous Night-Heron and Purple Swamphen.

This means that several data bases and field tracking stations are needed to monitor ecological changes in a watershed system as large and complex as Ngerikiil.

The overall bird diversity (25 species) of the Ngerikiil watershed is relatively rich, ranking the conservation priority of the area in the top 10th percentile of terrestrial forests in Palau. Monitoring the watershed is important from a biodiversity conservation point of view and from a water quality perspective.

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

PALAU MEGAPODE ~ Assessment the Status of an Endangered Species in the Rock Islands

In 2012, the Rock Islands Southern Lagoon Conservation Area in the state of Koror was inscribed as Palau's first and, so far, only UNESCO World Heritage Site based on a combination of cultural, scenic and biodiversity criteria. The Rock Islands are a primary breeding ground for a rare bird, the Palau Megapode. In response to the UNESCO World Heritage inscription, a partnership of Belau National Museum, Palau Conservation Society and Koror State Government launched a comprehensive assessment of the status of the Palau Megapode in the World Heritage Site. The assessment was supported by a grant from the Royal Forest and Bird Protection Society of New Zealand through the BirdLife International Community Conservation Fund. The following pages summarize the results of the assessment. The Natural History Gallery at Belau National Museum features an exhibition of the full results of the megapode assessment.



Palau Megapode
Bekai
Megapodius laperouse senex

An Unusual, Rare and Endangered Bird

Megapodes are a family of 22 species of chicken-like birds that are found in Australia, the Philippines and several regions of Oceania including Micronesia. The Palau Megapode (picture) is an endemic subspecies of the Micronesian Megapode and is the largest native terrestrial bird in Palau. The only other subspecies of the Micronesian Megapode is found in the northern Marianna islands. The total number of Micronesian Megapodes left in the world is an estimated 1,300 to 1,700 birds. Due to their low populations and restricted ranges, both subspecies are listed as Endangered by the IUCN and BirdLife International.

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Megapode Nesting Mounds

Palau Megapodes live in the low-lying coastal forests inland from many of the beaches that dot the rock islands landscape. Their breeding grounds are typically located in forested areas with a full canopy. On the shady floor of the forest, megapodes build earthen nesting mounds to protect their eggs. The center of the mound contains a core of fallen leaves and other organic matter that serve as a compost pile to create warmth for incubating the eggs. The core is covered with soil, sand or coral rubble to complete its construction. Breeding and nest-building is a year-round activity for megapodes. A nesting mound may remain active over many years and the accumulated soil or sand can reach impressive proportions. The exceptionally large nesting mound pictured below is over six feet tall and has been in continual use for many years.



During the incubation period, parent birds actively tend their nesting mound by removing or adding soil to maintain the incubation temperature inside the mound. When the eggs finally hatch, the chicks are on their own - having to dig their way out of the mound and begin looking for food without any help from their parents.

Megapodes are notoriously difficult to monitor because they tend to hide in the dense forest. An alternative technique is to monitor nesting mounds, which are comparatively easy to locate and monitor. During the recent assessment, museum scientists documented mound locations as well as bird activity in order to provide a more complete picture of the status of the Palau Megapode in the rock islands.

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Results of the Assessment of the Status of the Palau Megapode in the Rock Islands

The megapode assessment team visited over 50 potential megapode sites in the Rock Islands to count birds and nesting mounds. Approximately half of the sites had megapodes and/or their nesting mounds. A total of 172 megapodes were seen or heard during the assessment however; a statistical analysis of the data estimated the total megapode population of the World Heritage Site at 230 and 280 birds, which is approximately 15% of the global population of Micronesian Megapodes and which qualifies the World Heritage Site as a megapode hotspot. The table 1 summarizes megapode counts at each rock island assessment locality.

Nesting mounds were mapped and classified as "active" if there was evidence of megapodes tending a mound or "inactive" if a mound appeared abandoned. The table 2 summarizes the number and status of the megapode nesting mounds that were found at each rock island locality during the assessment. The satellite map on the facing page shows the location of each active nesting mound found during the assessment.

Table 1
MEGAPODE COUNTS

Locality	Count
Babelomekang	3
Bailechesengel	8
Cheleu	30
Dmasech	23
Euidelcholl	5
Ioulomekang	4
Kmekumer	2
Lilblau	9
Mariar	1
Moir	1
Ngchus	2
Ngeanges	8
Ngebedangel	2
Ngchelobel	4
Ngerechong	32
Ngeremdiu	2
Ngerengchol	2
Ngermeaus	1
Ngeroblobang	5
Ulong	28
Total	172



Table 2
MEGAPODE NESTING MOUNDS

Locality	Active	Inactive	Total	Pct Active
Bailechesengel	8	8	16	50.00
Belual a Kelat	1	3	4	25.00
Betikl	0	1	1	0.00
Cheleu	12	21	33	36.36
Dmasech	15	7	22	68.18
Euidelcholl	2	5	7	28.57
Iuolomekang	2	2	4	50.00
Kisaks	0	2	2	0.00
Kmekumer	4	2	6	66.67
Lilblau	5	3	8	62.50
Mariar	1	6	7	14.29
Moir	1	0	1	100.00
Ngchus	0	3	3	0.00
Ngeanges	4	7	11	36.36
Ngebedangel	2	0	2	100.00
Ngerechong	14	13	27	51.85
Ngeremdiu	1	2	3	33.33
Ngerengchol	2	2	4	50.00
Ngeroblobang	7	3	10	70.00
Ngidech	1	1	2	50.00
Ngis	2	1	3	66.67
Ulong	8	18	26	30.77
Totals	92	110	202	45.54

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Satellite map of the active nesting mounds of the Palau Megapode as of November 2012

(green dots mark locations of active mounds)

Ulong I.

Ngeanges I.

Ngerukewid Nature Reserve

Rock Islands
Southern Lagoon
~
UNESCO World
Heritage Site

Mecherechar I.

Ngemelis Conservation Area

Ngerechong I.

State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Immediate Threats to the Survival of the Palau Megapode

Climate Change

The chief threat to the survival of the Palau Megapode is rising sea levels from global warming due to climate change. Exceptionally high tides from rising sea levels threaten to erode away coastal nesting mounds and eventually flood the low-lying beachfront forests where the megapode breeding grounds are located. This threat is already evident in the active nesting mound pictured at left, which is partly eroded from exceptionally high tides. As the sea level continues to rise, the tides will become progressively higher and destroy or flood an increasing number of nesting mounds until none are left.



Typhoons

A related threat is inundation of nesting mounds and destruction of habitat by typhoons. The formerly active nesting mound pictured at right was inundated by the tidal surge from Supertyphoon Bopha (December 2012) and subsequently abandoned by the megapodes that built it. A post-typhoon assessment by Belau National Museum and Palau Conservation Society estimated that up to 10% of the active nesting mounds in the Rock Island Southern Lagoon World Heritage Site may have been lost to Typhoon Bopha. In addition, the forest canopy above at least one breeding ground site was destroyed by typhoon winds and the site with all its nesting mounds was totally abandoned by the megapodes.



State of Palau's Birds: What We Know About the Changing State of Birds in Palau

Megapode Assessment Team (l. to r.)

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Heather Ketebengang - Palau Conservation Society
Chen Po-hao - Taiwan ICDF/Koror State Government
Godines Ngiltii - Palau Conservation Society
Milang Eberdong - Belau National Museum
Alan R. Olsen - Belau National Museum



Koror State Rangers

The Koror State Rangers organization and the Honorable Yositaka Adachi (center), Governor of the State of Koror, provided top-notch assistance and support for the megapode assessment project.

For more information about the Rock Islands Southern Lagoon World Heritage Site contact
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Pressure: Monitoring Changes in Bird Diversity

Protected Areas Network



Standardized Protocol for the Environmental Monitoring
of Terrestrial and Coastal Protected Areas

Republic of Palau
January 2013

A New Protocol for the Micronesia Challenge and the Protected Areas Network (PAN)

The Protected Areas Network Act of the Republic of Palau (RPPL No. 6-39) supports the Micronesia Challenge of the Convention on Biological Diversity and many other important global, national and local conservation initiatives by providing access to technical resources for the environmental monitoring of important forest, wetland and coastal protected areas. Based on the results of field research conducted by Belau National Museum and Palau Forestry Office for the Palau Ecosystem-Based Management (EBM) initiative, a standard protocol was formulated for the environmental monitoring of terrestrial and coastal protected areas using bird diversity as a primary indicator of overall biodiversity. The biomonitoring methods and indicators in the protocol were deliberated and endorsed by the Micronesia Challenge Terrestrial Indicators Group at meetings held in Chuuk (2011) and Palau (2012) and was submitted to the Palau Ministry of Natural Resources, Environment and Tourism in August 2012 for adoption under the PAN regulatory process. Pursuant to the Protected Areas Network regulations, the Ministry officially adopted the protocol on January 8th 2013.

Titled *Standardized Protocol for the Environmental Monitoring of Terrestrial and Coastal Protected Areas*, the official protocol (pictured left) is available in electronic format from the Office of the Protected Areas Network.

Response: What Is Being Done to Improve the Status of Birds

PAN Monitoring Protocol ~ Indicator Species

In addition to using the overall diversity of plants, invertebrates and birds to monitor PAN sites, the PAN terrestrial monitoring protocol designates certain keystone species (right) as indicators of ecosystem health. In terrestrial forests, the indicator species are canopy frugivores (Palau Fruit-Dove and Micronesian Imperial-Pigeon) and an omnivore (Palau Bush-Warbler). Indicator species for coastal marine ecosystems are apex predators (Rufous Night-Heron, Pacific Reef-Heron and Little Pied Cormorant). In mangrove ecosystems where there are no keystone bird indicators, the protocol uses sesarimid crabs as the primary indicator species group. Supplemental indicators are provided by the protocol for optional use by managers of protected areas where appropriate. These optional indicators may include vegetation profiles, aquatic macro-invertebrates, leaf-litter ants and flying foxes.

Ridge-to-Reef

As a comprehensive approach to environmental monitoring, the PAN protocol provides a ridge-to-reef framework for biodiversity monitoring; effectively bridging the gaps between terrestrial and marine protected areas.

Micronesia Challenge/PAN Indicator Species



Forest Birds, left to right: Palau Fruit-Dove, Palau Bush-Warbler, Micronesian Imperial-Pigeon



Coastal Birds, left to right: Rufous Night-Heron, Pacific Reef-Heron, Little Pied Cormorant



Sesarimid crabs

Response: What Is Being Done to Improve the Status of Birds

RUFOUS NIGHT - HERON (MELABA OB) ~ Assessment of a Coastal Indicator Species

In June 2012, the National Program for Monitoring Forest and Coastal Birds conducted a population assessment of the Rufous Night-Heron, a resident bird that serves as a primary indicator species for monitoring coastal habitats. Over a four-day period, night-herons were counted at various coastal locations (map) during low tide when the birds can be seen foraging on exposed tidal flats. This first-time assessment of the Rufous Night-Heron in Palau estimated that Palau's total population of Rufous Night-Herons is approximately 1,200 adult birds. The results of the assessment were submitted to Wetlands International for inclusion in that organization's global database to be published in an upcoming edition of the *Waterbird Population Estimates*, a global project for monitoring change in bird populations.



The Rufous Night-Heron, *Nycticorax caledonicus pelewensis*, is a regional endemic subspecies found in Palau and the Federated States of Micronesia. When its coastal feeding grounds are covered by seawater at high tide, night-herons congregate with other coastal birds at inland sites (pictured left) to wait for the next low tide.

Response: What Is Being Done to Improve the Status of Birds



Rufous Night-Heron adult
Choll hamlet, Ngaraard



Rufous Night-Heron adult
(breeding plumage)
Ngiwal

Monitoring Coastal Marine Resources

Coastal monitoring is important not only for the management of marine resources but also because over half of the bird species in Palau depend on the bounty of the sea for food and survival. The Rufous Night-Heron is an excellent indicator of the biological richness of marine coastal waters because the species is attracted to areas with bountiful food ~ fish, crabs and other marine invertebrates. Coastal areas with rich, pristine waters may attract up to 60 or 70 night-herons at low tide while areas that are impacted by silt or pollution attract few or no night-herons. Monitoring night-herons in marine protected areas provides an early warning system for detecting and measuring change in the richness of the coastal waters to the benefit of both people and birds, who share the abundant marine resources of Palau.



Rufous Night-Heron adult,
hunting for food in a tidal flat



Rufous Night-Heron juvenile,
waiting for the next low tide

Guardian of Coastal Marine Resources



Rufous Night-Heron
Melabaob
Nycticorax caledonicus pelewensis

GALLERY OF COMMON BIRDS OF THE ROCK ISLAND SOUTHERN
LAGOON WORLD HERITAGE SITE



White-tailed Tropicbird
Dudek
Phaethon lepturus

Common Forest Birds of the Rock Islands Southern Lagoon World Heritage Site



Palau Swiftlet
Chesisekiakid
Aerodramus pelewensis



Dusky White-eye
Chetitalial
Zosterops finschii



Giant White-eye
—
Megazosterops palauensis



Palau Flycatcher
Charmelachull
Myiagra erythrops



Palau Fantail
Melimdelebbet
Rhipidura lepida



Palau Ground-Dove
Omekrengukid
Gallicolumba canifrons

Common Forest Birds of the Rock Islands Southern Lagoon World Heritage Site



Micronesian Starling
Kiuud
Aplonis opaca



Micronesian Honeyeater
Chesisebangiau
Myzomela rubrata



Nicobar Pigeon
Laib
Caloenas nicobarica



Palau Megapode
Bekai
Megapodius laperouse senex



Blue-faced Parrotfinch
Erythrura trichoa



Morningbird
Tutau
Colluricincla tenebrosa

Common Seabirds of the Rock Islands Southern Lagoon World Heritage Site



Front - Black Noddy
Bedaoch
Anous minutus

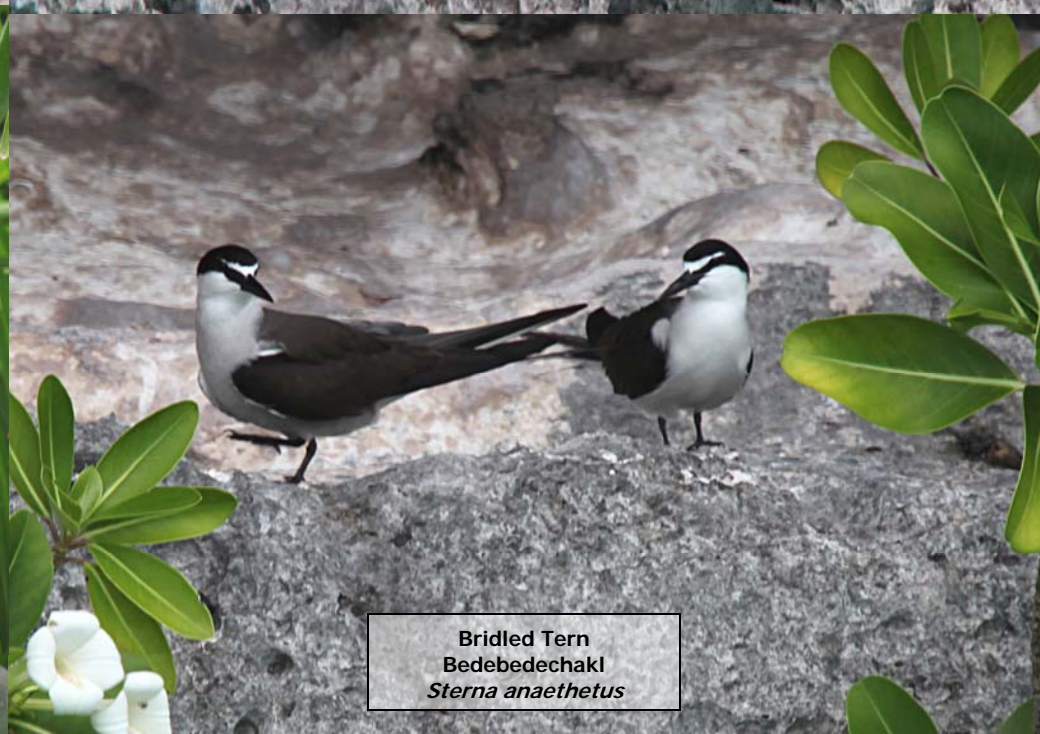
Rear - Greater Crested Tern
Roall
Sterna bergii



Black-naped Tern
Kerkirs
Sterna sumatrana



Brown Noddy
Mechadelbedaoch
Anous stolidus



Bridled Tern
Bedebedechakl
Sterna anaethetus

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Micronesian Imperial-Pigeons
Ieb
Ducula oceanica

