Guam Comprehensive Wildlife Conservation Strategy (GCWCS)

November 7, 2006

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To Whom It May Concern:

The following government officials hereby pledge support for the actions stated in this Guam Comprehensive Wildlife Conservation Strategy. This plan advocates that partnerships between natural resource stakeholders be established and nurtured to obtain goals set forth in this strategy.

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Executive Summary

With the passage of the Commerce, Justice, and State Appropriations Act of 2001, Congress mandated that each state and territory develop its own comprehensive strategy. The strategy is required to have eight elements including a description of the status of species determined to be a species of greatest conservation need, important habitats and their condition, conservation actions, monitoring of these species, and gauging conservation success. Important in the development is a "good faith effort" to include the public in the development.

Guam, a US territory, is the southernmost island in the Mariana Archipelago and the largest island in Micronesia, with a landmass of 560 km^2, and a population of 154,000 people. This high island contains a northern portion of the island is a limestone plateau, rising nearly 200 meters above sea level in some places. The southern half of the island is old weathered volcanic material with a cap of limestone most prominent on the Mt. Lamlam-Alifan ridge. The highest point of the island is Mt. Lamlam, in the south, an elevation of 406 meters. Guam's tropical climate averages daily temperatures ranging from 24-30°C (75-86°F) and average annual rainfall is about 218 cm (86 in). The island has a wet and a dry season. The wet season runs from June to November and the dry season from January to April, with December and May being transitional months.

Prior to writing Guam's Comprehensive Wildlife Conservation Strategy various agencies, groups, non-profit organizations, and the public in general were solicited for input (Element 7 and 8). Several public meetings were conducted to provide a venue to encourage pubic input in to the document, allowing individuals to voice concerns or ideas of what should be incorporated into the plan. The public meetings were sparsely attended but efforts to educate the public of the plan will continue. The plan is available on the Division of Aquatic and Wildlife Resources website (www.guamdawr.org).

Guam's Comprehensive Wildlife Conservation Strategies (GCWCS) identified 65 species including 31 terrestrial (mammals-2, birds-13, lizards-5, snails-3, insects-2 and plants-6), 7 freshwater (fish-4, eel-1, plants-2), and 27 marine organisms (marine mammals-14, fish-2, clams-4, gastropod-1, spiny lobster-1, sea turtle-2, marine plants-3). A conservation table is devoted to each of the summarizing their status, goals, objectives, and action plans (Elements 1, 3, and 4). Besides identifying actions necessary for each species, other conservation actions that affect general groups of species were identified and included the development of memoranda of understanding, rehabilitation of habitats, public education, and law enforcement.

In addition, groups of native organisms were included in this category as needing attention to differentiate between those meeting species of greatest conservation need status and those that don't. Further investigations of these groups should elucidate the proper designations the species within each group should have.

The recovery of native species cannot be achieved without the maintenance and recovery of their habitat. Guam's CWCS presents 23 maps showing the location and relative

conditions of habitats and conservation areas important to the conservation and recovery of Guam's species of greatest conservation need (Element 2). Freshwater habitats including marshes, rivers and man-made reservoirs all support freshwater plants and animals, including the Mariana common moorhen. The areas under local control, including the Anao, Cotal, and Balonos conservation areas, as well as conservation areas under federal control can serve as areas for recovering terrestrial species. There are five marine preserves that provide refugia for many marine species. These areas vary in their condition as suitable habitat for recovery for terrestrial species. Areas in the southern part of Guam tended to have habitat in dire need of programs to replace dominate grasslands (*Miscanthus floridulus*) with suitable native forest habitat. The northern areas have more intact forest but need other management actions such as ungulate control and out planting of certain plant species to enhance the quality of the habitat.

The introduction of predators and other invasives have played a key part in the decline and extirpation of many of Guam's native species. The brown treesnake (*Boiga irregularis*) and predatory flatworm must be controlled and be part of implementation of the habitat recovery. While *in situ* programs are occurring, captive breeding programs must be implemented to build a stock of captive native forest birds, lizards, and snails. This program would build a population of organisms for release in conservation areas ready to receive them, i.e., appropriate measures that were limiting in the first place have been remedied. In other cases, such as the island swiftlet and Mariana common moorhen, where populations continue to persist in the wild on Guam, brown treesnake control programs will protect the resource. Guam's rivers and streams and organisms within are vulnerable to introductions of exotics species that could easily threatened native aquatic species. Introduction of exotics, man-made dams, and erosion threaten this highly fragile environment and its native organisms.

Monitoring the progress of conservation actions is an important component (Element 5). Guam's CWCS suggests utilizing existing survey programs to develop the information base for monitoring the status of the species; such as in bird surveys, sampling plots, reef surveys, and aerial surveys. Freshwater and marine habitats are vulnerable to land-based activities and programs to monitor these activities and their impacts to the aquatic environments must be implemented. The plan identifies local action strategies that address human activities that impact freshwater and marine ecosystems. Information gathered by this effort will be used to address changes in the status of species, and will be incorporated in the review five and ten year review (Element 6).

Guam's CWCS incorporates a wholistic approach by including public education and law enforcement as vital components of the plan. While implementing actions to improve the status of species of greatest conservation, it is key to involve the public in the stewardship of the resources. In addition, enforcement of terrestrial and marine natural resource laws are important.

Road Map to the Eight Required Elements

This section is provided to assist the NAAT evaluate this document for the purpose of determining if and/or how well Guam's Comprehensive Wildlife Conservation Strategy (GCWCS) meets the eight required elements.

Please refer to the following page numbers in order to examine how each of the elements was addressed in the development of Guam's CWCS.

Element 1. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.

NAAT Guidance	Chapter	Page #	Table Figure	Page #	Appendix	Page #
A. The Strategy indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.	1 3	20-21 68-172			2 5	217 224
B. The strategy includes information about both abundance and distribution for species in all major groups to the extent that data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.	3	68-172				
C. The Strategy identifies low and declining populations to the extent data are available.	3	68-172				
D. All major groups of wildlife have been considered or an explanation is provided as to why they were not. The State may indicate whether these groups are to be included in a future Strategy revision.	3	68-85				
E. The Strategy describes the process used to select the species in greatest need of conservation. The quantity of information in the Strategy is determined by the State with input from its partners, based on what is available to the State.	3	68-69			4	220

Element 2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1).

NAAT Guidance	Chapter	Page #	Table Figure	Page #	Appendix	Page #
A. The Strategy provides a reasonable explanation for the level of detail provided; if insufficient, the Strategy identifies the	2 3	27-43 86-				

types of future action that will be taken to obtain the information.		172				
B. Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.	2	27-43	2 6 7	31 35 38	3	218

Element 3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improve conservation of these species and habitats.

NAAT Guidance	**Chapter**	**Page #**	**Table Figure**	**Page #**	**Appendix**	**Page #**
A. The Strategy indicates sources of information used to determine the problems or threats.	3	86-172				
B. The threats/problems are described in sufficient detail to develop focused conservation actions.	3	86-172				
C. The Strategy considers threats/problems, regardless of their origins (local, State, national and international), where relevant to the State's species and habitats.	3	86-172				
D. If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.	3	86-172				
E. The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and survey projects after the Strategy is approved.	3 5	86-172 185-196				

Element 4. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.

NAAT Guidance	**Chapter**	**Page #**	**Table Figure**	**Page #**	**Appendix**	**Page #**
A. The Strategy identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.	4	176-181				
B. The Strategy describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.	4	176-181	24	183		

C. The Strategy links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions (outlined in Element 5).	4	176-182				
D. The Strategy describes conservation actions that could be addressed by Federal agencies or regional, national or international partners and shared with other States.	4	176-182				
E. If available information is insufficient to describe needed conservation actions, the Strategy identifies research or survey needs for obtaining information to develop specific conservation actions.	4	176-182				
F. The Strategy identifies the relative priority of conservation actions.	4	176-182				

Element 5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions.

NAAT Guidance	**Chapter**	**Page #**	**Table Figure**	**Page #**	**Appendix**	**Page #**
A. The Strategy describes plans for monitoring species identified in (1) and their habitats.	5	185-196				
B. The Strategy describes how the outcomes of the conservation actions will be monitored.	5	185-196				
C. If monitoring is not identified for a species or species group, the Strategy explains why it is not appropriate, necessary or possible.	3	68				
D. Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.	5	185-196				
E. The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.	5	185-196				
F. The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation efforts.	5	185-196				
G. The Strategy is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.	5	196				

Element 6. Descriptions of procedures to review the Comprehensive Wildlife Strategy at intervals not to exceed 10 years.

NAAT Guidance	Chapter	Page #	Table Figure	Page #	Appendix	Page #
A. The State describes the process that will be used to review the Strategy within the next ten years.	6	198				

Element 7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Comprehensive Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats.

NAAT Guidance	Chapter	Page #	Table Figure	Page #	Appendix	Page #
A. The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, Indian tribes in the development of its Strategy.	7	200				
B. The State describes its continued coordination with these agencies and tribes in the implementation, review and revision of its Strategy.	6 7	198 200			7	241

Element 8. Provisions to ensure public participation in the development, revisions, and implementation of projects and programs. Congress has affirmed that broad public participation is an essential element of this process.

NAAT Guidance	Chapter	Page #	Table Figure	Page #	Appendix	Page #
A. The State describes the extent of its efforts to involve the public in the development of its Strategy.	8	202-203			8	248
B. The States describes its continued public involvement in the implementation and revision of its Strategy.	8	202-203				

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Acronyms and Abbreviations

AAFB – Andersen Air Force Base
ACOE – Army Corps of Engineers
AZA – American Zoo and Aquarium Association
BSP – Bureau of Statistics and Plans, Government of Guam
CITES – Convention on International Trade of Endangered Species
CNMI – Commonwealth of the Northern Marianas
COMNAVMAR – Commander US Naval Forces Marianas
CZM – Coastal Zone Management
DOA – Department of Agriculture, Government of Guam
DPR – Department of Parks and Recreation, Government of Guam
EO-LAS – Education Outreach Local Action Strategy
ERA – Ecological Reserve Area
ESA – Endangered Species Act
FIA – Forest Inventory and Analysis
FSRD – Forestry and Soil Resources Division, Government of Guam
GCA – Guam Code Annotated
GCMP – Guam Coastal Management Program
GCRICC – Guam Coral Reef Initiative Coordination Committee
GCWCS – Guam Comprehensive Wildlife Conservation Strategy
GDAWR – Guam Division of Aquatic and Wildlife Resources, Government of Guam
GEPA – Guam Environmental Protection Agency
GNWR – Guam National Wildlife Refuge
GVB – Guam Visitors Bureau
NGO – Non-Government Organization
NRCS – Natural Resources Conservation Service, USDA
OIA – Office of Insular Affairs, Department of the Interior
PL – Public Law, Government of Guam
SOGCN – Species of Greatest Conservation Need
SSP – Species Survival Program
SWGP – State Wildlife Grant Program
UOG – University of Guam
USAF – United States Air Force
USDA – United States Department of Agriculture
USDA-WS – USDA Wildlife Services
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
USGS BRD – USGS Biological Research Division
USN – United States Navy

Mission Statement

The mission of the Guam Department of Agriculture's Division of Aquatic and Wildlife Resources is to effectively manage, preserve, protect, and restore Guam's natural resources now and for the future.

Preamble

The island of Guam is home to a variety of native terrestrial and aquatic species. Unfortunately, the island has also experienced a high rate of extinctions and many terrestrial species are endangered, due primarily to the introduction of non-native species, such as the brown treesnake.

The primary goal of the Guam Comprehensive Wildlife Conservation Strategy (GCWCS) is to provide for the effective management, preservation, protection, and restoration of the island's natural resources especially those species of greatest conservation need, now and for the future. The Guam Department of Agriculture's Division of Aquatic and Wildlife Resources (GDAWR) is the lead agency in the management of Guam's natural resources. This includes all management activities associated with aquatic and terrestrial fauna. Guam DAWR also manages the island's hunting and fishing programs, conducts all associated monitoring and assessment, and coordinates successful captive rearing and propagation programs for the recovery of endangered species.

The GCWCS will address the three required provisions set forth in the Commerce, Justice, and State Appropriations Act of 2001, including the development of:

1. Projects or supplementation of projects devoted to Guam's wildlife species with the greatest conservation need,
2. Wildlife-associated recreation projects, and,
3. Wildlife conservation education projects.

For purposes of this document, 'wildlife' means any species of wild, free-ranging fauna, including fish, and native fauna in captive breeding programs that are for reintroduction into previously occupied areas, or, in designated experimental sites. To effectively meet this goal, GDAWR will partner with other local and federal agencies, non-governmental organizations, the private sector, and the community.

This strategy will be comprehensive and take into consideration all aspects of conservation. Congress has directed that strategies focus on species of greatest conservation need, and encompass all wildlife and wildlife issues. The eight requirements set forth by Congress that must be incorporated into the strategy include the following (See Appendix 1):

1. Information on the distribution and abundance of species of wildlife to determine which species are in peril.
2. Locations and condition of habitats essential to the conservation of species identified by GDAWR.
3. Problems that may adversely affect the species listed by GDAWR and identify potential solutions to improve the conservation of these species and habitats.
4. Prioritize conservation actions to conserve the described species and habitats.
5. Proposed plans to monitor the species and habitats listed to ensure the effectiveness of conservation actions. Guam DAWR must also ensure

conservation actions can be adapted to new information or changing conditions should the need arise.

6. Procedures to review the strategy at intervals not to exceed ten years.
7. Plans to coordinate the development, implementation, review, and revision of the strategy with Federal, State, and local agencies.
8. Collaboration with other conservation partners in formulating the plan, through public participation.

The strategy should be a document that will guide conservation activities as they relate to species of greatest conservation need.

CHAPTER 1: Introduction

Guam, a US territory located at 13°28' N, 144°45' E, is the southernmost island in the Mariana Archipelago and the largest island in Micronesia, with a landmass of 560 km^2. The northern portion of the island is a limestone plateau, rising nearly 200 meters above sea level in some places, which overlies rock of volcanic origin (Lander 1997). The southern half of the island is old weathered volcanic material with a cap of limestone most prominent on the Mt. Lamlam-Alifan ridge (Fosberg 1960). The highest point of the island is Mt. Lamlam, in the south, an elevation of 406 meters. The grasslands and ravine forests characterizes the vegetation in the south (Fosberg 1960). Wetlands are also an important habitat type occurring in the south.

Guam has a tropical climate, with average daily temperatures ranging from 24-30°C (75-86°F). The average annual rainfall is 218 cm (86 in) (National Weather Service, http://www.prh.noaa.gov/guam/normal.html, Accessed 1/24/05). The island has a wet and a dry season. The wet season runs from June to November and the dry season from January to April, with December and May being transitional months. During the wet season, humidity is high and weak southerly or southeasterly winds occur. In contrast, during the dry season, humidity is relatively low and the island experiences northeasterly trade winds (Engbring and Ramsey 1984). Humidity ranges from 65-90%. Typhoons can occur anytime of the year, but are more common during the wet season (NOAA 1982).

Under natural conditions, Guam hosted a rich diversity of terrestrial and aquatic species. Over 100 species of birds have been documented on the island including migrant, wetland, seabird, grassland, and forest birds (Reichel and Glass 1991, Engbring and Fritts 1988). Three native mammals were also known to Guam, including the Marianas fruit bat (*Pteropus mariannus mariannus*), little Marianas fruit bat (*Pteropus tokudae*) and Pacific sheath-tailed bat (*Emballonura semicaudata rotensis*), although the Marianas fruit bat is the only extant species. There are six native reptiles, five skink species, and one gecko species that are still found in the wild. Several native tree snail species still exist in low numbers on Guam. Two species of snails, *Samoana fragilis* and *Partula radiolata*, have been on the candidate list of the Endangered Species Act (ESA; 1973) for more than 10 years and currently do not receive federal protection. Guam has more than 320 native plant species of which six deserve greater attention, but unfortunately only one, *Serianthes nelsonii*, is eligible for funding under the ESA. In addition, Guam's marine environment includes more than 5000 known species (Paulay 2003).

Over the last 50 years Guam has experienced tremendous domestic growth and suffered significant environmental degradation island-wide. Guam's native flora and fauna have been impacted by various threats, such as the introduction of invasive species, poor land management practices, and overexploitation. These anthropogenic threats are exacerbated by the frequency with which the island is impacted by typhoons. In the last decade, Guam has been hit directly by four storms with sustained winds greater than 150 miles per hour and suffered high wave and winds from large systems passing near Guam (Guard et al. 2003). The various resource agencies of the Government of Guam continue to address these issues, knowing that economic prosperity and preservation of the

Chamorro culture are dependent on the successful recovery and sustainable use of the island's natural resources.

The island possesses a variety of terrestrial habitats, including limestone and ravine forests, savanna complex, and strand vegetation. One hundred named rivers are found in the southern part of the island, along with 2 man-made reservoirs (Best and Davidson 1981). Marine habitats include fringing, patch, submerged and barrier reefs, offshore banks, seagrass beds, and mangroves. The combined area of coral reef and lagoon is approximately 69 km^2 in nearshore waters between 0-3 nmi, and an additional 110 km^2 in waters greater than 3 nmi offshore (Hunter 1995). Sea surface temperatures range from about 27-30ºC, with higher temperatures measured on the reef flats and in portions of the lagoons (Paulay 2003a).

Given its small size, the entire island of Guam has been designated, both locally and federally, as coastal zone. This gives resource managers the authority to incorporate all aspects of the watershed in terms of planning, funding, and implementing management actions. Guam is divided into 19 watersheds in the southern half of the island. These areas are defined by hydrologic unit boundaries based on a 14-digit sub-watershed level (typically 10,000 to 40,000 acres, with a minimum of 3,000 acres) developed by Natural Resources Conservation Service (NRCS) in coordination with the United States Geological Survey (USGS) system developed for larger drainage areas (Guam Clean Water Action Plan 1998). The Northern Guam sub-watershed was defined in the Guam Clean Water Action Plan (1998) as an area that has no clearly defined drainage ways, composed of a shallow soil layer over permeable limestone, with little or no runoff. This sub-watershed has been further delineated into sub-basins as more complete data on the flow of water through the northern aquifer become available.

In southern Guam, a mountain ridge running along the western coast creates small, steep watersheds to the west and broader floodplains draining into longer, larger rivers to the east. Of Guam's 100 named rivers and streams are located in the southern half of the island (Best and Davidson 1981), forty-six drain into the ocean. The largest of these, the Talofofo, drains an area of approximately 72.84 km^2 (~18,000 acres) (Best and Davidson 1981).

There are several man-made reservoirs almost all built after World War II. No naturally occurring lakes can be found on Guam. Many of these reservoirs are no longer used for their original purpose. Fena Lake is the largest and most valuable reservoir for its supply of fresh water and the surround habitats.

Goal

The goal of the Guam Comprehensive Wildlife Conservation Strategy is to promote the recovery and sustainable use of Guam's native aquatic and terrestrial species, especially those of greatest conservation need.

Authority

The Department of Agriculture, to be called the Department from here on, is responsible for the control and regulation of fish and game in and about Guam and the administration of laws pertaining to them (5 Guam Code Annotated (GCA), Chapter 63, §63102, see Table 1). GCA defined fish and game as "any aquatic animal life" and "all native or introduced species of wild birds or wild animals." The Department is also given regulatory power over endangered species (Title 5 GCA, Chapter 63, §63205). It has the authority to promulgate a list of endangered species to be adopted through the Administration Adjudication Act and approved by the Guam Legislature. Title 5 GCA, §63205 also authorizes the Department to enter into agreements with federal, or public agencies, or any person for the purpose of administration, research or management of these resources. The Department, in cooperation with the Department of Parks and Recreation (DPR) and other agencies of the Government of Guam, also has the authority to control and manage conservation reserves on Guam (Title 5 GCA, Chapter 63, §63401).

Pursuant to Section 6 of the Endangered Species Act, a cooperative agreement exists between the Department and the USFWS. This agreement obligates the Department to protect US listed species (see Appendix 2). It also provides for funding and implementation of programs for endangered species research and recovery activities. The Department is also required to enforce other Federal laws such as the Migratory Bird Treaty Act of 1918, Marine Mammal Protection Act of 1972 and Lacey Act of 1981 (as amended).

Other Government of Guam resource agencies have mandates related to management of natural resources (that affect the species of greatest conservation need). Public Law (PL) 11-191 established the Guam Environmental Protection Agency (GEPA) on March 3, 1973. GEPA's mission is "to provide a united, integrated, and comprehensive island-wide program of environmental protection and to provide a framework to fulfill that task" (Title 10 GCA, Chapter 45, §45102). The Government of Guam's Bureau of Statistics and Plans (BSP) administer the Guam Coastal Management Plan (GCMP) through the Coastal Zone Management Act of 1972 (PL 92-583, as amended; PL 94-370). The GCMP guides the use, protection, and development of land and ocean resources within Guam's coastal zone. The "coastal zone" can be defined as all non-federal property within the Territory, including offshore islands and all submerged lands and waters out to three nautical miles.

Table 1. Authorities related to Natural Resource Management on Guam.

No.	Authority or Law	Summary
1.	Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884)	Affords protection of Federally listed species.
2.	Migratory Bird Treated Act of 1918 (16 U.S.C.)	Affords protection specifically listed migrant species.
3.	Sikes Act of 1960 (16 U.S.C. 670a–670o as amended through P.L. 106-580, Dec. 29, 2000)	Promotes effectual planning, development, maintenance, and coordination of wildlife, fish, and game conservation and rehabilitation in military reservations.
4.	USFWS Cooperative Agreement	An agreement that allows Guam to implement endangered species recovery programs.
5.	Guam Endangered Species Act, 5 GCA 63208, PL – 15-36	Law allows for the adjudication of an endangered species list for Guam.
6.	Game, Forestry and Conservation, 5 GCA, Chapter 63, PL 6-85	Law describing the authority of the Department of Agriculture
7.	Protection of Wild Animals, 5 GCA 63121	List species that are considered protected.
8.	Fish, Game, Forestry and Conservation, 5 GCA, 63101-63117	Laws protecting Guam's fish resources.
9.	Concurrent Jurisdiction	Organic Act of Guam
10.	Lacey Act (P.L. 97-79, 95 Stat. 1073, 16 U.S.C. 3371-3378, approved November 16, 1981, and as amended by P.L. 100-653, 102 Stat. 3825, approved November 14, 1988, and P.L. 98-327, 98 Stat. 271, approved June 25, 1984)	Under this law, it is unlawful to import, export, sell, acquire, or purchase fish, wildlife or plants taken, possessed, transported, or sold: 1) in violation of US or Indian law, or 2) in interstate or foreign commerce involving any fish, wildlife, or plants taken possessed or sold in violation of State or foreign law.
11.	Marine Mammal Protection Act of 1972 as amended through P.L. 107-136, Jan. 24, 2002	Law established to protect marine mammals US waters and by US citizens on the high seas and the importation of marine mammals and marine mammal products into the US
12.	Convention of International Trade of Endangered Species (CITES) (entered in force 1975)	Convention on International Trade in Endangered Species. This is an international agreement between Governments that ensures international trade in specimens of wild animals and plants does not threaten their survival.

Funding Sources

The strength of this GCWCS will be the Department's ability to secure funding to carry out its plans. Funding sources include the Sport Fish and Wildlife Restoration Act, US ESA Section 6, Coral Reef Initiative, Western Pacific Fisheries Council (WesPacFIN), Coastal Zone Management (CZM), Clean Water Act Section 319, and National Marine Fisheries Service (NMFS) Sea Turtle Recovery. The Department also receives Office of Insular Affairs (OIA) funding for brown treesnake control. Local funding sources include a general fund appropriation for the Department's Law Enforcement section and the Wildlife Conservation Fund that receives monies from hunting license and permit fees, private/Non-Government Organization (NGO) donations, and penalties for natural resource violations. Additional funding may be obtained from funding sources such as Safe Harbor Agreements, Department of Defense Legacy Funding, the South Pacific Regional Environmental Programme (SPREP), Government of Guam Local Appropriations, in-kind donations from Walt Disney World, and Land Acquisition Grants (Federal).

Guam has received single appropriations from the US Congress through State Wildlife Grant Programs (SWGP) and the Wildlife Conservation Restoration Program. Acceptance of the SWGP funding was contingent on the development of a GCWCS. Development of this document will qualify the Department for continued funding under SWGP.

CHAPTER 2: Key Habitats, Conservation Lands, and Marine Preserves (Element 2)

Chapter two outlines key habitat types for both terrestrial and aquatic organisms listed in Guam's Species of Greatest Conservation Need (SOGCN). A map of all vegetation, water, and urban areas for Guam was produced by US Department of Agriculture Forest Service Region 5 (2005) and was used to determine habitat types within conservation areas and other government lands. A summary of Guam's 24 habitat types based on the Forest Service Region 5 map has been consolidated into five vegetation classifications in Figure 1 (eg., forest include all woody vegetation). This GIS map helped GDAWR fulfill element two that required descriptions and relative conditions and community types be identified.

Key Habitats

Terrestrial Habitats

Prior to their demise, many of Guam's terrestrial native species were found throughout the island and in a variety of habitats (Jenkins 1983). Though much habitat remains available, the introduction of the brown treesnake has resulted in the loss of many of Guam's native species of birds and lizards, and is probably preventing the recovery of the Mariana fruit bat (Savidge 1987, Rodda et al. 1997, Wiles 1987a).

There are eight general terrestrial habitat types found on Guam as described by Fosberg (1960), Stone (1970), and Engbring and Ramsey (1984) (see Appendix 3). Donnegan et al. (2002) provided additional habitat descriptions in the Forest Inventory and Analysis (FIA) that was used to "estimate forest area, tree stem volume and biomass, tree damages, and associated understory vegetation." The vegetation maps used in GCWCS are derived from the June 2005 release of the Guam Detailed Vegetation Map created by the US Department of Agriculture (USDA) Forest Service Region 5 State and Private Forestry; Forest Health Protection. The maps were created using geographic modeling techniques that utilized IKONOS satellite imagery and ancillary data such as demographic and soil layers. The analysis was limited to a 1-acre minimum mapping unit; therefore parcels of habitat smaller than 1 acre are not adequately depicted in these maps (Figures 2-13).

Limestone forests, scrub (secondary forest), mixed woodland, ravine forests, strand, and beach strand are important for all of Guam's native avian, invertebrate, reptilian, and mammalian species. Grassland, coconut grove, and open field provide habitat to native species, though to a lesser degree. The following describe the key habitat types, location, and current status important to the management and conservation of Guam's species of greatest conservation need (Element 1). A summary of the status of these habitats is provided in Table 2.

Limestone forest. Limestone forest is composed principally of a mature growth of native trees and plants, with a moderately dense canopy of 10-30 m high. There are no or only a few openings in the canopy, and understory vegetation varies from open to dense. Species of trees including *Ficus sp.*, *Intsia bijuga*, *Artocarpus marianensis* and *Elaeocarpus joga* are commonly found in this forest type. There are several distinct limestone forest types including *Artocarpus-Ficus, Mammea, Cordia, Merrilliodendron-Ficus*, and *Pandanus* (Donnegan et al. 2002).

Limestone forests are found on the northern limestone plateau and on large limestone outcroppings in southern Guam (Figure 6A). Donnegan et al. (2002) reported limestone and scrub forests comprise 34% of total forested areas on Guam. However, recent vegetation mapping indicated that only 13.06% was actually composed of limestone forests (Brown 2005). The structure of limestone forests is slowly changing due to the presence of Philippine deer (*Cervus mariannus*) and feral pigs (*Sus scrofra*) as they browse on seeds and seedlings retarding any regeneration of forest plants (Wiles et al. 1999). Typhoons, loss of pollinators, loss of habitat due to development, and introduction of aggressive invasive plant species exacerbate this condition. The current status for limestone forests is slowly declining. Without intervention and restoration this habitat type will be altered so severely that it will not sustain reintroduction of SOGCN. This habitat is vital for almost all of Guam's native forest birds, snails, insects, lizards, and two fruit bat species.

Scrub forest or *Secondary growth forest*. Scrub forest is a degraded, yet diverse, brush-type forest, generally with an open canopy under 10 m high and a dense understory (Jenkins 1983, Engbring and Ramsey 1984). The distribution of scrub forests on Guam is illustrated in Figure 10B. The plant species are similar to those in more mature limestone forests, but are at an earlier stage of development. In northern Guam, this habitat is dominated by *Vitex parviflora,* an introduced species from the Philippines. Other introduced species that may be found include *Leucaena*, *Casuarina*, *Morinda,* and *Triphasia*. However, within this forested area native plants can be found as understory cover including *Pipturus*, *Macaranga*, *Neisosperma, Pandanus, Cyanometra,* and other species.

Much of the Tarague Plateau and Northwest Field region in northern Guam is scrub forest. Donnegan et al. (2002) lumped scrub forest with limestone forest and reported 34% of Guam's available habitat. Brown (2005) reported 22.62% of this habitat on Guam. Pure examples of these forest types tend to be rare and mixtures of primary and secondary species. Historically, these areas (Tarague and Northwest Field) were cleared for military purposes and repeated destructions by typhoons have played a major role in creating these forests.

The same factors impacting limestone forests are changing the structure of scrub forest (feral deer and pigs, invasive plant species, and typhoons). In the absence of deer, pigs, and invasive plants, scrub forest would regenerate into primary limestone forest habitat. Intervention is needed to ensure the continued existence of this habitat type.

Open field or Large mowed area. Open field composes about 1.36% of the available habitat on Guam, and includes agriculture fields (ranches and cattle pasture) and other open areas including runways, communication stations, and parks (Engbring and Ramsey 1984). These habitats contain a variety of grass species including *Paspalum, Panicum, Chrysopogon, and Sorghum.* A typical scrub forest surrounds this habitat type in most places within the central portion of Northern Guam (Fosberg 1960). Open field habitats are the result of human disturbance. Open fields that are mowed and maintained provide

important habitat for migratory birds including plovers, sandpipers, and others. Unfortunately, these habitats provide the ideal habitat for invasive weeds to take hold.

Coconut grove. Coconut grove consists of stands of abandoned coconut plantations (Engbring and Ramsey 1984). A typical forest, consist of trees emerging 15-25 m high with the understory containing a variety of native and non-native shrubs and young coconut palms. Coconut grove (*Cocos nucifera)* is more common along sandy coastal areas such as Tarague, Tanguissan, Ritidian, Uruno and Pajon Basins. Small patches of *Cocos* are found throughout the northern plateau, most cover less than 5 ha of area. These groves may be diverse with some native and introduced plant species below the canopy (Engbring and Ramsey 1984). Coconut groves make up about 0.76% of the available habitat on Guam (Brown 2005). Coconut palms are susceptible to termites and typhoons. In these habitats, the understory shows a tremendous amount of uprooting by feral pigs. A few native species of birds previously use this habitat including Guam Micronesian kingfishers, rails, and fantails.

Broken forest or *Mixed woodland*. Mixed woodland is habitat similar to the limestone and ravine forest but dissected by many small, open or scrubby fields (Engbring and Ramsey 1984). Broken forest contains both native and naturalized vegetation having much lower more open canopy unlike mature limestone forest containing *Neisosperma, Artocarpus, Pandanus, and Cocos* (Jenkins 1983). Like open fields, broken forest is a result to human disturbance occuring in northern and central Guam (Jenkins 1983, Enbring and Ramsey 1984). Though Donnegan et al. (2002) lumped broken forest with all forested lands reporting about 34%, an estimated 0.19% of land area is composed of this habitat type on Guam (Brown 2005). Currently this habitat is relatively poor due to ungulate damage and disturbance.

Ravine forest tends to follow topographic contours such as river valleys and depressions. Guam's ravine forests are highly degraded and contain many non-native species including betel-nut palm (*Areca cathecu*) and palma brava (*Heterospate elata*). Native species that can be found in these forests are *Ficus prolixa, Glochidion mariannensis, Hibiscus tiliaceus, Pandanus tectorius,* and *Premna serratifolia*.

This habitat type is found in southern Guam, which is more volcanic in origin (Figure 9A). Historically, ravine forest was more abundant. However, it has been reduced in quality and quantity by damage from deer, pigs, fire, and introduced plant species. There is little native ravine forest left and efforts to restore these areas are underway.

Efforts by the Department of Agriculture's Forestry and Soil Resources Division (FSRD) to improve much of the degraded habitat of southern Guam began in 1997. FSRD started out-plantings of *Acacia sp*. in the badlands, areas where much of the organic topsoil had washed away. In August 2005, FSRD began out-plantings of several native species to reclaim these areas. With the rehabilitation of the ravine forest habitat and control of invasive predators, management and recovery efforts for SOGCN listed species can proceed.

Savanna or Grassland. Savanna is a habitat type primarily found in Southern Guam (Figure 10A). The habitat is on volcanic soil and not usually flat (Fosberg 1960). Grasslands is comprised mostly with *Miscanthus* (swordgrass) and *Dimeria*, and scattered fire-susceptible *Casuarina* and fire-resistant *Pandanus*, which however is stunted and poor (Stone 1970). The savanna is often swept with uncontrolled, often deliberately started, grass fires. As a result marginal trees are killed and swordgrass, and associated savanna species expand their total area (Stone 1970). This condition is further excerbated by off-road vehicles that are driven in these areas eroding the bare soil especially when during the rainy season. Currently, savanna covers 21.02% of land area in the southern region encroaching surrounding forested areas. This habitat type is important as a foraging habitat for the Island swiftlet.

Beach strand. Beach strand is a habitat comprised with open sand beaches, barren coastal outcroppings, and coastal areas of sparse vegetation generally 2-3 meters or shorter in height (Engbring and Ramsey 1984). In most areas, open sand beaches are bordered with a mix of scrub and limestone forest. The dominant plant is *Pemphis,* a salt-tolerant species common on the pitted limestone of the windward coast. *Tournefortia* and *Casuarina* are two other salt-tolerant tree species found along beach strands. Currently this habitat type is relatively stable in most areas such as Cocos Island, Ritidian, Pati, Tarague and Pajon Basins, and Islets around southern Guam. Beach strand is important for nesting seabirds, reptiles (nesting for turtles and lizards), and invertebrate species.

Strand forest. Stand forest is part of a beach strand habitat, but considered more inland from the beach strand (Fosberg 1960, Figure 11A). Strand forest has a mixture of trees at the top of the beach, and on the sand flats, immediately behind it there may be a forest of *Pisonia, Hernandia, Cordia, Barringtonia*, and *Casuarina* in most places (Stone 1970). Strand forest is found along Northern Guam coastline and parts of Southern Guam, where *Leucaena* is dominant. This habitat is relatively poor due to man and feral ungulate disturbance and is susceptible to typhoon damage and infestation. Strand forest covers 3.47% of land area.

Shoreline. Shoreline habitat tends to follow the coast surrounding Guam, Cocos Island and other islets. This habitat type is mostly bare sand with limestone outcroppings and coral fragments comprised of *Ipomoea* and two grass species, *Sporobolus* and *Thuarea* (Fosberg 1960). Shoreline covers 0.08% of area on Guam and is important to reef herons, sea turtles as a nesting ground, and migratory birds.

Limestone Caves. Limestone caves (Karst caves) are formed from natural solution of limestone rock by water (Taborosi 2004). These caves are found both in the north and in a few areas of the south where limestone rock areas are found (USFWS 1991). Caves provide important roost sites to Sheath-tailed bats and Island swiftlets. These roost caves are vulnerable to disturbance and invasive species.

Table 2. Terrestrial habitats on Guam their relative condition, percent cover and current needs.

Habitat	Location	Percent Area of Guam	Relative Condition	Current Needs
Limestone Forest	Mostly Northern some Southern	13.06	Decreasing	Control feral pig and deer Remove and prevent invasive species Native tree reforestation Public Awareness
Scrub forest	Northern-Southern	22.62	Increasing	Control feral pig and deer Remove and prevent invasive species Reforestation Public Awareness
Open field	Northern-Central	1.36	Increase	Remove and prevent invasive species Continue mowing and lot maintenance Control feral pig and deer
Coconut grove	Northern	0.76	Stable	Implement feral pig control, Remove and prevent invasive species Outplanting of native trees.
Broken forest	Northern/ Southern Guam	0.19	Stable	Implement ungulate control, Outplantingwith native trees Native tree reforestation
Ravine forest	Southern Guam	8.3	Decreasing	Control/Prevent Grassland Fires Implement feral ungulate Invasive species control, Native tree reforestation outplanting
Grassland	Mostly Southern Guam	21.02	Increasing	Control/Prevent grassland fires Prevent off-road vehicle impacts Improve public awareness Monitor development and clearing, Bio-control for invasive plant species Native tree reforestation
Beach strand	Northern/ Southern	0.08	Stable	Implement erosion control Implement invasive species control Implement coastal management plans
Strand forest	Northern/ Southern	3.47	Unknown	Control feral pig and deer Remove and prevent invasive species Prevent further loss
Shoreline	Cocos Island, other islets,	0.08	Stable	Monitor erosion Implement invasive species control Implement coastal management plans
Caves	Northern/ Southern Guam		Stable	Prevent filling of caves Prevent human distubance Invasive species control Reforest surrounding area w native trees

Freshwater Habitats

Guam has considerably more wetlands and a wider variety of types than any of the other Mariana Islands. All of its rivers and nearly all wetlands occur in the southern and central parts of the island, where clay or argillaceous limestone soils retard water percolation and permit surface waters to accumulate. Many interior wetlands are located along the upper drainages of rivers and smaller tributaries. In contrast, the northern limestone plateau allows rapid water seepage, and consequently only a few marshy areas and ephemeral streams exist in the vicinity of Mt. Santa Rosa. Four basic categories of wetlands are described below, with larger sites often having more than one type and their relative condition summarized in Table 6.

Freshwater swamps. Freshwater swamps of woody vegetation are the largest category of wetland and may be found on the edges of marshes, along river courses, and in wet depressions in forests. *H. tiliaceus* is usually the major species involved, although the largest tract of swamp forest on the island, the Talofofo River Valley, is dominated by *Barringtonia racemosa* (Fosberg 1960). Other trees that may be present are *P. tectorius*, *Cynometra ramiflora* and *A. catechu.*

Freshwater marshes. Natural freshwater marshes are also common, with individual sites varying in size from the Agana Swamp (approximately 0.96 km^2 or 237 acres of marshland) to many that are smaller than 0.5 ha (1.2 acres). Most are dominated by dense, nearly pure stands of *Phragmites karka* that are 2-5 m tall (Fosberg 1960). Other grasses (*e.g. Panicum muticum*), sedges (*e.g. Eleocharis ochrostachys* and *Cyperus* spp.) and the fern *Acrostichum aureum* are often present but usually less prevalent. Two other natural wetlands are important to the Mariana common moorhen (*Gallinula chloropus guami*) include the Atantano, and Namo wetlands (Takano 2002, Ritter and Savidge 1999).

Reservoirs. Man-made freshwater wetlands were originally constructed as water impoundments for humans, cattle and crop irrigation, and are found widely through southern Guam. Many are no longer used but they continue to collect water and maintain aquatic ecosystems. The largest is Fena Lake (0.81 km^2 or 200 acres), which still functions as an important reservoir for drinking water. Other sites are much smaller and tend to have deeper, more open water than natural marshes. These may include ponds dug for aquaculture purposes. Vegetation is variable, but *Phragmites* and *Hibiscus* are usually minor components. A number of these sites are crucial to the preservation of the Mariana common moorhen (Stinson et al. 1991) and are very important to migratory species.

The Masso Reservoir is a 9105 m^2 (2.25 acre) man-made reservoir located in Piti. Guam DAWR plans to begin work in 2005 to restore the reservoir to a state suitable for public fishing, and also enhance it as habitat for the endangered Mariana common moorhen. The Navy constructed the reservoir just after World War II to act as a source for drinking water. Due to chronic sedimentation problems, the project was abandoned in 1951. The Navy retained ownership of the land containing the reservoir until 2000, when it was returned to the Government of Guam. Ownership of the reservoir was transferred from the Ancestral Lands Commission to the Department of Agriculture through Executive

Order (E.O. 2006-14). Guam DAWR has again received funding to rehabilitate the Masso Reservoir in Piti. Work on the site will include dredging the reservoir to its original depth, and installation of both a fishing platform and educational signage.

Mangrove Areas (Brackish/Estuarine)
Estuarine wetlands occur in areas of tidal intrusion or brackish water, and consist primarily of mangroves and the lower channels of rivers. These habitats are facilitated by a daily tidal variation of about 75-90 cm. The largest concentrations of mangroves exist along the eastern shores of Apra Harbor, with smaller zones present in Merizo and Inarajan. Although they only total about 0.02 km^2 (5.56 acres), Guam's mangroves are the most extensive and diverse in the Mariana Islands. Species include *Rhizophora mucronata*, *R. apiculata*, *Bruguiera gymnorrhiza*, *Avicennia marina*, *Lumnitzera littorea*, *N. fruticans*, *Xylocarpus moluccensis*, *Heritiera littoralis*, *H. tiliaceus* and *Acrostichum aureum* (Fosberg 1960, Moore et al. 1977). Nine of the island's 46 rivers that empty into the ocean have true estuarine zones. The lower channels of these rivers, which are typically only 5-20 m wide and 1-4 m deep, have elevated salinity levels that extend 0.5-1.6 km upstream (Wilder 1976). *N. fruticans* is a common indicator plant of river zones with brackish water regimes. Marshes of bulrushes (*Scirpus littoralis*) are a third estuarine community, and are found at several locations in Apra Harbor. The largest area is the artificial San Luis Ponds. This habitat type is important for many species of migratory shorebirds, native aquatic and terrestrial invertebrates, and aquatic vertebrates.

Rivers
The island has 100 rivers and streams, ranging in length from less than 1 km to more than 5 km, all located in the volcanic southern half of the island (Best and Davidson 1981). In southern Guam, a mountain ridge running along the western coast creates small, steep watersheds to the west and broader floodplains draining into longer, larger rivers to the east. Of Guam's 100 named rivers and streams, forty-six drain into the ocean. The largest of these, the Talofofo, drains an area of approximately 72.83 km^2 (Best and Davidson 1981).

Tables 3-5 show data for some of the representative rivers of Guam. Note the greater lengths and watersheds for rivers draining to the east coast.

Table 3. West coast rivers.

River	River length	Area drained *	Max flow *	Min Flow*	Average flow *
Aplacho	2.805 kilometers	1.3 km^2	1690 ft^3/sec	.12 ft^3/sec	NA
La Sa Fua	4.633 kilometers	2.75 km^2	1440 ft^3/sec	.12 ft^3/sec	4.39 ft3/sec
Umatac	2.987 kilometers	5.46 km^2	7460 ft^3/sec	.10 ft^3/sec	8.59 ft3/sec

Table 4. Central rivers (draining into Fena Lake).

River	River length	Area Drained*	Max flo*	Min flo*	Average flow*
Imong	2.088 kilometers	5.05 km^2	6100 ft^3/sec	.36 ft^3/sec	9.52 ft^3/sec
Almagosa	2.195 kilometers	3.42km^2	2650 ft^3/sec	.05 ft^3/sec	5.98 ft^3/sec
Maulap	2.438 kilometers	2.98km^2	2420 ft^3/sec	.31 ft^3/sec	5.02 ft^3/sec

Table 5. East coast rivers.

River	River length	Area Drained*	Max flo*	Min flo*	Average flow*
Ugum	11.460 kilometers	14.92km^2	14,700 ft^3/sec	2.7 ft^3/sec	24.2 ft^3/secft^3/sec
Ylig	11.994 kilometers	16.78km^2	4900 ft^3/sec	.07 ft^3/sec	27.2 ft^3/sec
Pago	10.060 kilometers	14.69km^2	17,300 ft^3/sec	No flow	26.1 ft^3/sec

* USGS Pacific Islands Water Center Web Site

Forty-six of Guam's rivers drain to the ocean. Nine of these forty-six rivers have true estuarine zones. Fish fauna of this section includes few native freshwater species, but many marine species including snappers, jacks, halfbeaks, and mullets. These reaches are characterized by soft, muddy or silt-laden substrates, slow moving, relatively, deep water. The terrain in this region is flat. The dominant vegetation along this stretch of a river includes mangroves, *Nypa*, and *Hibiscus*.

Upstream of saltwater influence, most marine species drop out, and *Kuhlia* becomes the dominant predator. Most of the native gobies and invertebrates appear in this region. Usually, the substrate in this area of rivers is sandy, or a mixture of sand and cobble, with areas of base-rock or clay. Channel width is generally narrower than the estuarine region. The slope of the terrain is gentle and water velocity is generally slow. Dominant vegetation in this region includes bamboo and *Hibiscus*.

Above the first waterfall on a river, the most common habitat found is riffles and plunge pools. This is an area characterized by small runs separated by small waterfalls and pools. In the dry season, water flow may stop in this region, and the pools become separated from each other. The substrate in these habitats is usually pavement or larger rocks. *Kuhlia* and *Stenogobius* are unable to get past a waterfall, and are not found upstream of the first major falls (>3 meters). Gobies and *Macrobrachium* shrimp are more common here, and *Anguilla* eels become the dominant predator. Water in this region is shallow (< 1 foot or 30.54 cm), except in the pools. This area generally has fast-flowing water, and a relatively steep elevation drop. Dominant vegetation in this region might include ferns, *Hibiscus*, and *Pandanus*.

Table 6. Freshwater habitats on Guam.

Habitat Type	Location	Percent of area	Relative Condition	Needs
Freshwater swamps	Edges of marshes, along river courses, wet depressions in forests	0.06%	Unknown	Implement current management plans/laws Control invasive species vegetation and animals
Freshwater marshes	Common from Central to southern Guam,	0.29%	Stable	Implement current management plans/laws Control invasive species vegetation Control bts
Reservoirs	Widely through southern Guam	0.01%	Unknown	Implement current management plans/laws Control invasive species vegetation
Mangrove	Southern Guam	0.14%	Stable	Implement current management plans/laws Control invasive species vegetation Prevent further loss
Rivers	Southern Guam	0.13%	Unknown	Implement current management plans/laws Reduce sedimentation Control invasive species vegetation

Marine Habitats

Guam's marine habitats are extremely complex and can be described in a number of ways. They can be classified by the type of cover (e.g. coral, seagrass, unconsolidated sediment, macroalgae) or by zone (e.g. reef flat, fore reef slope). The combination of these two classifications leads to a large number of specialized habitats, so this document will primarily refer to reef zones, and describe some of the more important types of cover found in each of these zones (see Table 7).

On Guam, reef flats are relatively flat platforms extending from a few meters to over a kilometer from the shoreline to the wave-washed reef margin. The seaward portion usually slightly elevated and often exposed at low tide, is known as the outer reef flat. The inner reef flat is adjacent to the shore and usually retains water during low tide and is often referred to as the "moat". Intertidal fringing reef flats have no significant moat development and are generally fully exposed during low tides. These reef flats are common along the southern coasts. In addition, some reef flats, such as the Achang reef flat, have middle reef flat moat development. In these areas the inner and outer reef flats are exposed during low tide, but the middle reef flat retains water. The reef flat zone may have a range of cover types including pavement, seagrass beds, staghorn coral (*Acropora)* thickets, *Porites* microatolls, sand/rubble fields, and macroalgae. Although all of these habitats are utilized by reef fish species, the seagrass beds and staghorn coral thickets are perhaps the most important reef flat habitats for juvenile reef fish considered species of concern.

Sea grass beds cover approximately 3.7 km^2 (917 acres) of reef flats in numerous coastal bays around Guam (NOAA 2005). Guam's sea grass beds are composed of three species: *Halodule uninervis, Enhalus acoroides,* and *Halophila minor* (Lobban and Tsuda 2003). These sea grass beds range in size from small beds a few meters in diameter to continuous beds nearly 1 km^2 in size. The largest of these sea grass beds are found along the reef flats in the southern part of the island including Cocos Lagoon and within the Achang Reef Flat Preserve. These sea grass beds are used as foraging grounds by green sea turtles (*Chelonia mydas*). Other substantial sea grass resources are located in East Agana Bay, Pago Bay, Piti Bomb Holes Marine Preserve, and Agat areas. These sea grass beds are important nursery areas for a number of reef fish species including emperors (*Lethrinidae*), wrasses (*Labridae*), and goatfish (*Mullidae*). Sea grass resources in Guam are threatened by land-based sources of pollution and recreational misuse and overuse including personal watercraft and trampling by divers.

Lagoon zones are areas enclosed by the low tide line of the inner edge of barrier reef flat. Guam has two areas that can be considered true lagoon zones: Apra Harbor and Cocos Lagoon in Merizo. The depth in these areas ranges from less than one meter to over 30 m. Apra Harbor has sandy and muddy bottom in between scattered patch reefs and shoals. These patch reefs and shoals boast some of the highest coral cover in Guam with many areas exceeding 100% coral cover. They also support diverse macroalgae and sponge communities. Cocos Lagoon is generally shallower than Apra Harbor and has a predominantly sand bottom with numerous small patch reefs scattered throughout. This sheltered area has delicate staghorn coral communities that provide safe refuge for Convention of International Trade of Endangered Species (CITES) listed juvenile humphead wrasse (*Cheilinus undulatus*) and other reef fish species of concern. The lagoon is also home to soft coral stands that provide unique habitat found in few locations in Guam's waters. These lagoons are utilized by a wide variety of reef fish species as well as both green (*C. mydas*) and hawksbill (*Eretmochelys imbricata*) sea turtles.

Channels connect lagoons or reef flats to the outer reef slope. Some examples of this type of reef zone are the Mannell and Mamaon Channels in Merizo leading into Cocos Lagoon. Many smaller channels are found leading from reef flat areas to the outer reef slope. These areas are strongly influenced by tidal currents and host a wide variety of plankton-feeding animals. Depending on the strength of the currents, channels may have a barren floor of shifting rubble or may be thickly covered in hard and soft corals. Based on data from the region, these areas are likely key spawning aggregation sites for a number of reef fish species. Mannell Channel in Merizo is an important congregating site for green sea turtles (*C. mydas*) and channels in Tumon and East Hagatña are known congregating sites for manta rays (*Manta birostris*) and other filter feeders.

The area extending from the seaward edge of reef flat to the submarine terrace is known as the reef front or fore reef slope. The coral communities and the structure of the substrate in this zone are directly related to the level of wave action and frequency of wave assault. Reef front zones that are protected from strong wave action is often characterized by a gentle slope covered with large stands of branching or tabular corals. As wave energy and exposure increase, the corals in these areas tend to become smaller

and more compact. Areas with severe wave action tend to be dominated by lower, stout branched corals. Channels in these areas may be strewn with boulders. Some of these areas have spur and groove formations characterized by alternating ridges and vertical sided channels.

Seaward of the reef front is the submarine terrace where the reef front flattens out. The channels become shallower with sand rather than rubble floor. In areas with constant surge the corals are low profile encrusting, stocky, or massive coral species. In sheltered areas large branching and tabular corals are common. These terraces are frequented by schools of surgeonfish and parrotfish.

The outer reef slope slopes down from the submarine terrace and into deep water. They are usually steep (greater than 30º) with moderate to high coral cover. Coral cover and species composition are strongly influenced by the slope's exposure to storm swells and presence of tidal currents. In general, coral cover and diversity remain high to depths of 40-60 m, with plate forms dominating the slope down to as deep as 112 m. Below this level gorgonians and soft corals dominate the slope.

Table 7. Summary of the status of marine habitats on Guam.

Marine habitats	Location	Total area	Relative Condition	Needs
Reef Flats - Sea Grass	All around Guam, most extensive on the western and southern shores Largest beds are along the southwest and southern coasts	5260 acres 917 acres	Stable	Continue Guam Coral Reef LAS Continue management of Marine Preserves Reduce land-based sources of pollution, Improve fisheries management, Address recreational misuse and global warming
Reef Front	All around Guam, most extensive on the western and southern coasts	15,125 acres	Stable	Continue Guam Coral Reef LAS Continue management of Marine Preserves Reduce land-based sources of pollution, Improve fisheries management Address recreational misuse and global warming. Maintain Marine Preserves
Lagoon	Primarily Apra Harbor / Cocos Lagoon	1,721 acres	Stable	Continue Guam Coral Reef LAS Continue Marine Preserves Reduce land-based sources of pollution Improve fisheries management, address recreational misuse and global warming. Maintain Marine Preserves.
Channel	All coastal areas.	280 acres	Stable	Continue Guam Coral Reef LAS Continue management of Marine Preserves Reduce land-based sources of pollution Improve fisheries management Address recreational misuse and global warming. Maintain Marine Preserves
Submarine Terrace	Surrounding island	Unknown	Unknown	Assess current status Reduce land-based sources of pollution, Improve fisheries management Address recreational misuse and global warming.
Outer reef Slope	Surrounding island	Unknown	Unknown	Assess current status Reduce land-based sources of pollution Improve fisheries management, Address recreational misuse and global warming.

Terrestrial Conservation Areas

The Government of Guam has recognized the need to protect and preserve the natural resources of the island. In 1956, the Department, in cooperation with other government agencies, was given the authority to control and manage land and water areas set aside as conservation areas (PL 3-103). In 1982, PL 16-62 reestablished the authority of the Department over Conservation Reserves having joint jurisdiction with the Department of Parks and Recreation. The development of a Master Plan for Park and Conservation Land (DOA and DPR 1999) was completed and followed the criteria that these lands had no claims, ownership, or interest attached to it.

Approximately 20% of Guam has been designated as local or federal conservation lands (Figure 14). The Government of Guam has identified three areas for conservation: Anao, Bolanos, and Cotal Conservation areas. An additional 20 areas, totaling approximately 4.40 km^2 or 1087 acres (Draft Master Plan for Park and Conservation Land 1999), were proposed to be included as conservation lands. Though this plan was never formally adopted, the proposed areas contain habitat that are vital to restoration efforts proposed in the GCWCS. Ratification of this plan would be beneficial to all species listed in Guam's SOGCN.

The conservation lands of Anao, Bolanos, and Cotal belong to the Government of Guam. The land area covered by the three areas is 16.5 km^2 (4077 acres) (Figure 14). These areas vary in habitat types and provide unique opportunities for restoration of SOGCN.

The Anao Conservation Area encompasses an area of 3.1 km^2 (764 acres) and is located in northeastern Guam. This conservation area contains several habitat types to include limestone forest (78.6%), scrub forest (14.7%), strand vegetation (3.9%), barren (0.4%), urban buildup (0.4%), urban cultivated (0.9%), and unknown (1.1%), (Figure 15).

Limestone forests dominate the upper plateau and windblown vegetation along the coastal cliffs. There is a contiguous band of limestone forest that runs north to Pati Point and west to Ritidian Point (part of the GNWR Overlay). Fruit bats likely use the area to forage due to the abundance of native limestone forest species. Access to the area is via a single dirt road to a footpath that leads down the cliff to the coast. No developed recreational facilities are present, but hikers, hunters, and fishermen utilize the area and an "educational trail" was established along the footpath.

Scrub forest is located along the northwestern perimeter of Anao. With proper ungulate control and out-planting by FSRD, limestone forest can be restored making it favorable for reintroducing native species. Brown treesnake control is also necessary and vital to this program.

Another habitat type located within the Anao Conservation area is strand vegetation. This habitat is located in the areas below the cliffline along the eastern edge bordering the Pacific Ocean. Control of predators and invasive plant species will ensure this area is maintained for listed SOGCN.

The Bolanos Conservation area, 11.6 km^2 (2,854 acres), is managed by GDAWR for hunting and outdoor recreation. The area is composed of savanna complex (*Miscanthus floridulus* and other grassland species) (47.1%), scrub forest (0.2%), ravine forest (50.2%), badlands (2.5%), barren areas (0.06%), and urban buildup (<0.01%) (Figure 16). Historically, the area was predominantly ravine forest with very little savanna complex. However, humans and ungulates have changed the landscape through agricultural burning and browsing. Today, Bolanos is nearly an even mix of savanna complex and ravine forest. The range of ravine forest is reduced in each successive dry season.

Bolanos Conservation Area is difficult to access and is limited to hikers and hunters. The mosaic of fire-dominated vegetation such as *M. floridulus* makes this area and its limited access a challenge for natural resource managers. The restoration of native fauna to Bolanos would require reducing savanna complex and rehabilitation to ravine forest. However, portions of Bolanos that still harbor native vegetation should be receptive to native fauna should sufficient habitat exist to support such reintroductions. All efforts to rehabilitate Bolanos should also involve ungulate and brown treesnake control.

The 2.7 km^2 (662 acres) of the Cotal Conservation Area is predominately covered by savanna complex (73.8%) with scrub forest (24.7%) and urban buildup (1.2%) being the next most abundant habitat types (Figure 17). Barren and badland habitats are less than one percent of the total area. Efforts to improve the habitat have been met by repeated arson. A stream is present in the area and provides for indigenous freshwater fauna and reef protection. At present, this area provides little forest values and is not connected to the southern Refuge Overlay. This area is accessible by the general public. Reforestation efforts combined with public education activities may be implemented in this area in order to restore SOGCN. The Department's FSRD has begun efforts to restore native species to this area that would make this area available to release efforts of native species of birds and other animals in the future. However, the prevalence of grassland fires in this area makes reforestation difficult and challenging.

In addition to locally managed conservation lands the federal government has identified conservation areas on Guam (Figure 14). On June 14, 1991, the USFWS published its intent to establish a wildlife refuge overlay (Federal Register Vol. 56, No. 115, pp. 27485-27493). The Guam National Wildlife Refuge (GNWR) Overlay was established in December 1993 creating the 97.1 km^2 (24,000-acre) GNWR Overlay. The Memorandum of Understanding (MOU) between the USFWS, the U. S. Navy (USN), and the U. S. Air Force (USAF) established the overlay units of the GNWR. The goal of this MOU was to develop cooperative agreements for the management of Guam's natural resources on federal and conservation lands. The USAF entered into a Cooperative Agreement with the USFWS with purpose of establishing the overlay units on lands administered by the USAF on Guam, and to define the management and administrative roles and responsibilities of the USAF for the GNWR. These federal agencies, among others, are valuable partners in the implementation of Guam's CWCS.

The GNWR Overlay includes a variety of habitat types within its boundaries. The habitats include limestone forest, scrub forest, savanna complex, ravine forest, strand vegetation, and Causarina thicket. Like the conservation areas that belong to the Government of Guam, the habitat contained within the GNWR is degraded. The overabundance of feral ungulates and other factors continue to degrade these habitats. Guam DAWR will work with GWNR management, AAFB, and COMNAVMAR to improve the habitat for the benefit of Guam's SOGCN.

Marine Preserves

Over 10% of Guam's coastline has been set aside in five marine preserves: Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat, and Pati Point (Figure 14). The preserves were established in 1997 in response to decreasing reef fish stocks, but were not fully enforced until 2001. Fishing activity is restricted in the preserves with limited cultural take permitted in three of the five areas.

The largest of the preserves, Pati Point Marine Preserve, contains 20 $km^{2,}$ or approximately 4900 acres reef environment. The area was originally designated as a marine preserve and managed area by the Air Force in 1973 (Stevens 1973). The preserve includes narrow reef flats edged by steep fore reef slopes that are populated by a wide variety of coral species. The beaches within this preserve are important green sea turtle (*C. mydas*) nesting areas. Limited access to the preserve provides some level of protection; however, enforcement of regulations becomes increasingly difficult. Under the territorial marine preserve designation, only hook and line fishing from shore is allowed for all species of fish.

The Tumon Bay Marine Preserve lies adjacent to the central tourist district on Guam. This 4.5 km^2 (1117 acre) preserve features a broad reef flat (2.7 km^2, 665 acres) and gently sloping fore reef slope (0.7 km^2, 166 acres), and broad bank/shelf habitat (1.42 km^2, 351 acres less than 100 feet deep). Almost 1 km^2 (253 acres) of this preserve is dominated by coral. On the fore reef slope, the dominant species is plate-and-pillar coral (*Porites (synarea) rus),* complemented by a wide variety of other species. The reef flat contains large stag horn (*Acropora),* lobe *(Porites)*, and lettuce (*Pavona)* coral stands. These coral stands provide rich habitat for a variety of fish species including the CITES listed Humphead wrasse (*C. undulatus*) and many other species of reef fish. Extensive sand patches that harbor sea cucumbers and a variety of scavengers complement this coral-dominated area. Limited traditional fishing with hook and line or talaya (cast net) from shore is allowed in this preserve for four types of fish: *kichu* (convict tangs, *Acanthurus triostegus), manahac or sesjun* (rabbitfish, *Siganus sp.*), *I'e* (juvenile jacks and trevallies, *Caranx sp.), and ti'ao* (juvenile goatfish, *Mullidae species).* Talaya may be used for *kichu and manahac or sesjun*, along the reef margin.

Piti Bomb Hole Preserve (3.6 km^2, or 896 acres) stretches from Asan Point to the outlet channel from the Cabras power plant. The broad reef flat (1.4 km^2, 349 acres) in Piti Bay extends from 72 m near the mouth of Tepungan Channel to 978m east of Asan Point (Randall and Eldredge 1976). The reef flat includes unique solution features known as the "bomb holes" that provide sheltered areas of deeper water. The deepest of these

sinkholes are 30-32 feet at mean lower low water (MLLW) (Tsuda and Donaldson 2004). These sinkholes are densely populated by a variety of hard and soft coral species. They host rich soft coral communities and fish and invertebrate assemblages not often found within the reef margin. In addition, Piti Bay's fore reef slope has unique rubble-pile habitats utilized by a number of unusual/rare species of echinoderms and mollusks (Paulay 1994). These features are not known from any other area of Guam. The western end of the preserve is transected by Tepungun Channel. Dolphins, large rays, and bumphead parrotfish (*Bolbometopon muricatum)* frequent this preserve. The main sinkhole is occupied by an 11 m (36 ft.) diameter underwater observatory that was completed in 1996. The Fish Eye Marine Park Observatory is accessed by a 1.8 m (6 ft.) wide and 290 m (950 ft.) long pier. The largest sinkhole is frequented by commercial scuba diving tours and is visited by up to 200 divers a day.

Sasa Bay Marine Preserve (3.1 km^2, or 770 acres) includes a significant subset (0.5 km^2, 126 acres) of the largest mangrove stand in the Mariana Archipelago. This preserve extends from the dry dock island to Polaris point and ends at the public right of way bordering Marine Corps Drive (Route 1). The northern border is route 18 and the southern is the road to Polaris Point. The diverse mangrove swamp serve as nursery grounds for jacks (*Carangidae*), barracudas (*Sphyraenidae*), snappers (*Lutjanidae*), and groupers (*Serranidae*) (Wiles and Ritter 1993). The bay also serves as a foraging ground for green and hawksbill sea turtles. Coral habitat (0.02 km^2, 4.5 acres) is limited inside of the preserve due to the heavy sediment load entering the bay from the Sasa and Aguada rivers.

The fifth preserve is the Achang Reef Flat Preserve in Merizo (4.8 km^2, or 1199 acres), which extends from the Ajayan Channel to Achang Bay. It includes a wide variety of habitats including mangroves, seagrass, sand, coral, and channel. The seagrass, mangrove, and estuarine areas of this preserve are important nursery area for a number of fish species. Manell channel, the largest channel included in the preserve, is an important congregation site for green sea turtles as the surrounding areas include rich foraging habitat including dense sea grass beds. Seasonal traditional fishing [as defined in 5 GCA Chapter 63 §63101] is permitted in this preserve for lesso' (juvenile forktail rabbitfish, *Siganus argenteus*), achemson (juvenile fusiliers, *Ptercaesio tile*), and atulai (big eye scad, *Selar crumenophthalmus*) under special permit.

Freshwater Conservation Areas

There are few freshwater conservation areas on Guam. Within the Sasa Bay Marine Preserve, a wetland site has been designated as a moorhen foraging site. There is also Fena Lake, the largest reservoir on Guam, which is important for nesting moorhens. Fena Lake is located in southern Guam, on Naval Ordnance Annex, which is part of the GNWR Overlay. Three rivers empty into this reservoir. Due to the relative inaccessibility of Naval Ordnance Annex, these are some of the most pristine river habitats on Guam.

Federal Marine Conservation Areas

The Guam National Wildlife Refuge Overlay includes the federally owned War in the Pacific National Historical Park, Guam National Wildlife Refuge, and two Naval Ecological Reserve Areas (ERA), Orote and Haputo (Figure 14). The marine portion of the two ecological reserve areas complement the marine preserves. These areas were established as mitigation for construction projects in Apra Harbor for the naval base. Managed by the US Navy, these areas are closed to commercial fishing, however there is little management or enforcement.

The Orote Peninsula ERA stretches from Orote Point south to Agat Bay. Diversity and species composition of the Orote Peninsula reefs are strongly influenced by physical factors such as wave exposure, currents, riverine influence, and bottom topography. A number of unique micro and macrohabitats exist in this area with very different assemblages found within each. A recent survey of the area indicated that Blue Hole, the Orote Boulder Fields, and the Orote Point Reef Slope were biologically important due to unique species and high biodiversity. The researchers identified 1252 species of marine animals within the ERA. This included 156 species of scleractinian corals, two of which (*Leptoseris n. sp.* and *Favia rotundata*) were new records for Guam. A total of 339 fish species were recorded, representing approximately 37% of the known species from Guam. Macroinvertebrates accounted for 657 species encountered during the qualitative surveys. Diversity appears to be related to habitat, with areas such as the reef flat between Neye Island and the coast, and the patch reefs in North Agat Bay, exhibiting high levels of diversity. In general, diversity declines from Orote Point southeastward and then increases again in the Agat area (Paulay 2001)

The Haputo ERA is located along the northwest coast of Guam, from just south of Haputo Beach to just north of Double Reef. The area is bounded by narrow, supratidal benches or unprotected rock faces; however, the area also contains two small, localized reef flats near Haputo Beach and Double Reef. Double Reef, an incipient barrier reef, is a unique feature in this area that creates highly heterogeneous habitat, including a distinct backreef community. Surveys identified, 944 species of marine animal, including 154 species of scleractinian corals. Quantitative studies indicated that coral cover was relatively high at most Haputo survey stations, ranging between 37-64%. This is higher than most surveyed locations in Guam's waters. Two hundred and seven fish species, approximately 22% of the known species from Guam, were identified at this site. Large piscivores and herbivores were rare. The study indicated that while corals were thriving, the fish targeted by the local fishermen were less diverse and less abundant at the Haputo ERA than expected. The low abundance of target species suggests that overfishing may also be a problem in this area.

Maps

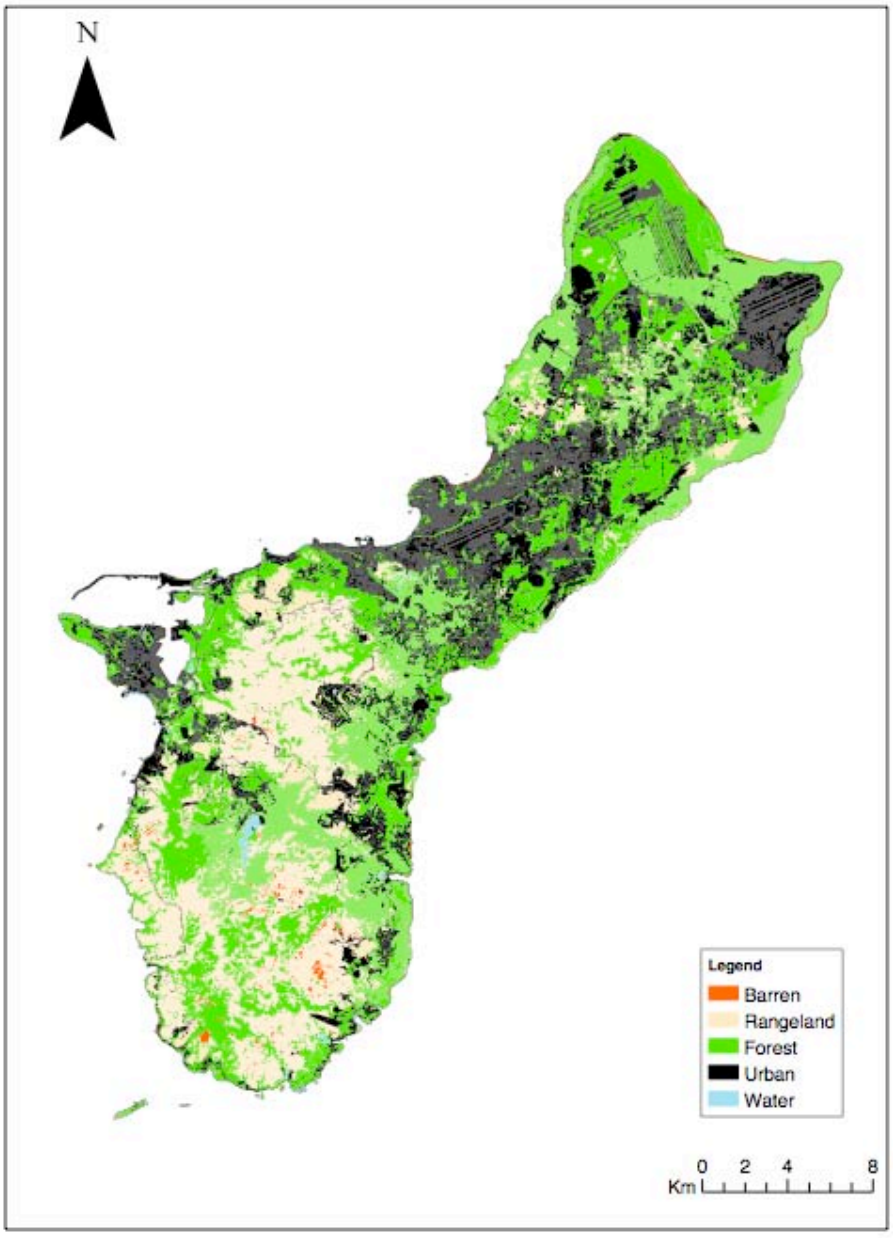


Figure 1. The distribution of various vegetation types around Guam [USDA 2005, Brown 2005].

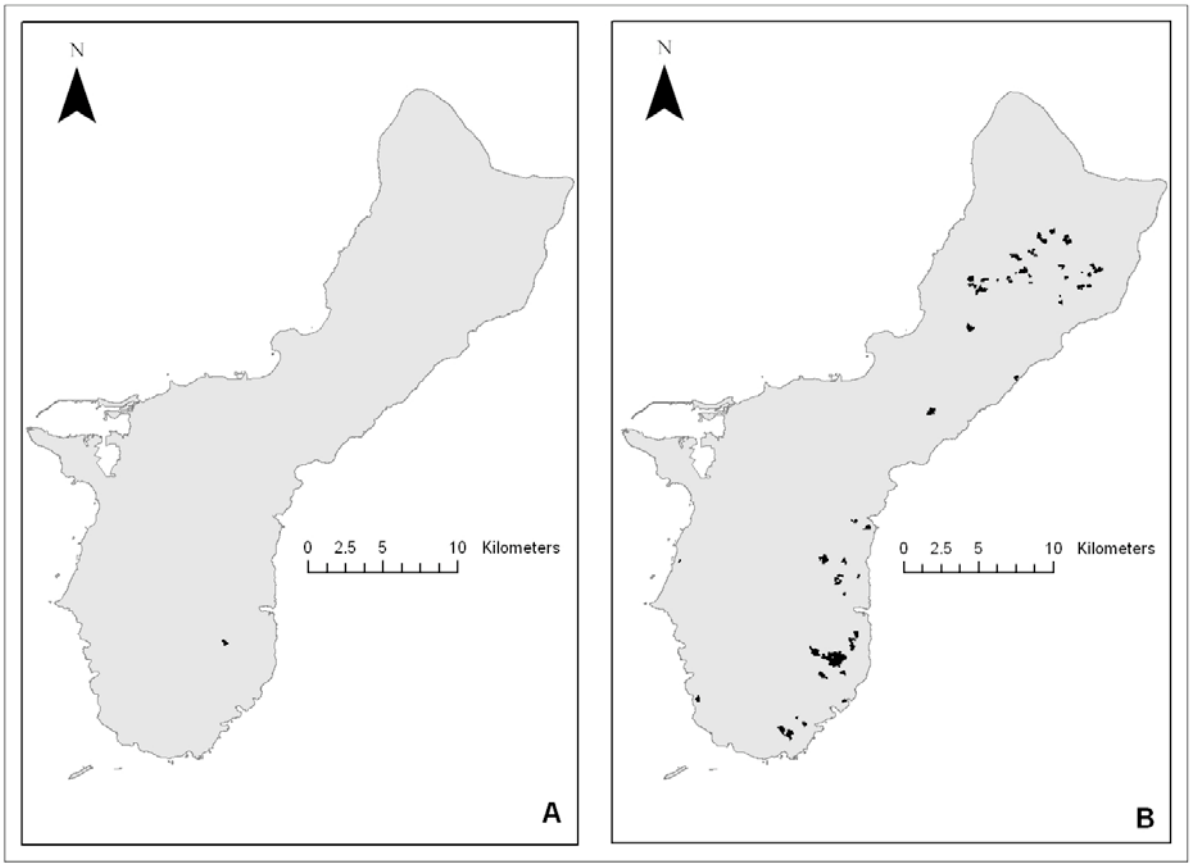


Figure 2. Location of Acacia Plantation (A) and Agricultural Field (B) habitats [USDA 2005, Brown 2005].

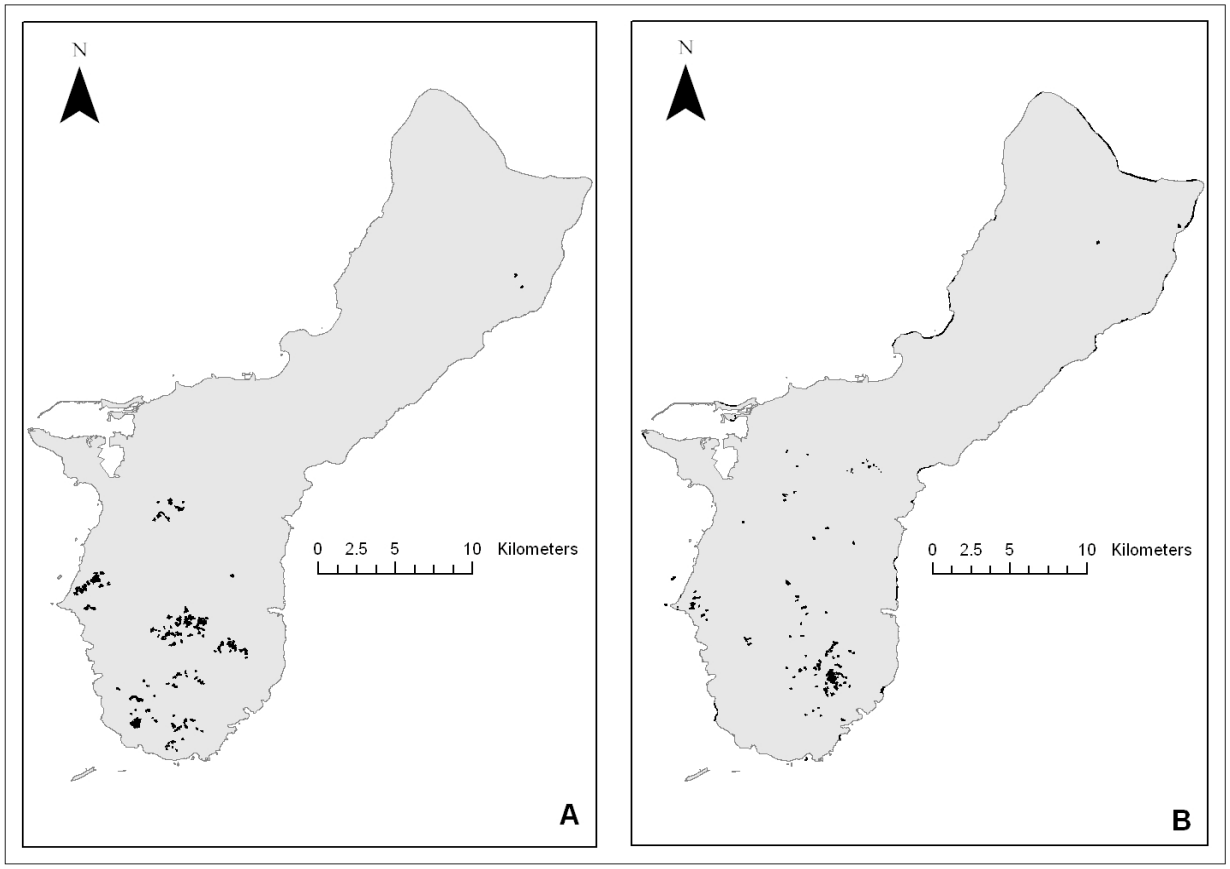


Figure 3. Location of Badlands (A) and Barren (B) habitats [USDA 2005, Brown 2005].

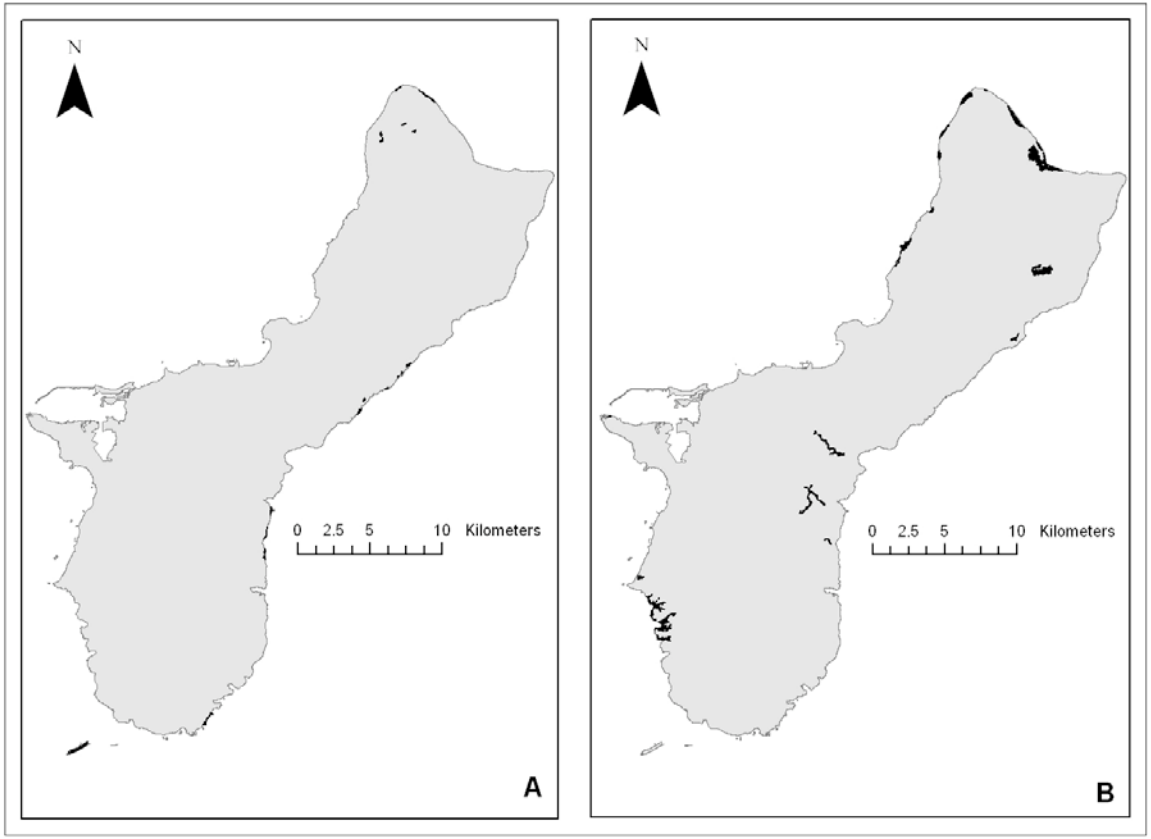


Figure 4. Location of Causarina Thicket (A) and Coconut Plantation (B) habitats [USDA 2005, Brown 2005].

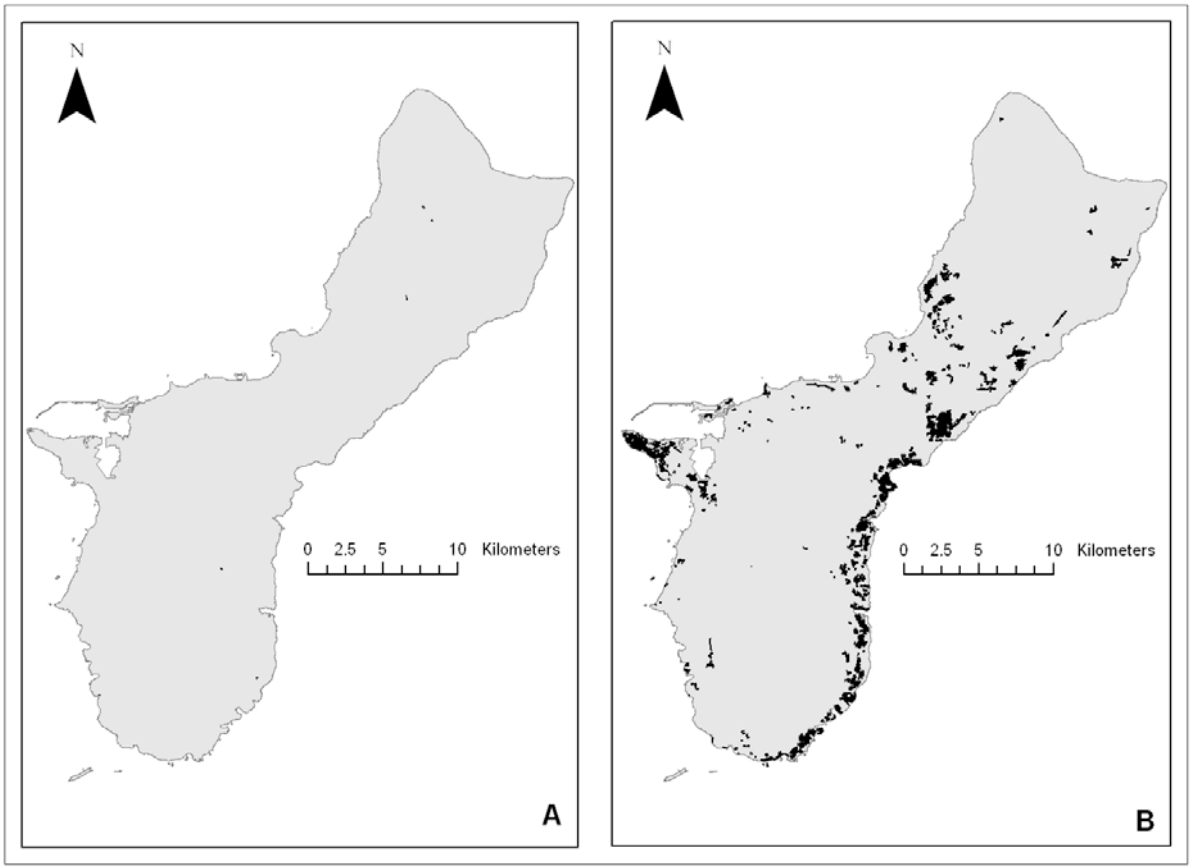


Figure 5. Location of Constructed Water (A) and *Leucaena* Stand (B) habitats [USDA 2005, Brown 2005].

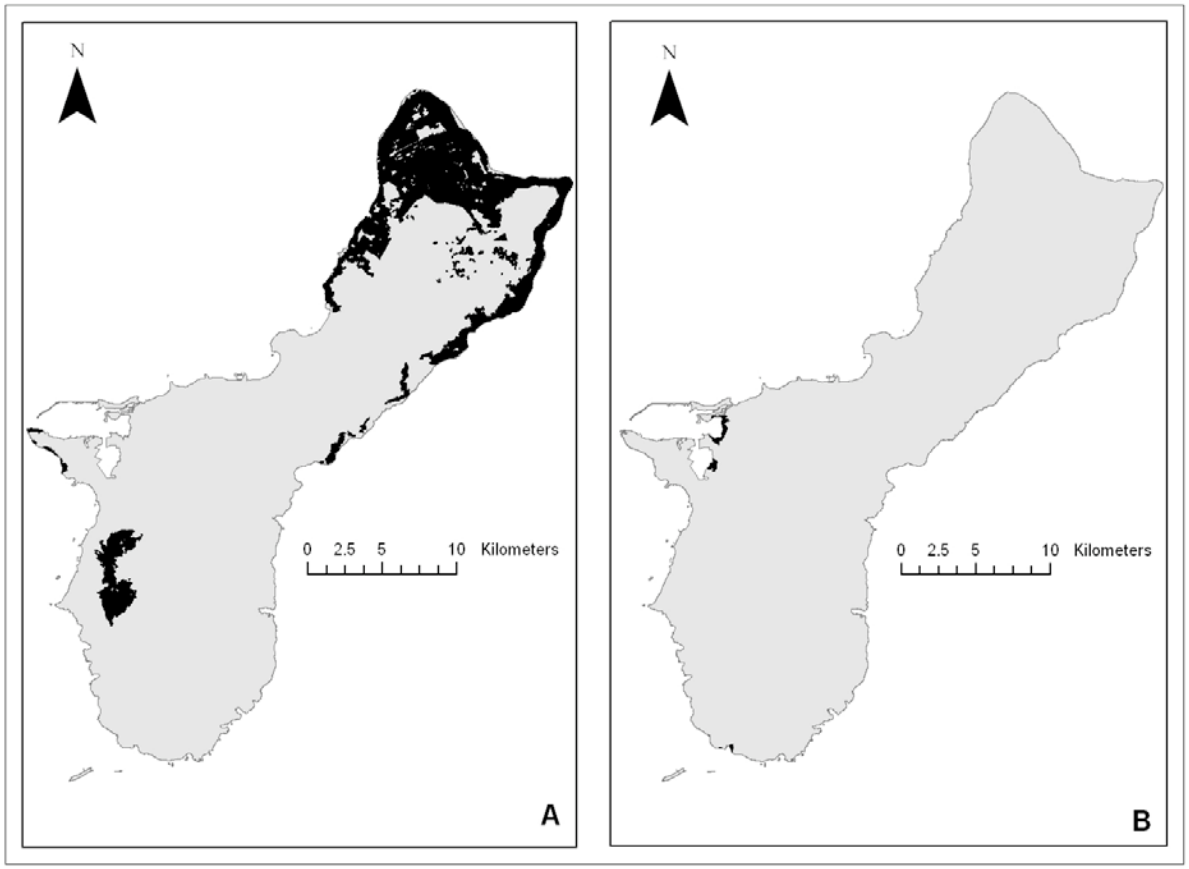


Figure 6. Location of Limestone Forest (A) and Mangrove Swamp (B) habitats [USDA 2005, Brown 2005].

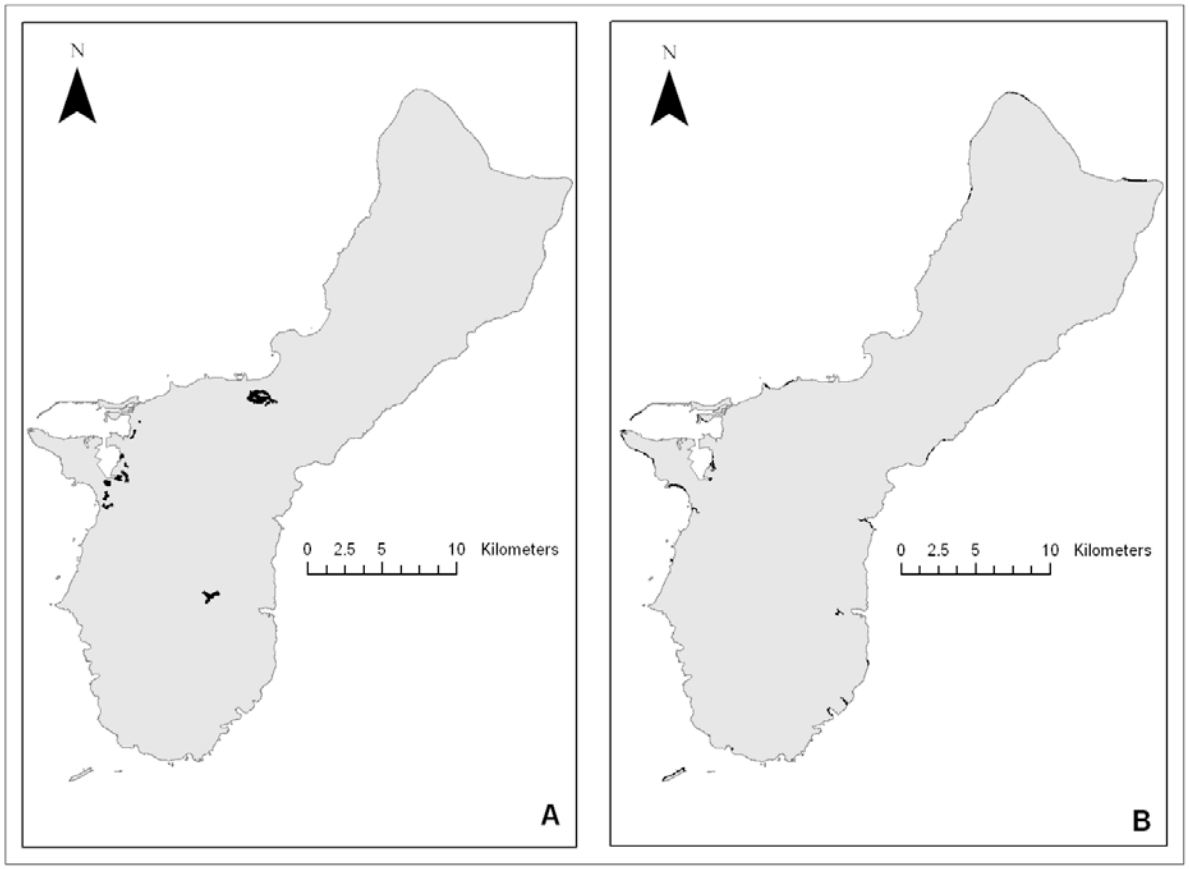


Figure 7. Location of Marsh Land (A) and Natural Water (B) habitats [USDA 2005, Brown 2005].

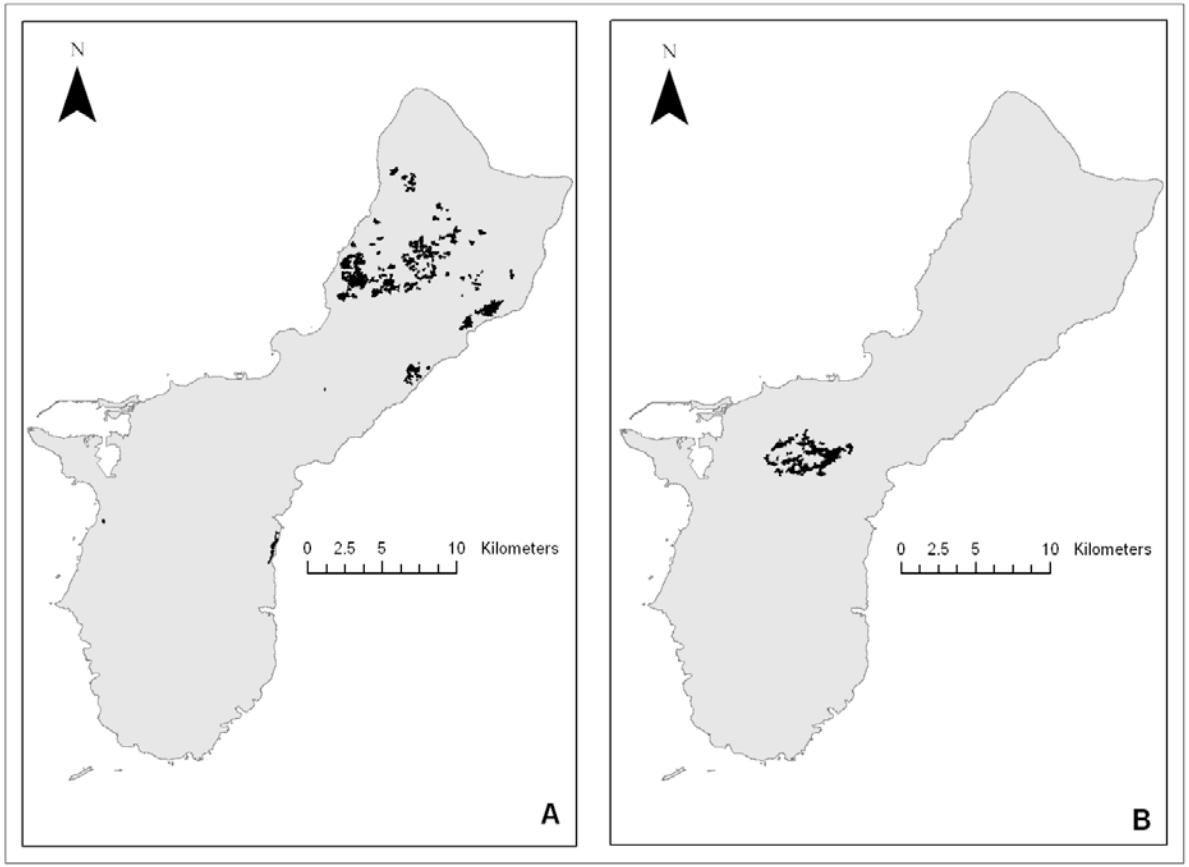


Figure 8. Location of Other Shrub Grass (A) and Palma Brava (B) habitats [USDA 2005, Brown 2005].

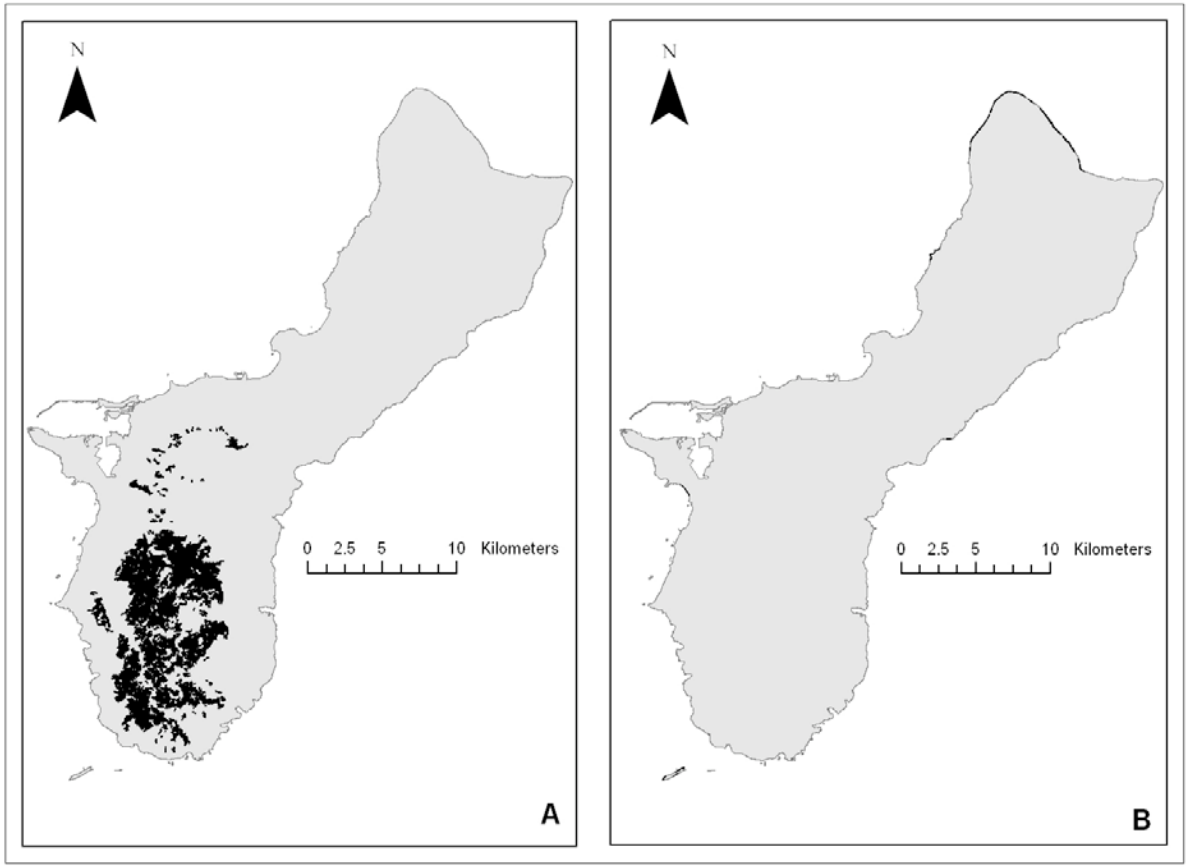


Figure 9. Location of Ravine Forest (A) and Sand, Beach, Bare Rocks (B) habitats [USDA 2005, Brown 2005].

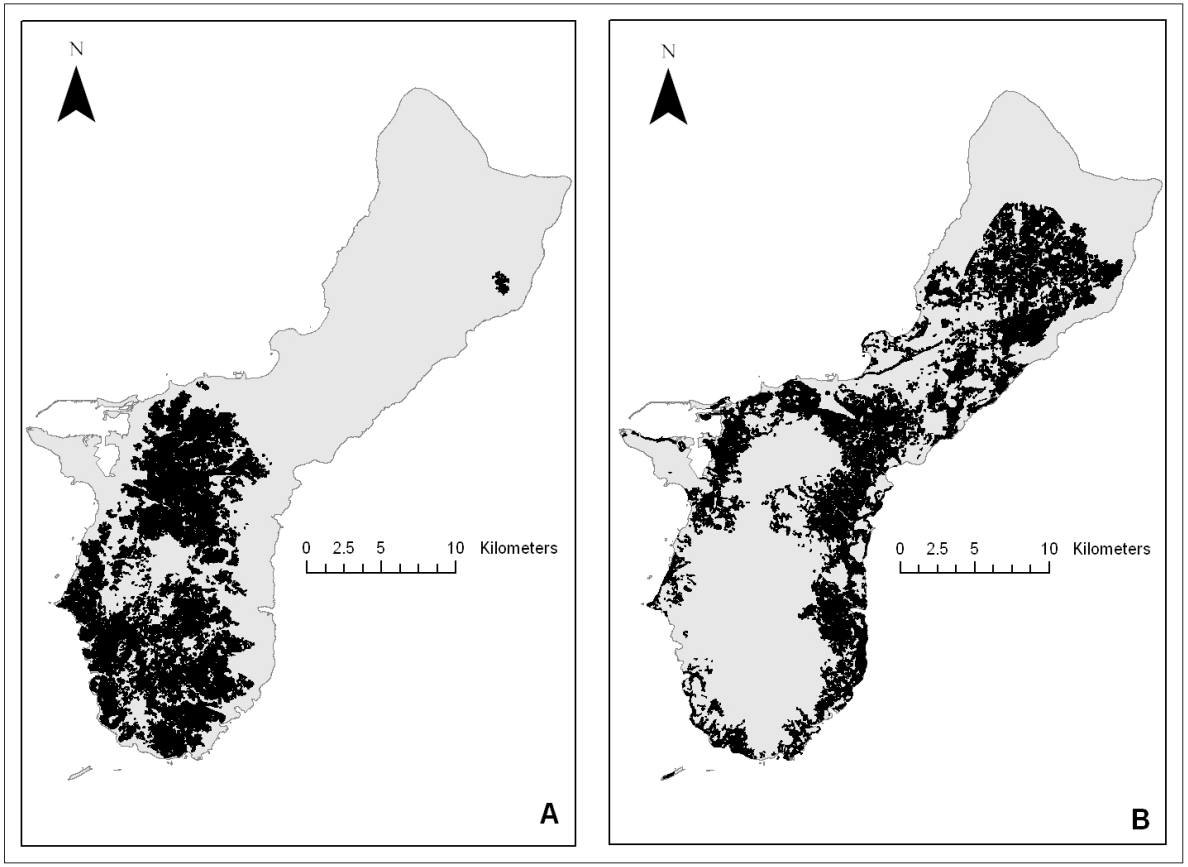


Figure 10. Location of Savanna Complex (A) and Scrub Forest (B) habitats [USDA 2005, Brown 2005].

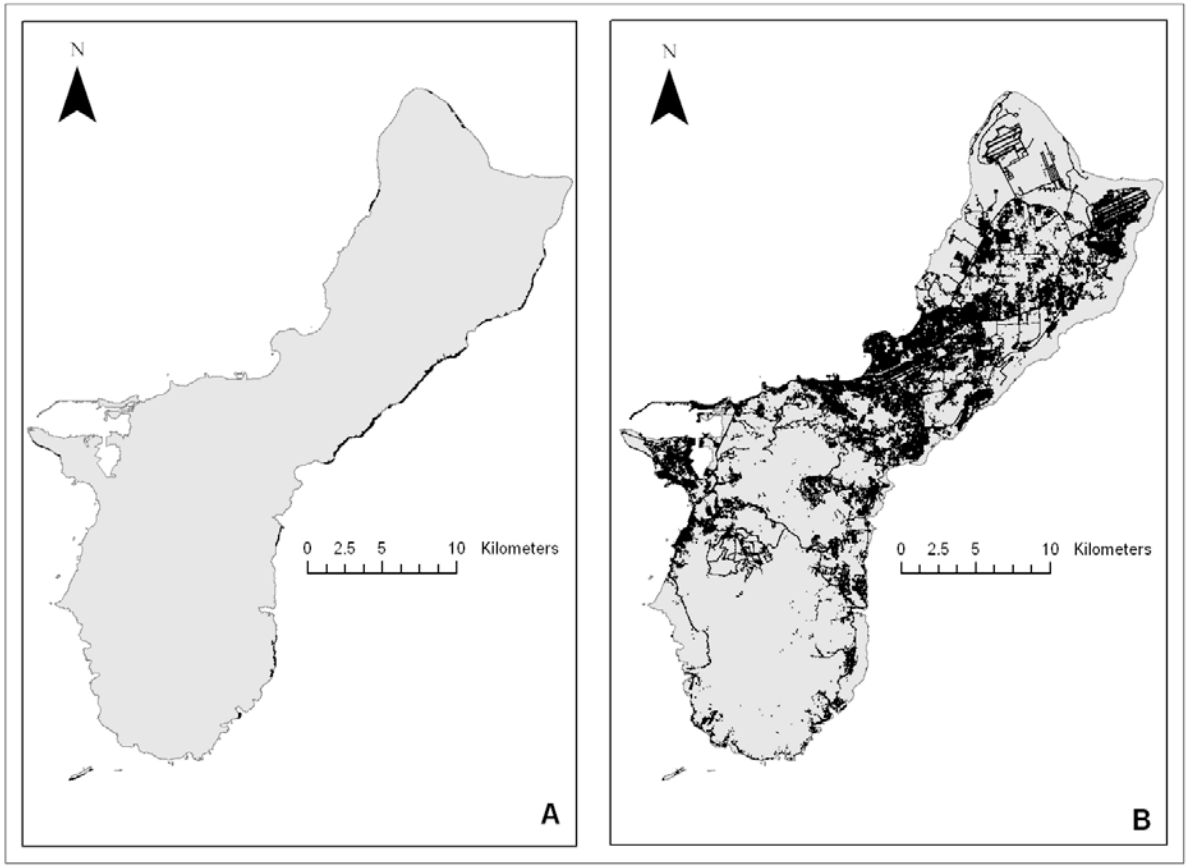


Figure 11. Location of Strand Vegetation (A) and Urban Buildup (B) habitats [USDA 2005, Brown 2005].

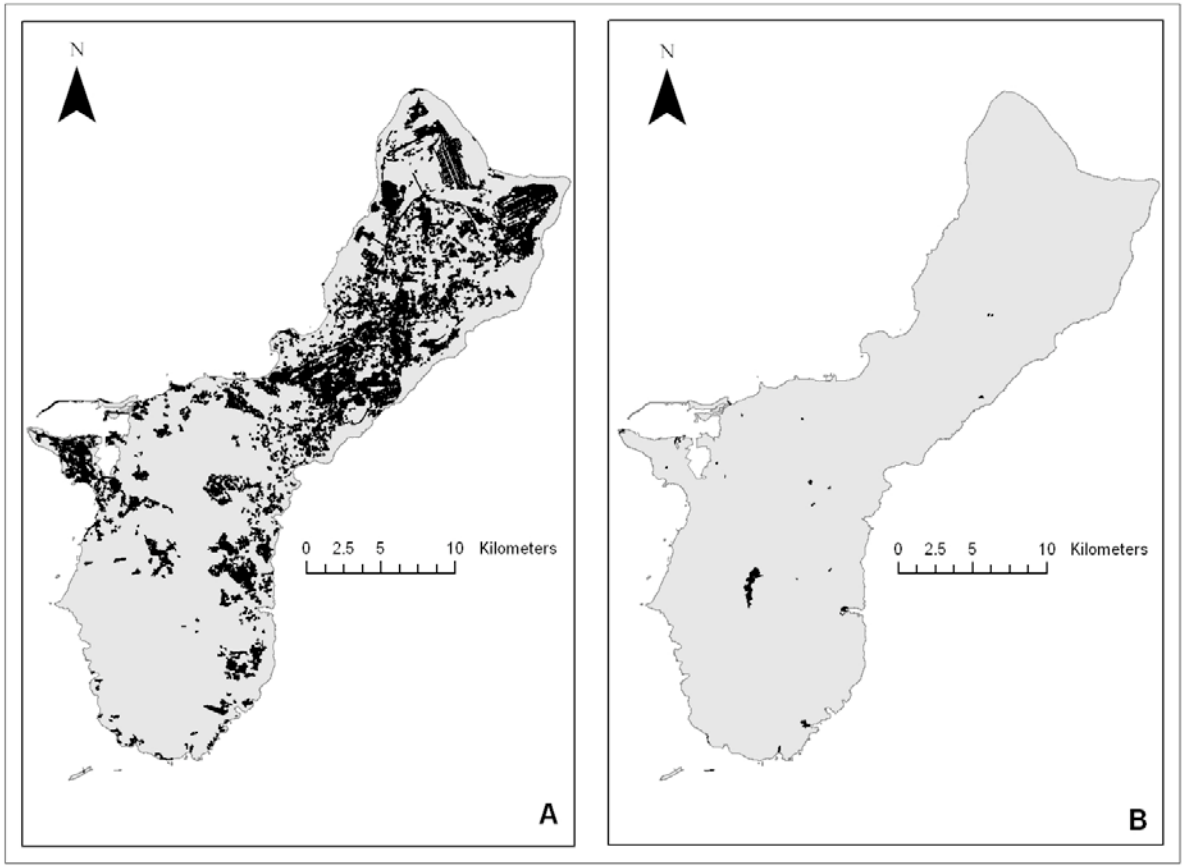


Figure 12. Location of Urban Cultivated (A) and Water (B) habitats [USDA 2005, Brown 2005].

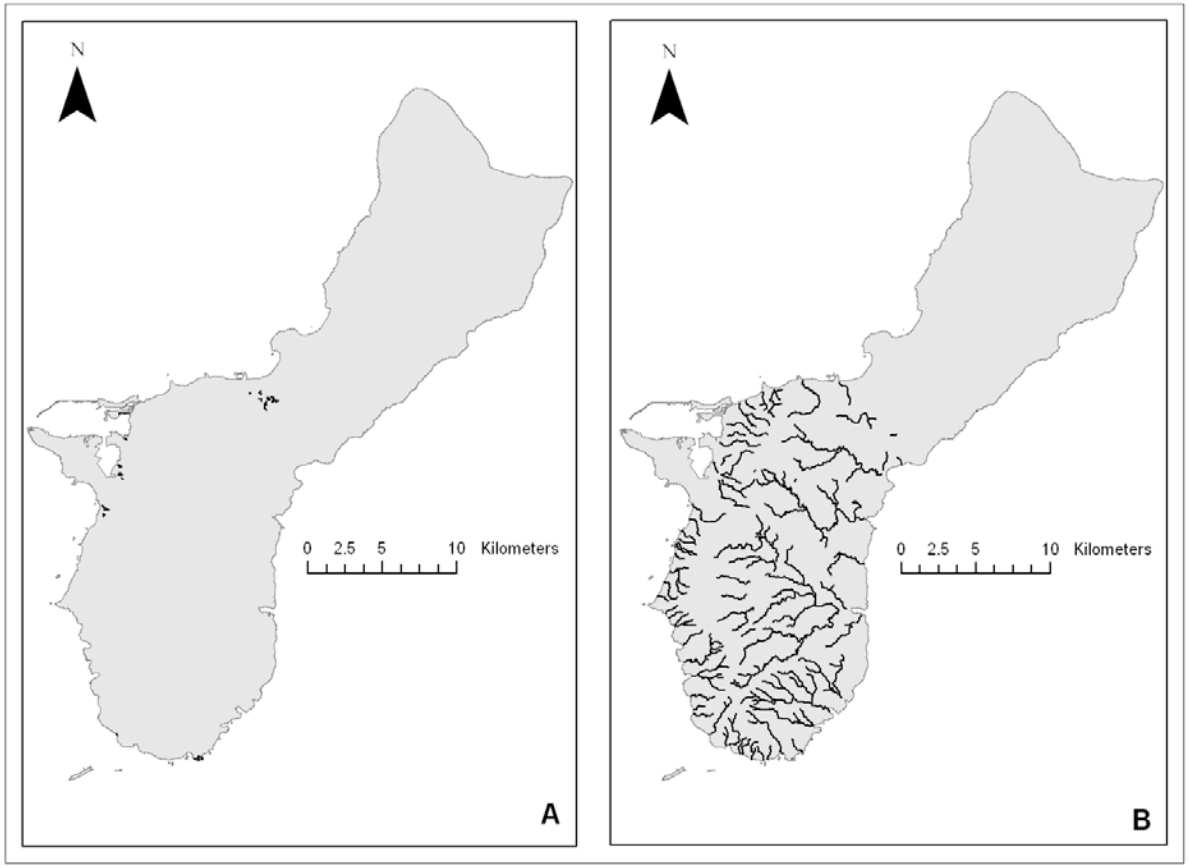


Figure 13. Location of Wetland (A) and River (B) habitats [USDA 2005, Brown 2005].

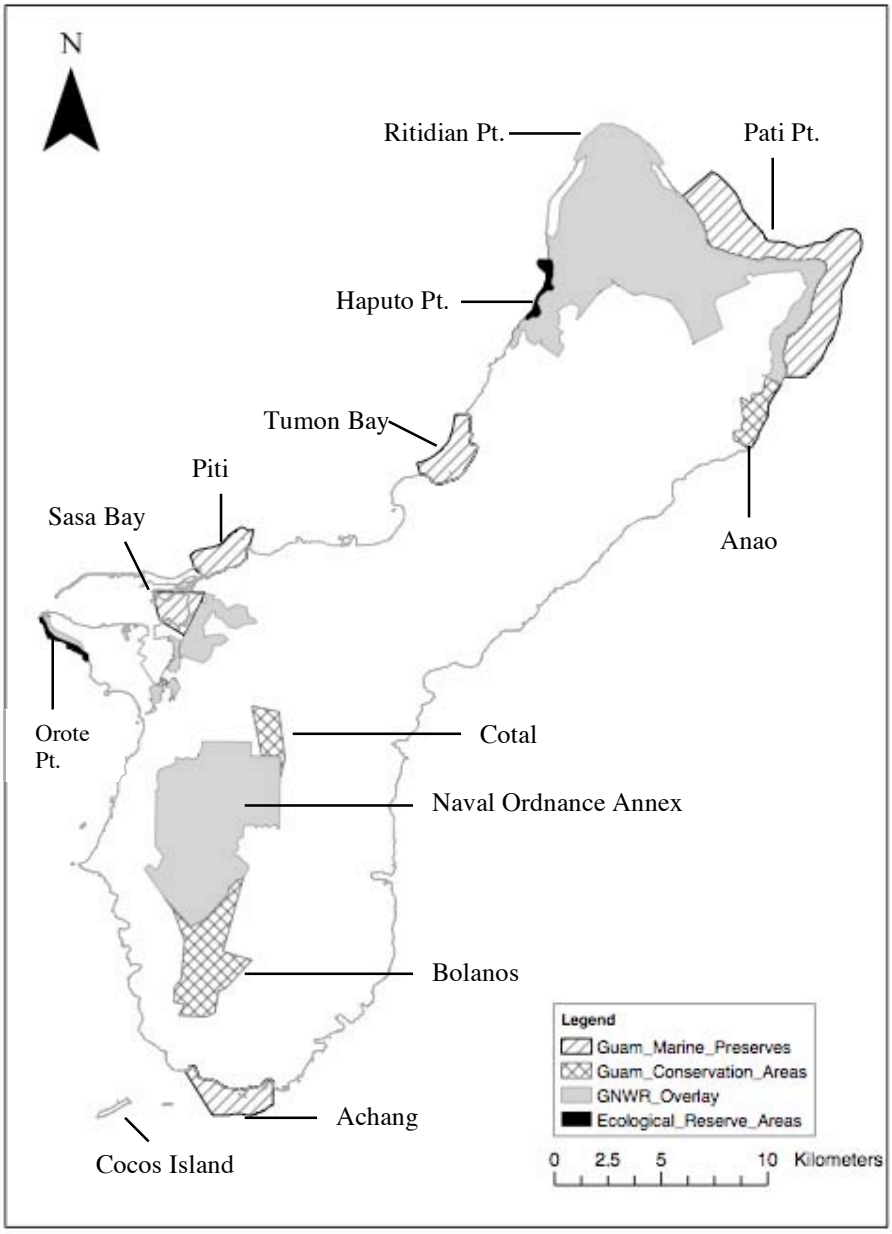


Figure 14. The location of conservation lands and marine preserves found on Guam [USFWS 2005, Brown 2005].

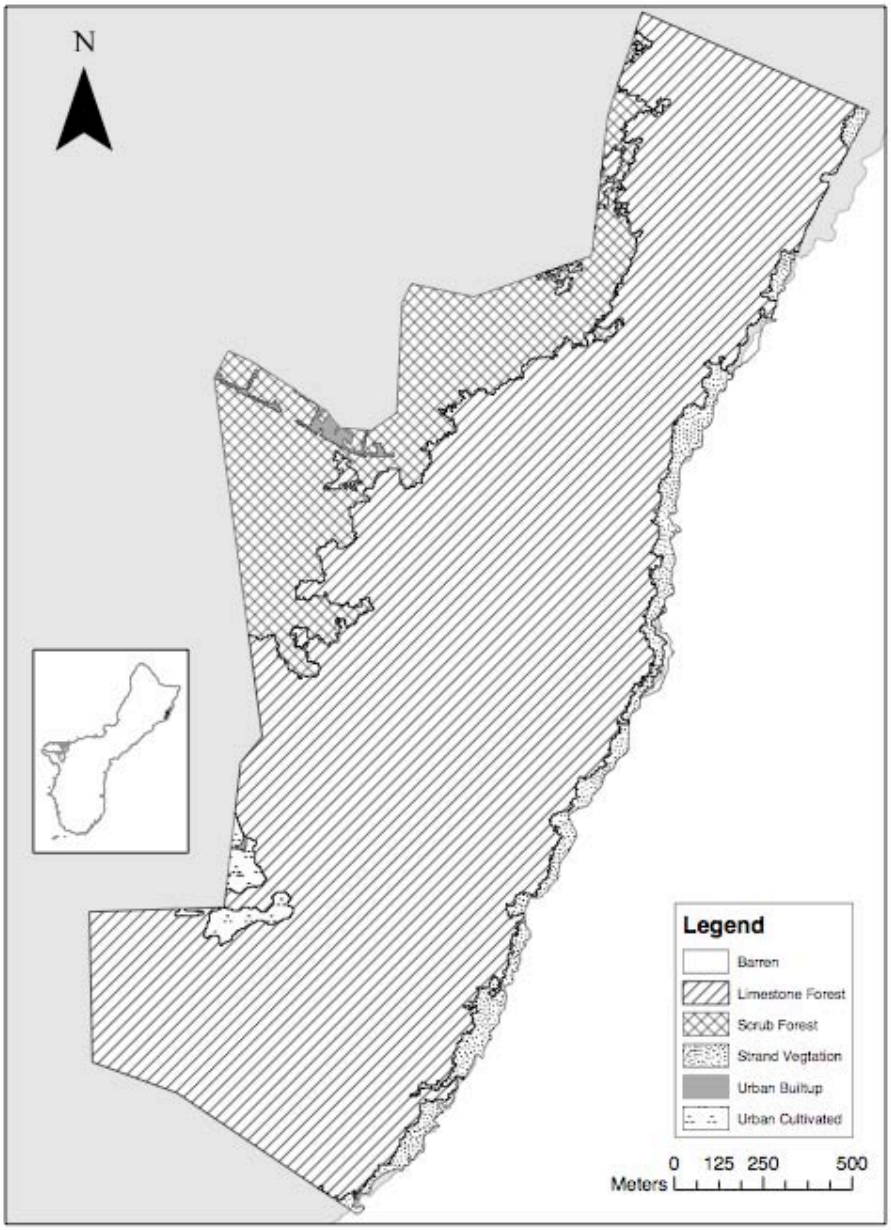


Figure 15. Habitats found within the Anao Conservation Area [USDA 2005, Brown 2005].

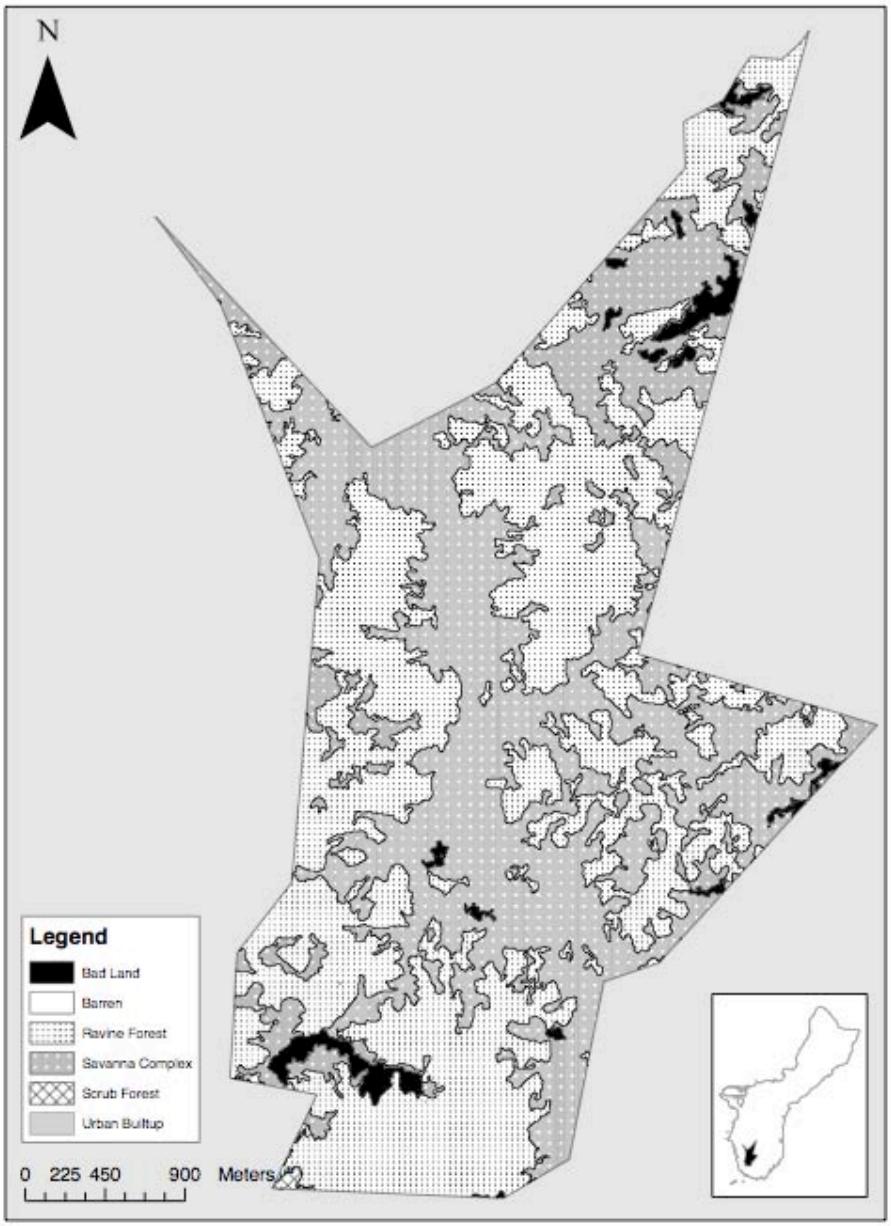


Figure 16. Habitats found within the Bolanos Conservation Area [USDA 2005, Brown 2005].

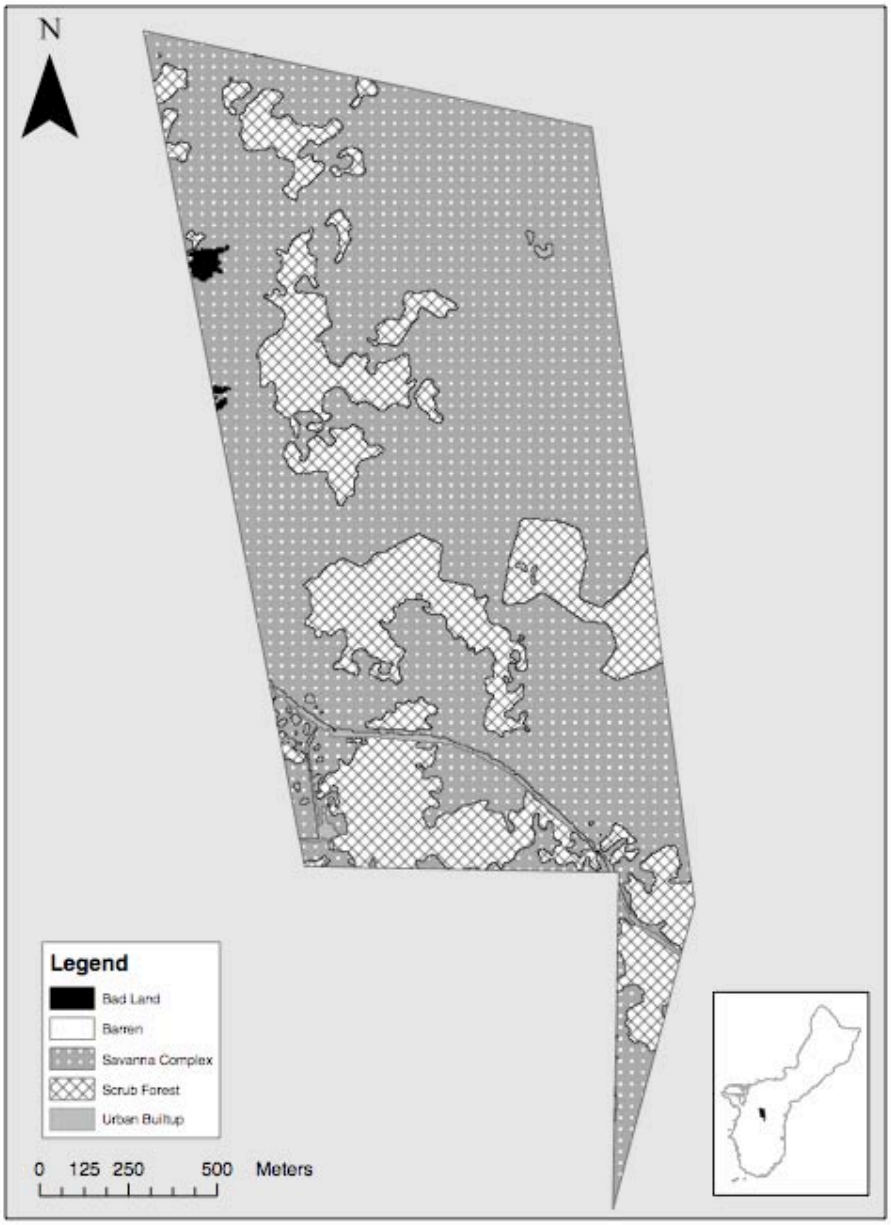


Figure 17. Habitats found within the Cotal Conservation Area [USDA 2005, Brown 2005].

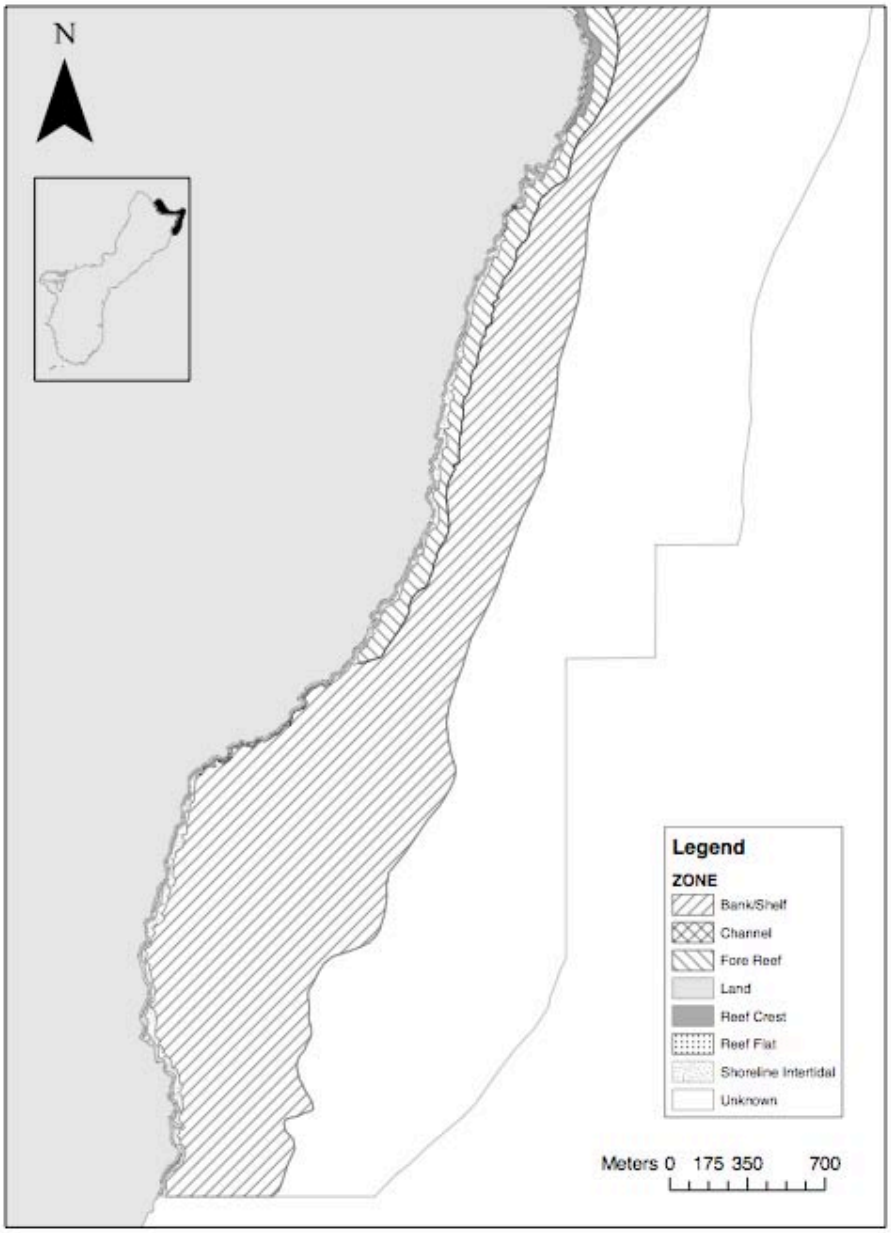


Figure 18. Habitats found within the eastern portion of the Pati Point Marine Preserve [NOAA 2005, Brown 2005].

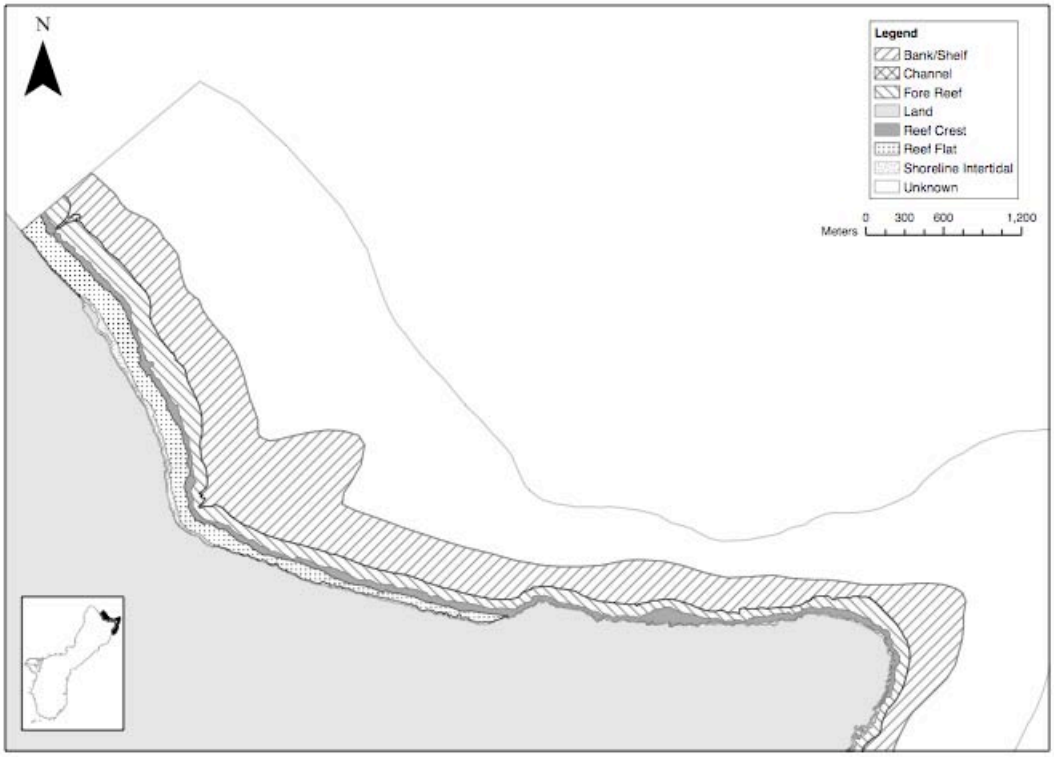


Figure 19. Habitats found within the northern portion of Pati Point Marine Preserve [NOAA 2005, Brown 2005].

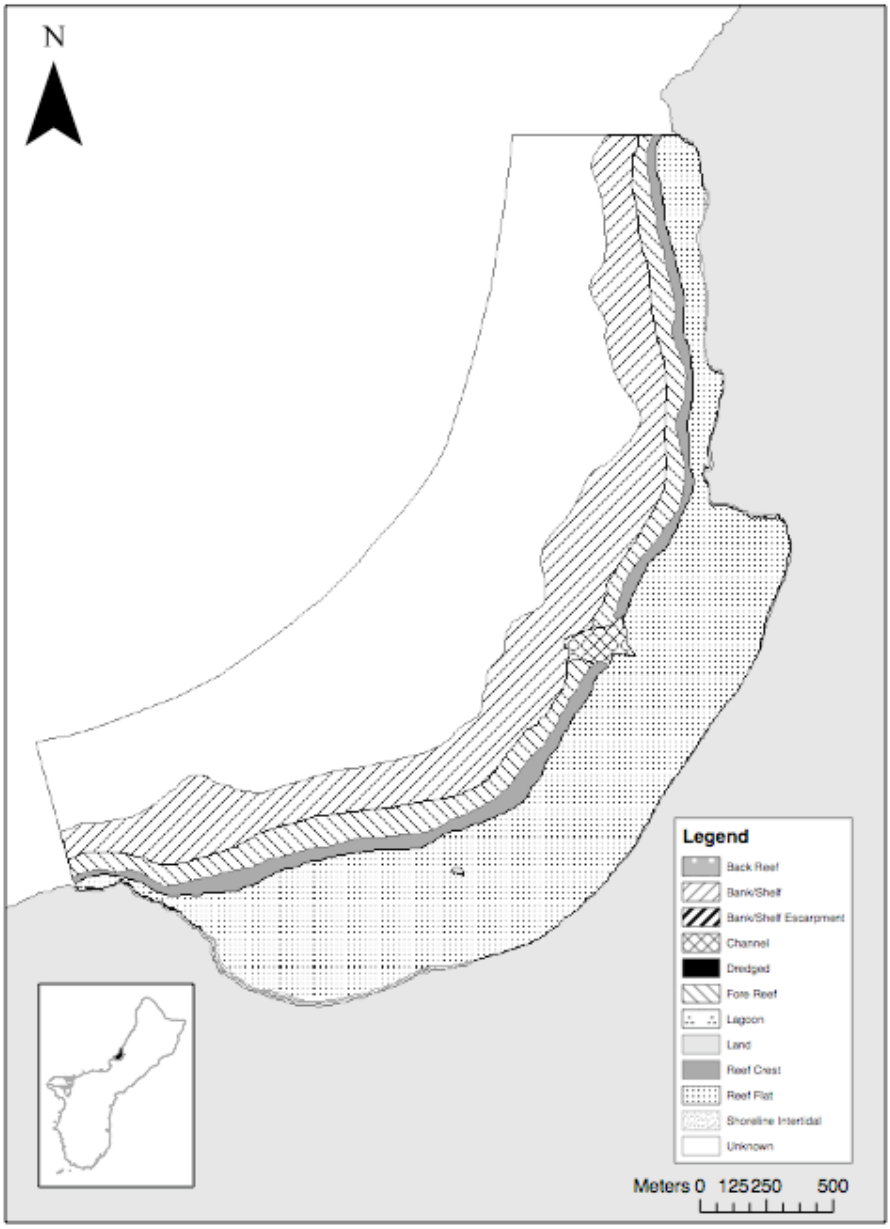


Figure 20. Habitats found in the Tumon Bay Marine Preserve [NOAA 2005, Brown 2005].

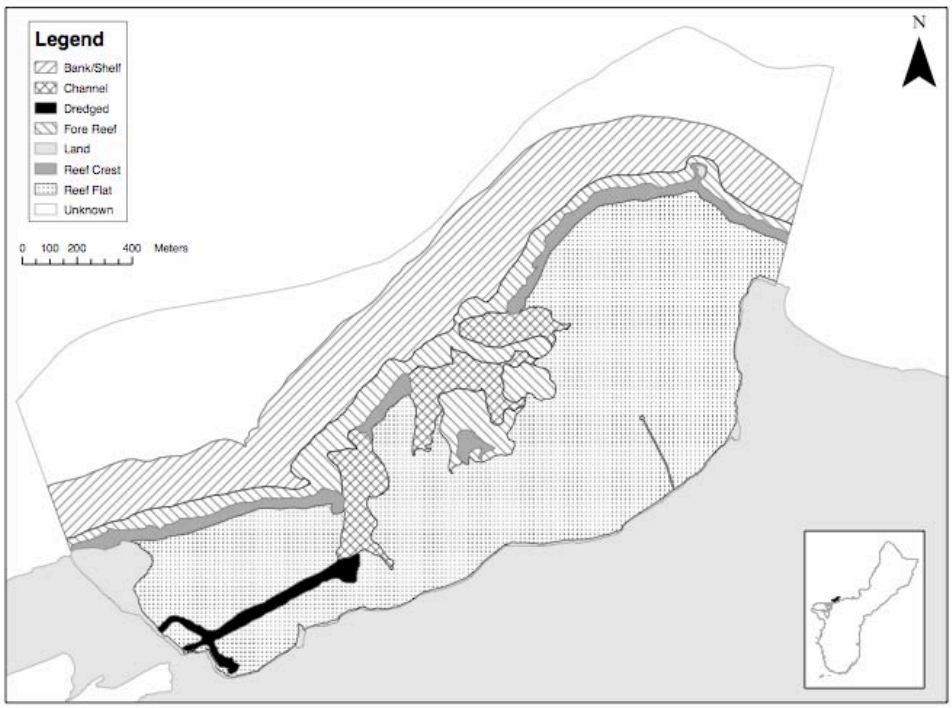


Figure 21. Habitats found within the Piti Bomb Hole Marine Preserve [NOAA 2005, Brown 2005].

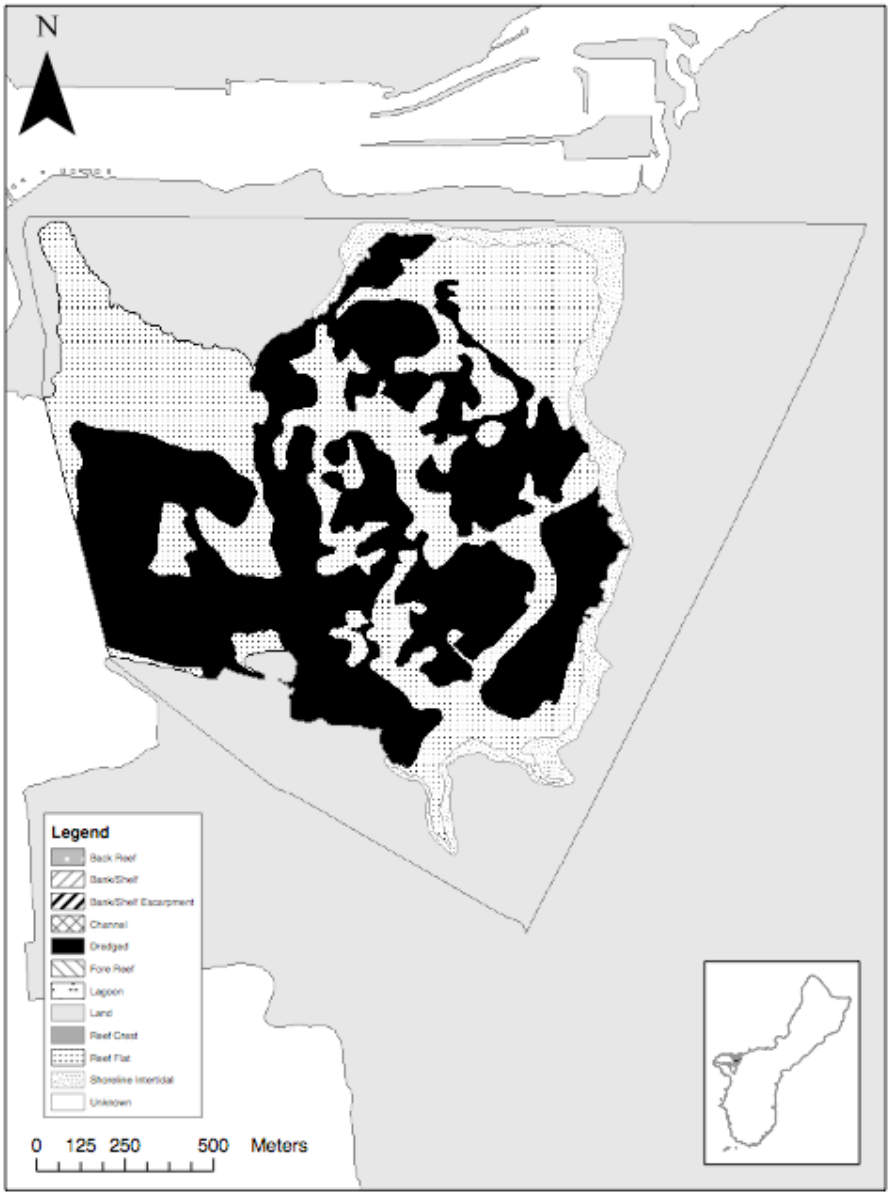


Figure 22. Habitats found within the Sasa Bay Marine Preserve [NOAA 2005, Brown 2005].

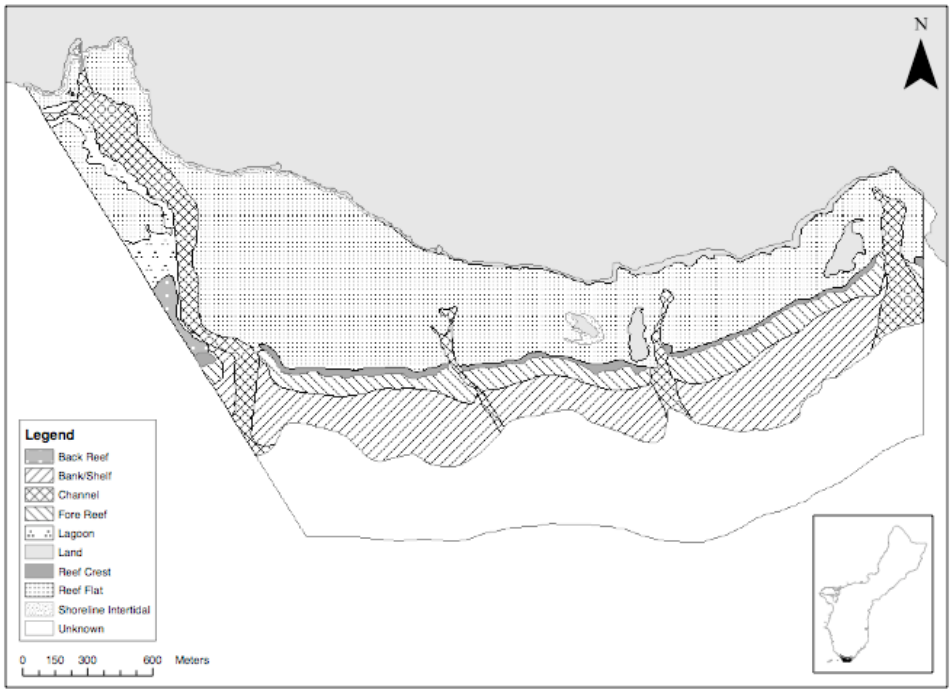


Figure 23. Habitats within the Achang Bay Marine Preserve [NOAA 2005, Brown 2005].

CHAPTER 3: Species of Greatest Conservation Need (SOGCN) (Elements 1 and 3)

Species of Greatest Conservation Need

Rationale for Species of Greatest Conservation Need

Guam's native fauna is unique in that many species have been impacted by the introduction of the brown treesnake (Savidge 1987). Historically, pesticide use and hunting have resulted in the demise of other species or reduction in numbers of certain species. Sixty-five SOGCN were included in the GCWCS inventory, as well as 20 general groups of organisms (Table 8). The species had to meet at least one of the following criteria for inclusion as a SOGCN (see Appendix 4):

1) The population of the species does not contain a self-sustained breeding population, there is no known breeding population, or is extirpated;
2) Population size is considered threatened or endangered;
3) A monitoring program is not in place;
4) The status of the population of the species is not known;
5) The range of the population is limited; or,
6) A funded program is not in place for that species.

Species considered extinct were not included as SOGCN. For Guam, these species include the little Mariana fruit bat, rufous fantail (*Rhipidura rufifrons*), Guam bridled white-eye (*Zosterops conspicilata conspicilata*), and Guam flycatcher (*Myiagra freycineti*). All of the remaining species are listed endangered either locally or federally. However, congenerics from the islands north of Guam could potentially be introduced on Guam to fill gaps in niches left by the loss of the endemic subspecies.

A tremendous amount of work remains to determine the status of whole groups of marine mammals and terrestrial invertebrates. Insects are, by far, the most enigmatic group of animal on Guam. The number of insect species that have yet to be identified and cataloged numbers over 4000 (A. Moore pers. comm. 2005). In this case, we considered the entire Order a single unit to encourage attention to this highly neglected group of native fauna.

Table 8. List of 65 species and an additional 20 groups recommended as SOGCN for Guam. The general species groups will be determined as more information allows finer separation of species and need.

Species/Groups	Species/Groups
Mariana fruit bat	Bryde's Whale
Pacific sheath-tailed bat	Sei Whale
Guam rail	Humpback Whale
White-throated ground dove	Cuvier's Beaked Whale
Mariana fruit-dove	Sperm Whale
Island swiftlet	Dwarf Sperm Whale
Micronesian kingfisher	Pygmy Sperm Whale
Mariana crow	Melonheaded Whale
Micronesian starling	Killer Whale
Micronesian honeyeater	Shortfinned Pilot Whale
Mariana common moorhen	Risso's Dolphin
Nightingale reed-warbler	Spinner Dolphin

Table 8. Continued

White-tailed tropic bird	Striped Dolphin
Pacific reef heron	Dugong, *Dugong dugon*
Brown booby	Napolean Wrasse, *Cheilinus undulatus*
Migratory Shore birds	Bumphead parrotfish, *Bolbometopon muricatum*
Snake-eye skink	Surgeonfish, Acanthuridae
Slevin's skink	Parrotfish, Scaridae
Azure-tailed skink	Emperors, Lethrinidae
Moth skink	Groupers, Serranidae
Micronesian gecko	Rabbitfish, Siganidae
Mariana Islands tree snail, *Partula gibba*	Snappers, Lutjanidae
Pacific tree snail, *Partula radiolata*	Goatfish, Mullidae
Mariana Islands fragile tree snail, *Samoana fragilis*	Butterflyfish, Chaetodontidae
Forest flicker, *Hypolimnasarakalulk marianensis*	Angelfish, Pomacanthidae
Marianas rusty, *Vagrans egistina*	Hawkfish, Cirrhitidae
Cyathea lunalata	Wrasse, Labridae
Cycas marianensis	Trevallies, Carangidae
Heritiera longipetiolata	Green Sea Turtle, *Chelonia mydas*
Merilliodendron megacarpum	Hawksbill turtle, *Eretmochelys imbricate*
Serianthes nelsonii	Spiny Lobster, *Paniluris sp.*
Tabernaemontana rotensis	Giant Clam, *Tridacna derasa*
Stream goby, *Stiphodon sp.*	Giant Clam, *Tridacna maxima*
Redbellied goby, *Sicyopus sp.*	Giant Clam, *Tridacna squamosa*
Marianas goby, *Stenogobius sp.*	Giant Clam, *Hippopus hippopus*
Flagtail, *Kuhlia rupestris*	Triton's Trumpet, *Charonia tritonis*
Giant marbled eel, *Anguilla marmorata*	Hard Coral, *Scaleractinia*
Atyid shrimp, Atyidae	Soft Coral
Tahitian prawns, *Macrobrachium* spp.	Sea grass, *Halodule uninervis*
Freshwater crabs, Varunid crabs	Sea grass, *Enhalus acoroides*
Nerite snails, *Neritidae*	Sea grass, *Halophila minor*
Thiarid snails, *Thiaridae*	
Water fern, *Ceratopteris thalictroides*	
Pond weed, *Potamo gariannense*	

Threats to Terrestrial SOGCN

There are many threats to Guam's native wildlife species. Some of the major threats to native species include but are not be limited to:

1. Introduced and invasive plants and animals
2. Loss and/or degradation of key habitat types
3. Limited information on many native species
4. Management issues

Introduced and Invasive Species

Guam's increasing population, growing economy, and strategic location has contributed to the escalating rate of intentional and accidental introductions of alien species.

Predators. Invasive species introductions, both intentional and accidental, have greatly affected Guam's native ecology. Guam's native terrestrial fauna have evolved in the absence of predators. The native wildlife populations are vulnerable to introduced predators such as brown treesnakes, rats (*Rattus sp.*), and feral cats (*Felis catus*). For example, high densities of feral cats in the Munitions Storage Area, AAFB have hampered reintroduction efforts of the Guam rail (*Gallirallus owstoni*) (GDAWR unpublished notes).

In the 1940s, the brown treesnake was accidentally introduced to Guam after World War II. The ecological damage caused by this snake to the island environment is well documented (Savidge 1987, Jaffe 1994, Conry 1988, Engbring and Fritts 1988, Wiles 1987, Rodda and Fritts 1992, Rodda et al. 1992a, 1997). The snake is largely responsible for the extirpation or decline of the island's resident bird species (Savidge 1987, see Appendix 6). This nocturnal and arboreal snake is capable of taking advantage of a variety of habitats and prey species (Rodda et al. 1992b, 1999b). Only three of 12 native forest bird species continue to persist in the wild on Guam, they include the Mariana crow (*Corvus kubaryi*), Micronesian starling (*Aplonis opaca guami*) and the Island swiftlet (*Aerodramus vanikorensis bartschi*). Additionally, two wetland species of birds: the Mariana common moorhen and the yellow bittern also continue to persist in the wild. Historically, the resident species were found throughout the forests of Guam (Seale 1901, Baker 1947, Marshall 1949, Jenkins 1983). The Micronesian megapode, Mariana mallard (*Anas platyrhyncos*), and White-browed rail (*Poliomnas cenereus*) were extirpated prior to the introduction of the brown treesnake (Engbring and Fritts 1988). Other invasive species, including curious skink (*Carlia ailanpalai*) have thrived in the presence of *Boiga*, making the snake not only a threat of itself, but also by association with other exotics.

Rats are a serious problem throughout the Pacific (Atkinson 1985, Milberg and Tyrberg 1993, Buden 2000). They are a major hurdle to recovery of many avian species because of predation of eggs and nestlings and are known to be predators of other small native animals. Rats can be found in all habitat types but are most abundant in urban areas on Guam. In forested areas of Guam, rats are not as abundant as on islands in the CNMI due to brown treesnake presence.

Puerto Rican treefrogs were transported to Guam via the horticultural industry. Greenhouse frogs (*Eleutherodactylus planirostris*) were discovered on Guam in October 2003, are established in at least five separate locations (GDAWR unpublished notes). Two coqui frogs (*E. coqui*) were collected in April 2004, and more have since been found. The coqui's call is high-pitched, and can reach a volume of 90 dB in chorus. In Hawaii, where *E. coqui* is established, it has caused millions of dollars in losses to export plant nurseries, the visitor industry via hotel cancellations, and the real estate market through declines in property values that are frog-infested (W. Pitt pers. comm. 2005).

Other introduced amphibians are having detrimental effects on Guam as well – at least eight frog species have been discovered since 2003. The barking frog (*Rana sp.*), probably introduced with aquacultural products, is a nuisance because of its call. The

noise produced by frogs in chorus has prompted residents in southern Guam to request assistance from the Department, and in some cases to use caustic chemicals as solutions. Aside from the nuisance, frogs are a likely food source for brown treesnakes, potentially increasing the size and changing the age and population structures of the snake population.

Plants. Invasive plant species have changed the composition of Guam's native forests. After World War II, the US military reseeded the island's barren landscape with tangantangan (*Leucaena leucocephala*). This species has continued to out-compete many native plants and is slowly changing the soil composition, making reforestation efforts more difficult (FSRD unpublished data). The chain of love (*Antigonon leptopus*) and dodder (*Cuscuta campestris*) are extremely aggressive vines that block sunlight and compete for water with native plants, smothering them altogether. Agalondi (*Vitex parviflora*) is a non-native tree that is now one of the most dominant trees on Guam, crowding out native plants and preventing recruitment in native forest.

Invasive species may completely replace native vegetation resulting in complete loss of key native habitats. After major typhoons and brush or forest fires, those plants that recover or reproduce quickly are most likely to survive and replenish the areas lost. Most invasive plants aggressively take over uninhabited areas, preventing the slower-growing native plants from gaining a foothold. For example, the palma brava (*Heterospathe elata*) has taken over many of Guam's southern ravines and valleys after brush fires, where chiute (*Cerbera dilatata*), and lalaha (*Pouteria ovovata*) should be dominant (Stone 1970).

Insects. Guam's native cycad (*Cycas marianensis*) is in decline due to the recent introduction of the Asian cycad scale, *Aulacaspis yasumatsui*. The infestation causes the tree to lose its leaves. Cycads are only able to replace leaves twice before dying, usually occurring after a few months of being infected with the insect. Without comprehensive treatment, the local population may be extirpated in as little as two years (A. Moore pers. comm. 2005). Recently discovered on Guam is a species of moth that lays its eggs on the new emerging leaves of cycad. The larvae, consumes the emerging leaves of the cyad and further exacerbates the problem of recovery for this species. This cycad is listed as one of Guam's SOGCN.

Other Invertebrates. Introduced snails have been a major factor in the reduction of native snail populations, along with predation by flatworms (*Platydemus manokwari*) [Hopper and Smith 1992]. The introduction of flatworms was intended to eradicate the invasive giant African land snail (*Achatina fulica*), which competes for resources with endemic land and tree snails (genera *Partula* and *Samoana*), but has impacted not only this invasive pest, but also native snails as well causing some to be near extinction. Freshwater snails *Pila conica*, *Pomacea canaliculata*, *Sinotaia magniciana*, and *Planorbis spp*. compete directly for food and habitat with native genera *Clithon*, *Neritina*, *Septaria*, and *Tharia*.

Pathogens. Disease and other pathogens can have a serious effect on the natural resources on an island. In today's global community, borders are minimized and diseases that affect humans and animals can be transmitted in a matter of hours via commercial aircraft. Guam is a hub for all goods and services moving to and from the US mainland, Asia, and the rest of Oceania. This makes Guam and other areas of Micronesia susceptible to diseases and pathogens that affect wildlife. West Nile Virus (WNV) is a major concern for all wildlife managers as well as public health officials. On the US mainland where the virus is widespread the mortality of crows infected is 100%. If this virus becomes established on Guam or in the CNMI, the effects may be disastrous for the Mariana crow and other forest species already in jeopardy.

Loss of Habitat, Ungulates and Management Issues. The loss of key habitats throughout the island is a problem that will have long-term effects on the restoration of SOGCN. The major factors exacerbating habitat loss are ungulates, development, stochastic events, and the introduction of invasive plant and animal species. Nothing can be done to control stochastic events. However, we can slow or halt the loss of habitat by controlling the other factors.

Probably the most difficult and labor-intensive factor to control is damage by feral ungulates. These animals alter the forest composition by browsing on the vegetation (deer and water buffalo) or by uprooting it (pigs). Most of the native flora is preferred because they do not possess the chemical and physical defenses found in many introduced plants. This form of artificial selection allows invasive plant species to dominate. One exception to this trend is in some areas of Pati Pt. where the native *Ochrosia marianensis*, a plant not favored by deer, have established monotypic stands (GDAWR unpublished notes).

Ungulates have been on Guam since the arrival of the first European inhabitants of the island (Wiles et al. 1999). They have become an important part of the culture for the native Chamorro people of Guam. The three ungulate species common in the wild are the Philippine deer, feral pig, and Asiatic water buffalo (*Bubalus bubalis*). A variety of habitats provide for these animals including native forest, wetlands, shoreline, grasslands, and a mosaic of other habitat types (Stone 1970). Management practices need to address need for conservation action while fulfilling cultural needs (Wiles et al. 1999).

Terrestrial SOGCN

Birds. Many species of animals are known to Guam. Over 100 species of birds are documented including migrant, wetland, seabird, grassland, and forest birds (Reichel and Glass 1991, Engbring and Fritts 1988). The status of birds listed as SOGCN for Guam is covered in the species tables on page 84.

There are two recovery plans for the forest birds of Guam. The recovery plan for the six federally listed native forest birds of Guam and Rota (Beck and Savidge 1990) covers the Guam rail, Guam subspecies of Micronesian kingfisher (*Halcyon cinnamomina cinnamomina*), Mariana crow, Guam flycatcher (*M. freycineti*), and the Guam bridled white-eye (*Zosterops c. conspicillata*). These species were grouped together for recovery

purposes because they occupy similar habitats and face similar threats. Unfortunately, the population of flycatchers and white-eyes on Guam went extinct in the mid-1980s and were removed from the endangered species list (USFWS 2004). The Guam subspecies of the rufous fantail (*Rhipidura rufifrons uraniae*) was not federally listed and went extinct in the mid-80s. The USFWS has completed draft recovery plans for the Mariana crow and Micronesian kingfisher.

A separate recovery plan was prepared for the island swiftlet for the Mariana Islands from Guam to Saipan (USFWS 1991). The island swiftlet was able to persist in spite of the brown treesnake and continues to survive in the wild, in several small colonies totaling over 500 birds. The majority of birds are found in one cave (Mahlac Cave) on the Naval Ordnance Annex in southern Guam. The swiftlet population is vulnerable to snake predation, habitat destruction, and various stochastic factors affecting cave sites, including human disturbance, typhoons and flooding. Recent snake trapping and video taping at Mahlac Cave suggests that snake predation is a major factor limiting the size of the colony. Prior to Typhoon Pongsona (December 2002), the population numbered over 800 birds and less than 400 one month after the typhoon. The swiftlet recovery plan identifies the need to increase the reproductive success of birds at colony sites, which should result if predation were reduced.

The Micronesian honeyeater (*Myzomela rubratra saffordi*), white-throated ground dove (*Gallicolumba xanthonura*), and Mariana fruit-dove (*Ptilinopus roseicapilla*) are no longer found on Guam. No recovery plan exists for these birds, though recovery efforts for endangered birds should benefit these species. There are no extant populations on Guam, conservation efforts to establish these birds would have include translocation of birds (eggs, chicks, or birds) from the CNMI, where they still occur. Seabirds including the red-footed booby (*Sula sula*) and white-tailed tropicbirds (*Phaethon lepturusi*) inhabited Guam further deserve attention.

Most of the major objectives outlined in the *Native Forest Birds of Guam and Rota of the Northern Mariana Islands Recovery Plan* (Beck and Savidge 1990) for recovery of the Guam rail have been implemented. GDAWR maintains a captive population of over 100 rails, and as many as 18 mainland zoos maintain and breed rails in captivity. Efforts to establish an experimental population on Rota for the purposes of preserving wildness and genetic variability in the species, and to serve as a source of birds for reintroduction to Guam, began in 1989. In December 1995, successful reproduction by captive Guam rails released on Rota was documented. Current survey information indicates that a breeding rail population on Rota is present but further releases are still warranted (GDAWR unpublished data).

Despite considerable progress in achieving recovery plan objectives for the Micronesian kingfisher this species continues to decline in captivity towards extinction. There are no kingfishers left in the wild on Guam. A captive population of kingfishers was established at mainland zoos in 1984 and 1985. The captive kingfisher population peaked at 65 individuals in 1990 and is currently unstable at approximately 60 birds. A partial recovery objective of 250 captive kingfishers cannot be reached under present conditions

as reproductive gain is offset annually by young adult mortality. Other limitations to population growth of captive kingfishers in captivity include mate incompatibility and aggression, rising levels of infertility, a decline in the number of fertile eggs that hatch, and continual exposure to avian tuberculosis at zoos. In May 1995, the Micronesian Kingfisher Species Survival Plan (MK SSP) Management Group held a conference to evaluate the captive-breeding program, resulting in the formulation of an action plan designed to stabilize and increase the kingfisher population. *The Micronesian Kingfisher Species Survival Plan Action Plan* was endorsed by GDAWR and USFWS, and contains many of the critical objectives for recovery that are outlined in the recovery plan. Unless expedient recovery actions are taken to reverse the decline of the Micronesian kingfisher in captivity and to repatriate the birds to Guam, this species may yet become extinct.

Techniques to protect nests of Mariana crows from brown treesnake predation have been developed and are being implemented. During the 1996 breeding season, avicultural intervention on Guam in the field had protected eight fertile eggs, and two young Mariana crows were successfully hand-reared and returned to the wild (GDAWR unpublished data). A major accomplishment of GDAWR's program was achieved when two captive-reared birds produced two clutches of fertile eggs in the wild in 2003. These eggs were successfully hatched in GDAWR's incubation facility. In spite of these successes, translocation of crows from Rota to Guam is considered a higher priority than captive breeding to protect the Mariana crow population.

Two other federally listed species, the Mariana common moorhen and island swiftlet continue to exist in the wild. Moorhens are poorly understood and have been neglected in terms of studies of life history and dispersal patterns. Guam has limited landmass and conflicts between wetland protection and the need to develop these areas for commercial or urban use is increasing. Studies of the moorhen are needed to make appropriate management decisions to maximize moorhen productivity, increase survivorship of young birds and minimize negative impacts, e.g. human encroachment into important areas, predation of brown treesnakes, feral cats, dogs, and pigs.

Mammals. Three native mammals are known to Guam including the Marianas fruit bat, little Marianas fruit bat and Pacific sheath-tailed bat. The Marianas fruit bat is the only extant bat on Guam. The Mariana fruit bat was listed with the forest birds on the US Endangered Species List in 1984 and a recovery plan for this species was developed (USFWS 1990b). Hunting was the major reason for the decline of the fruit bat. Though poaching has been controlled, the bat population has not recovered probably due to predation by brown treesnakes. Wiles (1987) suggested that snake predation of pups while their mothers were foraging was the main cause of poor recruitment. From 1980-82, the bat population was estimated to be about 850-1000 bats (USFWS 1990). Currently, the population numbers less than 200. Without local recruitment Guam's population will remain highly dependent on the Rota population for migration of animals.

Terrestrial Plants. There are 320 native plant species known to occur on Guam. These plants are part of many different communities that are a diverse assemblage of endemic, indigenous, and introduced species. Together these plant communities are of high value

to the island's ecosystem, natural resources, and people. Plants improve soil quality and reduce erosion, which helps sustain healthy coral reefs. Many native plant species were traditionally used for construction (homes, canoes, tools, and woven materials), food, and medicine.

Of the 320 native species, GDAWR and FSRD have identified six terrestrial plant species to be included as SOGCN. Two of the six deserve considerable and immediate attention. The first is the federally listed *S. nelsonii*. The Guam population of *S. nelsonii* consists of one adult tree and several seedlings. In 1994, the USFWS published a recovery plan for *S. nelsonii* that outlined objectives to recover the species, such as managing the Rota and Guam populations by protecting trees from feral ungulates with fences, controlling insect pests, habitat protection, and propagation and seeding of new areas (USFWS 1994). The second species requiring immediate attention and action is *C. marianensis*. This species was once one of the most abundant forest species. The accidental introduction of the Asian cycad scale is decimating the population throughout the island. Unfortunately, there is little funding available to implement island-wide control of the pest. Control of the scale would be extremely labor intensive and expensive. Other plants listed as SOGCN are *Tabernaemontana rotensis*, *Cyathea lunalata*, *Heritiera longipetiolata*, and *Merriliodendrum megacarpum*.

Presently, major threats to the species include typhoons, development, insect pests, fire, and browsing by feral ungulates. Also, the introduction of species and varieties of the same genera may result in new varieties through cross-pollination. A genetic study should be done to ensure that reforesting efforts maintain the genetic integrity.

Freshwater Plants and Animals

Guam has 100 named rivers and streams, all located in the volcanic southern half of the island (Best and Davidson 1981). These rivers are host to a wide variety of aquatic organisms, including fish, snails, shrimp, and plants. Guam's freshwater floral and faunal compositions are fairly typical for oceanic islands. Gobies are the most abundant fish, nerites and thiarids are common snails, and *Macrobrachium* and atyid shrimp are the dominant crustaceans.

Freshwater Vertebrates. Guam's native freshwater fish fauna consists of 11 species; two eels, one flagtail, one sleeper, and seven gobies (Table 9). All of Guam's native fishes are useful indicators of water quality and stream health. Three species of native fishes have very limited distributions, and are at greatest risk from habitat loss. Two of Guam's native fish species (*Stiphodon* sp. and *Sicyopus* sp.) are found only in the southern Mariana Islands, and one species (*Stenogobius* sp.) is known only from Guam. *Stiphodon* and *Sicyopus* favor hard substrates, such as rock and clay, which can be covered by excess sedimentation or overgrown with algae due to excessive nutrients in the water. *Stenogobius* is only found over sandy and soft substrates in the lower reaches of rivers. Excessive water flow due to riverbank alteration or loss of riparian vegetation can scour a riverbed, causing the loss of sandy substrates.

All native stream fishes exhibit an amphidromous life history, in which part of the organism's life cycle, usually the larval phase, is spent in the marine environment, while the remainder is spent in a freshwater environment. All of these species except the eels

spawn in freshwater. The young are carried to the ocean by river currents, where they spend between two weeks and six months as larvae. They then return to freshwater, where they metamorphose into juveniles and spend the rest of their lives. The eels mature in freshwater, but migrate to the sea to spawn. After spawning, the adults die. When the eggs hatch, the young migrate back to freshwater, where they spend the rest of their lives.

Because of these life histories, native fish are vulnerable to stream blockage. It is vital that rivers are left clear of dams or other blockage for returning fish to travel upstream to find suitable habitat. An ongoing study by GDAWR is monitoring the effect a dam has on native stream fauna.

Table 9. List of Guam's native freshwater fishes (Kami et al. 1968).

Guam's Native Freshwater Fishes		
Family	Scientific Name	Common Name
Anguillidae	*Anguilla marmorata*	marbled eel
	Anguilla bicolor	
Kuhliidae	*Kuhlia rupestris*	river flagtail
Eleotridae	*Eleotris fusca*	brown sleeper
Gobiidae	*Awaous guamensis*	Guam goby
	Awaous ocellaris	spotfin goby
	Sicyopus sp.	red bellied goby
	Sicyopterus macrostetholepis	red tailed goby
	Stiphodon sp.	river goby
	Stiphodon percnopterygionus	black finned goby
	Stenogobius sp.	Marianas goby

Freshwater Invertebrates. Guam has seventeen species of native snails, belonging to two families (Table 10). The only freshwater invertebrates of concern on Guam are the thiarid snail (*Stenomelania plicaria*), and the neritid snail (*Neritodryas subsulcata*). *Stenomelania* has a limited distribution on Guam, being found in a few rivers. *Neritodryas* is very uncommon on Guam, though it is widespread through the Indo-Pacific.

The neritids are herbivores, feeding exclusively on algae and diatoms found growing on rocks and other solid substrates. Neritids have an amphidromous life history, similar to that of the fish. Eggs are deposited in freshwater, the young hatch, and are swept to the ocean. After a marine larval stage, they return to freshwater to mature. *Nerites* deposit their egg cases on solid substrates, including other nerites.

Thiarids are omnivorous, feeding on both plant and animal material. They are normally found on sand or other soft substrates, where they spend a good portion of the day buried. *Thiarids* live their entire life cycle in freshwater. They are live bearing, releasing crawl-away young that are miniature copies of the adults.

Table 10. Guam's native freshwater snails.

Family	Species	Family	Species
Neritidae	*Clithon coronata*	Thiaridae	*Melanoides riqueti*
	Clithon oualaniensis		*Melanoides tuberculata*
	Clithon sowerbiamul		*Stenomelania plicaria*
	Neritina auriculata		*Thiara granifera*
	Neritina pullicida		*Thiara scabra*
	Neritina pulligera		
	Neritina squamipicta		
	Neritina turrita		
	Neritina variegata		
	Neritodryas subsulcata		
	Septaria lineata		
	Septaria porcellana		

Crustaceans. Guam has at least 12 species of freshwater crustaceans: nine species of freshwater shrimp (Table 11) and at least three species of freshwater crab. As far as known, all species are amphidromous, with a marine larval stage, and a freshwater adult stage.

Two families of shrimp are represented on Guam, Atyidae and Palaemonidae. The atyids are small (less than 4 cm in length). They are herbivores or detritovores, feeding on the substrate with a series of brush-like chelae. The genera *Atyoida* and *Atyopsis* are generally found in shallow water, in high current areas. *Caradina* is generally found in slow-moving, deeper waters. *Halocaradina* has greatly reduced eyes, and is found on Guam only in caves and sinkholes along the east coast. Atyid shrimp are food for both fish and birds.

The palaemonids are larger (up to 15cm in length). They are omnivores, and feed with an enlarged pair of chelipeds, or pincers. Palaemonid shrimp are widespread on Guam: found in rivers, reservoirs and caves. They are able to survive in intermittent pools in the headwaters of streams, and are frequently the only fauna of such habitats. Palaemonid shrimp are frequently taken as food by people on Guam.

Crabs. The freshwater crabs of Guam are poorly known. They form a rather inconspicuous part of the freshwater fauna. Three species are known to Guam: *Ptychognathus sp*., *Sesarma sp*., and *Varuna* cf. *littorata (*Family: Grapsidae).

Table 11. Native crustaceans of Guam.

Family	Species	Family	Species
Atyidae	*Atyoida pilipes*	Palaemonidae	*Macrobrachium lar*
	Atyopsis spinipes		*Macrobrachium latimanus*
	Caridina longirostris		
	Caridina nilotica		
	Caridina serratirostris		
	Caridina typus		
	Halocaradina trigonopthalma		

Native Aquatic Plants. Guam has at least three species of native aquatic plants (Table 12). The genera are cosmopolitan in distribution, and two of the three species have wide distributions. One species, *Potamogeton mariannensis,* may be endemic to Guam. *Potamageton* are flowering plants, and can produce both sexually and vegetatively. *Ceratopteris* is a fern, and reproduces via airborne spores. While none of these plants are abundant, they all have a fairly wide distribution on Guam. *Potamogeton* and *Ceratopteris* have relatively soft, submerged leaves, and are at risk from overfeeding by exotic snails and herbivorous fish.

Nipa palms (*Nypa fruticans*) are found on Guam only in the lower reaches of rivers that exhibit a true estuarine habitat. Nipa palms are found along only ten rivers on Guam (GDAWR data 2005). Nipa palms were traditionally used for thatch, as the leaves are last longer than coconut leaves. Due to over-harvesting and habitat loss, Nipa has become uncommon, and is now protected by Guam law.

Table 12. Guam's native aquatic plants.

Family	Species	Habitat
Potamogetonaceae	*Potamogeton lucens*	Slow moving water, soft substrates
	Potamogeton mariannensis	Slow moving water, soft substrates
Parkeriaceae	*Ceratopteris thalictroides*	Sluggish water, mainly lakes and ponds

Threats to Freshwater Fauna. In addition to habitat alteration threatening Guam's native fish fauna, invasive species are also a cause for concern. Guam has a large introduced fish population, with at least eleven species now established (Table 13). The exotic fishes have become established via numerous routes. Some, such as snakeheads and catfish, were brought to Guam for aquaculture. Others, such as guppies and swordtails,

are escapees/releases from home aquaria. Still others, such as *Gambusia* and tilapia (*Oreochrmis mossambicus* and *Tilapia zilli*), were introduced to help combat other pests.

The eel, flagtail, and sleeper are predators, feeding on fish, snails, and other aquatic invertebrates. The two species of *Awaous*, the *Stenogobius,* and the *Sicyopus* are omnivores, feeding on plant and animal material. *Stiphodon* and *Sicyopterus* are herbivores, grazing on algae growing on river substrates. While *Awaous* and *Anguilla* have Indo-Pacific-wide distributions, several of these species have very limited ranges. The *Stiphodon* sp. and *Sicyopus* sp. are know only from the southern Mariana islands, while the *Stenogobius* is known only from Guam.

The eels mature in freshwater, but migrate to the sea to spawn. After spawning, the adults die. When the eggs hatch, the young migrate back to freshwater, where they spend the rest of their lives. Because of this life history, it is imperative that rivers are left clear of dams or other blockage for returning fish to travel upstream to find suitable habitat. An ongoing study by GDAWR is monitoring the effect a dam has on native stream fauna. Dams affect native fauna in two ways. First, a dam acts as a physical barrier to some native organisms. Organisms not able to pass upstream of the dam are limited to the reaches of rivers below the dam.

Some organisms are able to pass the reservoir and breed. Young are passively carried downstream to the ocean for the marine portion of their life history. If the young are prevented from reaching the marine environment within the first few days of hatching, they will not survive. Young hatched above a dam can become caught in the reservoir formed behind the dam, and perish. Studies by GDAWR indicate the diversity of native organisms is much lower in the three rivers feeding into the reservoir than in three controlled rivers located outside the Fena watershed, as well as the control river leading from the Fena dam.

While hard data is lacking, anecdotal evidence collected by GDAWR indicates an impact on native fish fauna by some introduced species. In rivers with heavy exotic populations, native fish are either less numerous, or distributed in a different way than in streams without exotics. Tilapia competes with native fish for food, while predators such as *Cichla, Channa*, and *Clarias*, feed on native fish and invertebrates. Currently, there are no efforts being made to control established exotic fishes. Guam DAWR and USFWS do regulate species coming into Guam via a permitting system and shipment inspections.

Invasive Aquatic Snails. Guam has at least seven species of exotic freshwater snails (Table 14). It is unknown if the introduced snails have had an impact on native flora or fauna, though herbivorous species probably fed on native aquatic plants. The introduced snails, however, can pose a human health risk. Two introduced species (*Pomacea* and *Pila*) are known vectors for schistosome parasites of humans. Additionally, some species are agricultural pests in other parts of Asia, especially where aquatic crops such as rice are grown.

Table 13. Guam's exotic freshwater fishes.

Family	Scientific Name	Common Name	Means of Introduction
Clariidae	*Clarias batrachus*	walking catfish	Escape from aquaculture facility
Cichlidae	*Cichla ocellaris*	Peacock bass	Purposeful introduction
	Oreochromis mossambicus	Mosambique tilapia	Purposeful introduction
	Tilapia zilli	red belly tilapia	Purposeful introduction
Poeciliidae	*Gambusia affinis*	mosquito Fish	Purposeful introduction
	Poecilia reticulata	guppy	Pet trade
	Poecilia veliferum	sailfin molly	Pet trade
	Xiphophorus helleri	swordtail	Pet trade
	Xiphophorus maculata	platy	Pet trade
Channidae	*Channa striata*	Asian snakehead	Escape from aquaculture facility
Cyprinidae	*Cyprinus carpio*	koi	Pet trade

Table 14. Guam's exotic freshwater snails.

Family	Species	Common Name	Means of Introduction
Ampullaridae	*Pila conica*	apple snail	Escape from aquaculture facility
Ampullaridae	*Pomacea canalicula*	apple snail	Escape from aquaculture facility
Viviparidae	*Sinotaia magniciano*	live bearing	Escape from aquaculture facility
Planorbidae	*Planorbid spp. (2)*	Ramshorn snail	Pet Trade
Lymnaeidae	*Lymnaea viridis*		Pet Trade
Physidae	*Physid sp.*		Pet Trade

Invasive Aquatic Plants. Guam has many species of invasive aquatic plants and animals (Table 15). The pet trade, aquaculture, and introductions by government entities are primary routes of introduction.

Guam has at least 5 species of invasive aquatic plants. Virtually all these have arrived on Guam via the ornamental plant or pet trades.

Duckweed, water lettuce, and water hyacinth are confined to one or two bodies of water. Water Lillies are found in ponds in yards and parks throughout Guam. *Hydrilla* is found throughout southern Guam, and is the most serious aquatic plant pest on island. *Hydrilla* occasionally clogs pumps at the Ugum water treatment plant, and many man-hours are spent each year clearing *Hydrilla* from around pump intakes (Ron Topasna, per. comm.). *Hydrilla* has also overwhelmed the Fena and Masso reservoirs, restricting sunlight to native plants.

Other factors affecting the freshwater fauna of Guam include uncontrolled clearing of riparian vegetation and the introduction of chemicals into Guam's streams. This has several deleterious effects on freshwater habitat. The loss of shade trees along the banks of rivers leads to an increase in water temperature. During the dry season on Guam, it is not uncommon for the headwaters of streams to become a series of disconnected pools as water levels drop. These pools, if not shaded, can become too warm for native organisms to live. When the rainy season comes, these pools act as a bank from which freshwater animals can repopulate streams. Without these reservoirs, stream repopulation is a much longer process, as animals must migrate from the lower reaches.

Table 15. Guam's introduced freshwater plants.

Family	Species	Common Name	Means of Introduction
Lemnaceae	*Lemna minor*	duckweed	Ornamental plant trade, also escape from aquaculture facilities
Hydrocharitaceae	*Hydrilla verticillata*	water weed	Unknown
Nymphaeaceae	*Nymphaea sp.*	water lillies	Ornamental plant trade
Araceae	*Pistia stratiotes*	water lettuce	Ornamental plant trade
Pontederiaceae	*Eichornia crassipes*	water hyacinth	Ornamental plant trade

The loss of shade can also lead to an increase in algae in streams where excess sunlight falls. Heavy algae growth can affect water chemistry, as well as deplete dissolved oxygen during evening hours, or when the algae dies. Heavy algae growth can also smother preferred habitat, forcing fish to move to new sites not conducive to their survival.

Frequently, following typhoons or other heavy rain events, GDAWR offices will receive calls regarding fish kills in rivers. These are sometimes caused by the intrusion of saltwater into habitats where fish have little or no tolerance for increased salinity levels, but the cause appears to be chemical. Possible sources include farms and gardens from which fertilizers and other chemicals are washed into the rivers, and excess soil from cleared land washes into rivers and reduces oxygen levels.

Guam DAWR law enforcement officers have responded to calls where rivers have been bleached. This is usually the result of people collecting freshwater shrimp. A net is set across a stream, bleach is poured into the water upstream from the net, and the resulting dead and dying animals are collected as they drift downstream into the net. This method is especially destructive, as non-target as well as target species are killed. The evidence of this method is large numbers of undersize shrimp and fish left dead in the river. After a bleaching event, a river takes years to recover.

Marine Animals and Plants

Guam's aquatic species face a number of threats. Many of these threats start as small problems in the upper reaches of Guam's watersheds and increase in severity near coastal areas and in marine ecosystems. Threats include loss of habitat due to development and associated impacts such as increased pollution, erosion, and sedimentation. Development can also result in physical barriers to migration for riverine fauna. Other threats include unsustainable harvest, use of destructive fishing methods, recreational impacts, and invasive species. Threats beyond local control include: typhoons, climate change, and ineffective regulation of fisheries resources in federally-controlled waters of Guam's Exclusive Economic Zone (EEZ).

Guam DAWR recognizes these threats and has focused its aquatic research efforts on assessing the impacts of fishing, pollution, and development on aquatic species and their habitats. A special effort is devoted to determining the impacts of dams on freshwater species. This research is complemented by a number of conservation actions aimed to raise public awareness of these impacts.

In addition to these focused research activities, GDAWR continuously monitors the status of aquatic species. Monitoring programs include biological surveys of rivers, nearshore reefs, and beaches and creel surveys to assess both the inshore and offshore fisheries. These efforts are complimented by Haggan-Watch and Reef Check, volunteer monitoring programs for sea turtles and coral reefs.

Guam DAWR believes that through continued monitoring, research, and community involvement we can proactively manage Guam's aquatic species of concern to ensure the continued sustainability of these species in Guam's waters.

Marine Vertebrates

Sea Turtles. Three species of sea turtle inhabit the waters of Guam: hawksbill, *Eretmochelys imbricata* (Linnaeus 1766), green, *Chelonia mydas* (Linnaeus 1758), and leatherback, *Dermochelys coriacea* (Vandelli 1761) [Eldredge 2003b]. Hawksbills and greens also nest on Guam. The US Endangered Species Act of 1973 protects all three species of sea turtles. Hawksbills were listed as endangered in 1973, greens as threatened in 1978, and leatherbacks as endangered in 1970. In addition, hawksbills and greens are protected under local law (5 GCA Chapter 63 §63101-63117): hawksbills as endangered and greens as threatened.

The green sea turtle is herbivorous and circumtropical in distribution. Individuals of this low-level nesting population are sighted throughout the year, particularly during December to February and May to June (NMFS-USFWS 1998a). Numerous individuals have been reported from northern Guam (Wiles et al. 1995).

Hawksbill turtles feed on sponges and are listed as endangered throughout their circumtropical range. Nesting individuals are virtually unknown on Guam; the first reported hawksbill turtle nest on Guam was in November 1991 (NMFS-USFWS 1998b).

The leatherback turtle is the largest species of marine turtle and is listed as endangered throughout its range. Individuals thrive on a diet of jellyfish and other soft-bodied animals. Although rare in the area, a 250-pound individual was rescued from southeast of Cocos Island, Guam, on April 1978 (Anon. 1987). During aerial surveys (October 1989-April 1991), 2.6 % of the turtles recorded were leatherbacks (NMFS-USFWS 1998c).

Threats. The life cycle of a sea turtle renders it vulnerable to various threats, both anthropogenic and natural. As eggs, they are vulnerable to predation by invasive species such as fire ants, pigs, and monitor lizards. Humans also occasionally take eggs. On shore, ghost crabs and birds, and then fish and other predators eat hatchlings when they enter the water. Juveniles and adults fall prey to sharks. Turtles also experience mortality due to anthropogenic effects such as oil spills, getting trapped in fishing nets and hooked as by-catch on longlines. Marine debris such as plastic bags can also be mistaken for jellyfish and other food items. Mating pairs and nesting females are vulnerable to poaching for human consumption. Turtle meat is culturally very important to Pacific Islanders and the rich protein source was certainly a contributing factor to their success at migrating throughout the Pacific (Amesbury 2003). Even though illegal, turtle meat is still commonly found in the backrooms at many island fiestas. Nesting beaches are impacted by development, especially loss of sand above mean high tide and the presence of high-intensity lighting. Light pollution confuses hatchlings, attuned to heading for the surf, normally the brightest part of the horizon.

Reef Fish. While many reef-associated species on Guam have shown declines in average size and abundance, two species are of particular concern; the humphead wrasse (*Cheilinus undulatus*), and the bumphead parrotfish (*Bolbometapon muricatum*).

The humphead wrasse or tanguisson, as it is known on Guam, is one of the largest reef associated fish, reaching a size of over seven feet, and a weight of over four hundred pounds (Myers 1999). It grows slowly, taking up to nineteen years to reach a weight of 70 pounds (Myers 1999). This slow growth rate, coupled with its habit of sleeping in caves in relatively shallow water, leaves the humphead vulnerable to overfishing. This species is one of the most popular and valuable in the live reef fish food trade in east Asia, and is therefore subject to a great deal of collecting pressure. Foreign fishing vessels have to travel further and further into the Pacific to meet demand. In 2004, the humphead wrasse was listed in CITES appendix II as a species of concern, primarily due to overfishing of the species throughout its range. Adult tanguisson are generally found on fore reef areas, and are very uncommon on Guam. Juveniles may be seen more frequently on reef flats, especially in the Marine Preserves.

The bumphead parrotfish, known as atuhong on Guam, is another large reef fish vulnerable to overfishing. It is also slow growing, and its habit of sleeping in large groups in shallow water makes it vulnerable to overfishing, particularly scuba spearfishing. This fish, like the tanguisson, is uncommon in heavily populated areas. However, in remote areas, or areas with low human populations, it can still be found in large numbers (Myers 1999). This species is not used in the live reef fish trade, and is

not subject to the intense foreign fishing pressure that the humphead is. The atuhong is now almost completely absent from Guam's waters.

Other groups of reef fish that are a concern on Guam include groupers (Serranidae) and fish collected for the aquarium trade (Chaetodontidae, Pomacanthidae, Cirrhitidae). Groupers' lifehistory make them vulnerable to overfishing. They are slow-growing with maturity coming after several years for most species (Myers 1999). Groupers are not migratory. Individuals usually find a cave or other structure to act as a home base, and seldom venture far from it. Not only does this make them easy to find but also replacement of individuals taken is a slow process. Groupers are voracious ambush predators, and will readily strike at lures or bait. They form seasonal spawning aggregations, based on a lunar cycle, and individuals may migrate for miles to congregate in favored sites (Myers 1999)

Aquarium fish collecting is not currently a major part of fish taken on Guam. In the 1980s and 1990s, however, Guam was a major source for aquarium fish in Japan and the United States. Hundreds of fish were shipped from Guam each month. The most popular species were rusty angelfish (*Centropyge shepardi*), flame hawkfish (*Neocirrhites armatus*), and butterfly fish (Chaetodontidae) (GDAWR). While no quantitative data has been taken, the populations of these species certainly had to be impacted by this level of collecting for multiple years. Flame hawkfish are fairly common in areas without aquarium fish collecting (Myers 1999). On Guam, however, this is not a common species.

Marine Mammals. According to Eldredge (2003a), there have been 13 species of marine mammal recorded for Guam. The most common species are spinner dolphins, pilot whales, and sperm whales. Species that have been reported from Guam and the Mariana Islands are listed in Appendix 5.

Status
The Marine Mammal Protection Act of 1972 protects all marine mammals found in the waters of Guam. Information about the marine mammals around Guam is limited to incidental reports (see Appendix 5). No rigorous study of populations has been undertaken to date.

Threats
Marine mammals are threatened by loss of nearshore habitat and feeding grounds due to land-based sources of pollution and overfishing. They are threatened by marine debris, getting caught as by-catch in nets and on longlines, oil spills, overzealous tour operators, etc.

Marine Invertebrates. Several marine invertebrates are of concern. Four mollusks of concern are the giant clam and the gastropod, Triton's trumpet snail. Guam currently has four species of giant clam; *Tridacna derasa* (transplanted), *Tridacna maximai, Tridacna squamosa,* and *Hippopu hippopus*. Local law on Guam currently restricts the taking of giant clams to individuals larger than 7 inches across. Also, no more than three

may be taken per day for food, and no more than ten shells may be taken per day for shell collecting, and no giant clams may be taken for commercial purposes.

Giant clams of the family Tridacnidae are widespread through the Indo-Pacific. *Tridacna* clams are notable for their mantle, which is large and brightly colored, and for their life history. Giant clams do not feed, but instead rely on symbiotic algae living in their mantle to produce food for them. Giant clams are collected for their meat, for their shells, and for the aquarium trade. Giant clams are a popular source of meat in many islands. The shells may be harvested for the shell trade, or may be used to make jewelry by indigenous peoples, including the Chamorro people of Guam. In recent years the aquarium trade has come to rely almost exclusively on farmed clams, and the take of wild clams for the aquarium trade is minimal. Due to over-harvesting, giant clams are becoming uncommon or even extinct in many parts of their native ranges. Giant clams are listed under CITES Appendix II as species of concern, thus international trade in these bivalves is restricted.

Corals. Corals are the backbone of the reef community, but they are also some of the most sensitive creatures in this ecosystem. Pollution, development, sedimentation, and climate change all pose serious threats to Guam's corals. Many of Guam's reefs have declined in health over the past 40 years. The average live coral cover on the fore reef slopes was approximately 50% in the 1960s (Randall 1971), but by the 1990s had dwindled to less than 25% live coral cover with only a few having over 50% live cover (Birkeland 1997). Still, in the past, Guam's reefs have recovered after drastic declines. For example, an outbreak of the crown-of-thorns starfish in the early 1970s reduced coral cover in some areas from 50-60% to less than 1%. Twelve years later, greater than 60% live coral cover was recorded for these areas (Colgan 1987). A more distressing indicator of the health of Guam's coral reefs is the marked decrease in rates of coral recruitment. In 1979, Birkeland et al. (1982) obtained 0.53 coral recruits per plexiglass fouling panel. The use of similar materials and experimental design in 1989 and 1992 resulted in just 0.004 and 0.009 coral recruits per plexiglass fouling plates, respectively (Birkeland1997).

Terrestrial Animals and Plants

Mammals

Common name: Mariana fruit bat
Chamorro name: fanihi
Scientific name: *Pteropus mariannus mariannus*

Historic and current status: The Mariana fruit bat is an endemic (subspecies) mammal to Guam and the Mariana Islands. Historically, several thousand bats occurred on Guam in 1950s and dwindled to as low as 50 in 1978[1]. By 1982, the bat population increased to 850-1000[2] fruit bats. The sudden rise in population may have resulted from a migrant population from Rota to Guam[3]. In 1984, along with many of Guam's native birds, the fruit bat was listed on the Endangered Species List. Currently, the population survives with less than 200 bats throughout Guam.

Threats: Poaching, predation uses of pesticides or chemical fertilizers, loss of habitat, and human disturbance may threaten this species to decrease. Brown treesnake predation may be contributing to the high mortality of young bats in the Guam population.

Habitat(s): Native mature limestone and ravine forest.

Goal: Restore a population of 3000 bats on Guam composed of two subpopulations of 1500 each: one in the north and south part of the island.

Objectives: To establish permanent colonies in the southern and northern part of Guam by creating areas controlled of poaching and brown treesnake predation. To survey for bats throughout Guam annually to monitor the status of the population throughout Guam.

Action plan: Introduced predators: Control the impacts of treesnakes on the remaining population by determining the feasibility of treesnake control measures at roost sites, and implement measures as appropriate. Habitat degradation and loss: Reduce deer and feral pig numbers at the colony and adjacent areas, develop and implement reforestation measures in Guam's local and federal conservation areas. Small or extirpated population: To monitor the population and distribution of bats. To control poaching of fruit bats. To explore and implement a captive breeding program for this species if feasible.

References:

1. U.S. Fish and Wildlife Service. 1990. Guam Mariana fruit bat and little Mariana fruit bat Recovery Plan. Portland, Oregon.
2. Wiles, G. J. 1981-1984. The current status, distribution and natural history of the Mariana fruit bats. Guam Aquatic and Wildlife Resources Division Annual Reports, FY 1981-1984. Department of Agriculture, Guam.
3. Wiles, G. J., C. F. Aguon, G. W. Davis and D. Grout. 1995. The status and

distribution of endangered animals and plants in Northern Guam. Micronesica 28: 31-49.

Common name: Pacific sheath-tail bat
Chamorro name: finihi lihyang
Scientific name: *Emballonura semicaudata rotensis*

Historic and current status: The sheath-tail bat is a subspecies endemic to Guam, Rota, Tinian, Saipan, and Aguiguan. Once occurred on Guam, the Pacific sheath-tailed bat was last seen in 1972[1]. Little is known with its ecological and historical past. This cave dwelling mammal now only exists in the island of Aguiguan, with an estimated 400-500 individuals[2]. Currently the Pacific sheath-tailed bat is extinct on Guam.

Threats: Predation, competition, human disturbance, and pesticides may have caused this species to be extirpated on Guam.

Habitat(s): Forages in forested areas, roost in caves in southern and northern Guam.

Goal: Re-establish a small population of bats to Guam.

Objectives: To establish a small population of bats in a historic snake-free cave in northern Guam. To assist CNMI efforts to conduct surveys and restore population in Aguiguan. To determine the feasibility of implementing a captive breeding program.

Action plan: Introduced predators: Establish snake-free caves for reintroduction of bats. Habitat degradation and loss: Prevent the destruction of caves historically known to harbor sheath-tailed bats. Reduce deer and feral pig numbers at the colony and adjacent areas, develop and implement reforestation techniques in Guam's local and federal conservation areas. Small or extirpated population: Work with the CNMI to monitor population and to plan for possible translocation to Guam for reintroduction of the species to Guam and to explore the feasibility of captive propagation for releases in Guam and CNMI.

References:

1. Wiles, G. J., C. F. Aguon, G. W. Davis and D. Grout. 1995. The status and distribution of endangered animals and plants in Northern Guam. Micronesica 28: 31-49.
2. Esselstyn J. A, G. J. Wiles, and A. Amar. 2004. Habitat use of the Pacific sheath-tailed bat (*Emballonura semicaudata*) on Aguiguan, Mariana Islands. Acta Chiropterologica 6: 303-308.

Birds

Common name: Guam rail **Chamorro name:** ko'ko' **Scientific name:** *Gallirallus owstoni*	
Historic and current status: The Guam rail, endemic to Guam, was formerly found island-wide. In 1960, an estimated 60,000 birds were throughout the island[1]. The rail disappeared from southern Guam in the early 1970's and observed in central and north Guam[2]. In 1981, an estimated 2,300 birds were found only in northern Guam with the largest concentration on Andersen Air Force Base[3]. Over 1500 rails were produced in captivity since the start of captive breeding in 1984[4]. Attempts to re-introduce the rails in a snake-controlled habitat occurred in 1998 and 2003. Several nests were found in the release site in Andersen Air Force Base, known as Area 50, and hatchlings were observed. The birds failed to establish themselves and were possible victims to feral cat predation. An experimental release program of rails on Rota began in 1989 with over 670 birds released to date. Currently there is an estimated 50 rails on Rota and over 110 birds in captivity on Guam in the Department's breeding facility. Additionally, there are over 30 birds in the participating United States zoos.	
Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and feral cat, feral dog, monitor lizard predation.	
Habitat(s): The Guam rail has been observed in all habitats except wetlands.	
Goal: To re-establish a breeding population of rails on Guam and Cocos Island.	
Objectives: To maintain captive breeding population to a level to provide for releases in the wild. To establish rails in predator controlled sites in designated sites on Guam.	
Action plan: Introduced predators: Continue and expand brown treesnake and feral cat control efforts at potential release sites, and to continue supporting efforts to improve brown treesnake control studies and measures. Small or extirpated populations: Continue captive breeding efforts, continue participation in Guam Rail Species Survival Plan, complete efforts to establish experimental population on Rota, CNMI, and determine additional sites for Guam rail introduction on Guam.	

References:

1. Jenkins, J. M. 1979. Natural history of the Guam rail. Condor 81: 404-408.
2. Beck, R. E., Jr., and J. A. Savidge. 1990. Native forest birds of Guam and Rota of the Commonwealth of the Northern Mariana Islands Recovery Plan. Region 1 USFWS. Department of Agriculture, Government of Guam.
3. Engbring, J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish and Wildlife Service FWS/OBS-84/20.
4. Guam rail studbook, American Zoo and Aquarium Association (AZA).

Common name: White-throated ground dove
Chamorro name: paluman apaka (male) and paluman fache' (female)
Scientific name: *Gallicolumba xanthonura*

Photo of female dove.

Historic and current status: This subspecies of White-throated ground dove is endemic to the Mariana Islands and Yap. Historically this species was found in all habitats on Guam. Once abundant throughout Guam, by the 1980's the population was limited to northern Guam numbering about 548 individuals[1]. Though species is extirpated on Guam and was last seen in 1987 in northern Guam[2] there were sightings of 2 males in 2003 in Andersen Air Force Base and another sighting of a male in January 2005, flying along the Talofofo ridgeline on southern Guam[3]. The three sightings are presumably of birds from nearby Island of Rota.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and feral cat, feral dog, monitor lizard predation.

Habitat(s): The ground dove was observed occupying various habitats throughout Guam, but principally prefers native limestone and ravine forests.

Goal: To restore a population of ground doves in northern and southern Guam.

Objectives: To reintroduce a breeding population to Guam by translocating eggs, chicks, and/or adults from the Northern Mariana Islands to Guam, and releasing birds into the wild in predator controlled sites. To explore the potential for captive breeding this species.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at potential release sites. Habitat degradation and loss: Reduce deer and feral pig numbers at potential release sites and adjacent areas, develop and implement reforestation techniques in Guam's conservation areas and military conservation lands. Small or extirpated populations: Work with CNMI government to translocate ground dove eggs, chicks and birds from the CNMI to Guam. Investigate the potential for captive breeding of doves, and implement if feasible.

References:

1. Engbring, J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish Wildlife Service, FWS/OBS-84/20.
2. Wiles, G. J., C. F. Aguon, G. W. Davis, and D. Grout. 1995. The status and distribution of endangered animals and plants in Northern Guam. Micronesica 28: 31-49.
3. Division of Aquatic and Wildlife Resources field notes. 2003-2005. Unpublished Data.

Common name: Mariana fruit-dove
Chamorro name: totot
Scientific name: *Ptilinopus roseicapilla*

Historic and current status: Endemic to Guam and the Northern Mariana Islands, the Mariana fruit dove was once found throughout Guam, excluding coastal strand and grassland. Surveys conducted in the 1970's indicated that the Mariana fruit dove population in southern Guam no longer existed and a severely reduced population in northern Guam[1]. This forest bird was extirpated on Guam in 1985[2]. Although they are not currently found on Guam, the Mariana fruit-dove still occurs in neighboring islands.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and feral cat, feral dog, monitor lizard predation.

Habitat(s): The fruit-doves were observed in all forested habitats including native limestone and ravine forest, except savanna complex and beach strands.

Goal: To restore a population of fruit-doves on in northern and southern Guam.

Objectives: To reintroduce a breeding population to Guam by translocating eggs, chicks, and/or adults from the Northern Mariana Islands to Guam, and releasing birds into the wild in predator controlled sites. To explore the potential for captive breeding this species.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at potential release sites. Habitat degradation and loss: Reduce deer and feral pig numbers at potential release sites and adjacent areas, develop and implement reforestation techniques on Guam's conservation areas and federal conservation lands. Small or extirpated populations: Work with CNMI to translocate Mariana fruit-dove eggs and chicks from Rota to Guam.

References:

1. Division of Aquatic and Wildlife Resources (GDAWR). 1970-1981. Annual Reports. Federal Aid to Wildlife Restoration (Pittman-Robertson Act). Department of Agriculture, Government of Guam.
2. Wiles, G. J., C. F. Aguon, G. W. Davis, and D. Grout. 1995. The status and distribution of endangered animals and plants in Northern Guam. Micronesica 28: 31-49.

Common name: Island swiftlet
Chamorro name: yayaguak
Scientific name: *Aerodramus vanikorensis bartschi*

Historic and current status: The Island swiftlet is endemic to the Mariana islands of Guam, Rota, Aguigan, Tinian and Saipan. Historically the Island swiftlet was widely distributed and common on Guam. This species was described the most common in 1945 surveys[1]. After being described as the most common bird on Guam, the swiftlets underwent a drastic decline during the late 1960's through the 1970's[2]. Today, the swiftlet population is estimated at over 500 birds a result of snake control efforts at the Mahlac, Maemong, and Fachi caves (south colony), Naval Ordnance Area. In early 2000, GDAWR received a report of a small number (less than 20 birds) in northern Guam, Janum Point.

Threats: Pesticides probably is the main cause of the decline of this species on Guam. However, other causes may have contributed to their decline include: disturbance of caves, typhoons, predation, pesticides, disease, and habitat loss or modification.

Habitat(s): The swiftlet nests and roosts on cave walls and ceiling. They forage in various habitats on Guam.

Goal: To restore populations in northern Guam.

Objectives: To expand the distribution of this population by recolonizing a cave in northern Guam by the translocation of swiftlets from the south colony. To maintain and enhance the population in the southern colony. To continue monitoring the population of swiftlets.

Action plan: Introduced predators: Continue snake control measures at the Mahlac, Maemong, and Fachi caves, and implement and expand area-wide brown treesnake control to potential release sites. Habitat degradation and loss: Prevent the loss of cave historically used by swiftlets, and reduce deer and feral pig numbers around potential release sites. Develop and implement reforestation measures on Guam conservation areas and national wildlife refuge overlay lands. Small or extirpated population: Monitor population abundance and distribution. Translocate birds from the southern population and re-introduce to historical swiftlet caves in the north.

References:

1. U.S. Fish and Wildlife Service. 1991. Recovery Plan for the Mariana Islands population of the Vanikoro swiftlet, *Aerodramus vanikorensis bartschi*. U.S. Fish and Wildlife Service, Portland, Oregon.
2. Jenkins, J. M. 1983. The native forest birds of Guam. Ornithological Monographs No. 31, The American Ornithologists' Union Washington, D.C.

Common name: Guam Micronesian kingfisher
Chamorro name: sihek
Scientific name: *Halcyon cinnamomina cinnamomina*

Historic and current status: Micronesian kingfisher is endemic to Guam. Historically they occurred throughout the island, but were not as abundant in ravine and coastal forests of southern Guam[1]. The kingfisher was last recorded in southern Guam by mid-1960[1]. In 1981, a population occurred only in northern Guam with an estimated 3,023 individuals[2]. In 1984, 19 individuals were captured captive for breeding. By 1988, this species was no longer found in wild on Guam[3]. Currently, seven birds are in captivity on Guam and about 70 in various U.S mainland zoos.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and feral cat, feral dog, monitor lizard predation.

Habitat(s): This species once occupied all habitats throughout Guam, except savanna complex and wetlands. As this species nests in cavities, forests with *Pisonia grandis* trees are particularly important.

Goal: To restore a wild population on Guam.

Objectives: To continue captive breeding efforts and build the population to 110 birds within the next 5 years for possible releases to the wild in snake-free areas.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake and feral cat (predator) control at potential release sites. Habitat degradation and loss: Reduce deer and feral pig numbers at potential release sites and adjacent areas, develop and implement reforestation measures on Guam's conservation areas and national wildlife refuge overlay lands. Small or extirpated populations: Continue participation in Micronesian kingfisher SSP, to continue captive breeding on Guam, and determine potential sites for Micronesian kingfisher re-introduction on Guam.

References:

1. Jenkins, J. M. 1983. The native forest birds of Guam. Ornithological Monographs No. 31, The American Ornithologists' Union Washington, D.C.
2. Micronesia kingfisher SSP, American Zoo and Aquarium Association (AZA).
3. Wiles, G. J., C. F. Aguon, G. W. Davis, and D. Grout. 1995. The status and distribution of Endangered Animals and Plants in Northern Guam. Micronesica 28: 31-49.

Common name: Mariana crow
Chamorro name: aga
Scientific name: *Corvus kubaryi*

Historic and current status: The Mariana crow is endemic to Guam and Rota. Historically, the crow was once abundant throughout Guam. In 1981, the crow population was restricted to parts of the northern plateau with an estimated 350 birds[1]. By 1999, fewer than 7 wild crows remained strictly on AAFB property[2]. Currently, there are 10 crows that inhabit the forest in AAFB, all from translocations of eggs and chicks from Rota. About 250-300 crows are found on Rota. An additional five crows will be released in AAFB. These birds are offspring from a breeding pair on AAFB.

Threats: The principal cause of population the decline has been the brown treesnake. Other factors may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, predation, food resources, inbreeding, and senescence[3]. Restoration of the crow could be hampered by the loss of forest habitat required by this species.

Habitat(s): The Mariana crow was found in most habitats on Guam, except the savanna. They were commonly observed in mature native forest, second growth and mix-woodlands[4].

Goal: To restore the crow population to 1984 levels in Guam of about 300 birds.

Objectives: To continue efforts to annually monitor pairs in the wild, locate and snake-proof nest trees, protect active nests from snake predation, and double clutch nesting pairs. To release hand-reared crows when 2-years old into conservation areas. To work with the CNMI Fish and Wildlife to translocate eggs or chicks from Rota to supplement both Guam and Rota populations.

Action plan: Introduced predators: Continue implementing electrical nest barriers to protect active crow nests, continue and expand area-wide brown treesnake control at release site and adjacent areas, and assess brown treesnake threshold for crow nesting efforts. Habitat degradation and loss: To manage deer and feral pig numbers on AAFB, develop and implement reforestation measures on conservation areas on Guam. Small or extirpated populations: Work with CNMI to continue translocation of Mariana crow eggs and chicks from Rota to Guam, and continue to implement aviculture enhancement techniques to increase the size of the Guam' crow population and to supplement the Rota population.

References:

1. Engbring J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. United States Fish and Wildlife Service FWS/OBS-84/20.
2. Jenkins, J. M. 1983. The native forest birds of Guam. Ornithological Monograph No. 31, The American Ornithologists' Union Washington, D.C.
3. National Research Council. 1997. The Scientific Bases for Preservation of the Mariana Crow. National Academy Press.
4. Division of Aquatic and Wildlife Resources (GDAWR). 1982-1999. Annual Reports. Department of Agriculture, Government of Guam. Unpublished Reports.

Common name: Micronesian starling
Chamorro name: sali
Scientific name: *Aplonis opaca guami*

Historic and current status: A subspecies endemic to Guam, Rota, Tinian, and Saipan, the Micronesian starling is a cavity nester. Historically, the starling was found throughout Guam occupying all habitats, but commonly in forested areas[1]. A survey in 1981 determined that the starling on Guam was one of the most abundant species during the survey[2]. Starlings are still found in AAFB housing area, and nearby Mount Santa Rosa. A recent bird survey[3] in 2005 recorded small numbers of juveniles and family groups observed along the Mount Santa Rosa and Andersen housing routes. In addition, an isolated population of less than 100 birds is found on Cocos Island, south of Guam.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and feral cat, feral dog, monitor lizard predation.

Habitat(s): The starling utilized all habitat types although they were more common in forested areas.

Goal: To increase population numbers and distribution in Guam.

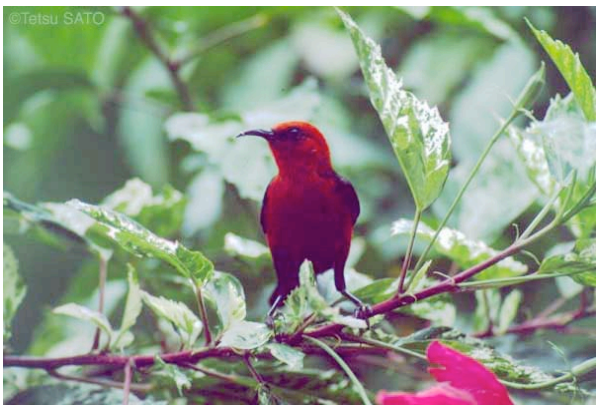
Objectives: To promote successful nesting in AAFB and Cocos Island, and other designated sites. To translocate birds from Cocos Island to snake-free areas.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at potential release sites. Habitat degradation and loss: Reduce deer and feral pig numbers at potential release sites. Develop and implement reforestation techniques on Guam's conservation areas. Small or extirpated population: Monitor population abundance and distribution in Northern Guam and Cocos Island. Translocate birds from Cocos Island to snake protected areas in Northern Guam.

References:

1. Jenkins, J. M. 1983. The native forest birds of Guam. The American Ornithologists' Union Washington, D. C.
2. Engbring, J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish Wildlife Service, FWS/OBS-84/20.
3. DAWR, unpublished data. Department of Agriculture.

Common name: Micronesian honeyeater
Chamorro name: egigi
Scientific name: *Myzomela rubratra saffordi*



Historic and current status: This subspecies of honeyeater is endemic to the Mariana Islands. Historically, this species was abundant throughout Guam occupying all habitats including urban areas[1]. In 1980, the declining population was found only in the Northwest field in AAFB[2]. By 1986, the bird was extirpated in Guam[3]. Currently, the honeyeater is found in neighboring islands of Rota and Saipan where healthy populations exist.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, human exploitation, typhoons, pesticides, competition, disease, and predation by feral cats, dogs, rats and monitor lizards.

Habitat(s): A versatile species, the honeyeater was once found in various habitat types on Guam including strand forest, scrub forest, limestone forest, urban and agriforest areas.

Goal: To restore populations of honeyeaters on Guam.

Objectives: To translocate to Guam honeyeaters from Rota or Saipan.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake feral cat and rat control at potential release sites. Small or extirpated populations: Develop agreements with CNMI for translocation of this species. Develop release and monitoring protocols for this species.

References:

1. Jenkins, J. M. 1983. The native forest birds of Guam. The American Ornithologists' Union Washington, D.C.
2. Engbring, J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish Wildlife Service, FWS/OBS-84/20.
3. Wiles, G. J., C. F. Aguon, G. W. Davis, and D. Grout. 1995. The status and distribution of Endangered Animals and Plants in Northern Guam. Micronesica 28: 31-49.

Common name: Mariana common moorhen
Chamorro name: pulattat
Scientific name: *Gallinula chloropus guami*

Historic and current status: The Mariana common moorhen is an endemic subspecies to Guam, Saipan, Tinian and Pagan. Before 1951, the population was noticeably abundant in freshwater areas[1]. The species has experienced population declines in recent years. Results from a 1981 survey showed that the moorhen was a rare, with only 2 birds accounted for during the survey[2]. By 1999, moorhen were found throughout the southern and central parts of Guam, with population estimated at 100-125 birds[3]. Currently, the population numbers about 90 birds[4]. Sightings of adult pairs with chicks are being made in wetland habitats throughout the island.

Threats: Possible causes that may lead to the decline of this species include: habitat loss and modification, competition, human disturbance, development and encroachment of undesirable vegetation and predation.

Habitat(s): The Mariana common moorhen is abundant in freshwater habitats both natural and manmade throughout Guam.

Goal: To restore and maintain a population throughout Guam's wetlands.

Objectives: To maintain wetland habitat and prevent encroachment by development and invasive species.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at potential sites, as well as, control for other predators. Habitat degradation and loss: Reduce and prevent loss of wetlands, and encroachment by invasive plants. To inventory the wetlands and implement a plan to open areas being choked by *Phragmites karka*. To assess the status of mitigation wetland areas and take appropriate management actions. Small or extirpated populations: Annually survey all wetlands including Fena Resevior, Atantano and Namo wetlands, as well as man-made basins and ponds, for moorhens.

References:

1. Baker, R. H. 1951. The avifauna of Micronesia, Its origin, evolution, and distribution. University of Kansas Publications Museum of Natural History 3: 1-359.
2. Engbring, J., and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish Wildlife Service, FWS/OBS-84/20.
3. Division of Aquatic and Wildlife Resources (GDAWR). 1999. Annual Reports. Federal Aid to Wildlife Restoration (Pittman-Robertson Act). Department of

Agriculture, Government of Guam. Unpublished Data.
4. Takano, L. 2003. Seasonal movement, home range, and abundance of the Mariana common moorhen (*Gallinula chloropus guami)* on Guam and the Northern Mariana Islands. Masters Thesis, Oregon State University.

Common name: Nightingale reed-warbler
Chamorro name: ga' kaliso/ga'karriso
Scientific name: *Acrocephalus luscinia luscinia*

Historic and current status: The Nightingale reed-warbler is an endemic subspecies to Guam, Saipan, and Almagan. Historically, this bird was known to be rare on Guam being restricted to wetlands[1]. By the 1960s, the Nightingale reed-warbler was considered to be common in four locales: Agana Swamp, Atantano River Marsh, Masso River Mouth, and an undescribed location in Agat[2]. After 1969, this bird species was not found in areas it once occupied[2]. Presently, the Nightingale reed-warbler no longer inhabits the wetlands in Guam.

Threats: The principal cause of decline and extinction in the wild is brown treesnake predation. Other causes that may have contributed to the decline may include: habitat loss and modification, wild fires, human exploitation and development, typhoons, pesticides, competition, disease, and ungulates.

Habitat(s): Restricted to adjacent areas in and near fresh and brackish water marshes.

Goal: To restore a viable population to Guam.

Objectives: To establish a breeding population on Guam by translocating eggs, chicks, and/or adults from the Northern Mariana Islands to Guam, and releasing birds into the wild in predator controlled sites.

Action plan: Introduced predators: Implement area-wide brown treesnake control in the wetlands on Guam. Habitat degradation and loss: Reduce deer and feral pig numbers, develop and implement habitat preparation techniques on wetlands, and enforce regulations on development and usage of the wetlands. Small or extirpated populations: Work closely with CNMI to translocate eggs, chicks and birds to Guam.

Reference:

1. Baker, R. H. 1951. The avifauna of Micronesia, Its origin, evolution, and distribution. University of Kansas Publications Museum of Natural History 3: 1-359.
2. Reichel, J. D., G. J. Wiles, and P. O. Glass. 1992. Island extinctions: the case of the endangered nightingale reed-warbler. Wilson Bulletin 104: 44-54.

Common name: White-tailed tropicbird
Chamorro name: utak or fakpe
Scientific name: *Phaethon lepturus*

Historic and current status: The White-tailed tropicbird occurs in all but the easternmost Pacific areas. Surveys in 1945 indicated a nesting colony in crevices along the cliff walls on northern Guam. In 1985, a small breeding population nested along the northern cliff at Two Lover's Point, Guam. Currently, no breeding pairs have been recorded. Though this species continues to be observed around Guam mainly as a visitor from the neighboring island of Rota.

Threats: Predation by the brown tree snake is the most likely reason for the loss of the resident population on Guam.

Habitat(s): Foraging from reef flat to open deep sea, nest in crevice located on cliff walls.

Goal: To restore a nesting population to northern Guam.

Objectives: To maintain snake free habitats along northern cliff walls.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at potential roost and nest sites. Habitat degradation and loss: To prevent loss of historic cliffline roost sites. Small or extirpated populations: Collect information on this species distribution and abundance. Identify potential nest and roosting sites on Guam, and take appropriate measures to promote nest success in these areas.

Reference:

1. Baker, Rollin H. 1951. The avifauna of Micronesia, Its origin, evolution, and distribution. University of Kansas Publications Museum of Natural History 3: 1-359.
2. Division of Aquatic and Wildlife Resources (GDAWR). 1985. Annual Reports. Federal Aid to Wildlife Restoration (Pittman-Robertson Act). Department Agriculture, Government of Guam

Common name: Pacific reef heron
Chamorro name: chuchuko'
Scientific name: *Egretta sacra*

Historic and current status: The Pacific reef heron occurs in many areas of the tropical Pacific, the pacific reef heron is an endemic shorebird to Guam. Historically, a breeding population occurred throughout the western coast (Orote Peninsula) to Cocos island[1]. In 1981, sightings were common in northern Guam during a survey, and several individuals were also seen along the Cocos island coast[2]. There is no evidence of this species breeding on Guam, though sightings of individuals still occur near Cocos Island. Currently, reef herons may be seen foraging along the reef flats during the day in the southern coast.

Threats: A possible cause that may lead to the absence of this species includes: snake and rat predation and habitat loss and modification.

Habitat(s): Pacific reef herons are found on reef flats, and occupying coastal strands and islets.

Goal: To determine the status of reef herons on Guam.

Objectives: To determine the status of the Guam population. To identify nesting areas and roost sites and implement appropriate protective measures.

Action plan: Determine population status: Conduct surveys for reef herons and identify location of nest sites. Introduced predators: Implement and expand area-wide brown treesnake and other predator controls necessary at potential nest sites.

References:

1. Baker, R. H. 1951. The avifauna of Micronesia, Its origin, evolution, and distribution. University of Kansas Publications Museum of Natural History 3: 1-359.
2. Engbring, J. and F. L. Ramsey. 1984. Distribution and abundance of the forest birds of Guam: results of a 1981 survey. U.S. Fish Wildlife Service. FWS/OBS-84/20.

Common name: Brown booby
Chamorro name: lu'ao
Scientific name: *Sula leucogaster*

Historic and current status: The Brown booby occurs throughout the tropical Pacific and south to Australia. Historically, brown boobies were not seen abundantly throughout Micronesia[1]. Twenty-five birds were seen roosting on Orote Point from June to August 1997[2]. Recently, incidental sightings of individuals from the eastern and southeastern shores of Guam have been made.

Threats: Predation by the brown treesnake and rats may have caused this species to be extirpated from Guam.

Habitat(s): Brown boobies nest on the ground or in cliff walls, and forage along reef flats, and are usually seen in flight along steep rocky cliffs.

Goal: To restore a population on Guam.

Objectives: Predator control in areas identified as historic nesting and roosting locations.

Action plan: Introduced predators: Implement and expand area-wide brown treesnake control at historical roost and nest sites. Small or extirpated populations: Survey coastal areas for potential brown booby roost sites.

References:

1. Baker, R. H. 1951. The avifauna of Micronesia, Its origin, evolution, and distribution. University of Kansas Publications Museum of Natural History 3: 1-359.
2. Division of Aquatic and Wildlife Resources (GDAWR). 1997. Annual Reports. Federal Aid to Wildlife Restoration (Pittman-Robertson Act). Department Agriculture, Government of Guam.

Common Name: Migratory Shorebirds
Chamorro Name:
Scientific Name:

Historic and current status: Over 40 species of migratory shorebirds representing Charadriidae and Scolopacidae are known to winter in Guam[1,2,3]. In addition, various species of terns, raptors, and egrets winter on Guam as vagrants, though in much smaller numbers. Studies indicate that a great majority of migrants fly over Guam[4]. Wetland, estuaries, tidal flats, grasslands, and uplands are important habitats for migrant shorebirds and resident shorebirds[3]. While some species are not considered important to the overall survivorship of the species, a few species of considered important.

Threats: Predators and loss of habitat remain significant factors in reducing the number of migrants on Guam. Though it is believe that a great number species make Guam a minor stop over in the migration, conservation actions remain important in supporting the survivorship of these species.

Habitat: Mud flats, reef flats, and open fields are important habitats for many of the shorebirds.

Goal: Increase the number of migratory shorebirds.

Objectives: 1.) Determine the abundance and distribution of shorebirds. 2.) Reduce brown treesnakes and rats in areas used by the different species. 3.) Prevent habitat loss.

Action Plan: Monthly shorebird surveys: Conduct monthly surveys for 2-years to determine the abundance and distribution of migratory shorebirds on Guam. Predator control: Where appropriate control predation on shorebirds. Habitat degradation and loss: Reduce or prevent the loss the habitat important to shorebirds.

Reference:

1. Reichel, J. D., and P. O. Glass. 1991. Checklist of the birds of the Mariana Islands. Ele'apio 51: 3-11.
2. Wiles, G. J., D. Worthington, R. E. Beck, Jr., C. F. Aguon, and R. L. Pyle. 2000. Noteworthy bird records for Micronesia, with summary of raptor sightings within the Mariana Islands, 1988-1999. Micronesica 32: 257-284.
3. Engilis, A., Jr., and M. Naughton. 2004. U. S. Pacific Islands regional shorebird conservation plan. U. S. Fish and Wildlife Service, Portland.
4. Williams, T. C., and J. M. Williams. 1988. Radar and visual observations of autumnal (southward) shorebird migration on Guam. Auk 105: 160-466.

Reptiles

Common Name: Snake-eye skink **Chamorro Name: g**uali'ek halom tano' **Scientific Name:** *Cryptoblepharus poecilopleurus*	
Historic and current status: An endemic species to Guam and throughout the Mariana Islands, the snake-eye skink was known to have a widespread range[1]. The last recorded specimen found on Guam was in 1969[2]. Its current status on Guam is unknown, although they still occur in Cocos Island.	
Threats: Possible cause of decline of this species may include: predation and competition with introduced skink species.	
Habitat: Observed near coastal strands, often found in loose, sandy soil.	
Goal: To restore populations to coastal areas of Guam.	
Objectives: To determine the status of this species on Guam and Cocos Island. To implement actions to improve species status.	
Action Plan: Introduced predators: Implement and expand area-wide brown treesnake, musk shrew, feral cat, rat control at potential habitat preference. Habitat degradation and loss: Prevent loss of habitats deemed important to the skinks. Small or extirpated populations: Identify lizard population abundance where they occur and consider the potential of captive propagation for future releases in protected areas on Guam.	
Reference: 1. Rodda G. H, T. H. Fritts, and J. D. Reichel. 1991. The distributional patterns of reptiles and amphibians in the Mariana Islands. Micronesica 24: 95-210. 2. Extinction and loss of species from Guam: lizards. www.mesc.usgs.gov	

Common Name: Slevin's skink
Chamorro Name: **g**uali'ek halom tano'
Scientific Name: *Emoia slevini*

Historic and current status: An endemic species to Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug. Historically this species was found throughout Guam and the other islands were it occurs. On Guam it has not been recorded since 1945. It was probably not common[1]. This species occurred on Cocos Island in the late 1980's-early 1990's[2]. Currently, the Slevin's skink is found in the northern islands of Sarigan, Guguan, Alamagan, Pagan, and Asuncion[2,3].

Threats: Possible cause to the decline of this species may include: predation and competition.

Habitat: Forested areas; found on the forest floors, in old fields, and low on tree trunks.

Goal: To restore the species to Guam and improve numbers on Cocos island.

Objectives: To supplement the current population on Guam and Cocos Island from other islands (CNMI).

Action Plan: Introduced predators: Implement and expand area-wide brown treesnake, musk shrew, feral cat, rat control at Cocos Island to increase abundance. Habitat degradation and loss: Prevent loss of habitats deemed important to the skinks. Small or extirpated population: Identify abundance of lizard population where they occur and consider the potential of captive propagation for future releases in protected sites on Guam.

References:

1. Extinctions and Loss of Species from Guam: Lizards. USGS www.mesc.usgs.gov
2. Rodda G. H, T. H. Fritts, and J. D. Reichel. 1991. The distributional patterns of reptiles and amphibians in the Mariana Islands. Micronesica. 24: 195-210.
3. Vogt, S. R., and L. L. Williams. 2004. Common flora and fauna of the Mariana Islands. Williams and Vogt Published.

Common Name: Azure-tailed skink
Chamorro Name: guali'ek galom tano'
Scientific Name: *Emoia cyanura*

Historic and current status: An endemic species to Guam, the Azure-tailed skink was once found in southern Guam in the area of the Geus River, which drains into the Cocos lagoon[1]. Currently, this species can only be found on Cocos Island. The status of the species on Cocos Island is unknown. Guam's population has been extirpated for years. This species is easily confused with the Blue-tailed skink (*Emoia caeruleocauda*).

Threats: Possible cause to the decline of this species may include: predation and competition with introduced skink species.

Habitat: Reportedly prefers hot, dry, open areas especially those near the coast[2].

Goal: To restore this species to Guam.

Objectives: To determine current status on Guam and Cocos Island. Reintroduce to native range on Guam.

Action Plan: Population survey: Survey Guam and Cocos Island to determine the current size and distribution of the population. Introduced predators: Implement and expand area-wide introduced species control of curious skinks, shrews, and rats. Habitat degradation and loss: Prevent loss of key coastal habitats deemed important to the skinks. Small and extirpated populations: Determine the status of this species on Guam and implement a captive propagation for future releases in protected areas on Guam.

Reference:

1. Rodda G. H, T. H. Fritts, and J. D. Reichel. 1991. The distributional patterns of reptiles and amphibians in the Mariana Islands. Micronesica. 24: 195-210.
2. McCoy, M. 1980. Reptiles of the Solomon Islands. Wau Ecology Institute Handbook No. 7., Wau Papua New Guinea.

Common Name: Moth skink
Chamorro Name: **g**uali'ek halom tano'
Scientific Name: *Lipinia noctua*

Historic and current status: The Moth skink is found in much of the western Pacific, in the Mariana Islands, it is found only on Guam[3]. An endemic species to the Marianas, this species was not common on Guam. However, four individuals were collected on a single day in 1986[1]. In the early 1990's, the Moth skink was known to occur at three areas: Hilaan Point, Haputo Beach, and Achae Point along the northwestern coast[2]. Though Vogt and Williams[3] indicate it occurs in central parts of Guam and abundant in the Naval Ordnance Annex area, but there is conflicting information on its status[1].

Threats: Possible cause to the decline of this species may include: predation and competition with introduced skink species.

Habitat: Moth skinks use large tree trunks with loose bark in forested areas.

Goal: To determine the current status of this species and take appropriate actions.

Objectives: To survey population of the Moth skink in Hilaan Point, Haputo Beach, Achae Point, Naval Ordnance and other potential areas on Guam.

Action Plan: Introduced predators: Implement and expand area-wide introduced species control, of curious skinks, shrew, and rats. Habitat degradation and loss: Prevent loss of key forested habitats deemed important to the skinks. Small and extirpated populations: Determine the status of this species on Guam and implement a captive breeding program for future releases in protected areas on Guam.

References:

1. Extinctions and Loss of Species from Guam: Lizards. USGS, www.mesc.usgs.gov.
2. Wiles, G. J., C. F. Aguon, G. W. Davis, and D. Grout. 1995. The status and distribution of endangered animals and plants in northern Guam. Micronesica 28(1): 31-49.
3. Vogt, S. R., and L. L. Williams. 2004. Common flora and fauna of the Mariana Islands. Williams and Vogt Published.

Common Name: Micronesian gecko
Chamorro Name: guali'ek halom tano'
Scientific Name: *Perochirus ateles*

Historic and current status: The Micronesian gecko is native to the Micronesia Islands, including Guam, Rota, Tinian, and Saipan. Historic reports indicated that this species was abundant during the pre-human period in the Marianas[1]. This gecko was present through the post-war period on Guam and in other southern Mariana Islands[2]. Currently, the Micronesian gecko is considered to be rare and information of this species is lacking.

Threats: Predation by brown treesnake, Oceanic gecko (*Gehrya oceanica)*, and feral cats is most likely the major reason for the loss of this species.

Habitat: Knowledge of this species' habitat preferences is poorly known. Historic records indicated specimens were found and collected in limestone forest and beach strands.

Goal: To locate and determine current status for this species.

Objectives: To conduct population surveys in historic sites as well as in limestone and beach strand habitats.

Action Plan: Introduced predators: Implement and expand area-wide control for predatory species, such as rats, cats, and snakes. Small and extirpated population: Work closely with private individual stakeholders and explore the feasibility of captive propagation for this species. Habitat degradation and loss: Prevent loss of key habitats for this species and implement a captive breeding program for future releases in protected areas on Guam.

Reference:

1. Pregill, G. K. 1998. Squamate reptiles from prehistoric sites in the Mariana Islands, Micronesica. Copeia 1998: 64-75.
2. Rodda, G. H., T. H. Fritts, and J. D. Reichel. 1991. The distributional patterns of reptiles and amphibians in the Mariana Islands. Micronesica 24: 195-210.

Terrestrial Gastropods

Common Name: Mariana Islands tree snail
Chamorro Name: akaleha'
Scientific Name: *Partula gibba*

Historic and current status: The Mariana Islands tree snail is endemic species to Guam and the northern Mariana Islands. It was discovered and collected in 1819 during the Freycinet Uranie expedition in 1817-1819[1]. Upon its discovery, this tree snail was considered to the most abundant on Guam. In 1920, Crampton collected 3,204 to determine geographic differences in shell patterns in 33 of his 39 sites studied[1]. No significant studies occurred until late 1980's and early 1990's. In 1989, historical sites were re-evaluated to determine population status. Thirty-four of Crampton's 39 sites, plus 13 new sites were studied. The Crampton's sites visited in 1989 supported no snails and one of the 13 new sites supported a small population[2,3]. In a 1995 survey, two humped tree snail populations were found in coastal areas[4]. In the same year, USFWS surveyed 15 sites on the Naval Magazine Ordnance area and found an abundance of ground shells but no living populations[4]. Currently, the status of this tree snail population is unknown.

Threats: The primary cause of decline for this species was from the predation by the introduced triclad flatworm, *Platydemus manokwari*. Other causes of decline may include: habitat loss due to land clearing for agricultural, and commercial development, intensive use of pesticides, extensive collecting of snails by naturalists and explorers, and wildland grass fires.

Habitat: The Mariana tree snail prefers cool, shaded forest habitats with high humidity. This species occupies tree branches.

Goal: To determine the status of the population and take appropriate measures to restore the population on Guam.

Objectives: To determine the status of the species and if feasible, implement a captive breeding program. To determine the feasibility of captive propagation and implement program.

Action Plan: Conduct survey for snails: Conduct survey of areas previously known to harbor snails. Introduced predators: In selected sites control predatory snails and flatworms. Habitat degradation and loss: Reduce deer and feral pig numbers around known colonies, develop and implement reforestation techniques on Guam's conservation areas and national wildlife refuge overlay lands. Small or extirpated population: Work closely with stakeholders and CNMI Fish and Wildlife Service to monitor populations within the Mariana Islands, and possibly translocate snails to Guam to supplement the existing population. Explore the feasibility of captive propagation of

this snail.

Reference:

1. Crampton, H. E. 1925. Studies on the variation, distribution, and evolution of the genus *Partula*. The species of the Mariana Islands, Guam and Saipan. Carnegie Institute Washington Publication 228A. vii + 116., 14 plates.
2. Hopper, D. R., and B. D. Smith. 1992. The status of tree snails (Gastropoda: Partulidae) on Guam, with a resurvey of sites studied by H.E. Crampton in 1920. Pacific Science 46: 77-85.
3. Kanehira, R. 1936. Forests of Rota. Bot. Zool. 4: 63-70.
4. Smith, B. D. 1995. Tree snails, tropical storms, and drought in the Mariana Islands. (Abstract only). Programs and abstracts, American Malacological Union, 61st Annual Meeting, Hilo, Hawaii.

Common Name: Pacific tree snail
Chamorro Name: akaleha'
Scientific Name: *Partula radiolata*

Historic and current status: The Pacific tree snail is endemic to Guam. In 1819, French naturalists failed to recognize specimens from this species as distinct from other partulid species inhabiting Guam[1]. During a return visit in 1828, zoologists collected samples of partulids but did not indicate population density[1]. Surveys in 1989 and 1991 were conducted to evaluate the population size of this species. At both times, this species was considered the predominant tree snail[2]. Currently, the population's status is unknown though it was found in the Mount Santa Rosa and Fadian Point.

Threats: The primary cause of decline for this species was from the predation by the introduced triclad flatworm, *Platydemus manokwari*. Other causes of decline may include: habitat loss due to land clearing for agricultural, and commercial development, intensive use of pesticides, extensive collecting of snails by naturalists and explorers, and wild grass fires.

Habitat: The Pacific tree snail prefers cool shaded forested areas with high humidity.

Goal: To restore the Pacific tree snail population.

Objectives: To determine the status of the Pacific tree snail and continue annual population surveys. To provide a protected sanctuary for breeding and longevity to occur. To determine the feasibility of captive propagation and implement program.

Action Plan: Introduced predators: To implement an area wide control for *P. manokwari* in areas where this species is known to occur. To identify other predators and implement control measures. Habitat degradation and loss: To control and monitor land clearing and prevent wildfires to preserve the native forest habitat for this species. Reforest native flora and control ungulates in the habitat were snails are found will allow the required preservation of this species. Small or extirpated population: To conduct surveys on Guam to determine current population size, structure, and distribution of this species. To develop a captive breeding program for this snail to restore the population and eliminate any possibly extinction to Guam.

Reference:

1. Crampton, H. E. 1925. Studies on the variation, distribution, and evolution of the genus *Partula*. The species of the Mariana Islands, Guam and Saipan. Carnegie Institute Washington Publication 228A. vii + 116 pages, 14 plates.
2. Hopper, D. R., and B. D. Smith. 1992. The status of tree snails (Gastropoda:

Partulidae) on Guam, with a resurvey of sites studied by H.E. Crampton in 1920. Pacific Science 46: 77-85.

Common Name: Mariana Island fragile tree snail
Chamorro Name: akaleha'
Scientific Name: *Samoana fragilis*

USFWS/Dave Hopper

Historic and current status: In the Mariana Islands, the Fragile tree snail was reported on Guam and Rota. Historically, it was considered rare when discovered in 1819 during the Freycinet Uranie expedition of 1817-1819[1]. Since then, no significant surveys occurred until the late 1980s and early 1990s[2,3]. This species was uncommon, as it was when first discovered in 1819. Currently, the fragile tree snail population remains uncommon.

Threats: The primary cause of decline for this species was from the predation by the introduced triclad flatworm, *Platydemus manokwari*. Other causes of decline may include: habitat loss due to land clearing for agricultural, and commercial development, intensive use of pesticides, extensive collecting of snails by naturalists and explorers, and wild grass fires.

Habitat: Fragile tree snail prefers cool shaded forest habitats with high humidity.

Goal: To implement a SSP for all native snails on Guam and continue annual surveys.

Objectives: To determine the status of the Mariana fragile snail and continue annual population surveys. To provide a protected sanctuary for breeding and longevity to occur. To determine the feasibility of captive propagation and implement program.

Action Plan: Introduced predators: Implement and expand area-wide control of *P. manokwari*. Habitat degradation and loss: Reduce deer and feral pig populations at colony and adjacent areas, develop and implement reforestation techniques on Guam's conservation areas and national wildlife refuge overlay lands. Small or extirpated population: To conduct surveys on Guam to determine current population size, structure, and locales of this species. To develop a captive breeding program for this snail to restore the population and eliminate any possibly extinction to Guam. Work closely with stakeholders and CNMI Fish and Wildlife Service to monitor populations within the Mariana Islands, and possible translocation of snails to Guam supplement existing population.

References:

1. Crampton, H. E. 1925. Studies on the variation, distribution, and evolution of the genus *Partula*. The species of the Mariana Islands, Guam and Saipan. Carnegie Inst. Washingon Publication 228A. vii + 116., 14 pl.
2. Hopper, D. R., and B. D. Smith. 1992. The status of tree snails (Gastropoda: Partulidae) on Guam, with a resurvey of sites studied by H.E. Crampton in 1920. Pacific Science 46: 77-85.
3. Kanehira, R. 1936. Forests of Rota. Botonica Zoological 4: 63-70.

Insects

Common Name: Forest flicker **Chamorro Name**: **Scientific Name**: *Hypolimnasarakalulk marianesis* (Fruhstorfer) *(Hypolimnas octocula marianesis)*	No Photo Available
Historic and current status: Swezey collected one single female from a *Hibiscus* flower on October 17, 1936[1]. Of the fourteen species of butterfly recorded by Swezey, *Hypolimnas arakalulk marianesis* appears to be the rarest[2]. Muniappan collected three specimens on a limestone plant, *Procris pedunculata* at Hilaan Point, on August 1975, one specimen from the AAFB on April 1982 and two specimens at Hilaan Point on September 2001 (Guam Agricultural Experiment Station Collection). The current status of this species is not known.	
Threats: Habitat loss for the host plants by introduced plant species, and predation of caterpillar by an ichneumonid wasp, are believed to be causes of this species rarity.	
Habitat: Limestone forests where the host plant, *Procris pedunculata*, occurs.	
Goal: To establish a viable population of *Hypolimnas arakalulk marianesis* in Guam.	
Objectives: To survey on Guam habitats containing *Procris* spp.. To study seasonal population dynamics of *H. a. marianesis* in the laboratory, culture *H. a. marianesis* in the laboratory, survey natural enemies, study the biology of the butterfly, and release laboratory reared butterfly in the *Procris* habitats.	
Action Plan: Habitat degradation and loss: Identify and map occurrences of *Procris pedunculata*. Reduce impacts of ungulates and invasive plants in limestone forests areas where *Procris* occurs. Small or extirpated population: Conduct monthly surveys at the Hilaan Point to observe seasonal activity for this butterfly species, and cultivate caterpillars of this species and rear them to adult stage in a parasite and predation free enclosure for propagation. Release reared in the lab adults in limestone habitats where the host plant is abundant and especially in conservation areas Guam.	
Reference: 1. Swezey, O. H. 1942. Insects of Guam. Lepidoptera (Butterflies of Guam.) Bull. B.P. Bishop Museum 172: 31-38. 2. Sampson, C. 1986. The *Hypolimnas octocula* complex, with notes on *H. inopinata* (Lepidoptera, Nymphalidae) Tyô to Ga 37: 15-43.	

Common Name: Marianas rusty **Chamorro Name**: **Scientific Name**: *Vagrans egistina*	

Historic and current status: This butterfly species was described from Guam and is confined to the Marianas. In 1932, Swezey found this species rare but widespread on Guam. In 1970's, several specimens were collected from *Maytenus thompsonii*. Not much is known for the current status on Guam.

Threats: Causes for this species to be rare includes; habitat loss of the host plants by introduced plant species, and predation of caterpillar by an ichneumonid wasp.

Habitat: Limestone forests where the host plant, *Maytenus thompsonii*, occurs.

Goal: To establish a viable population of *Vagrans egistina* in Guam.

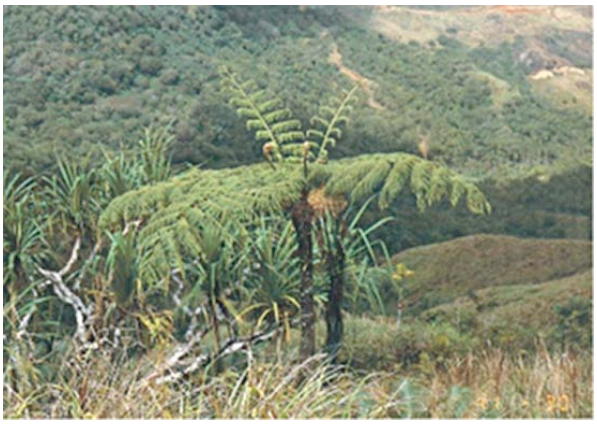
Objectives: To survey *Maytenus thomponsii* habitats on Guam, determine seasonal population dynamics of *V. egistina,* and in the laboratory, culture *V. egistina*. To survey for natural enemies of *Vagrans*, and study its biology. To release laboratory reared butterflies in habitats containing *Maytenus*.

Action Plan: Habitat degradation and loss: Identify and map localities with *Maytenus thompsonii*, and reduce and prevent the development, and possible encroachment of invasive plants in these areas. Small or extirpated population: Conduct monthly surveys to determine its seasonality. To cultivate caterpillars of this species and rear them to adult stage in a parasite and predation free enclosures for propagation. Release lab reared adults in limestone habitats where the host plant is abundant especially in conservation areas.

Reference:

1. Schreiner, I. H., and D. M. Nafus. 1997. Butterflies of Micronesia. Agricultural Experiment Station, College of Agriculture and Life Sciences, Univ. of Guam. 30p.

Terrestrial Plants

Common name: Tree fern **Chamorro name**: chacha **Scientific name**: *Cyathea lunalata*	
Historic and current status: The tree fern has always been considered rare, and is found in hills in southern Guam[1]. This species is still rare, but can still be found is southern mountains in muddy drainage slopes.	
Threats: Presently, major threats include typhoons and wildland fires reducing the habitat in which this species lives.	
Habitat(s): Southern hills of Guam, wet ravines and muddy drainage slopes	
Goal: To restore tree fern populations.	
Objectives: To survey the island and determine the density and distribution of the fern. To protect remaining areas harboring the tree fern. To propagate this species and out plant in conservation areas in southern Guam.	
Action plan: Small or extirpated population: Identify locations of species, and collaborate with the University of Guam or people who are knowledgeable of fern propagation. Protect existing populations from wildland fires. Conduct studies into the ecology and biology of this species. Begin propagating this species for outplanting.	
Reference: 1. Stone, B. C. 1970. The flora of Guam. Micronesica 6: 1-659. 2. Moore, P. H. and P. D. McMakin. 1979. Plants of Guam. University of Guam, College of Agriculture and Life Sciences.	

Common name: Federico nut **Chamorro name**: fadang **Scientific name**: *Cycas marianensis*	

Historic and current status: The fadang was historically considered common, being found throughout Guam in undisturbed limestone areas, coastal areas, and can be found in ravine forests and savanna summits[1]. Though still common throughout Guam, the recent introduction of the Asian scale, *Aulacaspis yasumatsui*, in 2003 is causing significant mortality among trees and will soon place in it in the endangered species status if immediate action to avert this problem is not taken (Aubrey Moore, pers. comm. 2005).

Threats: Presently, the recent introduction of the Asian cycad scale, poses the most significant threat to fadang. Other threats include ungulate damage, typhoons, wild land fires, and development.

Habitat(s): Limestone areas, coastal areas, ravine forests, and savanna summits

Goal: To prevent extirpation of the fadang population.

Objectives: To prevent further loss of cycads due to the Asian cycad scale infestation by the application of appropriate treatments. To propagate seedlings in a scale-free enclosure to prevent further fadang loss.

Action plan: Introduced herbivores: To quickly implement biological control treatment program to protect remaining fadang trees against the Asian scale especially in conservation areas. To reduce deer and pig numbers in areas where cycads are most abundant. Small or extirpated population: Collect seeds and propagate at least 100-300 bi-annually for distribution.

Reference:

1. Stone, B. C. 1970. The flora of Guam. Micronesica 6: 1-659.

Common name:
Chamorro name: ufa halomtano'
Scientific name: *Heritiera longipetiolata*

Historic and current status: This species is endemic to Guam, Rota, and Saipan[1]. Historically restricted to limestone cliffs and plateaus[1,2], currently ufa is considered rare. It is rarely found flowering and fruiting presenting a challenge for nursery propagation experts.

Threats: Presently, major threats include ungulate damage, typhoons, and the rare occurrence of flowering and fruiting hinders this species.

Habitat(s): Limestone cliffs and plateaus on Guam.

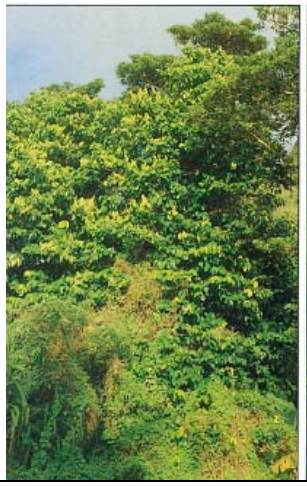
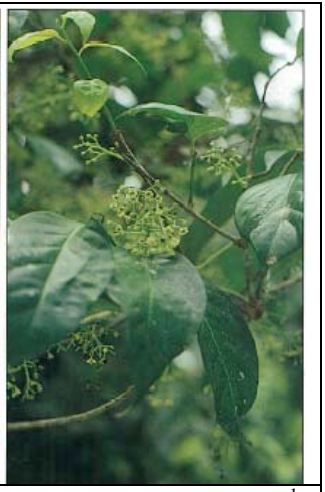
Goal: To maintain a viable population throughout the island.

Objectives: To collect seeds from fruiting trees and develop a nursery of seedlings for out planting. To increase the number of trees conservation areas by outplanting seedlings. To increase the number of trees in the wild by out plantings by plants grown in nurseries.

Action plan: Introduced herbivores: To reduce deer and feral pig numbers in areas where ufa occurs. To monitor trees to prevent insect infestation. Small or extirpated population: Collect seeds seasonally and propagate at least 100-300 bi-annually for distribution. To install enclosures around trees to protect seeds and seedlings from deer and feral pigs.

Reference:

1. Stone, B. C. 1970. The flora of Guam. Micronesica 6: 1-659.
2. Moore, P. H., and P. D. McMakin. 1979. Plants of Guam. University of Guam, College of Agriculture and Life Sciences.

Common name: **Chamorro name**: faniok **Scientific name**: *Merrilliodendron megacarpum*	 

Historic and current status: Faniok is considered rare in Guam's limestone forest[1]. Trees have been found only in few locations including Hilaan Point, Haputo, Mount Lam Lam, Mount Tenjo and 1 known tree in the Agana spring area[1, 2]. The status of this species in these areas is unknown.

Threats: Threats to the species include ungulate damage, typhoons, development, and possible insect infestation.

Habitat(s): Limestone forest.

Goal: To restore population throughout the island.

Objectives: To determine the abundance and distribution of this species throughout Guam. To monitor trees quarterly for opportunities to collect seeds to propagate in a nursery. To outplant seedlings in areas protected from deer and feral pigs.

Action plan: Introduced herbivores: To reduce deer and feral pig numbers where faniok occurs. Small or extirpated population: Monitor population and distribution of this species. Collect seeds seasonally and propagate at least 100 bi-annually for distribution.

Reference:

1. Stone, B. C. 1970. The flora of Guam. Micronesica 6: 1-659.
2. Moore, P. H. and P. D. McMakin. 1979. Plants of Guam. University of Guam, College of Agriculture and Life Sciences.

Common name: Fire Tree
Chamorro name: tronkon guafi, hayun lagu
Scientific name: *Serianthes nelsonii*

Historic and current status: Tronkon guafi is endemic to Guam and Rota[1]. Historic records of this tree are only known from the north of Guam[1,2]. However, there are quite a few trees remain on Rota. This species was federally listed as endangered on February 18, 1987 (52 CFR 4907-4910). Only one adult tree is known to remain on Guam, and over 60 adult trees on Rota.

Threats: Threats to the species include herbivory by ungulates (deer and feral pigs), damage caused by mealy bugs, and butterfly (*Eurema blanda*), typhoons, insect damage.

Habitat(s): Limestone and Ravine forests.

Goal: To increase population throughout the island.

Objectives: To protect only remaining adult tree and to propagate seedlings.

Action plan: Habitat loss: To prevent further damage to the remaining adult tree and surrounding forest. Small populaions: To collect plant material from Guam and Rota, and propagate at least 200-300 bi-annually and outplant seedlings in protective enclosures from ungulates. Monitor plants for insect infestations.

References:

1. Stone, B. C. 1970. The flora of Guam. Micronesica 6: 1-659.
2. USFWS. 1994. Recovery plan for *Serianthes nelsonii*. U. S. Fish and Wildlife Service, Portland, OR.

Common Name: None **Chamorro Name:** **Scientific Name:** *Tabernaemontana rotensis*	

Historic and current status: *Tabernaemontana* is endemic to Guam and Rota. The population on Guam was previously believed to be composed of only one adult tree. Recent observations have expanded that number to well over 200 individuals plants found in various parts of northern and southern Guam[1]. On Rota, less than 60 trees have been as well. Historically this species of plant was found in the mature limestone forests. Through harvesting and herbivory by ungulates, the *Tabernaemontana* population was thought to have dwindled to one individual on Guam. However, more individuals have been found than once thought. This species endemic status to only two islands warrants it being in the SOGCN.

Threats: Herbivory and insect infestations probably are major factors limiting its abundance.

Habitat: This species is found in native limestone forest. Efforts to improve the state of condition of the forest should improve the status of this species.

Goal: To maintain a healthy population of *Tabernaemontana*.

Objectives: To determine the status and distribution of this species.

Action Plan: Population Assessment: Conduct an island-wide survey of the plant to determine its status on Guam and to implement appropriate management actions.

Reference:

1. Division of Aquatic and Wildlife Resources (GDAWR). Unpublished Data. Department of Agriculture, Government of Guam.

Aquatic Animals and Plants

Freshwater Fishes

Common name: Stream Goby **Chamorro name:** atot **Scientific name:** *Stiphodon* sp.	
Historic and current status: Only known from the southern Mariana islands. The most abundant fish in almost all freshwater habitats on Guam. Has a marine larval stage. Must reach salt water during early life history.	
Threats: Introduced fish and plants, degradation of water quality.	
Habitat(s): Generally found on hard substrates, most common in medium to fast flowing water. Herbivorous, mainly feeds on algae attached to rocks and clay.	
Goal: To maintain current population status.	
Objectives: To control introduced predators, maintain water quality.	
Action plan: Assess current population structure and size: To maintain information on its status on Guam. Protect habitat: control sedimentation to protect hard substrates. Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
References: 1. Kami, H. T., I. T. Ikahara, and F. P. Deleon. 1968. Checklist of Guam Fishes. Micronesica 4 (1): 95-131.	

Common name: Redbellied Goby **Chamorro name:** atot **Scientific name:** *Sicyopus* sp.	No Photo Available
Historic and current status: Only known from the southern Mariana islands. Widespread, but relatively uncommon. Has a marine larval stage. Must reach salt water during early life history.	
Threats: Introduced species, degradation of water quality.	
Habitat(s): Generally found on hard substrates, most common in medium to fast flowing water. Omnivorous, feeds on small aquatic invertebrates as well as some algae.	
Goal: To maintain current population status.	
Objectives: To control introduced predators, maintain water quality.	
Action plan: Assess current population structure and size: To determine the current status of this species on Guam. Protect habitat: Control sedimentation to protect hard substrates. Ensure water quality is maintained and passage to the ocean is maintained to allow for life history to be successfully completed.	
Reference: 1. Best, B. R., and C. E. Davidson. 1981. Inventory and Atlas of the Inland Aquatic Ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory Technical Report 75.	

Common name: Marianas Goby **Chamorro name:** atot **Scientific name:** *Stenogobius* sp.	
Historic and current status: Discovered in 1994, it is only known from Guam. Widespread on Guam, and relatively common. Omnivorous, feeding on plant and animals it sifts from the sand. Has a marine larval stage. Must reach salt water during early life history. As very few endemics seem to fair well, because it is an endemic warrants its placement in SOGCN.	
Threats: Loss of habitat, degradation of water quality.	
Habitat(s): Lower reaches of rivers on soft sandy or muddy substrates.	
Goal: To maintain current population status.	
Objectives: To control loss of habitat, maintain water quality.	
Action plan: Assess current population structure and size: To determine the current status of this species on Guam. Protect habitat: To control loss of riparian vegetation to limit loss of substrate. Ensure water quality is maintained and passage to the ocean is maintained to allow for life history to be successfully completed.	
Reference: 1. New Record for Guam.	

Common name: Flagtail **Chamorro name:** umatan **Scientific name:** *Kuhlia rupestris*	
Historic and current status: Indigenous to the western and southern Pacific. Found in freshwater lentic habitats, it has a marine larval stage and must reach the salt water during its early life history.	
Threats: Introduced fish and diseases.	
Habitat(s): Rivers and streams across the western and southern Pacific.	
Goal: To maintain current population.	
Objectives: To protect from habitat loss and introduced competitors and diseases.	
Action plan: Assess current population structure and size: To determine the current status of this species on Guam. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
Reference: 1. Kami, H. T., I. T. Ikahara, and F. P. Deleon. 1968. Checklist of Guam Fishes. Micronesica 4 (1): 95-131.	

Common name: Giant Marbled Eel **Chamorro name:** hasule **Scientific name**: *Anguilla marmorata*	
Historic and current status: Widespread throughout the Indo-Pacific. They are common food species for many Pacific indigenous peoples. This species migrates to the ocean to spawn. The young eel then return to freshwater after an extended larval stage.	
Threats: Overfishing and habitat modification.	
Habitat(s): Tropical rivers and streams. Spawns in the western Pacific.	
Goal: maintain current population.	
Objectives: To protect from overfishing, maintain habitat to allow passage to spawning grounds.	
Action plan: Assess current population structure and size: To determine the current abundance and distribution on Guam. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
Reference: 1. Kami, H. T., I. T. Ikahara, and F. P. Deleon. 1968. Checklist of Guam Fishes. Micronesica 4 (1): 95-131.	

Freshwater Crustaceans

Common name: Atyid shrimp (at least 6 species) **Chamorro name:** uhang **Scientific name:** Atyidae	
Historic and current status: Common and widespread on Guam, especially in the upper reaches of rivers. Some genera prefer fast moving water, while others prefer slow moving back waters and pools. All species have a marine larval stage. Must reach salt water during early life history. These shrimp feed on algae and other benthic material.	
Threats: Introduced predators	
Habitat(s): Rocky and hard substrates in rivers throughout the Pacific.	
Goal: To maintain current population.	
Objectives: To maintain substrate and water quality.	
Action plan: Assess current population structure and size: To determine the current status of each of the species on Guam. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
References: 1. Leberer, T., and Y. Cai. 2003. Shrimps of the family Atyidae from Guam, Mariana Islands. Micronesica 35-36: 353-358. 2. Best, B. R., and C. E. Davidson. 1981. Inventory and atlas of the inland aquatic ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory Technical Report 75.	

Common name: Tahitian prawns (2 species) **Chamorro name:** uhang **Scientific name:** *Macrobrachium* spp.	
Historic and current status: Common to abundant in rivers on Guam, especially in upper reaches. Omnivores, feeding on detritus, plant and animal material. All species have a marine larval stage. Commonly trapped for food by local fishermen.	
Threats: Introduced predators, loss of habitat, over fishing and destructive fishing methods.	
Habitat(s): Practically all freshwater habitats on Guam.	
Goal: To maintain current population.	
Objectives: Maintain substrate and water quality.	
Action plan: Assess current population structure and size: To maintain current information on the status of this species on Guam. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
References: 1. Paulay, G., R. Kropp, P. K. L. Ng, and L. G. Eldridge. 2003. The Crustaceans and Pycnogonids of the Mariana Islands. Micronesica 35-36: 456-513. 2. Best, B. R., and C. E. Davidson. 1981. Inventory and atlas of the inland aquatic ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory, Technical Report 75.	

Common name: Freshwater crabs (> 3 species) **Chamorro name:** **Scientific name:** *Varunid* crabs	
Historic and current status: Common and widespread on Guam, especially in the upper reaches of rivers. Most found in fast moving waters on rocky or hard substrates. All species have a marine larval stage. Must reach salt water during early life history. These crabs feed on algae and other benthic material.	
Threats: Introduced predators, loss of water quality.	
Habitat(s): Rocky and hard substrates in rivers throughout the Pacific.	
Goal: To maintain current population.	
Objectives: Maintain substrate and water quality.	
Action plan: Assess current population structure and size: To determine the current status of this species on Guam. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
References:1. Paulay, G., R. Kropp, P. K. L. Ng, and L. G. Eldridge. 2003. The crustaceans and Pycnogonids of the Mariana Islands. Micronesica 35-36: 456-513. 2. Best, B. R., and C. E. Davidson. 1981. Inventory and atlas of the inland aquatic ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory Technical Report 75.	

Freshwater Gastropods

Common name: Nerite snails (12 species) **Chamorro name:** akaleha' **Scientific name:** *Neritidae*	
Historic and current status: Nerite snails are common and widespread on Guam, especially in the upper reaches of rivers. This snail has a marine larval stage. Must reach salt water during early life history. Feeds on algae and other benthic material.	
Threats: Introduced predators.	
Habitat(s): Rocky and hard substrates in rivers throughout the Pacific.	
Goal: To maintain current population.	
Objectives: To maintain substrate and water quality.	
Action plan: Assess current population structure and size: To determine the current size and distribution of the 12 species of snails. Protect habitat: Ensure water quality is maintained and passage to the ocean is maintained to allow for spawning to be successfully completed.	
References: 1. Smith, B. 2003. Prosobranch Gastropods of Guam Micronesica. 35-36: 244-270. 2. Best, B. R., and C. E. Davidson. 1981. Inventory and atlas of the inland aquatic ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory Technical Report 75.	

Common name: Thiarid snails (5 species)
Chamorro name: akaleha'
Scientific name: *Thiaridae*

Historic and current status: Some of the species of this snail are common to abundant in rivers on Guam, especially lower reaches. However, some species are very limited in distribution and abundance. The snails give birth to live young with no marine stage. The snails feed principally on detritus and organic debris.

Threats: Introduced predators, loss of habitat.

Habitat(s): Soft substrates in rivers and lakes.

Goal: To maintain current populations.

Objectives: To determine the distribution and abundance of the various species of snails. To maintain substrate and water quality of the river and lake environments.

Action plan: Assess current population structure and size: To survey the various rivers and lakes on Guam to determine the abundance and distribution of the various species of snails. Protect habitat: To protect the aquatic environment from land base pollution by the implementation of programs that minimize siltation of rivers and streams.

References:

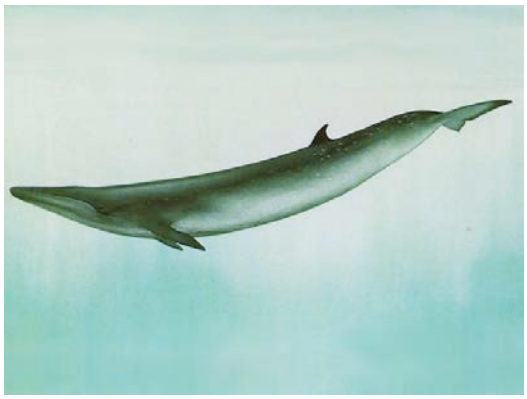
1. Smith, B. 2003. Prosobranch Gastropods of Guam. Micronesica 35-36: 244-270.
2. Best, B. R., and C. E. Davidson. 1981. Inventory and atlas of the inland aquatic ecosystems of the Marianas Archipelago. University of Guam Marine Laboratory Technical Report 75.

Freshwater Plants

Common name: Water Fern **Chamorro name:** **Scientific name:** *Ceratopteris thalictroides*	
Historic and current status: The native water fern is common in Fena Lake. Elsewhere, it is widespread, but nowhere common on Guam. This water may be an endemic species.	
Threats: Introduced predators and loss of habitat.	
Habitat(s): Slow moving or stagnant water, ponds, lakes.	
Goal: Identify species and maintain current population.	
Objectives: To protect from habitat loss and from predators. To determine the taxonomic status of this species.	
Action plan: Assess current population structure and size: To determine the status of this species. Protect habitat: Ensure habitat is kept free of invasive plants and animals.	
Reference: 1. Stemmerman, L. 1981. A guide to Pacific wetland plants. Army Corps of Engineers, Honolulu District.	

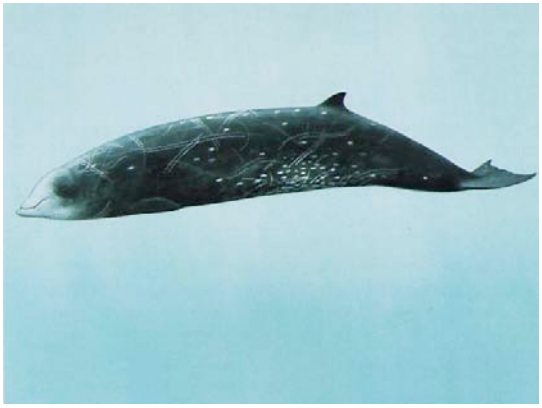
Common name: Pond Weed **Chamorro name**: chaiguan gadook **Scientific name**: *Potamogeton mariannense*	
Historic and current status: Chaiguan gaddok may be endemic to Guam. This species of pondweed is widespread, but nowhere common.	
Threats: Introduced plants and animals, loss of substrate	
Habitat(s): Usually found in slow moving stretches of rivers with soft sandy or muddy substrate.	
Goal: To preserve suitable habitat for this species.	
Objectives: Remove and/or control potential threats	
Action plan: Assess current population structure and size: To determine the status of this species. Protect habitat: Remove introduced predators, control loss of substrate.	
1. Stemmerman, L. 1981. A Guide to Pacific Wetland Plants. Army Corps of Engineers, Honolulu District.	

Marine Mammals

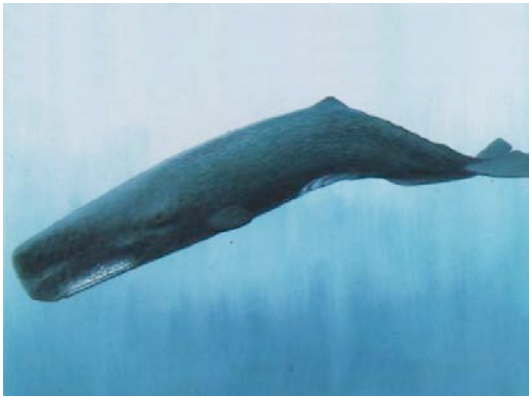
Common name: Bryde's Whale **Chamorro name:** bayena **Scientific name:** *Balaenoptera edeni*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix 1 of CITES; population information not available.	
Threats: Seismic operations; collision with large vessels; entanglement in fishing gear; defense operations; pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to bio-accumulation of toxic substances in body tissues; over-fishing of prey species, particularly commercial species such as anchovy.	
Habitat(s): Temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40°N and S, or the 20°isotherm.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36:653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Sei Whale **Chamorro name:** bayena **Scientific name:** *Balaenoptera borealis*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix 1 of CITES; population information not available.	
Threats: Seismic operations; collision with large vessels; entanglement in fishing gear; pollution, including increasing amounts of plastic debris at sea, oil spills, and dumping of industrial wastes into waterways and the sea, leading to bio-accumulation of toxic substances in body tissues, though less serious for species rarely feeding in low latitudes; over-harvest for scientific studies.	
Habitat(s): Oceanic, undertaking long migrations between warm water breeding grounds and colder water feeding grounds, between 40°N and S.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Humpback Whale **Chamorro name:** bayena **Scientific name:** *Megaptera novaeangliae*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix 1 of CITES; population information not available.	
Threats: Harassment from whale watching and research vessels/aircraft, pleasure craft, swimmers and divers; coastal seismic operations; defense operations; collision with large vessels; entanglement in fishing gear/shark nets; pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to bio-accumulation of toxic substances in body tissues, though less serious for species rarely feeding in low latitudes.	
Habitat(s): Antarctic pelagic, in summer; temperate–subtropical/tropical coastal in winter.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Cuvier's Beaked Whale **Chamorro name:** bayena **Scientific name:** *Ziphius cavirostris*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.	
Threats: Possible entanglement in drift-nets and other nets set, lost or discarded in international waters; competition from expanding commercial fisheries, especially on pelagic squids; pollution leading to accumulation of toxic substances in body tissues.	
Habitat(s): Tropical (ca 22–32°C) to sub-polar (ca 1–8°C) deep oceanic waters.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Sperm Whale
Chamorro name: bayena
Scientific name: *Physeter macrocephalus*



Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix I of CITES; population information not available.

Threats: Not Available

Habitat(s): Pelagic, offshore, in deep water; population centers found in temperate/tropical waters where breeding/nursing schools, and groups of young males, occur; concentrations found where seabed rises steeply from great depth (e.g. on 'steep-to' coasts and near oceanic islands, probably associated with concentrations of major food—deep-sea cephalopods—in areas of upwelling). Only adult males, usually solitary or in small loose groups, found in cold waters (i.e. north or south of ca 45°S).

Goal: To determine the importance of Guam's waters to the conservation of marine mammals.

Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.

Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.

References:

1. Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005.
2. Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660.
3. Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.

Common name: Dwarf Sperm Whale
Chamorro name: bayena
Scientific name: *Kogia sima*

Historic and current status: Protected under the Marine Mammal Protection Act (1972); not listed in either Appendix I or II of CITES; population information not available.

Threats: Seismic operations; collision with large vessels; entanglement in fishing gear; defense operations, pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to bio-accumulation of toxic substances in body tissues.

Habitat(s): Oceanic, apart from colder waters, but more coastal than pygmy sperm whale.

Goal: To determine the importance of Guam's waters to the conservation of marine mammals.

Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.

Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.

References:

1. Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005.
2. Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660.
3. Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.

Common name: Pygmy Sperm Whale
Chamorro name: bayena
Scientific name: *Kogia breviceps*

Historic and current status: Protected under the Marine Mammal Protection Act (1972); not listed in either Appendix I or II of CITES; population information not available.

Threats: Seismic operations; collision with large vessels; entanglement in fishing gear; pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to bio-accumulation of toxic substances in body tissues.

Habitat(s): Oceanic, apart from colder waters.

Goal: To determine the importance of Guam's waters to the conservation of marine mammals.

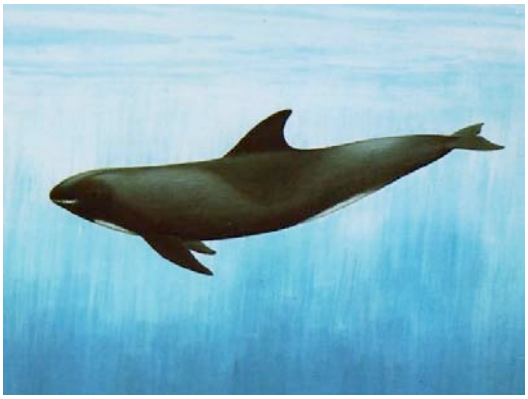
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.

Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.

References:

1. Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005.
2. Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660.
3. Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.

Common name: Melonheaded Whale
Chamorro name: bayena
Scientific name: *Peponocephala electra*



Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.

Threats: Possible illegal and incidental catches in gill-nets and small numbers taken in the purse-seine nets of the eastern tropical Pacific; captured in low numbers in small cetacean fisheries in several places, including Japan, Indonesia and Sri Lanka; entanglement in drift-nets and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues.

Habitat(s): Pelagic and oceanic. Primarily tropical and subtropical but can be found in temperate waters. Inhabits warm waters (usually >25°C), mainly equatorial. Generally in upwelling areas.

Goal: To determine the importance of Guam's waters to the conservation of marine mammals.

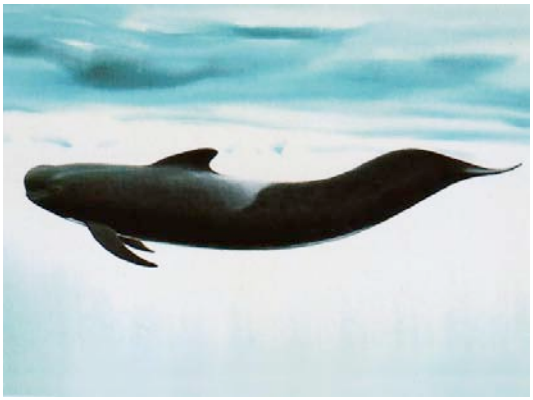
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.

Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.

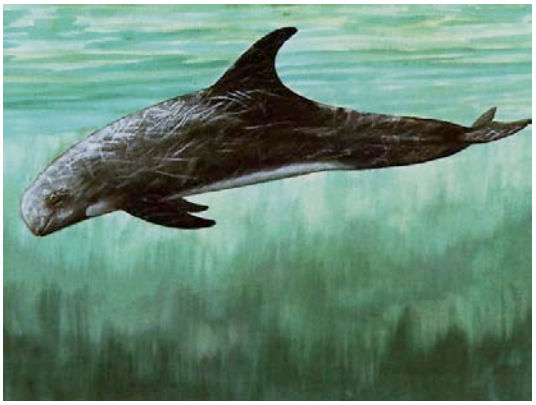
References:

1. Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005.
2. Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660.
3. Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.

Common name: Killer Whale **Chamorro name:** bayena **Scientific name:** *Orcinus orca*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.	
Threats: Is long-lived and a top predator, making it highly susceptible to accumulating high levels of heavy metals and organochlorines; reduction of food resources by overfishing of prey species; entanglement in drift-nets and in lost or discarded netting.	
Habitat(s): Oceanic, pelagic and neritic, in warm and cold waters; may be more common in cold, deep waters; often seen near seal colonies.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Shortfinned Pilot Whale **Chamorro name:** bayena **Scientific name:** *Globicephala macrorhynchus*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.	
Threats: Entanglement in drift-nets and other nets set, lost or discarded in international waters; competition from expanding commercial fisheries; pollution leading to accumulation of toxic substances in body tissues.	
Habitat(s): Tropical (ca 22–32°C) to temperate (ca 10–22°C) oceanic waters, approaching coastal seas.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Risso's Dolphin
Chamorro name: toninos
Scientific name: *Grampus griseus*



Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.

Threats: Possible illegal and incidental catches; captured in small numbers in directed fisheries in several parts of the world, including Indonesia and Solomon Islands; entanglement in drift-nets and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues.

Habitat(s): Tropical, subtropical, temperate and subantarctic waters; has been sighted both inshore and well offshore, although generally considered pelagic and oceanic; sea temperatures 15°–30°C; frequently seen over continental slope.

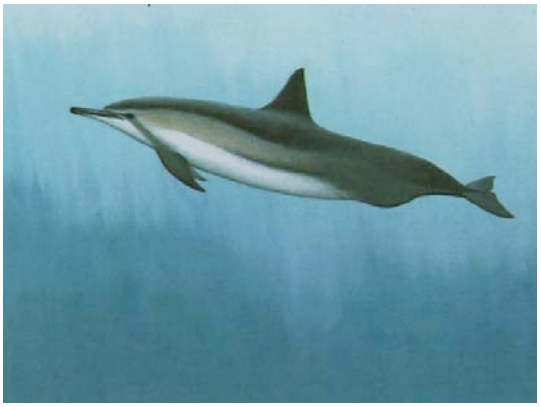
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.

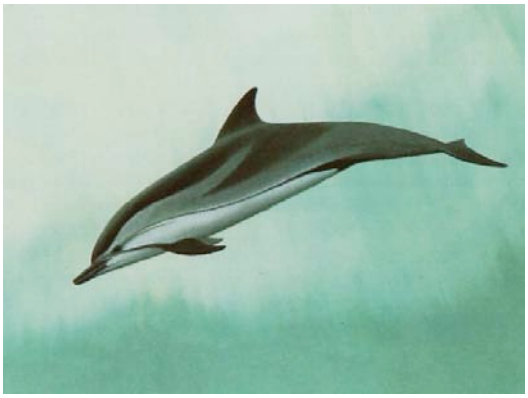
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.

Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.

References:

1. Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005.
2. Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660.
3. Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.

Common name: Spinner Dolphin **Chamorro name:** toninos **Scientific name:** *Stenella longirostris*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.	
Threats: Incidental catch in gill-net fishery and shrimp trawls; purse-seine netting in the eastern tropical Pacific; captured in small numbers in directed fishery in Solomon Islands; entanglement in drift-nets and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues.	
Habitat(s): Primarily pelagic but can be neritic in some regions; tropical, subtropical and occasionally temperate waters; associates with tuna, pantropical spotted dolphin and sea birds, under certain oceanographic conditions (i.e. well-defined, shallow, 100 m deep pelagic habitats in restricted areas).	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
References: **1.** Australia Department of Environment and Heritage. 2005. http://www.deh.gov.au/coasts/species/cetaceans/ accessed on 25 July, 2005. **2.** Eldredge, L. 2003b. The marine reptiles and mammals of Guam. Micronesica 35-36: 653-660. **3.** Rice, D. W. 1998. Marine mammals of the world: systematics and distribution. Society for Marine Mammalogy, Special Publication 4.	

Common name: Striped Dolphin **Chamorro name:** toninos **Scientific name:** *Stenella coeruleoalba*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); listed in Appendix II of CITES; population information not available.	
Threats: Incidental catch; direct and indirect catch in Sri Lanka and the Solomon Islands; large numbers taken by the Japanese drive fishery; entanglement in drift-nets and in lost or discarded netting; pollution (including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea) leading to bio-accumulation of toxic substances in body tissues.	
Habitat(s): Pelagic. Deep water and outer edge of continental slope. Tropical, subtropical and warm temperate waters. Possible vagrants recorded in colder waters.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
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Common name: Dugong **Chamorro name:** **Scientific name:** *Dugong dugon*	
Historic and current status: Protected under the Marine Mammal Protection Act (1972); population information not available.	
Threats: Habitat loss; direct take; collisions with small vessels in shallow water.	
Habitat(s): Shallow, tropical waters throughout the Indo-Pacific region; feed primarily in seagrass beds. Most of the world's population of dugongs is now found in northern Australian waters between Shark Bay in Western Australia and Moreton Bay in Queensland.	
Goal: To determine the importance of Guam's waters to the conservation of marine mammals.	
Objectives: To survey annually Guam's waters to determine the abundance and distribution of the various species of marine mammals and make appropriate management recommendations.	
Action plan: To conduct quarterly aerial surveys around Guam's waters to determine the abundance and distribution of the marine mammal species found around Guam's waters.	
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Marine Fishes

Common name: Humphead Wrasse or Napolean Wrasse **Chamorro name:** tanguisson[1] **Scientific name:** *Cheilinus undulatus*	
Historic and current status: Heavily fished by SCUBA equipped spear fishermen. Adults are rarely seen. Juveniles are more frequently seen, especially in the marine preserves.	
Threats: Human take of adults and juveniles, habitat degradation	
Habitat(s): Adults inhabit outer reef slopes and channel slopes. Juveniles occur in coral-rich areas of lagoon reefs, particularly among thickets of staghorn Acropora thickets[2]. Juveniles are found in Cocos Lagoon, Tumon Bay Marine Preserve, and Piti Bomb Holes Preserve (DAWR unpublished data, M. Tupper UOGML pers. com.)	
Goal: Sustain population to facilitate de-listing from CITES and to prevent listing on Endangered Species List.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica. 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Bumphead Parrotfish
Chamorro name: atuhong[1]
Scientific name: *Bolbometopon muricatum*

Historic and current status: Stocks have steadily declined in Guam. Sightings are rare.

Threats: This species feeds substantially on live coral and requires healthy reef habitat for survival and is threatened by the loss of this habitat. Due to its habit of sleeping in schools it is also vulnerable to commercial spear-fishing.

Habitat(s): Clear outer lagoon and seaward reefs at depths of 1 to at least 30m. In unfished areas it may enter outer reef flats at low tide.[2]

Goal: To recover population to historic levels.

Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: Provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.

References:

1. Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118.
2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Common name: Surgeonfish
Chamorro name: hugupau, tataga, guasa', hangon, guagnas, hiyuk, kichu[1]
Scientific name: Acanthuridae

Historic and current status: Popular food fish, this family is heavily fished using a number of techniques including gill nets and spearfishing.

Threats: Overfishing, loss of habitat

Habitat(s): Varied, adults generally in lagoons and seaward reefs. Juveniles often in protected, turbid, inshore waters.[2]

Goal: To manage populations for sustainable fishing.

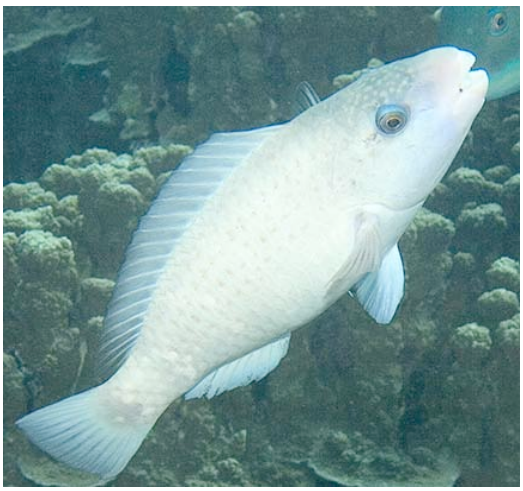
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.

References:

1. Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118.
2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Common name: Parrotfish
Chamorro name: laggua, palaksi[1]
Scientific name: Scaridae



Historic and current status: Popular food fish, this family is heavily fished using a number of techniques including gill nets, spearfishing.

Threats: Overfishing, loss of habitat

Habitat(s): Varied, adults generally in lagoons and seaward reefs although some occur exclusively in reef flat and shallow lagoon areas dominated by seagrass or dense algae beds. Juveniles often in protected, inshore waters including reef flats and lagoons, but may also be found on seaward reefs.[2]

Goal: To manage populations for sustainable fishing.

Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.

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2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Common name: Emperors
Chamorro name: mafute, lililuk[1]
Scientific name: Lethrinidae

Historic and current status: Popular food fish, this family is heavily fished using a number of techniques including gill nets, spearfishing, hook and line.

Threats: Overfishing, loss of habitat

Habitat(s): Varied, adults generally in lagoons and seaward reefs although some occur as well as reef flat and shallow lagoon areas, including seagrass, mangroves, and shallow sandy areas. Juveniles often in protected, inshore waters including reef flats and lagoons, but may also be found on seaward reefs.[2]

Goal: To manage populations for sustainable fishing.

Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.

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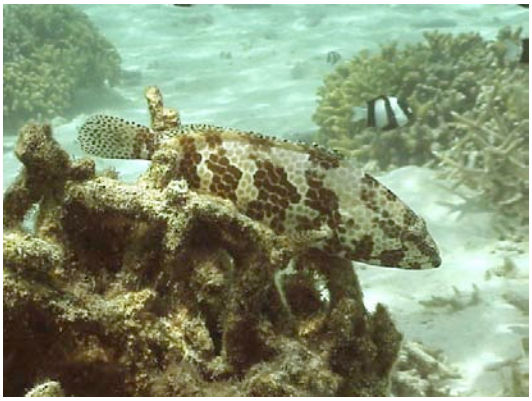
2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Common name: Groupers **Chamorro name:** gadao, gadao pentu, gadao maluslus, gadao matingon, gadao mama'te, gadao alutong finu[1] **Scientific name:** Serranidae	
Historic and current status: Popular food fish, this family is heavily fished using a number of techniques including gill nets, spearfishing, hook and line.	
Threats: Overfishing, loss of habitat	
Habitat(s): Varied, adults generally in lagoons and seaward reefs although some occur as well as reef flat and shallow lagoon areas, including seagrass, mangroves, and shallow sandy areas. Juveniles often in protected, inshore waters including reef flats and lagoons, but may also be found on seaward reefs.[2]	
Goal: To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: Toprovide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
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Common name: Rabbitfish **Chamorro names:** sesjun, manahak, manahak ha 'tang, manahac lesu, hiting fade[1] **Scientific name:** Siganidae	
Historic and current status: Popular food fish, this family is heavily fished using a number of techniques including talaya, hook and line, gill net, and spear	
Threats: Overfishing, loss of habitat	
Habitat(s): Reef flats, lagoons and bays, and fore reefs.[2]	
Goal: To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Snappers **Chamorro names: t**agafi, fafaet, funai, kakaka, bua, matanhagon, lagu[1] **Scientific name:** Lutjanidae	
Historic and current status: Popular food fish taken with hook and line, spear, and gillnet. Some species are shunned due to chronic incidence of ciguatera toxin.	
Threats: Overfishing, loss of habitat	
Habitat(s): Varied, adults generally in lagoons and seaward reefs although some occur as well as reef flat and shallow lagoon areas, including seagrass, mangroves, and shallow sandy areas. Some species are the principal fisheries species taken from deep reefs (>500 ft). Juveniles often in protected, inshore waters including reef flats and lagoons. Some species are frequently found in brackish or freshwater habitats.[2]	
Goal: To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Goatfish **Chamorro name:** sakmoneti, tiao, sakmoneten acho', sakmoneten amariyu, sakmoneten lasu lahi, sakmoneten le'ao[1] **Scientific name:** Mullidae	
Historic and current status: Popular food fish. Juveniles recruit in large schools, and form a culturally important fishery. Juveniles are taken with tekin (gill net), and talaya (throw net), while adults are more frequently taken with hook and line or spear. In terms of total weight, the fourth most important family of inshore fishes taken during 2003.	
Threats: Overfishing, loss of habitat	
Habitat(s): Juveniles are found in reef flats and bays, usually over sandy substrate. Adults may be found on reef flats, as well as seaward reefs, up to 300 feet deep.[2]	
Goal: To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Butterflyfish **Chamorro name:** ababang, ababang lonnat, ababang rayao, ababang pintado[1] **Scientific name:** Chaetodontidae	
Historic and current status: Not traditionally taken as a food fish by Chamorro population. Sometimes taken for food by people from other islands. Butterflyfish are some of the most popular species taken for the home aquarium trade, although many species do poorly in captivity.	
Threats: Overfishing by the aquarium trade, loss of habitat	
Habitat(s): Many species are closely associated with coral reefs. Most are found on reef flats or seaward reef slopes. Some species are obligate coral feeders, and as such, are indicators of a reef's health. Some species are found on deep reefs (> 200 feet).[2]	
Goal: To manage and maintain current population status.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: develop educational materials, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Angelfish **Chamorro name:** ababang[1] **Scientific name:** Pomacanthidae	
Historic and current status: Not traditionally taken as a food fish by Chamorro population. Sometimes taken for food by people from other islands. Angelfish are some of the most popular species taken for the home aquarium trade, although many species do poorly in captivity.	
Threats: Overfishing by the aquarium trade, loss of habitat	
Habitat(s): This family inhabits reef flats, clear lagoons, seaward reef slopes, and channels. Some species are found on deep reefs. [2]	
Goal: To manage and maintain current population status.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: to provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: develop educational materials, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Hawkfish
Chamorro name: aluda[1]
Scientific name: Cirrhitidae

Historic and current status: The stocky hawkfish (*Cirrhitus pinnulatus*) is often fished for food. Other species are taken incidentally by hook and line, but for the most part this is not a targeted family. Some species are very popular in the home aquarium trade, and are at risk of over collection.

Threats: Overfishing (C. pinnulatus), aquarium collection, loss of habitat. Collection of these species for the aquarium trade often leads to the destruction of the corals they inhabit.

Habitat(s): Hawkfish are closely associated with coral reefs. Members of this family inhabit lagoons, reef fronts, submarine terraces, and seaward reefs up to at least 100m. Some species within this family are found exclusively with certain coral species such as antler coral (*Pocillopora eydouxi*) and *Acropora* species.[2]

Goal: To manage and maintain current population status.

Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

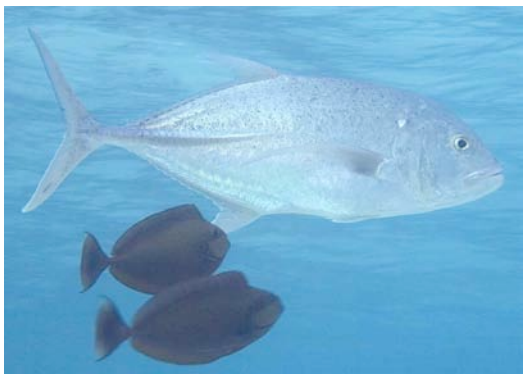
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials, include in fisheries management plans.

References:

1. Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118.
2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Common name: Wrasses **Chamorro name:** palaksi, a'aga, lalacha' mamate[1] **Scientific name:** Labridae	
Historic and current status: Wrasses are popular food fish on Guam. They are frequently taken on hook and line, with tekin (gill nets), and with spear. Wrasses are carnivores, feeding on reef invertebrates and smaller fishes.	
Threats: Overfishing, loss of habitat	
Habitat(s): Wrasses are found in almost all coral reef habitats, from seagrass beds to sandy reef flats, to seaward reef slopes and deep reefs (> 500 feet). In some habitats, wrasses are among the most abundant species found.	
Goal: To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: develop educational materials, include in fisheries management plans.	
References: **1.** Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118. **2.** Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.	

Common name: Jacks and Trevallies
Chamorro name: i'e, tarakitu, mamulan[1]
Scientific name: Carangidae



Historic and current status: Popular food fish. Juveniles recruit in large schools, and form a culturally important fishery. Juveniles are taken with hook and line and talaya (throw net), while adults are more frequently taken with hook and line or spear. In terms of total weight, the second most important family of inshore fishes taken during 2003.

Threats: Overfishing, loss of habitat

Habitat(s): Juveniles are found on reef flats or around floating objects such as buoys and floating debris. Adults are found on reef flats and seaward reefs to a depth of at least 300 feet.[2]

Goal: To manage populations for sustainable fishing.

Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.

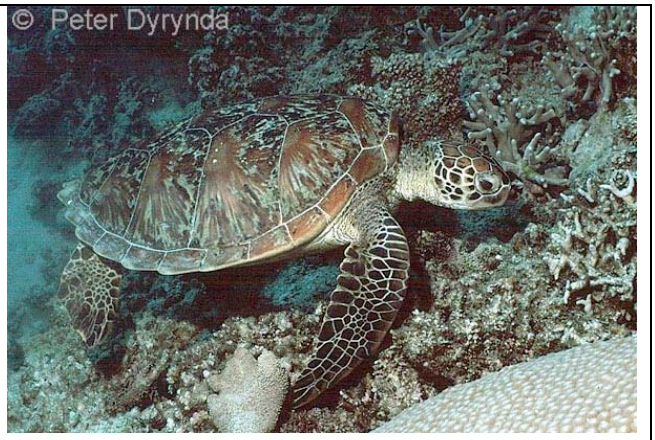
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: develop educational materials highlighting slow growth rate, include in fisheries management plans.

References:

1. Kerr, A. M. 1990. Chamorro fish names. Micronesica 23: 93-118.
2. Myers, R. F. 1999. Micronesian reef fishes: A practical guide to the identification of the Inshore Marine Fishes of the Tropical Central and Western Pacific, 3rd edition. Coral Graphics: Barrigada, Guam.

Marine Reptiles

Common name: Green Sea Turtle
Chamorro name: haggan
Scientific name: *Chelonia mydas*



Historic and current status: The green turtle is the most common sea turtle species found in the waters of Guam[1]. It is listed both federally and locally as threatened. They are recorded throughout the year, but groups of individuals are often seen in Manell Channel and Cocos Lagoon, particularly during December to February and May to June[2]. Nesting season normally occurs from April to July, but recent nesting activity suggests the possibility of two nesting seasons on Guam. Important nesting sites on Guam include the Northwestern coastline from Falcona Beach to Tarague, and Cocos Island.

Threats: Predation on eggs and hatchlings by introduced species, human take of eggs and adults (mainly for food), loss of habitat, taken as by-catch, oil spills, marine debris.

Habitat(s): Adult green turtles feed primarily on sea grass and algae. They can be seen throughout the island, in all marine habitats.

Goal: Restore population to a sustainable level and remove from Guam and US Endangered Species Lists.

Objectives: Assess current population structure and size, protect habitat, reduce illegal take through outreach and education.

Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for sea turtles in and about Guam; survey Guam's beaches for sea turtle nesting activity throughout the nesting period. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions; include sea turtle nesting and foraging habitat under the highest level of protection in the Guam Seashore Reserve Plan; include sea turtle nesting and foraging habitat on Environmental Sensitivity Index (ESI) maps. Reduce illegal take through outreach and education: To develop a volunteer program to monitor nesting activity, create educational materials, and conduct presentations for school and community groups.

Reference:

1. Kolinski, S. P. 2005. Sea Turtle Abundance at Isolated Reefs of the Mariana Archipelago. Micronesica 37(2): 287-296
2. NMFS-USFWS [National Marine Fisheries Service-U. S. Fish and Wildlife Service]. 1998a. Recovery plan for U.S. Pacific populations of the green turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD.

Common name: Hawksbill turtle
Chamorro name: haggan karai
Scientific name: *Eretmochelys imbricata*

Historic and current status: Hawksbill turtles are less common in the waters of Guam[1]. They are listed both federally and locally as endangered. The first hawksbill turtle nest was not reported on Guam until November 1991[2].

Threats: Predation on eggs and hatchlings by introduced species, human take of eggs and adults (for food and shells), loss of habitat, taken as by-catch, oil spills, marine debris[1].

Habitat(s): Hawksbill turtles feed primarily on sponges. They can be seen in all nearshore habitat types[1]. Apra Harbor is an important foraging area.

Goal: Restore population to a sustainable level and remove from Guam and US Endangered Species Lists.

Objectives: Assess current population structure and size, protect habitat, reduce illegal take through outreach and education.

Action plan: Assess current population structure and size: collect baseline population size, demography (age and sex), genetic, and distribution information for sea turtles in and about Guam; survey Guam's beaches for sea turtle nesting activity throughout the nesting period. Protect habitat: provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions; include sea turtle nesting and foraging habitat under the highest level of protection in the Guam Seashore Reserve Plan; include sea turtle nesting and foraging habitat on Environmental Sensitivity Index (ESI) maps. Reduce illegal take through outreach and education: develop a volunteer program to monitor nesting activity, create educational materials, and conduct presentations for school and community groups.

Reference:

1. Kolinski, S. P. 2005. Sea Turtle Abundance at Isolated Reefs of the Mariana Archipelago. Micronesica 37(2): 287-296
2. NMFS-USFWS. 1998b. Recovery plan for U.S. Pacific populations of the hawksbill turtle (*Eretmochelys imbricata*). National Marine Fisheries Service, Silver Spring, MD.

Marine Arthropods

Common name: Spiny Lobster **Chamorro name**: mahonggang **Scientific name:** *Paniluris* sp.	
Historic and current status: This species is harvested for food. In 2003, it was the top ranked crustacean harvested with over 2,200 kg (4,800 lbs) collected[1].	
Threats: Overfishing, loss of habitat.	
Habitat(s): Surf zone, reef front, may feed in reef flats.	
Goal: : To manage populations for sustainable fishing.	
Objectives: Assess current population structure and size, protect habitat, manage take through outreach and education.	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
References: 1. Gutierrez, J. T. 2003. Fisheries participation, effort, and harvest surveys. Government of Guam, Department of Agriculture, Division of Aquatic and Wildlife Resources, Annual Report.	

Marine Bivalves

Common name: Giant Clam **Chamorro name:** hima **Scientific name:** *Tridacna derasa*	
Historic and current status: Giant clams have been collected for their meat as well as their shells[1]. The shells are carved into traditional jewelry. Tridacna clams are listed on CITES appendix II. International trade in the meat or shells is prohibited. Tridacna are regulated under Guam law. Only clams with a shell width greater than 7 inches can be harvested.	
Threats: Overfishing[2], loss of habitat	
Habitat(s): Reef flats and seaward reefs to a depth of at least 60 feet[2].	
Goal: Sustain population to facilitate de-listing from CITES and to prevent listing on Endangered Species List.	
Objectives: To manage and increase population to allow sustainable fishing	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
Reference: **1.** Flores Jr., T. 1995. Giant Clam Transplantation. pp. 57-59. *In* Guam Department of Agriculture, Division of Aquatic and Wildlife Resources, Annual Report Fiscal year 1990, 124 pp. **2.** Flores Jr., T. 1996. Giant Clam Transplantation. pp. 77-79. *In* Guam Department of Agriculture, Division of Aquatic and Wildlife Resources, Annual Report Fiscal year 1996, 136 pp.	

Common name: Giant Clam **Chamorro name:** hima **Scientific name:** *Tridacna maxima* *Tridacna squamosa* *Hippopus hippopus*	
Historic and current status: Giant clams have been collected for their meat as well as their shells. The shells are carved into traditional jewelry. Tridacna clams are listed on CITES Appendix II. International trade in the meat or shells is prohibited. Tridacna are regulated under Guam law. Only clams with a shell width greater than 7 inches can be harvested.	
Threats: Overfishing, loss of habitat	
Habitat(s): Reef flats and seaward reefs to a depth of at least 60 feet.	
Goal: Sustain population to de-listing from CITES and to prevent listing on Endangered Species List.	
Objectives: To manage and increase population to allow sustainable fishing	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
Reference: **1.** Paulay, G. 2003. The Bivalvia (Mollusca) of Guam. Micronesica 35-36: 218-243. **2.** Myers, R. F. 1990. Giant Clam Transplantation. pp.89-91. *In* Department of Agriculture, Division of Aquatic and Wildlife Resources, Annual Report Fiscal year 1990, 176pp.	

Marine Gastropods

Common name: Triton's Trumpet **Chamorro name:** **Scientific name:** *Charonia tritonis*	
Historic and current status: The Triton's Trumpet (*Charonia tritonis*) is a large snail, with an attractive shell highly prized by shell collectors. In areas of dense human population, these animals are quite rare[1]. In some areas, these snails are collected as a food item, and the shells may be used as horns by some island people, but more frequently they are taken for decorative purposes (C. Jones, pers. comm. 2005*)*. Triton's trumpet feed on echinoderms, and indeed is one of the few natural predators of the Crown of Thorns sea star[1]. Triton's Trumpet has recently been listed in CITES Appendix II as a species of concern, thus international trade in this species is restricted.	
Threats: Overfishing, loss of habitat	
Habitat(s): Areas of rich coral growth	
Goal: Sustain population and to prevent listing on Endangered Species List.	
Objectives: To manage and increase population to allow sustainable fishing	
Action plan: Assess current population structure and size: To collect baseline population size, demography (age and sex), genetic, and distribution information for Guam's stocks. Protect habitat: To provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To develop educational materials highlighting slow growth rate, include in fisheries management plans.	
Reference: **1.** Smith, B. D. 2003. Prosobranch gastropods of Guam. Micronesica 35-36: 244-270.	

Anthozoans (Corals)

Common name: Hard Coral **Chamorro name:** cho'cho' **Scientific name:** Scleractinia	

Historic and current status: Many of Guam's reefs have declined in health over the past 40 years. The average live coral cover on the fore reef slopes was approximately 50% in the 1960s[3], but by the 1990s had dwindled to less than 25% live coral cover with only a few having over 50% live cover[2]. Still, in the past, Guam's reefs have recovered after drastic declines. A more distressing indicator of the health of Guam's coral reefs is the marked decrease in rates of coral recruitment. In 1979, 0.53 coral recruits were observed per plexiglass fouling panel[1]. The use of similar materials and experimental design in 1989 and 1992 resulted in just 0.004 and 0.009 coral recruits per plexiglass fouling plates, respectively[2].

Threats: Land based sources of pollution (sedimentation, pollution), recreational misuse, climate change, disease.

Habitat(s): Highly variable, mangrove swamps, estuaries, and reef flats to up to 100m deep.

Goal: To maintain or expand Guam's hard coral resources.

Objectives: Take action to limit impacts to coral resources and conduct assessments and monitoring of hard coral resources in Guam's waters.

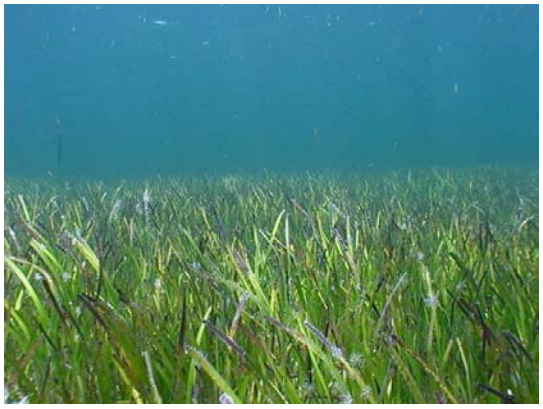
Action plan: Assess current population structure and size: conduct *in situ* surveys of Guam's coral resources including percent cover, species composition, rugosity, disease. Protect habitat: restore vegetation within watersheds draining into coastal bays with significant coral resources, create, and monitor water quality. Provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: To educate local residents on need for re-vegetation, raise public awareness of the impacts of wildland arson, and educate divers.

References:

1. Birkeland, C. 1997. Status of coral reefs in the Marianas. pp. 91-100. In: Dollar, R., and C. Birkeland. (eds.) Status of coral reefs in the Pacific. Hawaii: Sea Grant College Program, School of Ocean and Earth Science and Technology, University of Hawaii.
2. Birkeland, C., D. Rowley, and R. H. Randall. 1982. Coral recruitment patterns at Guam. pp. 2: 339-344. In: Proceedings of the Fourth International Coral Reef Symposium, Manila.
3. Randall, R. H. 1971. Tanguisson-Tumon, Guam coral reefs before, during and after the crown-of-thorns starfish (*Acanthaster*) predation. M.S. Thesis for the University of Guam, Department of Biology.

Common name: Soft Coral **Chamorro name:** **Scientific name:** Subclass Octocorallia	
Historic and current status: Populations expanded in some areas in the last thirty years, but seem to be declining at present. These corals serve as important habitat for a number of marine invertebrates.	
Threats: Land based sources of pollution (sedimentation, chemicals), climate change, destruction by shell collectors, disease.	
Habitat(s): Habitats vary greatly from reef flats to over 100m (330 ft.). Many are filter feeders and prefer areas with strong currents.	
Goal: To maintain or expand Guam's soft coral resources.	
Objectives: Take action to limit impacts to coral resources and conduct assessments and monitoring of soft coral resources in Guam's waters.	
Action plan: Assess current population structure and size: conduct in situ surveys of Guam's coral resources including percent cover, species composition, and disease. Protect habitat: restore vegetation within watersheds draining into coastal bays with significant coral resources, create, and monitor water quality. Provide for adequate protection of habitat in ACOE and Guam Seashore Clearance permit conditions. Reduce take through outreach and education: educate local residents on need for re-vegetation, raise public awareness of the impacts of wildland arson, and educate divers.	
References: 1. Colin, P. L., and C. Arneson. 1995. Tropical Pacific Invertebrates. Coral Reef Press, Beverly Hills, California.	

Marine Plants

Common name: Sea Grasses **Chamorro name:** lo'u **Scientific name:** *Halodule uninervis*, *Enhalus acoroides*, *Halophila minor*	
Historic and current status: Seagrass beds are widespread throughout Guam's reef flats. While past estimates are unavailable, it is believed that seagrass resources have declined due to modifications of Guam's reef flat environments such as dredging and sedimentation. More recently, trampling by divers has become a serious issue in the seagrass beds in Piti Bay. According to the most recent satellite image analysis conducted by NOAA, seagrass covers approximately 3 km^2 of the nearshore reef environment.[1]	
Threats: Sedimentation, habitat alteration, recreational impacts.	
Habitat(s): Shallow reef flats of nearshore reefs.	
Goal: To maintain or expand Guam's seagrass resources.	
Objectives: Conduct assessments of seagrass density and extent in Guam's nearshore waters.	
Action plan: Assess current population structure and size: To conduct on the ground surveys of Guam's seagrass resources including species composition, density, and extent. Protect habitat: restore vegetation within watersheds draining into coastal bays with significant seagrass resources, create walkways through significant seagrass resources. Reduce take through outreach and education: To educate local residents on need for re-vegetation, raise public awareness of the impacts of wildland arson, educate divers about seagrass bed's importance to fisheries.	
References: 1. NOAA National Centers for Coastal Ocean Science (NCCOS). 2005. Atlas of the shallow-water benthic habitats of American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. NOAA Technical Memorandum NOS NCCOS 8, Biogeography Team. Silver Spring, MD.	

CHAPTER 4: Conservation Actions (Element 4)

Conservation actions fall under several categories including legal protection of conservation lands and interagency agreements, restoration of conservation lands to a state useful for native animals, removal or at least control of limiting factors, public education and compatible public use of these areas, and law enforcement, especially for species historical (and currently) harvested for food. Included in these actions is the need to implement or maintain captive breeding efforts while areas are prepared for reintroduction of native species. Each conservation action considered was given a Priority 1, 2, 3. Priority 1 is highest and 3 being least. In setting these priorities, all actions should at sometime reach Priority 1. However, timing of these priorities is such that essentially, depending on the stage of the conservation effort, their priority may be lower than expected. Specific conservation actions are indicated separately in each of the species mentioned (Chapter 3). Terrestrial conservation actions are illustrated in Figure 24 [this chapter].

Terrestrial

Legal Protection for Habitats and Wildlife

Guam has several local laws providing protection for native flora and fauna. The Department has the authority to enforce and submit changes for adjudication the laws that govern Game, Forestry, and Conservation (5 GCA, Chapter 63, PL-6-85). In addition to ensuring the authority to enforce these laws, Guam code also provides a list of species that are to be protected (5 GCA, §63121 and §63101-63117). The Endangered Species Act, 5 GCA, §63208 allows for the adjudication of an endangered species list for Guam. The responsibility to promulgate the Endangered Species list falls to the Department who then provides the list to the Attorney General of Guam and the Legislature for adjudication.

In an effort to provide maximum legal protection for the habitats for preserving and enhancing the recovery and/or restoration of wildlife to Guam (Priority 1), the following objectives will be implemented:

- To develop cooperative agreements with USFWS, AAFB-USAF, and Navy to include federal and Guam Conservation Lands as part of the Guam Wildlife Refuge Overlay. Develop cooperative agreements for management, research and protection of endangered species and species of greatest conservation. Priority 1.

- To develop Safe Harbor Agreements with private landowners in other areas adjacent to Conservation Land where wildlife may benefit. Priority 3.

- To determine boundary lines for all the Conservation Lands, and to further pursue the possibility of incorporating previously proposed conservation areas. Priority 2

- To develop Memorandum of Understanding with the CNMI to facilitate the conservation restoration measures of shared (historically) fauna and plants. Priority 1

Habitat Assessment and Rehabilitation
Guam is approximately 48% forested but there are few large areas of uniform vegetation (Donnegan 2002, and Fosberg 1998). The need to assess the state of habitats throughout the island is vital to the rehabilitation of these areas before any reintroductions of native fauna can be done. This assessment will be done in conjunction with predator and ungulate control. The following objectives will be pursued to assess the current state of the habitat, develop and implement plans to take appropriation actions to improve the habitat, or else maintain habitat as native forestland:

- To develop plans to improve habitats in conservation areas, to include reforestation, fire prevention, and control of invasive plants. Assist the Forestry and Soil Resources Division in developing forest recovery plans to include reforestation programs for Guam's Conservation Lands to include the control and removal of invasive, noxious plant species, replanting of native species, and protection of these areas with firebreaks. Priority 1

- To determine the status of plants listed as a SOGCN. Priority 1

- To improve man-made habitat at Masso reservoir for the Mariana common moorhen, and other wetland species. Priority 3

- To protect of native trees and plants from human destruction. Priority 3

- To develop regulations controlling the harvest of medicinal plants and wood within the Conservation Lands. Priority 3

Captive Breeding and Translocation
Captive breeding and translocation are and will always be an essential management tool for natural resource managers who work with small populations. Currently, GDAWR captive propagates two species of birds, the Guam rail and Micronesian kingfisher. The facility also holds and hand-rears Mariana crows collected as eggs and chicks from the wild on Guam and Rota. The GDAWR facility can house and support 144 rails, 10 crows, and 16 kingfishers. The Department envisions the creation a new larger facility that would support conservation efforts on Guam and throughout Micronesia. Guam has the infrastructure that would support such a facility and could be the "hub" of Micronesia for captive propagation.

Most of Guam's SOGCN would benefit from a large facility which would have facilities for mammals, birds, reptiles, gastropods and other invertebrates that may be in need of captive propagation. The progeny from captive breeding efforts would be released back into the wild. In addition to the benefits for Guam's SOGCN, the new facility could serve the region as a refuge and breeding center for all terrestrial species in peril throughout Micronesia.

The beginning and/or continuation of captive breeding (propagation) and translocation efforts of regional endemics and indigenous species for Guam and Micronesia will be addressed by the following objectives:

- Construct a new captive propagation facility on Guam by 2010 that would serve the needs of Guam's SOGCN and Micronesia. Priority 1

- Determine the need to captive breed other SOGCN. Implement captive propagation of endemic species of animals and plants for release into the wild, continue captive breeding of Guam rails and Micronesian kingfishers, and hand-rearing efforts for the Mariana crow. Priority 1

- Protection of plants in the wild from insect infestation and other maladies. Priority 1

- To determine the feasibility of translocation of shared SOGCN from the CNMI. Priority 2

- To provide an adequate number of SOGCN plants for planting in Conservation Areas. Collect seeds and seedlings from the wild for transplantation to Conservation Areas. Priority 2

Control of Limiting Factors

Snake barriers (Aguon et al. 1999 and 2002, Campbell 1999, Perry et al. 1998, and Rodda et al. 1999a) and perimeter trapping have been demonstrated to be effective in removing snakes in areas larger than 1-hectare (Engeman and Linnell 1998, Engeman et. al. 1998). A combination of both techniques may be employed considering the uneven substrate characteristic of much of Guam's northern limestone forest. As birds settle into territories and begin to breed, electrical barriers then can be used to protect their nests.

Guam DAWR, US Department of Agriculture, Wildlife Services, US Geological Survey, Biological Research Division, and several other government and private investigators made advances in the use of traps and barriers to control of brown treesnakes. Area-wide snake control, using both removal and exclusion methodologies was tested at Area 50 Northwest Field and demonstrated the possibility for successfully reintroducing Guam rails and other native forest birds in the near future. Such reintroduction efforts utilized methods originally developed for introduction of rails on Rota. Feral cat control remains a major obstacle to the establishment of a small population of rails. Given the significant advances in brown treesnake control, it is appropriate to continue activities toward the recovery of the Guam rail and establishment of a population in the wild on Guam.

Methods for eradicating snakes from remote locations in the wild need to be applied to protect swiftlet colony sites, such as Mahlac Cave, from snake predation. Currently, snake traps using a live mouse as an attractant, are used to reduce snake abundance around island swiftlet caves. This method is labor intensive, especially when applied at remote sites. More cost-effective techniques need to be developed.

The endemic Guam Micronesian kingfisher can also benefit from large scale snake control. Application of barriers and area-wide snake removal will assist in efforts to repatriate kingfishers back into the wild. Releases of other indigenous birds no longer found Guam and still found in the Marianas Islands may follow as large areas are controlled for snakes. The following objectives will be pursued to control limiting factors affecting SOGCN:

- To control brown treesnake abundance in Conservation Areas and selected sites for release of SOGCN species. Guam DAWR, USDA-WS, NWRC, and USGS-BRD will determine what appropriate snake control measures may be used for each of the areas. In addition, predator control measures will include the control of dogs, cats, and rodents. Priority 1

- To develop and implement a program for reducing abundance of ungulates in the conservation areas. Priority 1

- To establish snake control around caves for the reintroduction of vertebrates including island swiftlet and Pacific sheath-tailed bat. Priority 2

- To develop plans to combat the impacts of invasive species and to prevent the introduction of new invasive species. Priority 2

Reintroduction and Restoration of SOGCN to Designated Habitats
The reintroduction and restoration of SOGCN to designated habitats is the ultimate goal of all the management and conservation efforts put forth in the GCWCS. The following objectives will be implemented for particular species and for all SOGCN:

- To inventory conservation areas for caves and identify other potential cave sites for brown treesnake control and translocation of *A. vanikorensis bartchi* and *E. semicaudata rotensis*. Priority 2

- To determine the status of wildlife in each of the conservation areas. Inventory fauna within each conservation area including: birds, mammals, reptiles, and insects. Priority 2

- To reintroduce native wildlife identified as SOGCN into conservation lands, GNWRO and other areas (i.e., Safe Harbors). Priority 2

Aquatic
Early aquatic management efforts by GDAWR were influenced by the USFWS and equivalent temperate zone state fish and wildlife agencies, focusing on individual species or groups of species that were important fishery resources. In the 1970s, GDAWR management decisions reflected the views and values of the times and GDAWR was responsible for a number of introductions of non-native freshwater organisms for aquaculture and sport fishing. However, beginning in the mid-1980s, due in part to an estimated 70% decline in catch per unit effort of inshore coral reef fish over a 15-year

period, the aquatics section began to shift its focus. In the mid-1990s, GDAWR resurrected the freshwater program, shifting from a focus on aquaculture and sport fish introductions to monitoring representative watersheds. During this time, GDAWR also took its first step in ecosystem based management of marine fisheries resources by creating the territories five marine preserves.

Freshwater

Most aquatic organisms on Guam use rheotaxis to find their way upstream. If these organisms are able to bypass or ascend obstructions like dams, they would reach an area of little or no current (reservoir) and are unable to continue their upstream migration. The organisms end up in the reservoir, where they are much more susceptible to predation, and are less likely to find suitable areas for feeding or spawning.

Some organisms are able to pass the reservoir, and breed. Young are passively carried downstream to the ocean for the marine portion of their life history. If the young are prevented from reaching the marine environment within a critical first few days of birth, they do not survive. Young born above a dam can become caught in the reservoir formed behind the dam, and perish. Studies by GDAWR indicate the diversity of native organisms is much lower in the three rivers feeding into the reservoir than in three control rivers located outside the Fena watershed, as well as the control river leading from the Fena dam.

To address these issues and the threats previously mentioned, the following objectives will be pursued**:**

- To determine the impacts of dams and other manmade structures that may have an impact on freshwater aquatic organisms. Priority 2

- To conduct a biological inventory of freshwater organisms for Guam. Priority 2

- To determine the extent and impact invasive species have on native freshwater species. Priority 2

Coral Reef Fisheries and Habitat

Guam is located near the center of biodiversity for coral reefs, with over 5000 species of marine organisms recorded on Guam's reefs. Hundreds of these are important fishery resources, while hundreds more are components of essential fish habitat. Faced with such complexity, GDAWR began to implement eco-system based management actions. One of these actions was the creation of Guam's five marine preserves in May 1997. The law creating the preserves called for setting aside areas restricting take of all marine organisms and protection for their associated habitat. That same year Governor Carl T.C. Gutierrez signed Executive Order 97-10, adopting the Guam Coral Reef Initiative and creating the Guam Coral Reef Initiative Coordinating Committee (GCRICC), of which GDAWR is a member.

As part of the GCRICC, GDAWR helped to identify the top five priority threats impacting Guam's coral reefs: land-based sources of pollution, overfishing, lack of public awareness, recreational misuse and overuse, and climate change/coral/beaching/disease. The GCRICC then selected local navigators to guide the development of 3-year Local Action Strategies (LAS) for each of these priority threats. These LAS are described in greater detail in Appendix 7.

The following objectives will be implemented:

- To continue the implementation of local action strategies (LAS), to include the determination of land-based sources of pollution, implement coral reef fisheries management actions, foster education and outreach programs, recreational use, climate change, and coral bleaching and disease. Priority 1

- To maintain established Marine Preserves. Priority 1

- To implement management actions to protect and improve the status of marine SOGCN within Guam's jurisdiction. Priority 2

Sea Turtles
Three species of sea turtles visit Guam's waters: Green sea turtles, hawksbill sea turtles, and leatherback sea turtles. Only two of these species, the green and hawksbill sea turtles, use the beaches of Guam as nesting grounds. Little is known about the habits and life histories of sea turtles in Micronesia. They are threatened by the loss of nesting habitat and foraging grounds, consumption for meat and shells, and fishing gear, especially nets and long lining.

Guam DAWR is taking steps to fill in this knowledge gap by studying both resident and nesting sea turtles in Guam's waters. Currently the focus is on green and hawksbill sea turtles as they are more frequently observed in Guam's waters and use the beaches for nesting. The objectives for protecting these species are:

- To develop and strengthen cooperative agreements with the USFWS, AAFB-USAF, and Navy to establish/continue nesting turtle monitoring, protect nesting and foraging habitat, and track migrating turtles. Priority 1.

- To facilitate a volunteer nesting turtle monitoring program, "Haggan-Watch", to involve the community in sea turtle conservation. Priority 1.

- To track resident sea turtles in order to understand their movements around the island and life history. Priority 2.

Marine Mammals
The marine mammals that visit Guam's waters have not been studied. Information is limited to sightings and for some of the dolphin species rough estimates of pod size and movements are known. The objectives for these species are:

- Educate public about marine mammals and steps they can take to help protect these species. Priority 2.

- Develop a volunteer reporting program for fishermen and tourist vessels for marine mammal sightings. Priority 3.

- Seek technical assistance from federal partners to gain information about marine mammals in Guam's waters. Priority 3.

Public Awareness and Education

Development of a Public Conservation Awareness Program

The need to foster an informed population in regard to conservation and the importance of natural resources to the island is critical to the success of any long-term conservation efforts. Guam DAWR and its partners in the GCWCS have identified a lack of public awareness as a priority threat to many of our conservation actions.

Guam has experienced success in creating public awareness for coral reef issues through Education and Outreach Local Action Strategies (EO LAS) developed by the Guam Coral Reef Initiative Coordinating Committee. For instance, the Guam Visitors Bureau (GVB) and the tourism industry are now working with the natural resources agencies to market Guam's coral reefs, and in particular the marine preserves, to the 1 million visitors that come to our island yearly. This new awareness of the economic value of our coral reef resources is beginning to create a sense of stewardship in the industry, absent during the economic boom of the 1980s and recession of the 1990s. The goal of the education and outreach local action strategy (EO LAS) is to increase awareness of the need for the protection of Guam's coral reefs through improved efforts in the community, in the classroom, and with policy makers. Other venues for introducing conservation awareness and outreach are the Island Pride Campaign and publications such as Man, Land and Sea. The Island Pride Campaign is a program that combines educational and environmental activities with fun events to teach children to love the island's resources and instill a sense of stewardship. The quarterly publication of Man, Land and Sea which is published through BSP is another outlet for public/private education and awareness campaigns.

To increase the awareness of the general public and private industry the following objectives will be implemented:

- To develop, implement and utilize existing programs to increase public awareness of natural resources and issues pertaining to them. Priority 1

- To develop outreach campaigns, educate the public and private industry of the value of preserving Guam's wildlife and habitats. Priority 1

- To develop a plan to addressing public awareness and education of conservation issues- websites, posters, presentation, public service announcements, enhance

and facilitate public involvement in conservation efforts. Develop a program to install signage and other forms of public outreach in conservation efforts. Priority 1

Recreation Activities within the Conservation Areas
The local Conservation Areas that have been established have limited accessibility for the general public. Hunters and off-road enthusiast are the main users of these areas. The Anao Conservation Area is a wonderful example of what a limestone forest should resemble. However, many individuals do not know about this Conservation Area because there are no signs indicating how to get there. The area is mainly used by the hunting community and must be accessed through private lands. By creating more opportunities for the public to get out and experience these areas firsthand, we can educate and instill a sense of stewardship of our natural resources. Providing greater accessibility through the creation of trails into and campsites on conservation lands we can ensure that future generations experience and appreciate the wonders of Guam's natural resources.

The GNWR's visitor center at Ritidian Point provides the opportunity for the public to experience nature and culture. This is the direction we should take with the conservation lands established by the Government of Guam. To assist in creating recreational activities with local conservation areas we will implement the following objectives:

- To allow public access to game species in Conservation Areas. Priority 2

- To develop signage identifying Guam's Conservation Areas; highlighting key habitat types, important fauna, geologic formations, and other key aspects of the Conservation Area. Priority 2

- To allow compatible public activities in Conservation Areas. Priority 3

Law Enforcement of Natural Resource Laws and Regulations
As stated previously, the Department and specifically GDAWR's Law Enforcement Section has the authority to enforce laws and regulations pertaining to the natural resources of Guam (Table 1). The ability of the Department's Law Enforcement officers to interdict individuals breaking laws and regulations has been hindered due to several factors. These factors include shortfalls in manpower and equipment, and public education about the rules and regulations governing natural resources on Guam. By far the biggest obstacle for enforcement is public education. The public must be properly educated as the laws and the reason for the laws that protect natural resources. To aid in the protection and enforcement of natural resource laws and regulations we will implement the following objectives:

- To protect Guam's endangered species and SOGCN from illegal harvesting or incidental take by enforcing Guam's natural resource regulations and developing regulations for SOGCN not protected under

current regulations. Priority 1

- To protect Guam's Marine Preserves. Priority 1
- By educating the public of Guam's natural resource regulations. Priority 1
- By creating and maintaining a volunteer conservation officer program to aid with monitoring activities in Conservation and other public lands. Priority 2
- By maintaining and promoting Conservation officer law enforcement skills. Priority 2

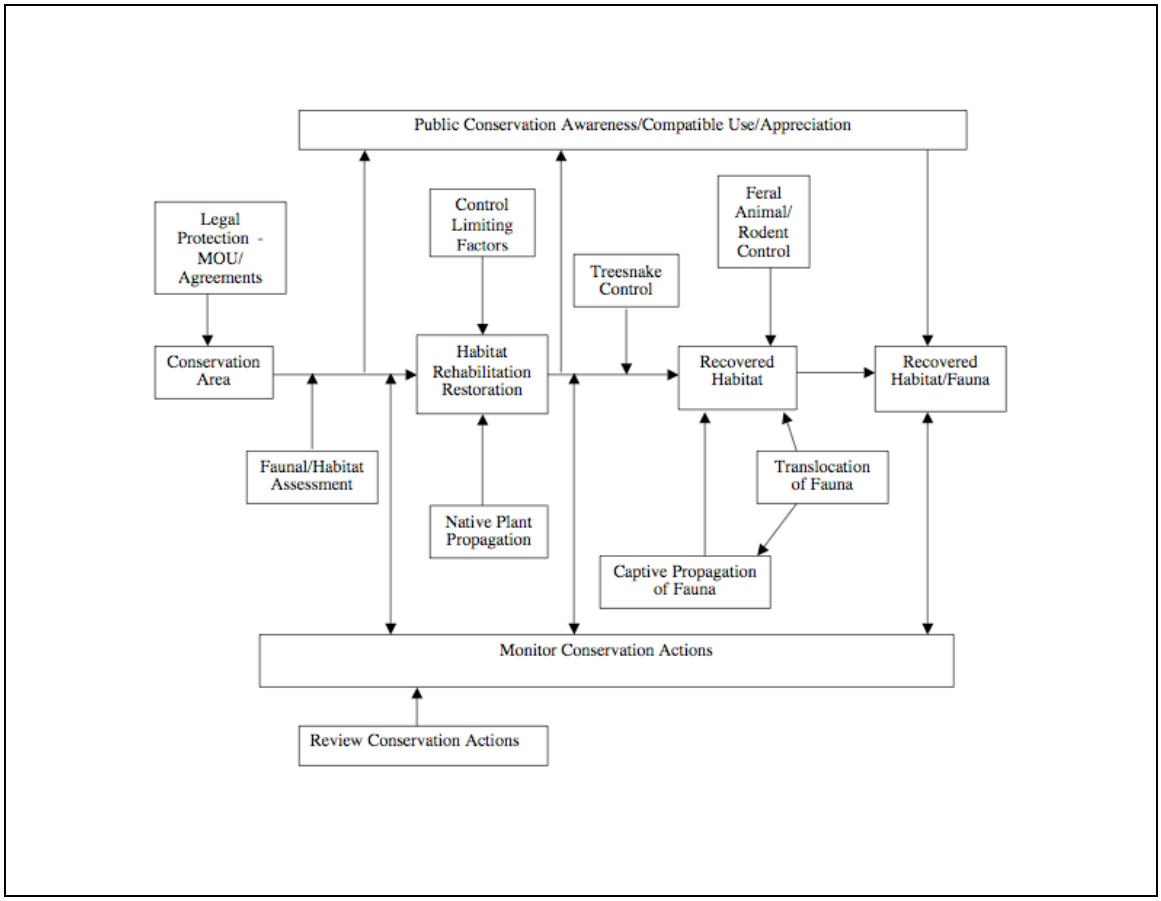


Figure 24. Diagram illustrating conservation actions for terrestrial plants and animals.

CHAPTER 5: Proposed Monitoring and Incorporation of New Information (Element 5)

Monitoring and Evaluation
Guam's CWCS encompasses monitoring and evaluation in three areas: 1) surveys (species and habitat); 2) effectiveness of proposed strategies; and 3) ten-year revision of the CWCS. The approach to monitoring and evaluation is based on expanding existing efforts in order to be cost effective, in light of limit financial resources (Schoonmaker and Luscombe 2005). For new efforts, the approach will be to focus on relevant, realistic, and effective monitoring and evaluation that is cost-effective, sustainable, and has minimal impact to native ecosystems.

Surveys of Species
Except for several species of resident native birds, a majority of Guam's terrestrial (both vertebrate and invertebrate) resident species of animals is extirpated or extinct, or found only in captivity or in low numbers. For those species still extant on Guam, monitoring of these populations as conservation actions are implemented will be important to conservation evaluations.

To standardize observations, personnel will be trained in identification and survey methods to insure that the data collected is as accurate as possible. Such training will include identification of calls for certain species, recording of number of animals observed, and use of standard bird survey techniques incorporated in Ramsey and Scott 1981.

Goals: To monitor the long-term population trends of SOGCN.

Objective 1: Conduct colony and/or island-wide counts indicating population trends over a five-year period;

Objective 2: Conduct colony and/or island-wide population surveys in relation to efforts to increase the quality and quantity of limestone and ravine forest habitats.

Mariana fruit bats and Sheath-tailed bats

- Colony Counts – Quarterly counts of all colonies. As new colonies are found they will be surveyed quarterly.

- Island-wide Survey - An island-wide survey, using randomly stratified fixed survey stations, will be established and conducted every 5 years.

Native Birds

- Direct Monitoring – A combination of radio telemetry and re-sighting banded birds will continue to be used for monitoring for extant bird populations, as well as, captive reared birds that are released into the wild. In the future, as captive flocks of Guam rails, Micronesian kingfishers are

large enough for release into the wild on Guam, monitoring with these methods will be valuable in determining the survivorship of released birds.

- Playback Surveys – As bird populations increase as a result of conservation efforts, surveys using tape-recorded crow calls along established survey transects will be reinitiated (these surveys were stopped in 1999 when Mariana crow populations were extremely low). These surveys involve playing tape-recorded calls at survey points a minimum of 300 meters apart for 2.5 minutes followed by a 2-minute silent period to record numbers, distance, and plumage condition. As the Mariana crow population increases and their distribution expands additional survey transects will be randomly selected to coincide with other forest bird surveys (see other extirpated forest birds below). Playback censuses are important in monitoring Guam rails released on Rota. Other re-introduced species of birds could be surveyed by this method as well.

- Roadside Counts – Annual May annual roadside counts along 23 survey routes around northern and southern Guam will continue to monitor the status of native and non-native bird species. Survey points are spaced 600 meters apart along roadways, and the number of birds heard and seen during a five-minute survey period at each station is recorded. This survey will expand to additional areas of Guam as populations of birds increase, and the frequency of counts may increase depending on need.

- Cave Exit Counts – Island swiftlets will be surveyed by counting the number of birds within the cave and then counting the number of birds entering and exiting the cave during a 1-2 hour period before dark (dark is defined as one hour after sunset). The swiftlet population for a cave is then estimated by subtracting the number of departures, from the number of arrivals, and adding the estimated number of swiftlets in the cave prior to the count. All counts are conducted with at least one observer at each cave entrance for a particular colony. In some cases, two observers are utilized, two counting the number of swiftlets entering a cave and the third person counting the number of birds exiting.

- Shorebird Surveys – Survey for migratory shorebirds, August through May, along shorelines (Togcha, and Dungca's Beach) and grassy fields to determine the abundance of specific shorebirds. Areas historically monitored will be surveyed initially to establish current baseline information and serve as a means of comparison. Other appropriate areas will be added. Information from Annual Marianas Audubon Christmas bird counts and other pertinent sources will be incorporated into the database on shorebird abundances in Guam.

Terrestrial Reptiles (skinks and geckos)

- Conduct annual surveys to determine the status of the each reptile SOGCN. These surveys will be conducted in Conservation Areas to monitor the status of each area, and the effectiveness of conservation measures. Additionally, surveys will conducted in areas known to historically harbor these lizards.

Invertebrates – Gastropods

- As the populations of remaining native snails are very small, visual surveys of native snails in areas historically known to contain them will be conducted to determine the current population numbers. Initial surveys will be conducted in the Hilaan, Tanguisson and Haputo areas.

- Conduct annual surveys in key areas to determine the status of each species to determine the efficacy of conservation efforts.

Invertebrates – Insects

- Conduct an assessment on the status and distribution of Guam's native insects to identify the species needing immediate conservation attention.

- Conduct annual surveys of species determined to be in need of close monitoring.

Predator and Invasive Species Surveys

The introduction of species to Guam, whether intentional or accidental, has had a negative impact on native species or their environment. The introduced brown treesnake caused significant damage to Guam's native vertebrate fauna. The recovery of native fauna hinges on the control of the snake. However, efforts to eradicate the snake must be combined with habitat restoration, captive breeding or translocations, and even the removal of other predators such as cats, dogs, and rats. Monitoring the abundance of the brown treesnake is important in determining the efficacy of brown treesnake control measures. In addition, monitoring the presence and distribution of other invasive species must also be emphasized.

Goal: To determine population trends and control of introduced predator invasive species that limit the recovery of SOGCN on Guam.

Objective 1: Monitor monthly abundance of brown treesnakes in Conservation Areas designated for restoration and where brown treesnake control is being implemented to determine the efficacy of treesnake control measures.

Objective 2: Identify the abundance and distribution of invasive species in Conservation Areas and remove these species.

- Implement area-wide brown treesnake control by snake trapping and/or barriers in conservation areas slated for release of SOGCN.

- Continue to support studies into improving brown treesnake control techniques.

- Assess brown treesnake control threshold for non-federally listed forest bird species and other SOGCN.

- Monitor the abundance of invasive species in Guam.

Monitoring Habitats and Conservation Areas

The GCWCS plan will entail the management and monitoring of restorative actions within conservation areas on Guam. Many conservation areas on Guam, both on military and government of Guam lands, are in dire need of restoration as a result of ungulate damage (Wiles et al. 1999). Conservation actions proposed by existing plans to rehabilitate designated forest habitats are important to restoring these areas to a natural state, as well as to making them suitable to the native fauna.

Fire and ungulate damage are probably the most significant factors leading to the loss of native habitat. Some areas heavily impacted by ungulates have changed into monospecific plant communities. The species of plants are usually the one that tend not to be palatable to ungulates. For example, *O. marianensis* is a native species that easily develops monotypic stands becaus it is not favored by deer. Much of southern areas of Guam is covered with *Miscanthus floridulus* because this grass species quickly flourishes in areas made available by repeated burning. The exotic palm, palma brava, has replaced native ravine forests in some areas.

Goal: To monitor the progress of restoration efforts of habitats.

Objective 1: Development of a GIS map of historic and current distribution for Guam.

Objective 2: To illustrate the reduction of habitat degradation and loss as control measures for deer and feral pigs are implemented in conservation areas.

<u>Vegetation GIS Maps for Guam</u>

- In 2005, the US Forest Service, FSRD, and private forestry completed a vegetation analysis for Guam utilizing 2002 IKONOS data (4 meter multi-spectral and 1 meter panchromatic) and 1994 aerial photography (USDA 2005). This research provides an assessment on habitat availability at a broad scale and will serve as a baseline for native forest restoration. A more detailed study will be completed every 10 years to monitor long-term trends in forest types on Guam.

- The map will be updated every 10-years. The map will be used to identify important trends in habitat restoration on Guam.

Monitoring Native Forests

- Conduct plant surveys (transects and counts) to determine the status and efficacy of conservation efforts for habitat in key areas. Vegetation transects will be used to assess the condition of the conservation. The abundance and diversity of the types of plant species in the conservation areas will be documented.

- Determine the status of conservation areas to determine the abundance of various native species of plants.

- Historic information will be compiled to provide baseline information on habitats and be compared to current trends and conditions.

- Information on conservation areas will be used to specifically determine what actions will be taken to improve the habitat for faunal and floral goals. Many areas principally need a reduction in feral deer and pig populations.

- Develop and implement reforestation techniques in Guam conservation areas and national wildlife refuge overlay lands.

Monitoring Wetland Habitats

- A map of the historic and current distribution of Guam's wetlands will be compiled. These maps will show trends of the distribution of the wetlands in Guam. Mitigation wetland sites, ponding basins, and other man-made ponds will be included in the inventory.

- As these areas encompass a greater area on Guam, broad scale monitoring will be used to assess conditions of these habitats. Appropriate partnership will be developed as some of these areas are privately or federally owned.

Aquatics Monitoring and Evaluation

Guam DAWR research priorities focus on the major threats to Guam's aquatic species: fishing, pollution, invasive species, development, recreation, and disease. Because freshwater and marine resources are intimately linked, impacts in the upper reaches of Guam's watersheds affect not only freshwater organisms, but are amplified throughout the watershed and impact marine organisms as well.

Partners such as the FSRD, GEPA, NPS, and scientists from the University of Guam are also seeking insight into the problems facing Guam's aquatic resources. Together these

organizations are tackling issues such as soil erosion rates, re-vegetation of badland areas, sedimentation on near-shore reef communities, pollution levels in coastal waters, and settling and recruitment rates of corals.

Survey of Freshwater Habitats and Organisms

Guam's native freshwater fauna are threatened by habitat loss due to sedimentation, eutrophication, and increased water flow caused by bank alteration and loss of riparian vegetation. Because of their amphidromous life histories, all of Guam's native fish species are vulnerable to stream blockage. Monitoring these species in their native habitat will allow GDAWR to monitor the existing stocks and to evaluate improvement due to management activities.

Goal: To monitor the long-term population trends of freshwater SOGCN.

Assessing Impacts of Dams

- Guam DAWR will be conducting a long-term study of the effect a manmade dam (Fena) has on the native freshwater fauna of Guam, as almost all of Guam's native freshwater fauna is amphidromous, with a marine larval stage in their life history before they return to freshwater to spend their adult lives. Dams affect native fauna. A dam acts as a physical barrier to some native organisms. Organisms not able to pass upstream of the dam are limited to the reaches of rivers below the dam.

- Guam DAWR will survey seven Guam rivers annually to monitor the effect a dam has on native fauna. The three rivers that feed into the Fena reservoir (Maagas, Almagosa, and Sadok) are classified experimental, and the river below Fena dam (Maulap) and three other rivers outside the Fena watershed (Ylig, Lonfit, and Manenggon) are the controls.

- In each river, a 200-meter section will be chosen, and divided into 20 10-meter segments. Within each segment, a quadrate will be randomly chosen and surveyed, for a total of 20 sample sites per river.

- Data collected at each quadrate will include species identification, number and size of individuals of each species observed, activity of observed animals, two most dominant substrate types, percentage of canopy cover over quadrate, area of quadrate, depth of water in quadrate, and average water velocity in quadrate, as well as observers, location, date and time.

River Inventory

- Guam DAWR will conduct a biological river inventory for Guam to obtain baseline biological data important for management of our freshwater resources. Of over 100 named rivers and streams, we have

biological information for about 12. Guam DAWR will be surveying rivers with no known biological information.

- Data collection includes visual surveys, as well as specimen collection using net and electrofishing. Guam DAWR now has biological information for 37 rivers, and eventually intends to collect information on all 100.

Freshwater river surveys

- The freshwater fishery resources will be monitored by surveying seven rivers in three watersheds each year for analysis and comparison between watersheds by using appropriate parametric or non-parametric tests. (See attached freshwater data collection sheet).

Reservoir Fisheries Monitoring

- Monitor the freshwater fishery in Fena Lake by conducting a stock assessment, using electrofishing and mark-recapture methodology, to determine species, species density, and other environmental parameters.

- The freshwater fishery resources in Masso reservoir will be monitored by conducting mark-recapture studies on a yearly basis to collect biological information of the freshwater fisheries resource.

Guam Environmental Monitoring and Assessment Program (EMAP) – Surface Waters

- Guam DAWR will participate in the development of the Guam Environmental Protection Agency's EMAP protocols for surface waters of the Western Pacific ecoregion. This program will monitor many parameters of river habitat health including general water chemistry, physical habitat parameters, periphyton community structure and abundance, biomass and chlorophyll, fish community structure and abundance, macroinvertebrate community structure and abundance, sediment chemistry, fish tissue chemistry, water column contaminants and rapid habitat and visual stream assessments. Guam DAWR staff will also assist GEPA with biological surveys.

Marine Species Surveys

There are a number of methods for assessing fish stocks in marine waters. Guam DAWR uses a variety of these methods to assess the impacts of fishing and effectiveness of the marine preserves as a fisheries management tools. These methods include creel surveys and in situ monitoring.

Goal: Management of Guam's Marine Fisheries Resources

Offshore Fisheries Participation, Effort, and Harvest Surveys

- To monitor the health of Guam's reef, bottom, and pelagic fishery resources by conducting 192 offshore surveys each year at the three largest boat launch facilities on island.

- To continue gathering limited biological data that will add to a long-term historical data base on Guam's fish species by conducting 192 offshore surveys over a one year period at the three largest boat launching facilities on island.

Inshore Fisheries Participation, Effort, and Harvest Surveys

- To monitor the health of Guam's reef and bottom fishery resources by conducting 192 inshore surveys each year along the coastline of Guam.

- To continue gathering limited biological data that will add to a long-term historical database on Guam's fish species by conducting 192 offshore surveys over a one-year period along the coastline of Guam.

- To monitor the health of Guam's reef and bottom fishery resources by conducting 24 aerial surveys each year along the coastline of Guam.

Assessing Guam's Reef Fish Spawning Aggregations

- Analyze 20 years of creel survey data to look for probable spawning aggregation encounters documented in the surveys to determine the species caught, approximate site location, date, time, tide, and moon phase by December 2005.

- Interview knowledgeable local fishermen and fishermen identified by the creel data analysis as having located an aggregation to locate the site on a map and provide any details about aggregations they have witnessed by April 2006.

- Analyze and compile data and enter onto a GIS map by August 2006.

Visual Stock Assessment Surveys of Marine Preserves and Control Sites

- To evaluate the effect on sport fish populations caused by the creation of five marine preserves where fishing is restricted or prohibited by conducting fish counts and timed-swim counts on at least 25 permanent transects located in reef flat and lagoon habitats in Achang Reef Flat Marine Preserve, Piti Bomb Holes Marine Preserve, Tumon Bay Preserve, Asan Bay, Pago Bay, and Cocos Lagoon over a one-year period.

- To evaluate the effect on sport fish populations caused by the creation of five marine preserves where fishing is restricted or prohibited by conducting fish counts, timed-swim counts, and video-transects/quadrant on at least 25 permanent transects located at the 20', 30', 40', and 50' depth contours of the fore reef slopes in Achang Reef Flat Marine Preserve, Piti Bomb Holes Marine Preserve, Tumon Bay Preserve, Asan Bay, and the backside of Cocos Lagoon, over a one-year period.

Marine Preserve Monitoring

- In 1997, Guam established five marine preserves around the island amounting to 11.8% of Guam's shoreline. Guam DAWR will continue to sample the fish populations and reef communities in two of the preserve areas and control sites to determine the effectiveness of the preserve system. These studies focus on the fish species targeted for consumption and for indicator species such as butterflyfish.

- The Piti Bomb Holes Preserve and the Achang Reef Flat Preserve are the experimental sites for the stock assessment surveys. Cocos Lagoon and the Asan fore reef slope serve as the control sites for the Piti Bomb Holes Preserve, while Pago Bay reef flat and Cocos fore reef slope serve as the control sites for the Achang Reef Flat Preserve.

- As in prior years, sixty-six (66) permanent belt transects (50m x5m) will be surveyed on the reef flats and fore reef slopes of two preserve sites, Piti Bomb Holes Preserve and Achang Reef Flat Preserve, and three control sites, Asan Bay, Cocos Lagoon, and Pago Bay. Two sets of transects will be on the fore reef slope at the 20', 30', 40', and 50' depth contours. Eight transects are on the reef flat at each site representing distinct microhabitats (seagrass, coral/algal/rubble, and sandy bottom).

- Fish communities will be surveyed using two different visual survey techniques along each transect. Density will be assessed using a visual fish census along a strip transect. Two fish counters following the 50 m long permanent transect, each counting all target fish within 2.5 m of their side of the transect. All target fish within this 250 m^2 area will be scored on data sheets based on their species and size class. Three size classes will be used based on the fork length of the fish (<15 cm, 15 cm-30 cm, >30 cm). The strip transect method will be complemented by a timed visual survey in the same area. At each site, fish counters will record the species and size class of all fish encountered in the area during a 30-minute interval.

- Data will be analyzed using Statview 4.5 for PC published by Abacus Concepts Inc. A two-tailed paired t-test (Sokal and Rohlf, 1995) will be used to compare fish densities and diversity over time within each study site. The Shannon diversity index will be used to calculate an index

number for species diversity and evenness at each site for both pre- and post-implementation data. A higher index number indicates greater diversity. If the assumptions of analysis of variance (ANOVA) are not met, even after transformations, a nonparametric test will be conducted (Sokal and Rohlf, 1995).

Guam Environmental Monitoring and Assessment Program – Coastal Waters

- This program will assess the biological condition of Guam's marine water using standardized methods. Reef fish, macroinvertebrates, macroalgae, and coral abundance will be recorded at 50 randomly selected sites throughout Guam's waters. This program will be complemented by water quality monitoring and sediment analysis.

Marine Turtles In-Water and Nesting Beach Surveys

- Aerial Surveys: Conduct monthly aerial surveys of species determined to be in need of close monitoring.

- Incorporate information from "Haggan-Watch" Volunteer program managed by GDAWR on turtle sightings.

Marine Habitat Monitoring and Evaluation

Since, healthy fish populations require healthy reef habitat, GDAWR and its partners also monitor the coral reef habitat through a number of projects to determine the impact of land based sources of pollution and other threats to healthy coral reef habitats.

Goal: To protect vital marine habitats and the aquatic life they contain.

Objective 1: To compile marine trend information to identify serious threats to Guam's marine resources.

Objective 2: To determine water quality indicators important to coral reefs to help manage Guam coral reefs, thereby benefiting the marine life.

Objective 3: Participate in Marianas Archipelago Reef Assessment and Monitoring Program (MARAMP) to improve the understanding of coral reef ecosystems, evaluate and reduce adverse impacts, enhance coral reef ecosystem-based fisheries management and conservation through cooperation with partners (federal and local agencies and non-governmental organizations), and provide scientific information needed to establish, strengthen, and manage MPAs (NOAA, Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Division website http://www.nmfs.hawaii.edu/crd).

Quantifying and Assessing the Effects of Sedimentation on Fish Abundance, Fish Diversity, and Benthic Habitats including corals

- To obtain a purchase order to obtain supplies and equipment needed for the project by December 2005.

- To assess Piti Bomb Holes Preserve and Fouha Bay, areas with current and future erosion control projects, and two appropriate control sites for detailed monitoring by December 2005.

- To conduct fish counts, timed-swim counts, and video-transects on 24 permanent transects located in the 20', 30', 40', and 50' depths of the fore reef slopes and reef flats of Piti Bomb Holes Preserve, Fouha Bay, and two control sites over a one year period.

- To install and monitor thirty sediment traps on a monthly basis each year during the study at Piti Bomb Holes Preserve, Fouha Bay, and two control sites in order to quantify sediment load at impacted sites.

Analyzing and Assessing Recreational Impacts on Coral Reef Habitat and Determining a Carrying Capacity within Marine Preserves

- Develop a scope of work and request for proposal by December 2005.

- Obtain a contract by June 2006 to assess the impacts of recreation activities within Tumon Bay and Piti Bomb Holes Marine Preserves on coral reef habitat by linking recreational activities to their effects on the abundance, diversity, and distribution of fishes, corals, macro-invertebrates, and marine plants as well as substrate cover, water clarity, temperature, dissolved oxygen, pH, and damage or pollution related to recreational activities and comparing the effects to appropriate control sites.

Guam Environmental Monitoring and Assessment Program – Coastal Waters

- Implement an Environmental Monitoring and Assessment Program (EMAP), to be conducted by GEPA and assisted by GDAWR staff. The EMAP program will assess the physical and chemical condition of Guam's Marine water using standardized methods and a suite of environmental indicators. This information will be used to rank the relative importance of various stressors on the affected resource types.

Marianas Archipelago Reef Assessment and Monitoring Program (MARAMP)

- Guam DAWR will participate in MARAMP cruise trips. The MARAMP is intended to be a long-term monitoring program with research cruises

scheduled bi-annually. The cruise usually comprised of staff from the NOAA Coral Reef Ecosystem Investigation Program, GDAWR, NPS, and the University of Guam Marine Laboratory to conduct a variety of ecological and oceanographic assessments, including the following:

- Benthic Habitat Mapping: multi-beam surveys, single beam QTC surveys, geodetic control, towed diver surveys, and TOAD towed camera surveys,

- Fish, Turtle, and Marine Mammal Surveys: belt transects, stationary point counts, towed diver surveys, roving diver surveys, and hydroacoustic surveys,

- Benthic Surveys (corals, other inverts, algae): belt transects, towed diver surveys, roving diver surveys, and TOAD towed camera surveys, and

- Oceanography: closely-spaced CTDs, drifters, subsurface temperature, ADCP transects, CREWS/SST buoys, current/wave moorings.

Data Management and Archiving

Faunal and Vegetation survey data will be archived with GDAWR. The information collected will be analyzed and reported in State Wildlife Grant reports, to include information on species abundance and distribution, and on habitat trends. Statistical analysis (either parametric or non-parametric) will be used to determine significant changes in abundances (Sokal and Rolhf 1995).

After 5-year's, programs implemented for each SOGCN will be assessed and a five-year report detailing the efforts, population trends, and management actions will be written.

Establishment of a Monitoring Group

In order to assist in the synthesis of the information gathered from monitoring of SOGCN and relevant habitats, a Guam Monitoring Group will be established. This group will be composed of appropriate local and federal agencies including but not limited to the Department of Agriculture (GDAWR and FSRD), US NRCS, USFWS Ecological Services, GNWR, USDA-Wildlife Services, USGS-BRD, and UOG. In addition, NGOs and private landowners will be invited to participate.

This group will be composed of individuals with expertise in resource management, habitat monitoring, data management, and public involvement. They will provide a comprehensive status of the habitats, their location and condition, and what conservation actions need to be taken.

CHAPTER 6: Periodic Review of Strategy (Element 6)

Ten –Year Review of the Strategy

Guam's CWCS will be fully reviewed every 10 years with interim reviews every five years. The interim reviews will be used to assess the success or failure of management objectives and to adjust management actions accordingly.

- The proposed management actions for Guam's SOGCN will be updated as new information is gathered from these reviews. The Department will coordinate, with its partners, a complete assessment of the strategy every 10 years.

- The Department and its partners will use the original eight elements and other criteria available at the time of revision. The effort will be in consultation with other stakeholders, both public and private.

- A review of the priority levels will be made to assure SOGCN needs are being addressed.

- The revision shall start at least 2 years before the tenth year and be completed by the end of the tenth year. The countdown to revision shall commence on October 1, 2005 and the first full revision shall be completed by October 1, 2015.

CHAPTER 7: Coordination of the development, Implementation, Review, and Revision of the GCWCS with Federal, State, and Local Agencies (Element 7)

Coordination with Federal, State, and Local Partners

Guam DAWR identified federal, state, and local stakeholders that may have had interest in providing input for the GCWCS. Letters informing Government of Guam agencies, University of Guam (UOG), USAF, USN, and NGOs (The Nature Conservancy and Marianas Audubon Society) of the development of GCWCS (See Appendix Public) were sent out in October and November 2004. Each of the agencies was invited to provide their concerns, input, and assistance.

Various government, state and regional partners provided assistance in the development of the GCWCS, while the Fisheries and Wildlife Sections of GDAWR headed the development of the GCWCS. The USFWS Ecological Services field office in Hawaii provided input on SOGCN, monitoring and conservation actions. In addition, guidance was given regarding format and content for most chapters within the GCWCS. Information on common species of greatest concern was shared with the State of Hawaii's Department of Land and Natural Resources, CNMI Division of Land and Natural Resources. Most of the information pertains to migratory shorebirds' status and action plans, which are implemented in the plan. Input on various portions of the plan was provided by: the University of Guam (UOG) Marine Lab on marine vertebrates and land snails; the UOG College of Agriculture and Life Sciences on insects and plants; and FSRD on terrestrial plants, as well as digital maps of conservation areas and information on the vegetation contained in them. The Nature Conservancy provided input for marine and aquatic sections as well as the overall development of the strategy. The Government of Guam's Department of Land Management provided assistance with maps and identifying conservation and public lands. The Mayor's Council of Guam provided assistance with the public meetings that were held at the Mayor's offices at several of the villages (Dededo, Sinajana, and Yona).

The Department will be coordinating with partners to identify new projects and review of existing projects discussed in Chapter 4 (Review and Revision).

CHAPTER 8: Broad Public Participation (Element 8)

Pre-GCWCS Draft Public Meetings:
The public was invited to participate in the development of Guam's CWCS (Appendix 8). The process began with a meeting with the Mayor's Council of Guam on November 17, 2004. Guam DAWR informed the Mayor's Council about the Eight Elements and the need for such a comprehensive plan. During the meeting with the council, one mayor indicated that he would like to see more native forest and native forest birds on the island. He also mentioned that removing the snakes is greatly needed to accomplish this task. Another mayor mentioned the need to educate the public and the challenges to get them involved in environmental activities to preserve the native forest habitats on Guam. Similar testimonials involved the preservation of the Asiatic water buffalo, or carabao. Another topic of discussion involved the availability of employment or opportunities for employment related to conservation measures for island residents.

The Mayor's Council was asked to help solicit input from the public through a series of three village meetings. They were asked to provide a venue for public meetings within their respective villages, and to garner interest from residents in attending the meetings. Meetings were held at village recreation centers or mayors office. The island was divided into three regions (north, central and south) to facilitate attendance.

An announcement was placed in the village mayor's news section of the local newspaper notifying the public to the dates, times, and locations of the three meetings. The meetings were held in the villages of Dededo on December 13, Yona on December 15, and in Sinajaña on December 16. Sign-up and comments sheets were placed at the entrances of each of the venues. A short PowerPoint presentation on the requirements and development of Guam's CWCS was made to those in attendance. Open discussions followed and the public was given information regarding how they could become involved with the development process.

Some of the concerns expressed by the public included:

- The development of village-hotel partnerships in relation to ecotourism.
- The preservation of native forest in relation to game species and concerns about possible limitations of hunting activities in conservation areas.
- The need for more introductions of native bird species and facilities to observe migratory birds during the winter months.
- The need to control the brown treesnake and other invasive species.

Post-GWCS Draft Public Meetings:
As portions of the draft GCWCS were completed the public was invited to review and provide input the on the contents of the draft. The draft GCWCS was available on the GDAWR website at www.guamdawr.org. Comments on the draft could be sent via email to mpwarner@guamdawr.org.

In addition to posting the draft on the GDAWR website, a public meeting was held on September 1, 2005 at the Mangilao Community Center. The meeting date, time and

location were published via the local newspaper and copies of the press release from the Department were sent to the broadcast media. The purpose of the meeting was to inform the public that the draft GCWCS was completed and the review and commenting period had begun. Comments were accepted through September 19, 2005. All comments received on or before this date have been addressed in this final version.

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Appendices

Appendix 1. Eight Required Elements

TEAMING WITH WILDLIFE

State Wildlife Conservation Strategies: Eight Required Elements

Congress identified eight required elements to be addressed in each state's wildlife conservation strategy. Congress also directed that the strategies must identify and be focused on the "species in greatest need of conservation," yet address the "full array of wildlife" and wildlife-related issues. The strategies must provide and make use of:

(1) **Information on the distribution and abundance of species of wildlife**, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,

(2) **Descriptions of locations and relative condition of key habitats and community types** essential to conservation of species identified in (1); and,

(3) **Descriptions of problems** which may adversely affect species identified in (1) or their habitats, **and priority research and survey efforts** needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,

(4) **Descriptions of conservation actions** proposed to conserve the identified species and habitats and priorities for implementing such actions; and,

(5) **Proposed plans for monitoring** species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,

(6) **Descriptions of procedures to review the strategy** at intervals not to exceed ten years; and,

(7) Plans for **coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes** that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

(8) Congress also affirmed through this legislation that **broad public participation** is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

The International Association of Fish and Wildlife Agencies
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(202) 624-7890 • www.iafwa.org • www.teaming.com

Appendix 2. Endangered and Threatened Species List for Guam

Guam endangered species, List No. 7 (F = federal listing, G = Guam list, T = federal threatened listing).

Chamorro Name	English Name	Scientific Name
Birds		
Koko (F/G)	Guam rail	*Gallirallus owstoni*
Pulattat (F/G)	Marinana common moorhen	*Gallinula chloropus guami*
Totot (G)	Mariana fruit-dove	*Ptilinopus roseicapilla*
Puluman apaka/fache (G)	White-throated ground dove	*Gallicolumba x. xanthonura*
Yayaguak (F/G)	Island swiftlet	*Aerodramus vanikorensis bartschi*
Sihek (F/G)	Micronesian kingfisher	*Halcyon c. cinnamomina*
Aga (F/G)	Mariana crow	*Corvus kubaryi*
Chuguangguang (F/G)	Guam flycatcher	*Myiagra freycineti*
Chichirika (G)	Rufous fantail	*Rhipidura rufifrons uraniae*
Sali (G)	Micronesian starling	*Aplonis opaca guami*
Egigi (G)	Micronesian honeyeater	*Myzomela rubratra saffordi*
Nossa (F/G)	Bridled white-eye	*Zosterops c. conspicillata*
Mammals		
Fanihi (F/G)	Marianas fruit at	*Pteropus m. mariannus*
Fanihi (F/G)	Little Marianas fruit bat	*Pteropus tokudae*
Payesyes (G)	Pacific sheath-tailed bat	*Emballonura semicaudata*
Reptiles		
Haggan Betde (T)	Green sea turtle	*Chelonia mydas*
Haggan Karai (F/G)	Hawksbill sea turtle	*Eretomochelys imbricata*
Achiak (G)	Oceanic gecko	*Gehyra oceanica*
Guali'ek (G)	Micronesian gecko	*Perochirus ateles*
Guali'ek (G)	Pacific Slender-toed gecko	*Nactus pelagicus*
Guali'ek Halom Tano' (G)	Snake-eyed skink	*Cryptoblepharus poecilopleurus*
Guali'ek Kantun Tasi (G)	Tide-pool skink	*Emoia atrocostata*
Guali'ek Halom Tano' (G)	Azure-tailed skink	*Emoia cyanura*
Guali'ek Halom Tano' (G)	Slevin's skink	*Emoia slevini*
Guali'ek Halom Tano' (G)	Moth skink	*Lipinia noctua*
Molluscs		
Akaleha' (G)	Guam tree snail	*Partula salifana*
Akaleha' (G)	Mariana Islands tree snail	*Partula gibba*
Akaleha' (G)	Pacific tree snail	*Partula radiolata*
Akaleha' (G)	Mariana Islands fragile tree snail	*Samoana fragilis*
Plants		
Tsatsa (G)	Tree fern	*Cyathea lunulata*
Hayun-lago (F/G)		*Serianthes nelsonii*
Ufa-halomtano (G)	Fire tree	*Heritiera longipetiolata*

Appendix 3. Description of Terrestrial Habitats

Eight general habitat types are defined (Fosberg 1960, Stone 1970, Engbring and Ramsey 1984). Donnegan et al. (2002) provided additional habitat descriptions that are more specific to a few of the habitats defined.

KEY HABITAT TYPES:

1) Primary Limestone Forest: This is a forest composed principally of native vegetation of trees and plants, with a moderately dense canopy of 10-30 m high. There are no or only a few openings, and understory vegetation varies from open to dense. An area composed of native trees and plants. Much of the uninhabited areas of far northern Guam, as well as the cliff and bench areas along the coast, are of this type. Species of trees including the *Ficus*, *Intsia*, *Artocarpus* and *Elaeocarpus* are commonly found in this forest.

   There several distinct limestone forest types including *Artocarpus-Ficus*, *Mammea, Merriliodendron-Ficus*, and *Pandanus.*

2) Broken Forest: This is mix woodland forest dissected by many small, open scrubby fields, which make up 10% - 25% of the area. Broken forest is the result of human disturbance and is confined mostly to the Central Plateau and Mt. Santa Rosa regions, near the Anao Conservation Area.

3) Scrub Forest: This diverse, brush forest generally has an open canopy under 10m high with dense understory. It is described by Jenkins (1983) as "second growth" or "scrub vegetation". The plant speices are generally similar to those in more mature limestone forests, but are at an earlier stage of development. *Leucaena* is not found in this forest because it is shade intolerant. In northern Guam this habitat is dominated by *Vitex parviflora*. However, within this forested area native plants can be found.

   Much of the Tarague Plateau and Northwest Field Region is scrub forest. Historically, these areas were cleared for military purposes and repeated typhoon destruction have played a major factor in creating these forests.

4) Coconut Grove – Historically, these areas were copra plantations or ranches. The canopy is, 15-25 m high, is moderately dense and generally complete. In most areas there is thick understory composed of a variety of native and non-native shrubs and young

trees including numerous young *Cocos* sp. Some coconut groves may contain native plants.

5) Beach Scrub – Open sand beaches, barren coastal outcroppings, and coastal areas of sparse vegetation generally 2-3 m or shorter in height comprise this habitat. The dominant plant is *Pemphis acidula*, a salt-tolerant species. Scrubby stands of *Pemphis* are most extensive from Mt. Santa Rosa to Pati Basin.

6) Openfield – This habitat includes agricultural fields, and other open areas that are removed from urban or residential areas. The open field habitat is a result of human disturbance. Disturbed areas containing a mix of non-native grasses, succulents and *Chromoleana*. May contain *Nephrolepis*, and other ferns.

7) Agriforest: This is highly dissected mosaic of dwellings, open fields, gardens, scrub fores, limestone forest, and old *Cocos* groves. Much of central portion of northern Guam consists of this habitat, especially the Central Plateau Region of Guam.

8) Urban: Urban and residential areas, adjacent fields and openings, and runways comprise this habitat. Most of AAFB is urban, as are several towns (Dededo and Yigo) in more southerly regions. The Northwest Field Region has numerous abandoned runways that are classed as urban; a typical scrub forest surrounds these runways.

9) Grassland – Usually found in south, these areas are dominated by *Miscanthus floridulus*, and may contain others species such *Pennisetum polystachyon* and *Dimeria chloridiformis*.

10) Ravine Forest: Common ravine forests include the non-native *Areca catechu*, *Ficus prolixa, Glochidion mariannensis, Hibicus tiliaceous, Pandanas tectorious*, and *Premna serratifolia*.

11) Halophytic Forest: Halophytic (salt adapted) forests are found along beaches in the north and south. Commonly composed of *Casuarina equisetifolia, Cocos nucifera, Guettarda speciosa, Hernandia Sonora, P. tectorius, Scaevola taccada, Thespesia populanea*, and *Tournefortia argentea*.

Appendix 4. Species Rationale Table

Species criteria for inclusion into Guam's SOGCN: (1) The population of the species does not contain a self-sustained breeding population, or no known breeding population, or is extirpated; (2) Population size is considered threatened, or endangered; (3) A monitoring program is not place; (4) The status of the population of the species is not known; (5) The range of the population is limited; or, (6) A funded program is not in place for that species.

		1	2	3	4	5	6
	Mammals						
1	Mariana fruit bat	X	X			X	X
2	Pacific sheath-tailed bat	X	X	X	X	X	X
	Forest Birds						
3	Guam rail*	X	X			X	
4	White-throated ground dove**	X	X			X	X
5	Mariana fruit-dove**	X	X			X	X
6	Island swiftlet*		X			X	X
7	Micronesian kingfisher*	X	X			X	
8	Mariana crow*	X	X			X	
9	Micronesian starling**		X			X	X
10	Micronesian honeyeater**	X	X			X	X
	Wetland Birds						
11	Mariana common moorhen		X	X		X	X
12	Nightingale reed-warbler	X					X
	Sea Birds						
13	White-tailed tropic bird			X			
14	Pacific reef heron			X			
15	Brown booby	X		X	X	X	X
16	Migratory Shore birds			X			
	Lizards & Geckos						
17	Snake-eye skink			X	X	X	X
18	Slevin's skink	X		X	X	X	X
19	Azure-tailed skink	X	X	X	X	X	X
20	Moth skink	X	X	X	X	X	X
21	Micronesian gecko		X	X	X		X
	Gastropods						
22	Mariana Islands tree snail, *Partula gibba*				X	X	X

23	Pacific tree snail, *Partula radiolata*				X	X	X
24	Mariana Islands fragile tree snail, *Samoana fragilis*				X	X	X
	Insects						
25	Forest flicker, *Hypolimnasarakalulk marianesis*		X	X	X	X	X
26	Marianas rusty, *Vagrans egistina*		X	X	X	X	X
	Terrestrial Plants						
27	*Serianthes nelsonii*	X	X			X	X
28	*Tabernaemontana rotensis*				X		X
29	*Cyathea lunalata*						X
30	*Cycas marianensis*						X
31	*Heritiera longipetiolata*				X		X
32	*Merilliodendron megacarpum*						X
	Freshwater Fish						
33	Stream goby, *Stiphodon sp.*				X	X	
34	Redbellied goby, *Sicyopus sp.*				X	X	
35	Marianas goby, *Stenogobius sp.*			X	X	X	
36	Flagtail, *Kuhlia rupestris*			X			
37	Giant marbled eel, *Anguilla marmorata*			X			
	Freshwater Gastropods						
38	Nerite snails, *Neritidae*				X	X	
39	Thiarid snails, *Thiaridae*				X	X	
	Freshwater Plants						
40	Water fern, *Ceratopteris thalictroides*			X	X	X	
41	Pond weed, *Potamo gariannense*			X	X	X	
	Marine Mammals						
42	Bryde's Whale, *Balaenoptera edeni*****		X	X	X		X

43	Sei Whale, *Balaenoptera borealis*****		X	X	X		X
44	Humpback Whale, *Megaptera novaeangliae*****		X	X	X		X
45	Cuvier's Beaked Whale, *Ziphius cavirostiris*****		X	X	X		X
46	Sperm Whale, *Physeter macrocephalus*****		X	X	X		X
47	Dwarf Sperm Whale, *Kogia sima*****		X	X	X		X
48	Pygmy Sperm Whale, *Kogia breviceps*****		X	X	X		X
49	Melonheaded Whale, *Peponocephala electra*****		X	X	X		X
50	Killer Whale, *Orcinus orca*****		X	X	X		X
51	Shortfinned Pilot Whale, *Globicephala macrorhynchus*****		X	X	X		X
52	Risso's Dolphin, *Grampus griseus*****		X	X	X		X
53	Spinner Dolphin, *Stenella longirostris*****		X	X	X		X
54	Striped Dolphin, *Stenella coeruleoalba*****		X	X	X		X
55	Dugong, *Dugong dugon*		X	X	X		X
	Marine Fish						
56	Napolean wrasse, *Cheilinus ndulates****		X		X		X
57	Bumphead parrotfish, *Bolbometopon muricatum****		X		X		X
58	Surgeonfish, Acanthuridae				X		
59	Parrotfish, Scaridae				X		
60	Emperors, Lethrinidae				X		
61	Groupers, Serranidae				X		
62	Rabbitfish, Siganidae				X		
63	Snappers, Lutjanidae				X		
64	Goatfish, Mullidae				X		
65	Butterflyfish, Chaetodontidae				X		

66	Angelfish, Pomacanthidae				X		
67	Hawkfish, Cirrhitidae				X		
68	Wrasse, Labridae				X		
69	Trevallies, Carangidae				X		
	Marine Reptiles						
70	Green sea turtle, *Chelonia mydas**, **		X				
71	Hawksbill turtle, *Eretmochelys imbricate**, **		X				
	Marine Arthropods						
72	Spiny lobster, *Paniluris sp*.			X	X		X
	Marine Mullusc						
73	Giant clam, *Tridacna derasa*		X	X	X		X
74	Giant clam, *Tridacna maxima*		X	X	X		X
75	Giant clam, *Tridacna squamosa*		X	X	X		X
76	Giant clam, *Hippopus hippopu*		X	X	X		X
	Marine Gastropod						
77	Triton's trumpet, *Charonia tritonis*		X	X	X		X
	Corals						
78	Hard Coral, Scaleractinia			X	X		X
79	Soft Coral, Octocorallia			X	X		X
	Marine Plants						
80	Sea grass, *Halodule uninervis*			X	X		X
81	Sea grass, *Enhalus acoroides*			X	X		X
82	Sea grass, *Halophila minor*			X	X		X

* Federally Listed Threatened or Endangered Species
** Locally Listed Threatened or Endangered Species
*** Candidate Species
**** Protected under the Marine Mammal Protection Act

Appendix 5. Records of Marine Mammals

Species	Record	Reference
Balaenoptera edeni Anderson, 1879 [Bryde's Whale]	Decomposed carcass, washed ashore some 500 m north of Sella Bay, Guam, on August 31, 1978.	Davis, 1978
Balaenoptera borealis Lesson, 1828 [Sei Whale]	A single specimen was sighted west of Saipan. Two tagged sei whales from the Northern Mariana Islands were later killed several hundred kilometers south of the western Aleutian Islands.	Masaki, 1972 Horwood, 1987.
Megaptera novaeangliae (Borowski, 1781) [Humpback Whale]	Stories of sightings and killings of 9 whales in one season were recorded in the southern Mariana Islands. Two whales were reported about 100 m off the reef margin at Uruno Point on February 25, 1978. Three were sighted off the west coast of Guam on February 13, 1991. A group of three was photographed off Saipan in February 1991. A mother and calf were sighted off the east coast of Rota in late February 1991. A group of six or more was photographed at the entrance to Apra Harbor in January 1996.	Beane, 1905 Eads, pers. comm. Eads, 1991 Darling & Mori, 1993 Stinson, pers. comm. Anon., 1996
Ziphius cavirostris Cuvier, 1823 [Cuvier's Beaked Whale]	This species has been reported in the Mariana and Bonin Islands area.	Masaki, 1972
Physeter macrocephalus Linnaeus, 1758 [Sperm Whale]	Sightings throughout the year between 1761 and 1920, especially around the Marianas, Pohnpei, and Kosrae. One 15-m albino sperm whale was found beached at Acho Bay, Inarajan, Guam on September 5, 1962. One stranding reported. Eight sperm whales were sighted June 15, 2001, including a young calf with a trailing umbilical cord.	Townsend, 1935 Bordallo, 1965, Kami & Lujan, 1976 www.mdaguam.com, accessed February 9, 2005
Kogia sima Owen, 1866 [Dwarf Sperm Whale]	One whale washed ashore at Asan, March 25, 1970. One whale washed ashore at Rizal Beach, December 6, 1974. Two specimens from Guam are deposited in the U.S. National	Kami & Lujan, 1976 Kami & Lujan, 1976 Reeves et al., 1999

	Museum. A dead dwarf sperm whale was found floating in Cocos Lagoon on August 24, 2002.	 Radway, 2002
Kogia breviceps (de Blainville, 1838) [Pygmy Sperm Whale]	A partially decayed specimen was found at NSD Beach at Naval Station (Apra Harbor), Guam on February 9, 1989.	Sherwood, 1989
Peponocephala electra (Gray, 1846) [Melonheaded Whale]	A stranded male melon-headed whale was reported from Inarajan, Guam, on April 1980.	Kami & Hosmer, 1982
Orcinus orca (Linnaeus, 1758) [Killer Whale]	One killer whale was found beached at Orote Point, Guam n August 1, 1981 Two large male and two female killer whales were observed just offshore between Orote Point and Facpi Point, Guam during the summer of 1987.	Kami & Hosmer, 1982 Naughton, pers. comm.; Eldredge, 1991
Globicephala macrorhynchus Gray, 1846 [Shortfinned Pilot Whale]	A large school of about ten individuals were reported near Uruno Point, Guam. The first known beaching of an individual on Guam was reported on July 6, 1980.	Birkeland, 1977 Kami & Hosmer, 1982; Donaldson, 1983
Grampus griseus (Cuvier, 1812) [Risso's Dolphin]	One group of Risso's dolphin was reported northwest of Guam. Additional sighting in the Mariana Islands and Guam were made during the winters 1993-1995.	Miyazaki & Wada, 1978 Miyashita et al., 1996
Stenella longirostris (Gray, 1828) [Spinner Dolphin]	A photo of two in the waters of Guam was published in 1984. Groups of 20 to 30 individuals were found at Pugua Patch Reef (Double Reef), Guam in April and May 1986 and in June 1988. Stinson (1994) reported spinner dolphins common throughout the Mariana Islands. Groups were common around Double Reef and Merizo throughout the late 90's and were the subjects of a dolphin-watching tourist industry.	Rock, 1984 Naughton, pers. comm. Paulay, pers. comm.
Stenella coeruleoalba (Meyen, 1833) [Striped Dolphin]	A single freshly dead female was found at Dadi Beach, Agat Bay, Guam on July 24, 1985. One additional record occurs from Guam.	Nitta, pers. comm. Wilson et al., 1987
Dugong dugon (Muller, 1776) [Dugong]	One recorded a single verified sighting of a dugong at the southern end of Cocos Lagoon in 1975. Eldredge (2003b) also	Randall et al., 1975

	mentions that several dugong sightings along the southeastern coast of Guam were reported in 1985. Sketches made by observers at the time matched the description of a dugong.	

Appendix 6. SOGCN Summary Tables

Common name *Scientific name*	Local listing	Federal listing	Habitat(s)	Threats	Status	Knowledge base	Action	Priority
TERRESTRIAL **Mammals** Mariana fruit bat *Pteropus m. mariannus*	E	E	Limestone and ravine forest	• Brown treesnake (BTS) predation • Human exploitation • Habitat loss	• < 50 individuals in AAFB bat colony • Status off base is unknown	Good	• BTS and ungulate control at colony • Implement recovery plan • Island wide surveys	• 1 • 1 • 2
Pacific sheath-tailed bat *Emballonura semicaudata rotensis*	E	E	Cave dwellers, Forested areas	• Human exploitation • Habitat loss • BTS predation	• Extirpated from the wild on Guam	Lacking	• Area-wide BTS control • Reintroduce to Guam • Habitat preparation	• 1 • 1 • 2
Forest Birds Mariana crow *Corvus kubaryi*	E	E	Limestone forest	• BTS and other invasive predators • Small population • Loss of habitat	• Ten individuals in the wild • Seven in GDAWR holding facility	Good	• Area wide BTS control • Supplement population • Snake barrier nest trees • Monitor population	• 1 • 1 • 1 • 2
Guam rail *Gallirallus owstonii*	E	E	Limestone forest, scrub forest, and savanna complex	• BTS, feral cats, and rats predation • Competition with introduced	• Captive population • Extirpated from the wild on Guam • ~ 600 rails reintroduced to	Good	• BTS and cat control at release sites • Reintroduce to Guam • Habitat preparation	• 1 • 1 • 2

Guam rail *Gallirallus owstonii*	E	E	Limestone forest, scrub forest, and savanna complex	• BTS, feral cats, and rats predation • Competition with introduced game species • Habitat loss	• Captive population • Extirpated from the wild on Guam • ~ 600 rails reintroduced to Rota since 1989	Good	• BTS and cat control at release sites • Reintroduce to Guam • Habitat preparation	• 1 • 1 • 2
Micronesian kingfisher *Halcyon cinnamomina cinnamomina*	E	E	Limestone forest	• BTS, feral cat, monitor lizard, and rat predation • Habitat loss	• Extirpated in the wild. • ~70 individuals in mainland zoos. • Three males and one female at GDAWR facility.	Good	• Continue captive breeding efforts • Continue support with Micronesian kingfisher Species Survival Plan (MK SSP) • Reforestation	• 1 • 1 • 2
Island swiftlet *Aerodramus vanikorensis bartschi*	E	E	Cave dwelling; forages over savanna complex and ravine forest	• BTS predation • Pesticides	• ~500-600 birds in a single colony in southern Guam. • Possibly two smaller populations in southern (1) and northern (1) Guam.	Good	• BTS control • Reintroduce to northern Guam • Monthly surveys	• 1 • 1 • 2
Mariana fruit-dove *Ptilinopus roseicapilla*	E		Limestone forest	• BTS, feral cat, monitor lizard, and rat predation • Habitat loss • Human exploitation	• Extirpated in Guam	Lacking	• Habitat preparation • Reintroduce to Guam • Develop knowledge base •	• 2 • 2 • 3
White-throated ground dove *Gallicolumba xanthonura*	E		Limestone forest	• BTS, feral cat, and rat predation • Habitat loss • Human exploitation	• Extirpated in Guam	Lacking	• BTS control • Survey	• 2 • 2

Micronesian honeyeater *Myzomela rubratta saffordi*	E		Found inhabiting all habitat types	• BTS, feral cats, and rat predation. • Habitat loss	• Extirpated on Guam	Lacking	• BTS control • Reintroduce to Guam	• 2 • 2
Wetland Birds Mariana common moorhen *Gallinula chloropus guami*	E	E	Freshwater habitat types (lake, pond, and springs)	• BTS, feral cat predation • Habitat loss	• Unknown	Good	• Survey and monitor population • BTS control • Habitat preservation	• 1 • 1 • 1
Nightingale reed-warbler *Acrocephalus luscinia luscinia*	E	E	Areas in or near brackish water or marsh habitats	• BTS predation • Habitat loss • Human exploitation • Wild fires	• Extirpated on Guam	Limited	• BTS control • Habitat preparation • Reintroduce to Guam	• 1 • 1 • 2
Seabirds Brown booby *Sula leucogaster*	E		Roost and nest on high cliff walls	• BTS predation • Habitat loss	• Unknown, frequent visitor to Guam	Good	• BTS control • Determine distribution and abundance • Identify and prepare roost and nest sites	• 1 • 1 • 2
White-tailed tropicbird *Phaethon lepturus*	E		Roost and nest on high cliff walls and tall trees	• BTS predation • Habitat loss	• Unknown, frequent visitor to Guam	Good	• BTS control • Determine distribution and abundance • Identify and prepare roost and nest sites	• 1 • 1 • 2
Pacific reef heron *Egretta sacra*	E		Roost and nest on islets on or near ground	• BTS predation • Habitat loss	• Unknown, frequent visitor to Guam	Good	• BTS control • Determine distribution and abundance • Identify and prepare roost and nest sites	• 1 • 1 • 2

Migratory Shore Birds			Mud flats, tidal flats, and open fields	• Predators • Habitat loss	• Unknown	Limited	• Determine the abundance and distribution • Reduce or prevent habitat loss and monitor important sites for contaminants and spills • Implement appropriate predation control	• 1 • 1 • 2
Reptiles Micronesian gecko *Perochirus ateles*	E		Historically found in Limestone forest and beach strand	• BTS, feral cats, and introduced gecko (*Gehrya oceanica)* predation	• Unknown	Lacking	• Determine abundance and distribution • Implement appropriate predation control	• 1 • 1
Snake-eye skink *Cryptoblepharus peocilopleurus*	E		Coastal strand, loose sand soil	• BTS, feral cats, and introduced gecko (*Gehrya oceanica)* predation • Competition	• Unknown	Lacking	• Determine abundance and distribution • BTS and cat control in habitat	• 1 • 1
Azure-tailed skink *Emoia cyanura*	E		Forest edge, loose ground cover	• BTS, feral cats, and introduced gecko (*Gehrya oceanica)* predation • Competition	• Unknown	Lacking	• Determine abundance and distribution • BTS and cat control in habitat	• 1 • 1
Slevin's skink *Emoia slevini*	E		Forest floors, old fields, low tree trunks	• BTS, feral cats, and introduced gecko (*Gehrya oceanica)* predation • Competition	• Unknown	Lacking	• Determine abundance and distribution • BTS and cat control in habitat	• 1 • 1

Moth Skink *Lipinia noctua*	E		Forested areas, large tree trunk	• BTS, feral cats, and introduced gecko (*Gehrya oceanica)* predation • Competition	• Unknown	Lacking	• Determine abundance and distribution • BTS and cat control in habitat	• 1 • 1
Gastropods Mariana Islands fragile tree snail *Samoana fragilis*	E		Limestone and ravine forest	• Habitat loss and modification • Predation by alien snail and flatworm • Wild grassland fires	• Unknown	Good	• Survey population • Predator control • Reforestation • Supplement smaller populations	• 1 • 1 • 1 • 1
Pacific tree snail *Partula radiolata*	T	*P	Limestone forest	• Habitat loss and modification • Predation by alien snail and flatworm • Wild grassland fires	• Unknown	Good	• Survey population • Predator control • Reforestation • Supplement smaller populations	• 1 • 1 • 1 • 1
Mariana Islands tree snail *Partula gibba*	T	*P	Limestone and ravine forest	• Habitat loss and modification • Predation by alien snail and flatworm • Wild grassland fires	• Unknown	Good	• Survey population • Predator control • Reforestation • Supplement smaller populations	• 1 • 1 • 1 • 1
Insects ***Family Nymphalidae*** Forest flicker *Hypolimnas octocula mariannensis*			Limestone forest	• Habitat loss for the host plant, *Procris*	• Unknown	Lacking	• Identify and map localities with *Procris p.,* and reduce encroachment of	• 1

				pedunculata • Predation of caterpillar by an ichneumonid wasp			invasive vines • Study seasonal activity for the butterfly • Cultivate caterpillars in a safe predator-free setting, to rear for release.	• 1 • 1
Marianas rusty *Vagrans egistina*			Limestone forest	• Habitat loss for the host plant *Maytenus thompsonii* • Predation by parasitoid wasps and ants	• Unknown	Lacking	• Identify and map localities with *Procris p.*, and reduce encroachment of invasive vines • Study seasonal activity for the butterfly • Cultivate caterpillars in a safe predator-free setting, to rear for release.	• 1 • 1 • 1
Plants Tree fern *Cyathea lunalata*	E		Ravine forest edge, usually on muddy hill slopes	• Habitat loss • Typhoons • Wild grass land fires	• Rare	Good	• Identify and map localities of species • Protect habitat • Collect and propagate seedlings	• 1 • 1 • 2
Federico Nut *Cycas marianensis*			Limestone forest, ravine forest, coastal areas, and savanna summits	• Asian cycad scale (*Aulacaspis yasumatsui*) infestation • Ungulate	• Common throughout Guam, many effected by Asian cycad scale	Good	• Biological control for Asian cycad scale • Collect seeds and propagate • Ungulate control	• 1 • 1 • 2

				damage • Wild grass land fires • Typhoons				
No Common Name *Heritiera longipetiolata*	E	E	Limestone forest	• Herbivory and damage • Rare fruiting occurrence • Typhoons	• Rare	Lacking	• Monitor for fruiting occurrence • Develop nursery for seedlings • Ungulate control in habitat	• 1 • 1 • 1
No Common Name *Merilliodendron megacarpum*			Limestone forest	• Herbivory • Typhoons • Development	• Rare	Good	• Ungulate control in habitat • Collect and propagate seedlings	• 1 • 3
Fire tree *Serianthes nelsonii*	E	E	Limestone and ravine forest	• Herbivory • Insect damage • Typhoons • Lack of propagation	• Rare	Good	• Ungulate control • Collect plant material for propagation and distribution	• 1 • 3
Tabernaemontana rotensis		E	Limestone forest	• Typhoons • Development • Browsing of new seedlings	• Common but not abundant	Good	• Determine distribution and status	• 1
AQUATIC **Marine mammals** Bryde's whale *Balaenoptera edeni*		E	Temperate to tropical waters, oceanic and inshore bounded by latitude 40˚ N and S or 20˚ isotherm	• Seismic operations • Collision with vessels • Entanglement • Defense operations	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3

				• Pollution • Loss of prey species				
Sei whale *Balaenoptera borealis*		E	Oceanic, warm water breeding, cold water feeding grounds, between 40˚ N and S.	• Seismic operations • Collision with vessels • Entanglement • Pollution • Rarity of low latitude feeding • Over-harvest for scientific studies	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Humpback whale *Megaptera novaeangliae*		E	Antartic pelagic, in summer: temperate to subtropical, in winter: tropical coastal	• Human disturbance • Coastal seismic operations • Defense operations • Collision with vessels • Entanglement • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Cuvier's beaked whale *Ziphius cavirostris*		E	Tropical to sub-polar deep oceanic waters	• Entanglement • Competition for food source • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Sperm whale *Physeter macrocephalus*		E	Pelagic, offshore, deep water, temperate-tropical	• Unknown	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Dwarf sperm whale *Koiga sima*		E	Oceanic, apart from colder waters, more coastal than	• Seismic operations • Collision • Entanglement	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3

			pygmy whale	• Defense • Operation • Pollution				
Pygmy sperm whale *Koiga breviceps*		E	Oceanic, apart from colder waters	• Seismic operations • Collision • Entanglement • Pollution • Toxicity	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Melonheaded whale *Peponocphala electra*		E	Pelagic and oceanic, primarily tropical and subtropical, temperate (< 25˚)	• Illegal and incidental fishing • Capture • Entanglement • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Killer whale *Orcinus orca*		E	Oceanic, pelagic, neritic, in warm and cold waters	• Heavy metals and organochlorine accumulation • Reduction of food resources • Entanglement	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Shortfinned pilot whale *Globicephala macrorhynchus*		E	Tropical to temperate oceanic waters approach coastal seas	• Entanglement • Lost and discarded • Competition • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Risso's dolphin *Grampus griseus*			Tropical, subtropical, temperate, subantarctic waters	• Incidental and illegal capture • Entanglement • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Spinner dolphin *Stenella longirostris*			Primary pelagic, can be neritic in same regions, tropical,	• Incidental and • Illegal catching • Capture • Entanglement	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3

Spinner dolphin *Stenella longirostris*			Primary pelagic, can be neritic in same regions, tropical, subtropical, and temperate waters	• Incidental and • Illegal catching • Capture • Entanglement • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Striped dolphins *Stenella coeruleoalba*			Pelagic, deep water, and outer continental slope.	• Incidental catch • Direct and indirect catch • Entanglement • Pollution	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Dugong *Dugong dugon*		E	Shallow tropical waters throughout Indo-Pacific region	• Habitat loss • Direct take • Collisions with small vessels	• Unknown	Lacking	• Public outreach • Monitoring	• 2 • 3
Freshwater Fishes Stream goby *Stiphodon* sp.			Freshwater streams	• Introduced fish and plants • Degradation of water quality	• Abundant	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Redbellied goby *Sicyopus* sp.			Freshwater streams	• Introduced fish and plants • Degradation of water quality	• Unknown	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Marianas goby *Stenogobius* sp.			Rivers; soft sandy or muddy substrates	• Loss of habitat • Degradation of water quality	• Common	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Flagtail *Kuhlia rupestris*			Rivers and streams	• Introduced fish and plants • Degradation of water quality	• Common	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Giant marbled eel *Anguilla marmorata*			Rivers and streams	• Over-fishing • Habitat modification	• Common	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Freshwater Crustaceans								

Tahitian prawns *Macrobrachium* sp.			All freshwater habitats on Guam	• Introduced predators • Habitat loss • Over-fishing • Destructive fishing method	• Common	Limited	• Public outreach • Protect habitat • Monitoring	• 1 • 1 • 2
Freshwater crabs Varunid crabs			Rocky and hard substrates in rivers	• Introduced predators • Loss of water quality	• Common	Limited	• Protect habitat • Monitoring	• 1 • 2
Freshwater Gastropods Nerite snails Neritidae			Rocky and hard substrates in rivers	• Introduced predators	• Common	Limited	• Protect habitat • Monitoring	• 1 • 2
Thiarid snails Thiaridae			Soft substrates in rivers and lakes	• Introduced predators • Habitat loss	• Common	Limited	• Protect habitat • Monitoring	• 1 • 2
Freshwater Plants Water ferns *Ceratopteris thalictroides*			Slow moving or stagnant water, ponds, lakes	• Introduced predators • Habitat loss	• Common	Limited	• Protect habitat • Monitoring	• 1 • 2
Pond weed *Potamongeton mariannense*			Slow moving stretches of rivers with soft or muddy substrates	• Introduced plants and animals • Substrate loss	• Uncommon	Limited	• Protect habitat • Monitoring	• 1 • 2
Marine Fishes Humphead wrasse (Napolean wrasse) *Cheilinus undulates*			Coral-rich lagoons to outer reef slopes	• Human take • Habitat degradation	• Heavily fished, adults rarely seen	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Bumphead parrotfish *Bolometopon muricatum*			Outer lagoon and seaweed reefs	• Over-fishing • Habitat loss	• Rare	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Surgeonfish			Inshore to	• Over-fishing	• Unknown	Limited	• Marine Preserves	• 1

Acanthuridae			lagoons and seaweed reefs	• Habitat loss			• Public outreach • Monitoring	• 1 • 2
Parrotfish *Scaridae*			Lagoons and seaweed flats, some in reef flats (seagrass or dense algae beds)	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Emperors *Lethrinidae*			Lagoons and seaweed reefs	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Groupers *Serranidae*			Lagoons and seaweed reefs	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Rabbitfish *Siganidae*			Varies	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Snappers *Lutjanidae*			Varies	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Goatfish *Mullidae*			Reef flats; young in sandy substrate, adults in seaward reefs (300 ft. depth)	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Butterflyfish *Chaetodontidae*			Coral reefs	• Capture for aquarium trade • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Angelfish *Pomacanthidae*			Reef flats, clear lagoons, seaward reef slopes, channels	• Capture for aquarium trade • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Hawkfish *Cirrhitidae*			Closely associated to coral reefs	• Over-fishing • Capture for aquarium trade • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Wrasses			All coral reef	• Over-fishing	• Unknown	Limited	• Marine Preserves	• 1

Labridae			habitats	• Habitat loss			• Public outreach • Monitoring	• 1 • 2
Jacks and Trevallies *Carangidae*			Reef flats; young usu. around floating objects, adults in depths up to 300 ft.	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Marine Mullusc Giant clam *Tridacna derasa*			Reef flats and seaward reefs in depths up to 60 ft.	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Giant clam *Tridacna maxima* *T. squamosa* *Hippopus hippopus*			Reef flats and seaward reefs in depths up to 60 ft.	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Marine Gastropod Triton's trumpet *Charonia tritonis*			Rich coral growth areas	• Over-fishing • Habitat loss	• Unknown	Limited	• Marine Preserves • Public outreach • Monitoring	• 1 • 1 • 2
Marine Reptiles Green sea turtle *Chelonia mydas*	T	T	All marine habitats	• Predation • Human take • Habitat loss • Oil spills • Marine debris	• Common in Guam's marine habitat	Good	• Monitoring • Public outreach • Marine preserves	• 2 • 1 • 1
Hawksbill turtle *Eretmochelys imbricata*	E	E	All nearshore habitat types	• Predation • Human take • Habitat loss • Oil spills • Marine debris	• Rare	Good	• Monitoring • Public outreach • Marine preserves	• 2 • 1 • 1
Marine Arthropods Spiny lobster *Paniluris* sp.			Surf zone, reef front, reef flats	• Over-fishing • Habitat loss	• Unknown	Good	• Monitoring • Marine preserves	• 2 • 1

Marine Arthropods Spiny lobster *Paniluris* sp.			Surf zone, reef front, reef flats	• Over-fishing • Habitat loss	• Unknown	Good	• Monitoring • Marine preserves • Public outreach	• 2 • 1 • 1
Marine Plants Sea grasses *Halodule uninervis, Enhalus acoroides, Halophila minor*			Shallow reef flats of nearshore reefs	• Sedimentation • Habitat alteration • Recreational impacts	• Declining	Good	• Monitoring • Marine preserves • Public outreach	• 2 • 1 • 1
Marine Anthozoans Hard coral Subclass Scleractinia			Highly variable, mangrove swamps, estuaries, and reef flats up to 100m deep	• Pollution • Sedimentation • Recreational misuse • Climate change • Disease	• Declining in health	Good	• Monitoring • Marine preserves • Public outreach	• 2 • 1 • 1
Soft coral			Varies in depths	• Sedimentation	• Declining	Good	• Monitoring	• 2

*P = Species proposed for listing under the US Federal Endangered Species Act.

Appendix 7. GCRICC Local Action Strategies

Guam recognizes the important benefits that coral reefs provide, and has developed a diverse assortment of laws, regulations, permits, policies, plans and education programs to serve as mechanisms for management of human activities that impact Guam's coral reefs (Gawel, 1999). Many of these, such as the Environmental Impact Assessment requirements, were not created specifically to protect coral ecosystems but now serve that purpose. Guam continues to expand and improve its management activities to address the threats identified above.

This process has been facilitated by the creation of the Guam Coral Reef Initiative Coordinating Committee (GCRICC) by Executive Order 97-10 in 1997. This committee prioritized the 13 threats identified in the National Coral Reef Action Strategy and selected the top five on which to focus for the next three years. By February 2003, the GCRICC had identified local navigators and drafted local action strategies (LAS) for the prioritized focus areas of land-based sources of pollution, fisheries management, outreach and education, recreational misuse and overuse, and climate change and coral bleaching. These local action strategies have provided a guiding framework for local resource agencies and have facilitated improved management and coordination between agencies. Current conservation management activities can be grouped according to the threat that they address (Figure 16.30).

The LAS process has also served to broaden the network of stakeholder groups working on coral reef issues. Members of the Guam Watershed Planning Committee (WPC), a group of local, federal, and non-governmental agencies involved primarily with watershed restoration, have become involved in the LAS development and members of the GCRICC now participate in the WPC. In addition, the University of Guam Marine Laboratory and Water and Environmental Research Institute, guided by the needs of the local natural resource agencies, have shifted much of their focus toward management-driven research. Recently, another crucial stakeholder group has been engaged. The Guam Visitors Bureau and the tourism industry are now working with the natural resources agencies to market Guam's coral reefs, and in particular the marine preserves, to the 1 million visitors that come to our island yearly. This new awareness of the economic value of our coral reef resources is beginning to create a sense of stewardship in the industry, absent during the economic boom of the 1980s and recession of the 1990s.

Current Conservation Management Activities in Guam

Land-Based Sources of Pollution

- Guam Seashore Protection Plan
- Soil Erosion and Sediment Control Regulations of 2000
- GEPA enforcing Section 401 and NPDES permits
- Watershed Restoration (DoAg)
- Watershed Planning Group
- Permit Conditions to Limit disturbance during coral

Fisheries Management

- Marine Preserve Areas (DAWR)
  - Enforcement
  - Education
  - Monitoring
- Creel Surveys (DAWR)
- School Presentations

Lack of Public Awareness

- Coral Awareness Campaign
  - Video
  - PSAs
  - Hotel Tent Cards
  - Coloring Books
- Island Pride Campaign
  - Trash Collections
  - Tree Planting
  - Snorkeling

Recreational Overuse & Misuse

- Informational campaign for Tumon Bay (GCMP/GVB)
- Beach Cleaning Permit Conditions (GVB)
- Eco-Permit for Marine Preserves (DAWR)

Local Action Strategies

Land-based Sources of Pollution

Guam identified land-based sources of pollution as its number one priority focus area in 2002 and local and federal stakeholders have developed a 3 year local action strategy to address this threat. This is also the most difficult threat to address as it involves a large number of stakeholders. This is complicated by the lack of cooperation from some key government of Guam agencies. The goal of the land-based sources of pollution local action strategy (LBSP LAS) is to improve the health of coral reef ecosystems by reducing the amount of sedimentation and pollution from anthropogenic sources such as development, fires, and agriculture in three priority watersheds on Guam.

Completed or ongoing projects identified in the LBSP LAS include: implementation of reforestation and best management practices in partnership with business and community groups on 5 demonstration plots in highly visible and commercially-developed sites in the villages of Tumon and Harmon; completion of a drainage and runoff study plan for reforestation of Ypao Beach Park; hiring of an anti-arson campaign coordinator who will develop workshops, PSAs, posters, and other outreach materials to address the problem of wildland fires in southern Guam; incorporation of USEPA Environmental Monitoring and Assessment Program (EMAP) protocols into a new Guam Water Quality Monitoring Strategy; development of a GIS based erosion potential model for estimating sediment

delivery to estuarine and coral reef environments of southern Guam; and reforestation and implementation of erosion-control practices in gullies and ravines of the Fouha watershed.

Several new projects in support of the goal of our LBSP LAS are proposed for funding under the NOAA State and Territory Coral Reef Management Grant, including: developing a digital watershed atlas for Guam that can be used by resource managers, regulators, and contractors in future restoration planning efforts, but also as an educational tool for teachers and the general public; measuring the effectiveness of the previous tree planting and implementation of erosion-control measures in Fouha watershed; evaluation of soft corals as a bioindicator alternative to more expensive semi-permeable membrane devices (SPMDs) to detect persistent contaminants in Guam's coastal waters (this is phase II, phase I was funded under the Guam FY04 Coastal Zone Management Grant); and providing workshops and training to senior managers, engineers, resource managers, regulators, and technical staff in key government agencies and the private sector encompassing concepts such as watershed assessment, planning, restoration, and implementation of innovative methods of riverbank and shoreline protection.

Coral Reef Fisheries Management

Traditionally, coral reef fishery resources formed a substantial part of the indigenous Chamorro community's diet and included finfish, invertebrates, and sea turtles (Amesbury and Hunter-Anderson, 2003). Today coral reef resources are both economically and culturally important. Reef fish, sea cucumbers, sea urchins, a variety of crustaceans, mollusks, and marine algae are all eaten locally. In addition to the cash and subsistence value of edible fish and invertebrates, reef-related fisheries are culturally important as family and group fishing is a common activity in Guam's coastal waters.

Because of the value derived from Guam's coral reef fisheries, both economically and culturally, the threat of overfishing is a serious concern. This threat became more apparent in the 1980's, when inshore fisheries data indicated that the number of hours spent fishing almost doubled, from 161,602 hours in 1984 to 300,861 in 1987, while the average catch per hour for reef fish declined (Sherwood, 1989). Data from recent creel surveys suggest that Guam's fisheries have not recovered from this decrease in the 1980s (Gutierrez, 2004). In response to these declines, GDAWR established 5 marine preserves in 1997, representing 11% of Guam's coastline (Tumon Bay, Piti Bomb Holes, Sasa Bay, Achang Reef Flat, and Pati Point). The preserves were fully implemented in 2001. Fishing activity is restricted in the preserves with limited cultural take permitted in three of the five areas.

Guam has completed most of the projects identified in our first fisheries management local action strategy (FM LAS), the goal of which was to increase the effectiveness of the 5 marine preserves through greater support of enforcement, public outreach, and targeted research. Completed or ongoing projects identified in the FM LAS include: studies on connectivity of the marine preserves with adjacent areas using larval tracking and telemetry for adult fish; development of marine preserve flyers, posters, PSAs, and

continued educational presentations to schoolchildren and the general public, hiring a natural resource prosecutor; implementation of a Conservation Officer Reserve Program; purchase of vehicles, a vessel and trailer, and equipment for law enforcement; drafting rules and regulations for a newly adopted marine preserve eco-permit, which will guide the types of non-fishing activities allowed within the marine preserves; and assessing the role of soft corals as reef fish habitat in Piti Bomb Holes marine preserve.

Currently, the second iteration of the FM LAS is being developed under the guidance of the newly promoted Fisheries Supervisor at GDAWR and the goal broadened to work toward achieving sustainable use of coral reef fisheries resources. New projects under the FM LAS proposed for funding under the NOAA State and Territory Coral Reef Management Grant include: additional support for the Conservation Officer Reserve Program to further improve enforcement of the marine preserves; development of pocket-sized fishing regulation booklets to increase public awareness of the marine preserves; and an assessment of algal abundance on Guam reef flats in relation to herbivore stocks and nutrients in marine preserves, to provide a better understanding of the relative importance of addressing overfishing versus land-based sources of pollution in restoring coral reef ecosystem health.

Education and Outreach

The need to foster an informed population in regard to coral reefs and their importance to the island is critical to the success of any long-term conservation efforts. Thus, the GCRICC identified a lack of public awareness as a priority threat to coral reefs. This threat and the subsequent local action strategy developed to address it offer the greatest opportunity for coordination among the other LAS; indeed specific education and outreach action items are identified in all of the other local action strategies.

Recently, another crucial stakeholder group has been engaged in the LAS process. The Guam Visitors Bureau and the tourism industry are now working with the natural resources agencies to market Guam's coral reefs, and in particular the marine preserves, to the 1 million visitors that come to our island yearly. This new awareness of the economic value of our coral reef resources is beginning to create a sense of stewardship in the industry, absent during the economic boom of the 1980s and recession of the 1990s. The goal of the education and outreach local action strategy (EO LAS) is to increase awareness of the need for the protection of Guam's coral reefs through improved efforts in the community, in the classroom, and with policy makers.

Completed or ongoing projects in support of the EO LAS include: development of an environmental curriculum (with an emphasis on coral reefs) for Guam's public and private schools; providing a scholarship for a student at UOGML to study coral reef conservation biology; conducting a coral reef managers course at UOGML; and contracting a professional marketing firm to develop and launch a professional, multi-media, coral reef awareness campaign featuring the same clownfish character ("Professor Kika Clearwater") in an educational video for use on incoming flights, movie theater slides, hotel room tent cards, coloring books, advertisements, and streetside banners. The

second year of funding for the scholarship at UOGML is proposed for funding under the NOAA State and Territory Coral Reef Management Grant.

Recreational Use

There are a number of recreational activities that utilize or impact coral reefs including snorkeling, SCUBA diving, and jet skiing. These activities are enjoyed by the over 1 million tourists visiting the island annually. According to the Guam Economic Development Authority, the tourism industry accounts for up to 60% of the government's annual revenues and provides more than 20,000 direct and indirect jobs. A previous exit survey of Japanese visitors noted that the highest rated optional tour categories were: Parasailing, Health Spas, Underwater Observation, and Jet-skiing (Japanese Exit Survey, 2001). This suggests that marine resources are very important to the tourist industry.

Guam residents enjoy a great many water and reef-related recreational activities as well, and in many cases these recreational users are some of the reefs strongest advocates. The goal of the recreational use local action strategy (RU LAS) is to identify and quantify major recreational uses of Guam's coastal and coral ecosystems, and reduce the negative impacts from recreational uses on these ecosystems. Completed and ongoing projects that fall under the RU LAS include: assessment of the effects of motorized personal watercraft on Guam coral reef ecosystems; development of kiosks containing informational brochures about coral reefs in hotel lobbies and hotel rooms, hiring of an additional Department of Parks and Recreation park ranger; maintenance and repair of shallow water mooring buoys at popular sites; and monitoring the impacts of recreational users on sea grass beds in Piti Bomb Holes marine preserves. New projects under the RU LAS proposed for funding under the NOAA State and Territory Coral Reef Management Grant include: mapping recreational areas of Guam's coast and include information on the type and frequency of use at each site; and identifying appropriate recreational areas for beginning scuba classes.

Climate Change, Coral Bleaching, and Disease

Large-scale coral bleaching events and associated coral mortality are not common on Guam. Since the establishment of the University of Guam Marine Laboratory in 1970, there have been only two recorded bleaching events, characterized by considerable inter-specific variation in bleaching response and little mortality. However, as sea surface temperatures continue to rise, coral bleaching events may become more frequent and more deleterious on Guam. Disease outbreaks threaten reefs worldwide and recent evidence points to an increase in both the number of diseases reported and their severity and geographic extent (Ward and Lafferty 2004).

Our current inadequate state of knowledge prevents the formulation of meaningful management strategies, particularly for poorly-studied Indo-Pacific reefs. Virtually nothing is known regarding diseases affecting the coral reefs of Guam, as no baseline assessment of disease prevalence has been accomplished to date. The climate change, coral bleaching, and disease local action strategy (CCCBD LAS) is under the guidance of a new faculty member at UOGML and is not yet fully developed. However, the current goal is to facilitate the inclusion of climate change, coral bleaching, and disease in

monitoring and management plans and activities on Guam's coral reefs. There are currently no completed or ongoing projects. Two projects submitted under the NOAA State and Territory Coral Reef Ecosystem Monitoring Grant will support this LAS: monitoring of coral bleaching, among other parameters at permanent monitoring sites; and assessment of baseline levels of coral disease. Both are components of a long-term, comprehensive coral reef monitoring strategy that is currently being developed by the Guam Coral Reef Monitoring Working Group.

Local Action Strategy Contact Information:

Land-based Sources of Pollution
Local Navigator: Mr. David Limtiaco
Chief, Forestry and Soil Resources Division
192 Dairy Road, Mangilao, Guam 96913
Tel: 671-735-3949; Fax: 671-734-0111
Email: dlimiti@vzpacifica.net

Coral Reef Fisheries Management
Local Navigator: Mr. Jay Gutierrez
Fisheries Supervisor, Division of Aquatic and Wildlife Resources
192 Dairy Road, Mangilao, Guam 96913
Tel: 671-735-3984; Fax: 671-734-6570
Email: jaytgutierrez@yahoo.com

Education and Outreach
Local Navigator: Ms. Evangeline Lujan
Bureau of Statistics and Plans, Guam Coastal Management Program
Governor Ricardo J. Bordallo Complex
513 West Marine Drive
Hagatna, Guam 96910
Tel: 671-475-9672; Fax: 671-475-1812
Email: vange@mail.gov.gu

Recreational Use
Local Navigator: Mr. Victor Torres
Bureau of Statistics and Plans
Governor Ricardo J. Bordallo Complex
513 West Marine Drive
Hagatna, Guam 96910
Tel: 671-475-9672; Fax: 671-475-1812
Email: vtorres@mail.gov.gu

Climate Change, Coral Bleaching, and Disease
Local Navigator: Dr. Laurie Raymundo

University of Guam Marine Laboratory
UOG Station, Mangilao, Guam 96913
Tel: 671-735-2184; Fax: 671-734-6767
Email: lraymundo@guam.uog.edu

Appendix 8. Outreach Documentation

Department of Agriculture
Dipåttamenton Agrikottura
142 Dairy Road, Mangilao, Guam 96913

Felix P. Camacho
Governor

Kaleo S. Moylan
Lt. Governor

Director's Office	734-3942/43; Fax 734-6569
Agricultural Development Services	734-3946; 735-3946; 735-3950
Plant Nursery	734-3949
Aquatic & Wildlife Resources	735-3955/56; Fax 734-6570
Forestry & Soil Resources	735-3949/51; Fax 734-0111
Plant Inspection Station	475-1426/27; Fax 477-9487

Paul C. Bassler
Director

Joseph D. Torres
Deputy Director

November 01, 2004

Memorandum

To: Director, Bureau or Statistics and Plans
Director, Department of Parks and Recreation
Director, Department of Land Management
Administrator, Guam Environmental Protection Agency
Administrative Director, Chamorro Land Trust
General Manager, Guam Power Authority
General Manager, Guam Telephone Authority

From: Director, Department of Agriculture

Subject: Comprehensive Wildlife Conservation Strategy (CWCS)

Hafa Adai! The Department of Agriculture, Guam Division of Aquatic and Wildlife Resources (GDAWR) has been tasked with the overall responsibility and authority for the producing Guam's Comprehensive Wildlife Conservation Strategy (GCWCS). The primary goal of GCWCS is to protect and manage those species of greatest conservation need in the territory. Guam is in prime position to receive federal funds for the conservation efforts outlined in the GCWCS as long as we can complete the plan by October 2005.

The GCWCS gives us the opportunity to address broader issues that include environmental and wildlife-related education, outdoor recreation, and wildlife related law enforcement. Part of our planning strategy is to involve all the stakeholders and request their input. We would like each agency to appoint a POC that will work with the GDAWR team to formulate and provide input for the comprehensive strategy.

Please contact Blaine Dicke or Jeffrey Quitugua at 735-3956 for more information regarding the GCWCRS. You may also choose to email them at tunings@hotmail.com or jdsquit@yahoo.com , respectively. Thank you for your attention to this matter. Time

is of the essence as we are looking at a June 2005 deadline for the final GCWCS document.

PAUL C. BASSLER

Department of Agriculture
Dipåttamenton Agrikottura
152 Dairy Road, Mangilao, Guam 96913

Felix P. Camacho
Governor

Kaleo S. Moylan
Lt. Governor

Director's Office	734-3942/43; Fax 734-6569
Agricultural Development Services	734-3946; 735-3946; 735-3950
Plant Nursery	734-3949
Aquatic & Wildlife Resources	735-3955/56; Fax 734-6570
Forestry & Soil Resources	735-3949/51; Fax 734-0111
Plant Inspection Station	475-1426/27; Fax 477-9487
Animal Health	734-3943; Fax 734-6569

Paul C. Bassler
Director

Joseph D. Torres
Deputy Director

November 16, 2004

Colonel P. K. White
Commander
36th AEW
Unit 14003
APO AP 96543-4003

Subject: Comprehensive Wildlife Conservation Strategy (CWCS)

Dear Colonel White:

Hafa Adai! The Department of Agriculture, Guam Division of Aquatic and Wildlife Resources (GDAWR) has been tasked with the overall responsibility and authority for the producing Guam's Comprehensive Wildlife Conservation Strategy (GCWCS). The primary goal of GCWCS is to protect and manage those species of greatest conservation need in the territory. Guam is in a prime position to receive federal funds for the conservation efforts outlined in the GCWCS as long as we can complete the plan by October 2005.

The GCWCS gives us the opportunity to address broader issues that include environmental and wildlife related education, outdoor recreation, and wildlife related law enforcement. Part of our planning strategy is to involve all the stakeholders and request their input.

If you would like to provide input for the comprehensive strategy, please contact Blaine Dicke or Jeffrey Quitugua at 735-3996 for more information regarding the GCWCS. You may also choose to email them at tuainos@hotmail.com or jdsquit@yahoo.com, respectively. Thank you for your attention to this matter. Time is of the essence as we are looking at a June 2005 deadline for the final GCWCS document.

Sincerely,

PAUL C. BASSLER

ATTENDANCE SHEET

Date: November 17, 2004 Time: 10:00 a.m.

Type of Meeting: [ ] Regular [xx] Special [ ] Officers CTO: 1022
A: 12:07

PLACE OF MEETING: MCCG C/R

MAYORS/VICE MAYORS	DISTRICT	CONTACT NOS.	SIGNATURE
AGUON, Peter S.	Barrigada	[redacted]	
AGUON, Vicente L.	Chalan Pago-Ordot		
BLAS, Jane U.	Barrigada		
BLAS, Nonito 'Nito' C.	Mangilao		
CHACO, Jesus B.	Agat		
DUENAS, Concepcion 'Connie' B.	Tamuning-Tumon		
DUENAS, Scott D.	Dededo		
HAGGARD, Isabel S.	Piti		
LEON GUERRERO, Anthony 'Barney' D.	Talofofo		
LEON GUERRERO, Nancy Taves	Tamuning-Tumon		
LIZAMA, Robert 'Bob' S.	Yigo		
LIZAMA, Vicente 'Ben' S.A.	Sinajana		
MCDONALD, Paul M.	Agana Hts.		
QUINATA, Tony A.	Umatac		
REYES, Johnny M.	Agat		
SABLAN, Daniel B.	Sinajana		
SAN NICOLAS, Vicente 'Benny' L.	Asan-Maina		
SAVARES, Melissa B.	Dededo		
TAINATONGO, Rita A.	Merizo		
TAITAGUE, Franklin M.	Inarajan		
TERLAJE, Jose 'Pedo' T.	Yona		
UNGACTA, Felix F.	Hagatna		
VILLAGOMEZ, Andrew 'Andy' C.	Mongmong-Toto-Maite		
WESLEY, Joseph 'Joe' C.	Santa Rita		

OFFICIAL REPRESENTATIVES	DISTRICT	SIGNATURE
Rose C. Benta	Talofofo	Rose Benta

Department of Agriculture
Dipåttamenton Agrikottura
142 Dairy Road, Mangilao, Guam 96913

Director's Office 734-3942/43; Fax 734-6569
Agricultural Development Services 734-3946; 735-3946; 735-3950
Plant Nursery 734-3949
Aquatic & Wildlife Resources 735-3955/56; Fax 734-6570
Forestry & Soil Resources 735-3949/51; Fax 734-0111
Plant Inspection Station 475-1426/27; Fax 477-9487

Felix P. Camacho
Governor

Kaleo S. Moylan
Lt. Governor

Paul C. Bassler
Director

Joseph D. Torres
Deputy Director

PRESS RELEASE

The Department of Agriculture's Division of Aquatic and Wildlife Resources announces the scheduling of public meetings regarding the development of Guam's Comprehensive Wildlife Conservation Strategy. The upcoming meetings will be held on December 15, at 7:00 p.m., at the Yona Community Center, and on December 16, at 7:00 p.m., at the Sinajana Community Center.

If you have any questions, please contact Blaine Dicke or Jeff Quitugua at 735-3996 or 3985.

APPROVED:

PAUL C. BASSLER

VILLAGE NEWS

Catriona Melyan, 4
e-mail: li

ALL VILLAGES

▲ The "Guam Christmas Pageant" will be held at 7 p.m. each night through Dec. 14 under the stars at the Ypao Beach Amphitheater. Bring blankets and beach chairs.

▲ The Department of Agriculture is conducting a public hearing on Comprehensive Wildlife Conservation Strategy at 7 p.m. Dec. 13 at the Dededo Community Center, Dec. 15 at the Yona Community Center, and Dec. 16 at the Sinajana Community Center.

▲ Department of Public Works solid waste customers should note trash will now be picked up a day earlier than the current schedule (there will be no trash pickup on Saturdays), effective Dec. 20. Trash must be placed in five-gallon (minimum) or 35-gallon (maximum) containers that are leakproof and waterproof, with a tight-fitting lid, and placed at the curb, or four feet from the edge of the roadway. Otherwise, it will not be picked up. Call 646-3147.

▲ The Department of Agriculture is responsible for animal control/quarantine programs, and will oversee the capture/impounding of stray dogs. Call your mayor's office or 734-3942/40.

▲ The Guam Educators Hall of Fame (PDK), Guam chapter, invites the community to identify and nominate deserving people they think should be considered for the Phi Delta Kappa Educators Hall of Fame. Nomination deadline is Dec. 17. Nominees must be at least age 60, if living; have made significant contributions to education on Guam; and need not have been a professional educator.

AGANA HEIGHTS

Mayor Paul M. McDonald
Telephone: 472-8285/86

▲ The village community [illegible]

Vice Mayor Melissa B. Savares
Telephone: 632-5203/5019

▲ The Guam Breast and Cervical Cancer Early Detection Program, or BCCEDP, at the Department of Public Health and Social Services, will enroll qualified women ages 50 to 64 who have no health insurance, MIP or who are underinsured, for free breast and cervical screening, 9 to 11 a.m. Dec. 24 at the Dededo mayor's office. Conditions apply for women age 50 and younger. Call the program at 735-0672/9130 for more information.

▲ The mayor's office will issue vouchers to residents, in conjunction with the BKA-KOKU village amnesty program, waiving all disposal fees for metal waste to be taken to the BKA-KOKU yard in Dededo. Call the mayor's office.

▲ The Lencho Park basketball court is now open.

▲ The Dededo Thursday night market is open 5:30 to 10 p.m. each Thursday at Lencho Park. Interested vendors should contact the mayor's office.

▲ Transactions for the Dededo flea market are 8 a.m. to noon Wednesdays and Thursdays, and slots are still available. Checks are no longer honored for payment.

HAGÅTÑA

Mayor Felix E. Ungacta
Telephone: 477-8045/47

INARAJAN

Mayor Franklin M. Taitague
Telephone: 475-2509/12

▲ The fourth annual Christmas Treat and Light Parade, tree-lighting ceremony and community get-together will be held at 6 p.m. Dec. 19, from the [illegible] of Chalan Chandiho on Route 4 down to the old fire station area in the

▲ Dec. 26 — Asan: Nino Perdido
▲ Jan. 8 — Tumon: Blessed Diego Luis de San Vitores
▲ Jan. 15 — Chalan Pago: Nuestra Senora de la Paz y Bien Viaje
▲ Jan. 22 — Mongmong: Nuestra Señora de las Aguas
▲ Jan. 29 — Maina: Our Lady of Purification

the Youth Crime Watch program should call the mayor's office or stop by for an application form.

MERIZO

Mayor Ella Taimatango
Telephone: 828-8312

▲ The mayor, MPC and staff invite Merizo residents to place a decorated postcard plyboard/sign in their yard or house, enhancing the holiday spirit for all.

▲ People who purchased tickets from the 2004 Pacifika Boys Volleyball team are advised that the drawing was held Nov. 17 at the mayor's office. Call the mayor's office to verify the winners' list. Winners must claim prizes by Dec. 31.

▲ A construction crew is conducting trenching along the roadsides of the village around Route 4 in the church area in order to convert overhead primary lines to underground lines, including the installation of duct lines. Residents are asked to be cautious.

▲ The Malo Hatam (Mathgroad) program is held 5 to 8 p.m. each Friday through December at Merizo Elementary School. Call Maria Cruz at 828-8000, Jessica Taitano at 828-2788 or Vick-

the top three winners.

▲ The December Piti community newsletter has been distributed. Stop by the mayor's office if you did not receive one.

SANTA RITA

Mayor Joseph C. Wesley
Telephone: 565-4337, 720-2514

▲ Our Lady of Guadalupe fiesta will be held through Dec. 12. Small concession stands will be in the community center and at cockfight events. Everyone is invited.

▲ Kolur Recycling will accept appliances with freon and other hazardous materials removed; otherwise, there will be a fee of $20; $30 for abandoned vehicles.

▲ Guma Mami will hold a garage sale, with proceeds benefiting adults with disabilities. Items should be donated before Jan. 17, at the Sinajana mayor's office, 7:30 a.m. to 4:30 p.m.; Guma Hinemlo, after 2:30 p.m.; or Sagan Mami, after 5 p.m. Call Marie Babauta at 477-1505/1760.

▲ The Guam Educators Hall of Fame (PDK), Guam chapter, invites the community to identify and nominate deserving people they think should be considered for the Phi Delta Kappa Educators Hall of Fame. Nomination deadline is Dec. 17. Nominees must be at least age 60, if living, have made significant contributions to education on Guam, and need not have been a professional educator. Forms are available at the mayor's office.

SINAJANA

Mayor Daniel A. Sablan
Vice Mayor Vicente S.A. Lizama
Telephone: 472-6707

▲ For trash pickup problems, call DPW's Solid Waste Division at 646-3151. Do not block trash bins during trash pickup

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are available at t[he]

▲ The Tamuning [...]
noon to 8 p.m. da[...]
a first-come, first-[...]
mayor's office.

UMATAC

Mayor Tony A. Q[...]
Telephone: 828-8[...]

▲ Bus shelters ar[...]
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tect the students fr[...]
conditions. They sh[...]

▲ The University o[...]
Extension Service [...]
culture and Life Sci[...]
reach education s[...]
latest research, to [...]
youth and the comm[...]
available at the ma[...]
ter Barcinas at 73[...]

▲ The Guam Publ[...]
will be at the GHU[...]
lage from 4:15 to [...]
and fourth Tuesday[...]

▲ F.Q. Sanchez Sc[...]
a Scholastic Book F[...]
2:30 p.m. through t[...]
and Thursday only. [...]
while supplies last.

YIGO

Mayor Robert S. [...]
Telephone: 653-[...]

▲ Children ages 7 [...]
ested in playing [...]
Dominic Pangelina[...]
the mayor's office.

▲ The Guam Public [...]
will be at the mayo[...]
2:45 p.m. Dec. [...]

▲ There will be a [...]
p.m. Dec. [...]

Department of Agriculture - Div. Of Aquatic and Wildlife Resources
Comprehensive Wildlife Conservation Strategy Public Meeting
Dededo Community Center - Northern Districts
December 13,2004

ATTENDANCE SIGN-UP SHEET

No.	Name (print)	Address	Contact #	E-Mail Address	Signature
1	Tino Aguon				
2	Blaine Dicke				
3	Jeffrey Quitugua				
4	Gerard I. Candoso	[illegible]	[redacted]		
5	Melissa B. Savares	205 Y-Seng Song Rd. Dededo			
6					
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Department of Agriculture - Div. Of Aquatic and Wildlife Resources
Comprehensive Wildlife Conservation Strategy Public Meeting
Yona Community Center - Southern Districts
December 15,2004

ATTENDANCE SIGN-UP SHEET

No.	Name (print)	Address	Contact #	E-Mail Address	Signature
1	DANA LUJAN	BOX 3069 HAGATNA	[redacted]	dana.lujan@[illegible]	[illegible]
2	Abraham Amison Jr.	P.O. BOX 4426 AAFANA		EAMISON@ITE.NET	[illegible]
3	OCTAVIA JONES	129-H Tajeron Hill TAL. Guam			[illegible]
4	Christopher Jones	129-H Tajeron Hill TAL. Guam		CHRISPUTA-JONES	[illegible]
5	Tina Aguon				
6	Miles	Sinajana			[illegible]
7	Castro	Sinajana			
8	Castro, Joseph	Dededo		Zoe-Arosi@msn.com	[illegible]
9	Medina, Shana	Mangilao			
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Department of Agriculture – Div. Of Aquatic and Wildlife Resources
Comprehensive Wildlife Conservation Strategy Public Meeting
Sinajana Community Center - Central Districts
December 16, 2004

ATTENDANCE SIGN-UP SHEET

No.	Name (print)	Address	Contact #	E-Mail Address	Signature
1	Anita Quitugua	POB 326561, Hagatna, GU	[redacted]		
2	[illegible]				
3	[illegible]				
4	Castro	Guahan			
5	MILES	Sinajana			
6	DANIEL FEJERAN	SINAJANA			
7	[illegible]	Sinajana			
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Department of Agriculture - Div. Of Aquatic and Wildlife Resources
Comprehensive Wildlife Conservation Strategy
Presentation: Mariana's Audubon Society
February 14, 2005

ATTENDANCE SIGN-UP SHEET

No.	Name (print)	Address	Contact #	E-Mail Address	Signature
1	L. Kjellerson	Biology - 406	[redacted]	[illegible]@netpci.com	[illegible]
2	D. Moore	P.O. Box 22303 GMF	[redacted]	dmoore@kuentos.net	DM
3	Anne Rinehart	Box 448 Hagatna	[redacted]	—	[illegible]
4	John Sullivan	P.O. Box 8484 Tamuning	[redacted]	john-sullivan@phs.com	[illegible]
5	Paul & Julie Duesenbury	Po Box 4326 AAFB 969[illegible]	[redacted]	[illegible]	[illegible]
6	"	"	[redacted]	"	Paul Duesenbury
7	Marilyn Vander Weide	P.O Box 2055 Agana 96932	[redacted]	marilyn@kuentos.guam.net	Marilyn Vander[illegible]
8	Juli Mudd	295-C Farenholt Ave Tamuning	[redacted]	juli@ite.net	J. Mudd
9	Kathy Lofdahl	Biology - 406	[redacted]	klofdahl@uog9.uog.edu	K. Lofdahl
10	Suzanne Medina	DAWR	[redacted]	medinas@[illegible]	[illegible]
11	Marcia Espengel	P.O. BOX 22295 GMF GU 96921	[redacted]	marcia_1000@hotma[illegible]	Marcia G.
12	Cristal Salas	P.O. Box 9804 Tamuning, GU 96931	[redacted]	goldengirl[illegible]5@hotmail.com	[illegible]
13	Carole Piercy	PO 4280 Hagatna,	[redacted]	caplay@ite.net	[illegible]
14	Richard C. Mazza	215 Ralphs Ln, Front Royal, VA 22630	[redacted]	RMAZZA@SI.EDU	[illegible]
15	Bill Ruffin	P.O. Box 4001 Hagatna, GU 96932	[redacted]	willci_99@yahoo.com	William Ruffin
16	Gretchen Grimm	PO Box 423 Hagatna 96932	[redacted]	gretchengrimm@hotmail.com	[illegible]
17	Dustin Janeke	PO Box 5322 U.O.G. Station	[redacted]	[illegible]	[illegible]
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24 PACIFIC SUNDAY NEWS, August 28, 2005 guampdn.com

VILLAGE NE

AGANA HEIGHTS

Mayor Paul M. McDonald
Telephone: 472-3285/6

▲ The parents, family and friends of the Guam Little Ruth League 13-year-old division All Stars are soliciting for yard work and cleaning jobs to raise funds to cover the cost of their off-island league trip to California. Call the mayor's office.

▲ Enrollment for the Agana Heights Boy/Cub Scouts is ongoing. Boys ages 7 to 17 should call the mayor's office. Scout leaders are needed. U.S. Navy personnel are welcome. Call the mayor's office.

AGAT

Mayor Carol S. Tayama
Vice Mayor Jesse B. Chaco
Telephone: 565-2538/31/32

▲ The Agat fiesta mini-carnival will be held from 6 p.m. to midnight Sept. 3, and 2 to 10 p.m. Sept. 4. Everyone is invited to help support the MPC and Agat Community Center. Fun, games, entertainment, [illegible] races, bingo and good food.

▲ Low impact aerobics classes 6 to 6:30 a.m. Monday to Friday at the Agat Community Center. All health workers are invited.

▲ The Agat/Santa Rita SDA Church is sponsoring "Guard Your Heart" from 5 to 7 p.m. each Sunday, Sept. 4 to Oct. 30. $30 if you register by Sept. [illegible]; $45 thereafter. Call Guam SDA Clinic at 647-7570.

▲ The Agat gym now requires an ID card for people who are going to use gym equipment. Call program coordinator Franklin Salas at 565-2531.

ASAN-MAINA

Mayor Vicente "Benny" L. San Nicolas
Telephone: 472-6581

▲ Town meeting at 7 p.m. Sept. 7 at the Asan-Maina Community Center. GWA representatives will introduce and provide information on the new radio-read meters to replace existing meters, and listen and assist village residents with their concerns and existing water and sewage problems in the village. Residents are encouraged to attend.

BARRIGADA

Mayor Jessie B. Palican
Vice Mayor June U. Blas

munity Center.

▲ The MPC meets 7 p.m. each first Tuesday; next meeting on Sept. 6.

▲ Department of Land Management hearing at 6 p.m. Sept. 9 on Sun Ho, Sun Woo Corp. conditional use permit application to convert an existing 2-story unit into office and staging area for company's equipment and materials in an agricultural zone; application packet is available for public review at the mayor's office.

CHALAN PAGO-ORDOT

Mayor Pedro "Pete" I. Borja
Telephone: 477-1333

▲ Parents of children who attend Agueda Johnston Middle School must drop off and pick up their children on the school campus. Loitering at the mayor's office, Catholic church and nearby stores is not allowed.

▲ Maintenance and repair of the village main roads (Routes 10 and 4) are under the jurisdiction of the Department of Public Works. The mayor's office is doing its best to offer support with available resources.

▲ To help make your neighborhood safer, residents are encouraged to volunteer for the Neighborhood Watch Program being implemented in the village. Interested block leaders should call the mayor's office.

DEDEDO

Mayor Melissa B. Savares
Vice Mayor Andrew "Peter Dalgo" A. Benavente
Telephone: 632-5203/5019

▲ Flea market transactions are conducted 6 a.m. to 4 p.m. Wednesdays and Thursdays only.

▲ The mayor's office is looking for people who specialize in grant writing to help the community. Call the mayor's office.

▲ The Astumbo gym staff is looking for volleyball players in a northern league to be formed: Division A, ages 15 to 25, and Division B, ages 14 to 17. Call Joe or Mel at 637-5002.

▲ The Dededo Soccer Club will register new and returning players for all divisions during practices that are held 4 to 6 p.m. each Tuesday and Thursday at the Guam Sports Complex, Harmon Loop Road, for under-6 and under-12

meeting at 6 p.m. Aug. 29 at the location of the former Guam Mass Transit Authority building, across from the Hagåtña pool. Residents are invited.

▲ Wreath-laying ceremony to commemorate the end of World War II and to honor World War II survivors and courageous soldiers of the U.S. armed services will be held at 9 a.m. Aug. 31 at the overlook on Nimitz Hill.

▲ Catholic Social Services will hold its fourth annual country-western hoedown from 5 to 11 p.m. Sept. 17 at the CSS Office in Barrigada Heights, behind the former PriceSmart. Proceeds will go toward providing services for homeless people and their families, abused women and children, and elderly and disabled people.

INARAJAN

Mayor Franklin M. Taitague
Telephone: 475-2509/12

▲ The MPC meeting will now be held at 7 p.m. each second Wednesday at the mayor's office.

▲ Inarajan Middle School will hold its open house from 6 to 8 p.m. Aug. 31. Parents are encouraged to attend. Election of officers for the school's [illegible] PTSO organization will also be held.

▲ Residents who are interested in providing minor rehabilitation work for a fee within the village's Guam Housing Corp. housing units should call the mayor's office or the GHC manager at 647-4143, ext. 127.

▲ Gef Pa'go election of four board members 8 a.m. to 4 p.m. Sept. 3 at Gef Pa'go. Call 828-7247.

▲ Gef Pa'go is accepting applications for an internship in historic building, construction, and tourism and hospitality to establish a list. Application forms may be picked up in the office. The internship program is funded by a grant from the Administration for Native Americans, Department of Health and Human Services.

MANGILAO

Mayor Nonito C. Blas
Telephone: 734-2163

▲ The Department of Agriculture's Division of Aquatic and Wildlife Resources will hold a public meeting concerning Guam's draft comprehensive wildlife conservation strategy at 7 p.m. Sept. 1 at the mayor's office. Call Elaine Olds or Jeff Quitugua at 735-3996/3988.

Department of Agriculture - Div. Of Aquatic and Wildlife Resources
Comprehensive Wildlife Conservation Strategy
Presentation: General Public
September 1, 2005

ATTENDANCE SIGN-UP SHEET

No.	Name (print)	Address	Contact #	E-Mail Address	Signature
1	Jay Gutierrez	163 Dary Road	[redacted]	jaytgutierrez@yahoo.com	[signature]
2	Brent Tibbetts	" "	[redacted]	brent.tibbetts@gmail.com	[signature]
3	Lloyd B. Dickes	907 Halsey Drive	[redacted]	blainedicks@yahoo.com	[signature]
4	Jeffrey Daniel S. Quitugua	135 Franquez St., Maite	[redacted]	jdsquit@yahoo.com	[signature]
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