Part II. Species Accounts

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U.S. Pacific Island Species Profiles

Short-tailed Albatross (Steller's Albatross) *Phoebastria albatrus*

Status

Federal: E **State: HI-E** **IUCN: VU** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	65d	140d	Oct-Jun	scrape	surface dip	pelagic, near-shore

Distribution, Population Status and Trends

Short-tailed Albatross (STAL) once ranged throughout the North Pacific breeding on islands in Japan and Korea. Today they breed only on Torishima and Minami-kojima, Japan.[1,2] Birds regularly visit the NWHI and individual birds have laid eggs at Midway Atoll in various years since at least the 1990s, but historical accounts of successful nesting are unsubstantiated.[3] STAL disperse widely throughout the temperate and subarctic North Pacific from Japan through CA. Birds are concentrated along the edge of the continental shelf in the northern Gulf of Alaska, Bering Sea, and along the Aleutian Is.[5,6,7,8]

STAL, once the most abundant North Pacific albatross, numbered in the millions until the late 19th century when the lucrative millinery trade developed.[9] By the 1930s, STAL had almost been wiped out. The last remaining breeding population on Torishima was considered extinct after World War II;[10] however, in 1950, a small number were found and the population began a slow recovery.[11,12,13] In 2002, the world population was estimated at approximately 1,700 individuals (including breeding and non-breeding birds), with 200-250 at Minami-kojima and 1,500 at Torishima.[14] The annual population growth is >6% per year.[15,16]

Ecology

STAL, largest of the North Pacific albatrosses, breed on oceanic islands and atolls.[4] On Torishima, they nest on open ground on fairly steep volcanic ash slopes next to clumps of grass or shrub. On Minami-kojima, they nest on a rocky terrace of a steep cliff. At Midway and other NWHI, STAL occur amongst nesting Laysan and Black-footed Albatross. Egg laying occurs from late Oct - Nov and chicks fledge in Jun.[4,17] They are monogamous with high rates of mate retention and philopatry. As many as 25% of breeding age adults may not return to the colony at any given year.[3,16] STAL feed their young until the time of their departure from

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breeding grounds in Jun.[4] Juveniles are dark brown and gradually acquire the white body plumage and golden head over a period of 10-15 years, but there is considerable variation.[4] Immatures remain at sea for several years before returning to breed[4] and age at first breeding is 5-6 years on average.[3]
STAL are surface feeders and scavengers, and are frequently encountered around fishing vessels. They feed more inshore than the other North Pacific albatrosses, often in sight of land.[18] In Japan, their diet consists of shrimp, squid, and fish which include bonita, flyingfish, and sardines.[19,20] There are no published data on life span but it is probably similar to the other North Pacific albatrosses. Average survival rate is 96%.[3,16]

Conservation Concerns and Activities

The primary STAL breeding colony at Torishima is located on an active volcano and there is significant threat of mortality and major habitat loss from volcanic eruptions. Within the last century, Torishima has experienced five eruption events over the past century with the most recent one occurring on Aug 11, 2002. Past eruptions have destroyed much of the original breeding site leaving sparsely vegetated steep slopes of loose volcanic soil. Without the protection provided by vegetation, eggs and chicks are at greater risk of mortality from monsoon rains, sand storms, and wind.[21] Current conservation

activities in Japan are concentrated on habitat stabilization in the original colony on Torishima and efforts to entice breeding birds to alternate sites on Torishima that are less likely to be affected by lava flows, mud slides, or erosion.[3] Concentration of the entire breeding population at just two islands, Torishima and Minami-kojima, make STAL extremely vulnerable to catastrophic events. Midway Atoll has been identified as a possible site for establishment of a breeding colony.[3] Midway is a logical candidate because STAL regularly visit and have displayed reproductive capacity (*e.g.,* courtship dances and egg laying). Decoys and recorded colony sounds have been deployed at Midway but it is unknown if they will prove effective in attracting breeding birds or if STAL will thrive at this location.

Bycatch in commercial fisheries is another known threat. Federal agencies are actively coordinating with industry and others to minimize STAL bycatch and U.S. fishers are required to employ multiple seabird avoidance measures. At sea, marine pollution, plastics, and oil spills are also threats.[20] Oil development in contested areas may be a problem in the future. Minami-kojima is disputed territory of Japan and China and consequently little biological research or management is conducted at this breeding site.

A Recovery Team has been formed and a recovery plan is being developed.

Recommended Actions

- Continue efforts to establish a breeding colony on Midway by using decoys and sound recordings or new techniques as they are developed.
- Support research and development of new gear types and/or fishing methods that reduce or eliminate bycatch and work with regulatory agencies and fishing industry to ensure compliance with regulations.
- Assist in the development of the recovery plan and support activities and actions outlined therein.

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References: 1. Hasegawa 1984; 2. King 1981; 3. USFWS 1999; 4. Tickell 2000; 5. Sanger 1972; 6. USFWS unpublished data. 7. McDermond and Morgan 1993; 8. Sherburne 1993; 9. Yamashina in Austin 1949; 10. Austin 1949; 11. Tickell 1973; 12. Tickell 1975; 13. Ono 1955; 14. H. Hasegawa, pers. comm 2002; 15. Hasegawa 1982; 16. Cochrane and Starfield 1999; 17. Hasegawa 1980; 18. Harrison 1990; 19. Hattori 1889; 20. Fujisawa 1967; 21. H. Hasegawa, pers. comm.1997.

Black-footed Albatross (Black Albatross, Moli)
Phoebastria nigripes

Status

Federal: BCC **State: HI-T** **IUCN: EN** **NAWCP: HI/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	65d	140d	Nov-Jun	scrape	surface dip, scavenge	pelagic

Distribution, Population Status and Trends

Black-footed Albatross (BFAL) breeding distribution is almost entirely restricted to the Hawaiian Islands with the exception of small breeding colonies off Japan.[1,2,3,4] In Hawai`i, colonies occur on the NWHI and Kaula and Lehua.[1] BFAL recently recolonized Wake.[24] During the breeding season, adults range mostly to the north and east of the Hawai`i colonies. Adults brooding chicks forage closer to the colonies (100s km), but after brooding many birds transit to continental shelf areas off North America while feeding chicks.[15] Nonbreeding birds disperse throughout the north Pacific between 20° and 58° N.[5,6] Compared to Laysan Albatross, BFAL have a more easterly at-sea distribution and regularly occur in large numbers off the coast of Canada and the U.S.[6,7]

The breeding population was estimated at approximately 58,000 breeding pairs in 2003-2004.[6] Greater than 95% nested in Hawai`i; the majority of the population breed on Laysan (19,500 pairs) and Midway (20,400 pairs). Historically, breeding colonies existed on Johnston and the Northern Marianas.[1,8] The population rebounded from a drastic population decline at the turn of the 20th century but over the past decade breeding populations appear to have declined slightly at the largest Hawaiian colonies.[6,9,10]

Ecology

Most BFAL nest on low coral and sand islands, on open sandy beaches or dunes, and sometimes among vegetation.[1,11] Egg laying occurs Nov - Dec and chicks fledge in mid-Jun.[12,13] Sexes are similar although males are slightly larger.[15] Pairs are highly philopatric and mate retention is high.[16,17] Birds do not breed every year.[5,14] Immature plumage is similar to adults, but first-year birds lack the white ring around the bill and white feathers at the base of the tail.[18] Age at first breeding probably averages 7-8 years.[19,20]

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BFAL are surface feeders, taking food by dipping and scavenging at the ocean's surface. They are also frequently encountered around fishing vessels and will scavenge ship offal.[21] Feeding aggregations of BFAL are common, but they rarely feed with other species.[22] In Hawai`i, the diet includes fish eggs, squid, deep-water crustaceans, fish, and zooplankton.[21] Flyingfish eggs are important, comprising >40% of the diet.[5,21] The oldest-known BFAL was at least 43 years old.[6]

Conservation Concerns and Activities

Between 1990-94, it is estimated that >23,000 BFAL were incidentally killed on longline hooks set in the North Pacific swordfish fishery.[6] An estimated 1,831 birds were killed annually between 1994-98 in the HI longline fishery, alone.[6] In addition, birds were lost to demersal longline fisheries in AK. Both AK and HI instituted regulations requiring mandatory mitigation measures to minimize bycatch. The Hawaiian longline fishery for swordfish was closed in 2001 and estimates of BFAL bycatch decreased to less than 100 birds per year. However, most fishers affected by this closure, moved their base of operation to CA where they were not required to employ mitigation measures. BFAL were taken in the CA-based fishery but the magnitude of the

kill is unknown. In 2004, mitigation measures were required in the CA-based fishery and a HI-based model swordfish fishery was opened with new restrictions to protect turtles.

In the 1950s and 1960s, albatross control programs conducted at Midway to protect aircraft resulted in the death of tens of thousands of albatross. Buildings, lights, antenna wires, and even introduced ironwood trees created obstacles that killed many BFAL at Midway each year.[5] Organochlorine levels in BFAL were higher than other albatross species and were high enough to increase the risk of eggshell thinning and subtle embryonic effects that decrease egg viability.[23] Ingestion of plastics is also a problem. BFAL nest close to the shoreline and sea level rise and storm tides associated with global warming pose a significant threat. In the past, introduced predators such as rats impacted populations on Kure and Midway, however, rats have been eradicated at all major breeding locations. Rats and cats occur at Wake and the Marianas and may hinder recolonization at these sites.

Recommended Actions

- Design and implement a statistically rigorous population monitoring program, including estimation of age-specific survival rates.
- Compile, analyze and report USFWS data collected at the breeding colonies. Analyze and report demographic information from 50 years of banding data.
- Complete a status assessment.
- Support efforts to estimate mortality from all U.S. and foreign fisheries and determine effects of this mortality on BFAL populations.
- Support continued research and development of mitigation measures and practices to prevent mortality in fisheries.
- Eradicate introduced predators on USPI where BFAL historically bred (*i.e.*, Wake, Johnston, and the Marianas).

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References: 1. Whittow 1993a; 2. Harrison *et al.* 1984; 3. Hasegawa 1982; 4. Hasegawa 1984; 5. Harrison 1990; 6. Cousins and Cooper 2000; 7. Sanger 1974a; 8. McDermond and Morgan 1993; 9. Lewison and Crowder 2002; 10. E. Flint, USFWS, pers. comm. 11. Tickell 2000; 12. Woodward 1972; 13. Fisher 1969; 14. Rice and Kenyon 1962a; 15. Fernandez *et al.* 2001; 16. Bailey 1952; 17. Fisher 1971; 18. Bourne 1982; 19. Rice and Kenyon 1962b; 20. Robbins 1966; 21. Harrison *et al.* 1983; 22. USFWS 1983c; 23. Ludwig *et al.* 1998; 24. Rauzon *et al.* in prep.

Laysan Albatross *Phoebastria immutabilis*

Status

Federal: BCC (67,68) **State: None** **IUCN: VU** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	~65d	165d	Nov-Jul	scrape	surface dip	pelagic

Distribution, Population Status and Trends

Laysan Albatross (LAAL) breeding range is centered in the Hawaiian Islands[1,2] with smaller colonies on the Bonin Is., Japan[2,18] and islands off west Mexico.[19,20,21] LAAL nest on all of the NWHI and on Kaua`i, Lehua, and O`ahu in the main islands. They have recolonized Wake and Johnston and one pair successfully bred on Wake in 2001.[23] Breeding adults forage primarily to the north and northwest of HI, to the Gulf of Alaska and the Aleutian Is.[3] During nonbreeding periods, adults disperse widely throughout the north Pacific tending more to the west than Black-footed Albatross.[2,4]

The 2003-2004 estimate was approximately 630,000 breeding pairs worldwide;[5] the largest colonies were at Midway and Laysan, with approximately 441,000 and 145,000 pairs, respectively.[17] There is concern that the population is declining, but the number of birds breeding each year can be quite variable and more rigorous demographic monitoring is needed to accurately track population trends. The breeding range is expanding with the small colonies off MX and birds recolonizing Johnston and Wake.

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Ecology

LAAL nest predominantly on low coral and sand islands. They tend to select nest sites closer to vegetation than Black-footed Albatross and typically nest on flat ground.[1,6] However, LAAL will nest in steep rocky areas (*e.g.,* Nihoa and Lehua).[7,22] Egg laying occurs Nov-Dec and chicks fledge in early-Jul.[1,7] Sexes are similar although males tend to be larger.[8] Pairs are philopatric and mate retention is high. About one-fifth of the experienced adults do not breed in a typical year.[2] Immature plumage is similar to that of adults.[1,8] Sexual maturity is reached at around 8-9 years (range 6-12 years).[9]

LAAL are surface feeders, taking food by dipping and scavenging at the ocean's surface.[1,7] They occasionally follow ships to scavenge refuse.[10] Feeding aggregations are common, but they almost never feed in association with other species.[11] In Hawai`i, the diet consists of squid, deep-water crustaceans, fish, and flyingfish eggs.[12] Squid constitute >50% of diet.[2,12] The oldest-known LAAL was 51 years.[13]

Conservation Concerns and Activities

Thousands of albatross were killed annually in high seas drift net fisheries until an international ban on the fisheries in 1993.[14] In the 1990s, thousands of LAAL were killed each year by longline fisheries.[14,15] The estimated bycatch has been reduced substantially in the U.S. fisheries as a result of a suite of management measures ranging from fishing closures to required seabird deterrents. Regulations now require U.S. longline fisheries to implement mandatory mitigation measures to minimize bycatch in AK, HI, and CA.

Predation by cats, dogs, and rats are a threat to LAAL in many areas. At Kilauea Point, Kaua`i nesting birds are protected by fences and predators are controlled near the colony, but occasional problems persist. Predators are controlled by the state near the colony at Kaena Pt., O`ahu, but

remain a problem. Rats have been eradicated on all NWHI. Between 1954-1964, control measures at Midway to reduce LAAL collisions with aircraft resulted in the death of tens of thousands of albatross.[16] LAAL nesting efforts are thwarted at Pacific Missile Range (Kaua`i), Dillingham Airfield (O`ahu) and Marine Corps Base Hawai`i (O`ahu) by egg collection and relocation of adults to ensure aircraft safety. At Midway, lead based paint has contaminated the soil around old military buildings and chicks ingesting the lead exhibit deformities or die. Buildings, lights, antenna wires, and even introduced ironwood trees have created obstacles that kill many LAAL on Midway.[2] Golden crown-beard, an invasive weed that is well established on Kure, Midway, and Pearl and Hermes may limit LAAL nesting densities, reduce productivity, and provide habitat for mosquitoes that spread avian pox. Over the past three decades, management of nesting habitat on Midway has led to an increase in LAAL numbers.

Recommended Actions

- Design and implement a statistically rigorous population monitoring program, including estimation of age-specific survival rates.
- Compile, analyze and report USFWS data collected at the breeding colonies. Analyze and report demographic information from 50 years of banding data.
- Review population sampling design at Laysan Is. and design a sampling program to estimate breeding populations at Midway.
- Support efforts to estimate mortality from all U.S. and foreign fisheries and determine effects of this mortality on LAAL populations.
- Support continued research and development of mitigation measures and practices to prevent mortality in fisheries.
- Eradicate introduced predators on USPI where LAAL historically bred or are establishing new colonies (*e.g.*, Wake, Johnston, and Kaena Pt, O`ahu).
- Control exotic vegetation at Midway, Pearl and Hermes, and Kure Atoll that degrades nesting habitat (*e.g.*, golden crown-beard).
- Work with the DOD in Hawai`i to investigate the potential for albatross nesting areas on military lands where albatross would not interfere with or endanger airfield operations.
- Remove lead contaminated soil around old buildings and building sites at Midway or otherwise eliminate the availability of the lead to albatross.
- Eradicate mosquitos (introduced vectors for avian pox) from Midway Atoll.

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References: 1. Whittow 1993b; 2. Harrison 1990; 3. Fernandez *et al.* 2001; 4. Shuntov 1974; 5. E. Flint pers. comm. 6. Fisher 1972; 7. USFWS 1983c; 8. Tickell 2000; 9. Fisher 1975; 10. Sanger 1974b; 11. Gould 1971; 12. Harrison *et al.* 1983; 13. C. Robbins, pers. comm. 14. McDermond and Morgan 1993; 15. Cousins and Cooper 2000; 16. Harrison *et al.* 1984; 17. USFWS unpubl. data; 18. Sugimura *et al.* 2003; 19. Pitman 1988; 20. Dunlap 1988; 21 Howell and Webb 1992; 22. VanderWerf *et al.* 2004; 23. M. Rauzon *et al.* in prep.

Hawaiian Petrel (Hawaiian Dark-rumped Petrel, `Ua`u)
Pterodroma sandwichensis

Status

Federal: E **State: HI-E** **IUCN: VU** **NAWCP: HI/HI**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	55d	110d	Apr-Dec	burrow	surface seizer	pelagic

Distribution, Population Status and Trends

Dark-rumped Petrel was recently split into two species based on genetic and morphological evidence, *Pterodroma sandwichensis* in Hawai`i and *P. phaeopygia* in Galapagos.[1,2] Hawaiian Petrels (HAPE) range over the central tropical Pacific but nest only in Hawai`i.[3] Fossil and archeological evidence indicate HAPE were common at all elevations on the main islands until humans arrived.[3,4] Today, there are small populations scattered widely on Maui, Kaua`i, Hawai`i, and probably Moloka`i , Lāna`i, Lehua, and sea stacks off Kaho`olawe.[3,13,17] At sea, birds are more abundant near the islands during the breeding season and range up to 1,300 km from colonies.[11]

Based on pelagic observations, the total population including juveniles and subadults was estimated at 20,000 with a breeding population of 4,500-5,000 pairs.[8,11] Approximately 1,000 pairs nest in Haleakala National Park, Maui.[3] There is also a small colony on Mauna Loa, Hawai`i.[18] Kaua`i populations are difficult to assess but potentially a large portion of the population nest on that island.[8] Overall population trends are unknown. Numbers breeding on Maui appear stable[3] and have increased in areas of Haleakala NP with active predator management.[6] On Hawai`i numbers may be declining due to predation by introduced predators.[3,16]

Ecology

On Hawai`i and Maui HAPE have been pushed to the limits of their habitat, nesting in the cold, xeric environment above 2,500 m primarily in national parks. On Kaua`i there is evidence that HAPE nest at lower elevations in densely vegetated rainy environments.[8] HAPE are colonial and nest in burrows, crevices in lava, or under ferns. Burrows are 1-9 m deep.[3] HAPE are monogamous and show a high degree of mate and nest-site fidelity.[3] Birds are nocturnal at the colony and appear to stage on the

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water nearshore prior to flying in to the nests.[8] Both sexes incubate and the 55 day incubation period is usually broken into 4-5 incubation shifts.[3] The single chick is brooded for 1-6 days and then fed every 2-3 days on average.[3,4] Age at first breeding is unknown but likely 5-6 years. Simons[4] found that 89% of the adult population breeds each year.

Prey is taken by dipping, surface-seizing, pattering and scavenging often in association with tuna or other subsurface predators.[7,14] HAPE have been observed feeding during the day but their diet indicates they may also feed at night.[4,14] Squid dominates the diet followed by fish (goatfish and lantern fish most common) and crustaceans.[3,4]

Conservation Concerns and Activities

The most serious threat to adult survival and reproductive success is predation by introduced predators at nesting colonies. The Haleakala colony is raided by mongooses, cats and rats which have caused breeding failure rates >70%.[3] Feral cats and mongooses are now controlled in accessible areas and reproductive success is significantly higher in fenced areas with active predator management.[6] Feral goats also cause mortality by

trampling burrows. Boundary fences at Haleakala NP provide a barrier to goats, pigs and dogs but they are also cause direct mortality; modification of the fences has reduced this mortality.[6] Axis deer numbers are increasing on Maui and they pose a new threat since they can jump over the existing fences but increasing the height of the fences would likely increase petrel mortality.[6] Research on the Mauna Loa colony suggests feral cats are a key predator.[16] The remoteness of these nesting sites make predator control difficult and as a result this colony is extremely vulnerable. Bright lights in the flight corridor to the ocean can disorient fledglings, leading to fallout and mortality; shielding of lights on Kaua`i has helped reduce this threat.[10,12,15] Collisions with powerlines also cause mortality.[9]

Recommended Actions

- Work with NPS, the state of Hawai`i and other land managers to control introduced predators and ungulates in the area of important colonies.
- Work with Kaua`i Electric to develop solutions to mortality caused by powerlines (*e.g.*, different spatial array, strategic tree planting, visual deterrents).
- Survey Lāna`i and Kaho`olawe to determine if HAPE are nesting. Locate and determine the size of Kau`ai colonies. Outline and implement a population monitoring program.
- Maintain a program to shield lights to reduce their effects on petrels and continue recovery efforts for grounded fledglings.
- Determine status on offshore islands such as Lehua, that could be made predator-free.

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References: 1. Browne *et al.* 1997; 2. Tomkins and Milne 1991; 3. Simons and Hodges 1998; 4. Simons 1985; 5. Howell and Pyle 1997; 6. Hodges and Nagata 2001; 7. Pitman 1986; 8. Ainley *et al.* 1997b; 9. Cooper and Day 1998; 10. Planning Solutions 2003; 11. Spear *et al.* 1995; 12. Telfer *et al.* 1987; 13. Day *et al.* 2003; 14 Pitman and Ballance 1997; 15. Reed *et al.* 1985; 16. Hu *et al.* 2001; 17. E. VanderWerf pers. obs.

Herald Petrel *Pterodroma arminjoniana*

Status

Federal: BCC 68 **State: None** **IUCN: None** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	60?d	100?d	May-?	surface	surface seizing	pelagic

Distribution, Population Status and Trends

Several polymorphic populations of Herald Petrels (HEPE) occur in the tropical and subtropical Atlantic, Indian and Pacific Oceans.[1] In the tropical Pacific, *P. a. heraldica* breeds on Raine Is. (off Australia), Tonga, Samoa, Cook, Marquesas, Tuamotu, Gambier and Pitcairn island groups and Easter Is.[1] There are three distinct color morphs and the birds at American Samoa are light morph.[6,7] Several authors have proposed full species status for the Pacific HEPE: *P. heraldica*.[4]

In the USPI, HEPE breed on Mt. Lata in the Ta`u Unit of the American Samoa National Park.[2,3,6] The only specimen of HEPE known from Samoa was collected on 6 May 1988.[6] Birds were observed on several occasions in the days leading up to this collection and 30-40 were counted calling and displaying over the densely forested ridgeline.[6] Lack of sightings since 1988 suggests this population is decreasing or is now extirpated on Ta`u.[3] World-wide population trend is unknown.

Ecology

HEPE nest on cliff ledges, slopes or ridges.[1] On the north side of Ta`u, the HEPE colony was in the nearly impenetrable vine thickets found above 670 m.[5,6] Nests were on the surface and birds visited the nesting colony during the day.[1,4] Phenology on Ta'u is difficult to assess given the limited data but birds appeared to breed in the austral winter, which coincides with breeding on other islands in the Pacific.[6] Birds were courting in May and their behavior in Jul indicated they were incubating eggs or feeding chicks.[6] Prospecting birds were also observed in Aug 1989 and this could indicate a protracted or year-round breeding season.[6] At other locations birds visit the colony throughout the year.[7]

The diet consists of squid, fish, crustaceans and other invertebrates such as sea striders.[8] Prey is taken by dipping or surface-seizing.

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Conservation Concerns and Activities

Introduced mammalian predators are the greatest threat on breeding islands. In Jul 2001, Norway rats were discovered on the summit of Ta`u.[3] Rats may have arrived with construction materials to repair hurricane damage in the 1980s and 1990s. The last observation of HEPE in American Samoa was in 1989. None were seen during several visits between 1999-2002, suggesting that the colony may have been extirpated by rats.[3] However given that many species are aseasonal breeders in the tropics, this species may still be extant on the island.

Recommended Actions

- Work with NPS and the Government of American Samoa to implement rat control in the vicinity of existing and historical petrel and shearwater colonies at Ta`u.
- Continue surveys at Ta`u to verify HEPE presence/absence.

Regional Contacts

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References: 1. Carboneras 1992a; 2. Engbring and Ramsey 1989; 3. M. Rauzon pers. comm.; 4. Pratt *et al.* 1987; 5. Pyle 1988; 6. Pyle *et al.* 1990; 7. Harrison 1983; 8. Imber *et al.* 1995.

Tahiti Petrel *Pterodroma (Pseudobulweria) rostrata*

Status

Federal: BCC **State: None** **IUCN: LR/nt** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	60?d	100?d	Nov-Jun	cavity	surface seizing	pelagic

Distribution, Population Status and Trends

Tahiti Petrels (TAPE) are endemic to the eastern and subtropical south Pacific, ranging from Mexico to Taiwan. Three subspecies are recognized.[8] They breed in the Society, Samoa, Fiji, and Marquesas islands and New Caledonia; possibly Tonga. In the USPI, TAPE breed in American Samoa on the islands of Ta`u, Tutuila, and possibly Olosega: on Mt. Lata, American Samoa National Park, Ta`u Unit;[5] and, on Ta`u Mountain in the Tafuna plain, Tutuila.[3] They have been reported from Olosega but no evidence of a colony was found in 1999, however, colonies could exist in inaccessible cliff areas.

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A live bird was collected on Guam in March 1986.[6] At sea, birds are most abundant in the vicinity of the breeding islands. During the austral winter, small numbers are recorded north of the equator in the central Pacific, but the main wintering range is presumed to be west of the breeding islands towards Australia.[9]

Some experts speculate that Ta`u birds may be a separate species. Feathers were collected for DNA analysis and submitted to the Smithsonian Institute, and sound recordings have been archived in the Cornell Library of Sounds. Recent work also indicates that TAPE are a distinct species from Beck's Petrel and should be in the genus *Pseudobulweria*.

Seabird surveys of Ta`u in 2001 indicate about five miles of summit rim habitat that TAPE likely use in addition to surrounding cliffs. Based on the estimated density of birds and potential nesting habitat, perhaps 1,000 pairs may breed over the island summit areas of this island.[7] Population trend is likely decreasing since Norway rats have reached the summit of Ta`u.

Ecology

TAPE breed on forested mountain slopes, and rims and craters of volcanic islands, at altitudes from 200-2,000 m.[2] Birds nest in loose colonies that can be up to 12 km inland.[2] A partially diurnal species in the Society Islands, TAPE are seen flying along mountain ridges in late afternoon.[7] Birds are normally nocturnal on land, coming and going at dusk and dawn.[1] Nests are in burrows or cavities and the rainforest nesting habitat is characterized by large tree root systems, with open chambers under trees and vines that were made by generations of TAPE diggings. On Ta`u, TAPE are austral summer breeders and lay their single egg in Dec. Chicks fledge in Jun.

Diet is unknown, but probably consists of fish and squid. Pratt *et al.*[1] labels TAPE as solitary birds of the open ocean that will follow ships, but birds have been observed in mixed-species feeding flocks in the Central Pacific, where small fish and squid are the typical diet.[9]

Conservation Concerns and Activities

Feral cats and rats affect TAPE populations throughout range. A newly discovered Norway rat infestation at the Ta`u colony is a major threat to the island population and NPS is considering a control program.[7] Bright lights affect TAPE in the Society Is. and the recovery of downed birds on American Samoa, indicates that lights or obstacles are a problem on these islands also.

Recommended Actions

- Work with NPS and Government of American Samoa to implement rat control at Ta`u colonies.
- Determine location and extent of American Samoa colonies and document population size. Develop a program to monitor trends.
- Determine taxonomic status of the Samoan population (e.g, DNA, morphometrics) and the Pacific distribution.
- Conduct research to collect basic life history information for USPI populations.
- Determine the magnitude of the problem bright lights and obstacles pose for this species.

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References: 1. Pratt *et al.* 1987; 2. Carboneras 1992a; 3. Muse and Muse 1982; 4. Baker 1952; 5. Pyle *et al.* 1990; 6. Wiles *et al.* 1987; 7. O'Connor and Rauzon 2004; 8. Clements 2000; 9. King 1967.

Phoenix Petrel *Pterodroma alba*

Status

Federal: BCC **State: None** **IUCN: EN** **NAWCP: HI/HI**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes?	1	60?d	100?d	year-round	scrape	dipping?	pelagic

Distribution, Population Status and Trends

Phoenix Petrel (PHPE) is endemic to the tropical Pacific and breeds in the Line, Phoenix, Marquesas, Tonga, Tuamotu, and Pitcairn islands.[3,4] Efforts to confirm their presence in recent years has been unsuccessful in the Marquesas, Tuamotus, and Tonga. Currently PHPE are thought to nest at only 10 locations.[11] U.S. islands in the Line and Phoenix groups do not currently host this species but decades of infestation by rats and cats may have extirpated populations or prevented colonization. At sea they are present in small numbers in the central Pacific, north to the Hawaiian Islands.[5]

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The population center appears to be at Kiritimati, Kiribati in the Line Archipelago (Christmas Is.).[11] In 1980-82, this colony, estimated at 20,000-25,000 birds, was believed to be the largest in the world.[1,2] Phoenix Is., Kiribati, may host significant numbers, but this is unconfirmed. Globally the range is contracting, populations are declining, and all colonies are threatened.

Ecology

PHPE nest on the ground on low coral or sand islands. Breeding occurs throughout the year , but two distinct peaks exist: roughly Nov-Feb and Apr-Jul.[6,7] PHPE is a diurnal species, which helps determine presence/absence, since it more conspicuous than other nocturnal petrels. Birds nest on the surface but eggs at Kiritimati were often laid in sheltered locations.[6]

The diet consists primarily of squid, and other invertebrates (*e.g.*, water striders) and fish.[6]

Conservation Concerns and Activities

The world status of PHPE is extremely precarious; it is threatened by feral cats, rats, rabbits, human encroachment and poaching, El Niño flooding, and sea level rise expected with global warming. The Polynesian rat is depleting the Kiritimati populations, and the recent arrival of black rats there has serious implications.[8] Rat control efforts have begun there, and the Polynesian rat was eradicated from Motu Upua in 2002.[9] Predator-free islets (Motu Tabu and Motu Upua) in the main lagoon and land-locked Isles Lagoon area are critical, but an atoll-wide plan for PHPE conservation and rat eradication remains unfunded.[8] Feral cats prevent the species from nesting on the main island and sporadic cat control on Kiritimati has failed to limit predation. Rats appear to have been eradicated from Oeno and perhaps Ducie Is. in the Pitcairn Group in 1997, allowing some reproductive success.

Rats and cats were eradicated from Howland, Baker and Jarvis and in 2001 an acoustic play back recorder designed to attract PHPE was installed at Jarvis (322 km from Kiritimati).[10] To date there is no evidence of PHPE at the island.

Recommended Actions

- Work with other nations in Oceania and especially Kiribati to enact conservation measures for PHPE.
- Expand efforts to assess the suitability of U.S. islands to support PHPE and if suitable work with international partners to attract or

translocate PHPE to U.S. islands within the historic range where exotic predators have been eradicated.

- Support Kiribati in efforts to eradicate rats and other predators from their islands, monitor for new introductions (*e.g.*, black rats), educate school children about PHPE, and support the nomination of Kiritimati as a World Heritage Site.

Regional Contacts

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William Everett - Endangered Species Recovery Council, La Jolla, CA

References: 1. Jones 2000; 2. Garnett 1984; 3. Bell and Bell 1998; 4. Carboneras 1992a; 5. King 1967; 6. Ashmole and Ashmole 1967; 7. Flint 2002; 8. Everett *et al.* 2002; 9. L. Jones, pers. comm.; 10. E. Flint, pers. comm.; 11. BirdLife International 2000.

Bonin Petrel *Pterodroma hypoleuca*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	49d	82d	Dec-Jun	burrow	surface, dip	pelagic

Distribution, Population Status and Trends

Bonin petrels (BOPE) range throughout the central Pacific with breeding colonies in Hawai`i and Japan (Bonin and Volcano islands).[2] During the breeding season birds are rarely seen at-sea south of 20°N.[8] During the non-breeding season a few stay in the vicinity of Hawai`i but most disperse widely over the subtropical north Pacific, north and west of Hawai`i towards Japan.[2,5]

In Hawai`i, BOPE nest on the NWHI from French Frigate Shoals to Kure; the main breeding colonies are at Lisianski (150,000-250,000 pairs)[9], Laysan (50,000-75,000 pairs)[9] and Midway (70,000 pairs)[13]. The population at Midway has increased since the removal of rats in 1997, from an estimated 2,500-5,000 pairs in 1979 to 70,000 pairs in 1999.[9,13] In the 1930s, Midway Atoll supported one of the largest colonies in the world with an estimated 250,000 pairs but populations were decimated by rats introduced in 1943.[3,4,6] Historically BOPE also bred on the main islands but colonies there are now extirpated.[7] Global population trends are unknown but trends in Hawai`i are increasing as birds recolonize Midway and Kure atolls following the removal of rats.

Ecology

BOPE are nocturnal on the NWHI colonies where they excavate burrows in the sandy soil.[1] They are monogamous and exhibit high rates of mate retention.[1] BOPE are winter breeders, returning to the colonies in Aug. Prior to egg-laying there is an exodus of up to 24 days.[1] The first eggs are laid in mid-Jan and both parents share in incubation; shifts at Midway averaged 6-8 days.[1] Chicks are fed a rich oil by both parents every 2 days on average.[11] Chicks fledge at approximately 82 days and their plumage is almost indistinguishable from that of adults. Late fledging chicks may be killed or forcibly ejected from burrows by Wedge-tailed Shearwaters returning to breed.[2] Chicks are assumed to be independent of adults after fledging and preliminary data indicate they return to the natal island at 1 year.[2]

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BOPE are fairly unique among Pterodroma petrels in having a diet that consists mainly of fish (rather than squid), especially lanternfish and hatchetfish; they also eat squid.[4,9] BOPE are believed to feed at night since most of their diet consists of deepwater species that migrate to the surface at night.[9] Usually solitary at sea, they sometimes occur in mixed species flocks.[10]

Conservation Concerns and Activities

Historically, BOPE have suffered from mammalian introductions to breeding islands. Introduced rabbits devegetated Lisianski and Laysan in the early 1900s resulting in population declines for many seabird species, due to soil erosion, destabilization of burrows, and sand storms that filled burrow entrances.[12] Rabbits were eradicated in 1923.[12] Rats were introduced to Midway and Kure in the 1940s in conjunction with military activities and over a 40 year period BOPE populations at Midway declined from ~500,000 to 5,000. Rats (black and Polynesian) were eradicated from both islands in the 1990s and populations of all small ground nesting seabirds are

rebounding. BOPE are nocturnal at the colonies and easily disoriented by artificial lighting, causing fatal collisions; the Service has removed or modified artificial lights and overhead wires at Midway to address this problem. Introduced plants such as golden crown-beard and sandbur degrade nesting habitat: the shallow root system provides poor soil stabilization and the dense thickets of crown-beard reduce access. Introduced ants at Kure may attack nestlings but more important they facilitate destruction of native vegetation by introduced scale insects.

Recommended Actions

- Eradicate golden crown-beard at Midway, Kure and Pearl and Hermes and prevent introductions elsewhere. Eradicate sandbur from Laysan.
- Develop and implement a monitoring program. Monitor population recovery at Midway and Kure post rat eradication.
- Conduct long-term demographic studies to document population trends, survival rates, reproductive success, and to acquire accurate estimates of the breeding populations.
- Investigate the ecology and effects of introduced ants and scale insects, including direct and indirect impacts on BOPE survival, reproductive behavior and reproductive performance. Investigate means to control or eradicate ants and scale without damaging the native/endemic fauna.

Regional Contacts

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References: 1. Grant, *et al*. 1983; 2. Seto and O'Daniel 1999; 3. Woodby 1988; 4. Harrison 1990; 5. Harrison 1983; 6. Hadden 1941; 7. Olson and James 1984; 8. King 1967; 9. Harrison *et al.* 1983; 10. Fefer *et al.* 1984; 11. Pettit *et al.* 1982; 12. Ely and Clapp 1973; 13. Small 1999.

Bulwer's Petrel (`Ou) *Bulweria bulwerii*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	44d	62d	May-Sep	crevice	surface seizing	pelagic

Distribution, Population Status and Trends

Bulwer's Petrel (BUPE) is a pantropical, highly pelagic species.[2] In the Pacific Ocean, BUPE breed on the Phoenix, Marquesas, Bonin, Volcano, and Hawaiian island groups, and probably in the Marshalls.[3,5] At sea distribution is not well documented but Hawaiian birds appear to disperse to the southeast of Hawai`i after the breeding season, probably to winter in the central and eastern Pacific.[6]

The global population size is unknown but the Pacific population exceeds 100,000 pairs. The largest colony is at Nihoa (75,000-100,000 pairs) where approximately 97% of the Hawaiian population and a large percentage of the Pacific population nest.[1] During the last century, BUPE nested on all of the NWHI except Kure, islets off the main Hawaiian Islands and a few remote sites on the main islands. BUPE were "abundant" at Midway before rats were introduced in 1943; they no longer breed at Midway.[4] At Johnston Atoll, a growing colony supports 60-80 pairs.[7] Population trends globally and in the USPI are unknown.

Ecology *(from Megyesi and O'Daniel 1997 unless otherwise noted)*

BUPE nest under cover in crevices, caves, rock and coral rubble, under vegetation or debris, and in man-made structures. Breeding is highly colonial. Most birds arrive at the Hawaiian colonies in Apr, egg laying occurs from mid May to mid Jun, and most young are fledged by early Oct.[8] Pairs are monogamous, with high mate and site fidelity. Both sexes share in incubation; shifts at Laysan averaged 9.5 days[8] and at Johnston males averaged 10.2 and females 5.8 days. At Layson, young are brooded for <5 days after which at least one adult returned to the nest almost every night.[8] Chicks fledge after two months, but before flight feathers are fully developed. Birds return to the colonies at 2 years of age but most do not nest until 6 years. The oldest known bird was 24 years.

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BUPE are solitary foragers. They migrate to areas of upwelling, feeding mainly on fish (lanternfishes and hatchetfishes) and squid, but also crustaceans and sea-striders.[4] Most of their prey are bioluminescent and migrate from deep water to the surface at night where they are caught by surface-seizing.[4]

Conservation Concerns and Activities

Predation by rats and cats occurs throughout the BUPE range. Rats eliminated BUPE from Sand Is., Midway. However, rat eradication has been accomplished at Midway and Kure, and BUPE are expected to reestablish breeding populations. The effects of house mice are unknown. Introduced ants have been observed entering and killing pipping eggs at colonies on Maui and Molokini.[9] In the NWHI and Johnston, storm tides can cause loss of chicks or eggs.[3] The extreme concentration of a large proportion of the Pacific population at one island renders this species vulnerable to catastrophic events at this location.

Recommended Actions

- Control or eradicate feral cats and rats from islets off the main Hawaiian Islands and at main

island sites such as Marine Corps Base Hawai`i, Kaneohe Bay, and Pyramid Beach.
- Eradicate mice from Midway and Johnston NWRs.
- Baseline population ecology studies are needed for this poorly known species.

Regional Contacts

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References: 1. Harrison *et al.* 1984; 2. Carboneras 1992a; 3. Megyesi and O'Daniel 1997; 4. Harrison 1990; 5.King 1967; 6. King 1970 in Megyesi and O'Daniel 1997; 7. USFWS unpubl. data.; 8. USFWS 1983c; 9. Fern Duvall, Hawaii DOFAW, pers. comm.

Wedge-tailed Shearwater (`Ua`u kani) *Puffinus pacificus*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: LC/LC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no?	1	54d	100d	Jun-Dec	burrow	contact dipping	pelagic

Distribution, Population Status and Trends

Wedge-tailed Shearwaters (WTSH) are widespread throughout the tropical and subtropical Indian and Pacific Oceans.[1] In the Pacific they breed from the Bonin Is. off Japan to the Revilla Gigedos off Mexico. At sea birds are most abundant near the colonies during the breeding season.[9] After the breeding season, Hawaiian birds probably migrate south to the Equatorial Countercurrent and east.[9] There are two color phases: light and dark. Light phase birds predominate at all breeding colonies north of 10°N except the Marianas where only dark phase birds occur.[9]

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WTSH are abundant, with a worldwide population greater than one million pairs.[1] In the USPI, most birds breed in the Hawaiian Islands with smaller colonies on Johnston and the Marianas. Approximately 270,000 pairs breed in Hawai`i and <2,000 pairs on the other islands of the USPI.[2,4,6,7] The largest colonies in the USPI are at Laysan (125,000-175,000 pairs), Nihoa (30,000-40,000) and Lisianski (10,000-30,000).[2] WTSH also nest in the main Hawaiian islands (40,000-60,000 pairs), including Lehua (23,000 pairs)[16], Kaula (1,500-2,500 pairs) and offshore islets such as Manana and Moku Lua off O`ahu (10,000-20,000 pairs each). Smaller colonies occur at Moku Manu, Moku`auia and Kapapa (O`ahu), and Molokini and other islets off Maui.[2] Although abundant and widespread, global populations are far below historical levels due primarily to human harvest, introduced predators, habitat degradation by introduced herbivores, and possibly competition with commercial fisheries.[1] However, eradication of cats and rats at Midway, Kure, Johnston and islands off the main Hawaiian Islands resulted in population increases as these sites.[4] In the USPI, most of the colonies have not been surveyed for 20-25 years, so trends cannot be assessed.

Ecology

WTSH excavate burrows or nest in rock crevices; nesting habitat is typically flat ground, plateaus, slopes or cliff tops. Pairs are monogamous and mate retention is strongly influenced by a pair's success the previous season.[12] Breeding generally occurs during the local summers in the subtropics but breeding cycles are less seasonal at equatorial colonies.[9] In Hawai`i nesting is very synchronous. Birds return to the colonies in Mar-Apr and most eggs are laid in Jun. Both parents incubate and shift length at Manana ranged from 4-12 days.[10] Most chicks hatch from Jul-Aug and most young fledge in Nov.[2,10] Birds return to breed at four years.[3]

Most sightings of WTSH at sea are of single birds or small groups but foraging birds are most often seen in large multi-species flocks associated with predatory fish, that drive prey to the surface.[9] In Hawai`i, the diet consists largely of larval goatfish, flyingfish, squirrelfish and flying squid.[11] WTSH often follow trawlers and other fishing boats discharging offal.

Conservation Concerns and Activities

Introduced predators are the greatest threat to WTSH in the USPI. Rats and cats have been eradicated from the NWHI and most of the remote USPI but they still exist on the main Hawaiian Islands, Wake and the Marianas. Feral cats are known to kill large numbers of adult WTSH at colonies in the main Hawaiian

Islands[8,17] Predator control in the main Hawaiian Islands has helped colonies become established and maintain themselves (*e.g.,* Mokapu Peninsula and Kaena Point, O`ahu; Kilauea Pt., Kaua`i). WTSH are recolonizing Baker and Wake after predator control.[5] At the two largest colonies (Laysan and Nihoa) endemic finches readily predate eggs that are left unattended (*e.g.,* due to researcher disturbance). Introduced Common Mynas were significant egg predators at Kilauea Pt., Kaua`i,[13] but placing chicken eggs treated with bird repellant throughout the colony, significantly lowered predation rates.[14] Artificial lights disorient fledglings, which collide with power lines and vehicles on the main Hawaiian Islands. Human trespass at colonies can cause burrow collapse. Contaminants (including mercury, lead and organochlorines) have been detected in Hawaiian birds and experimentally applied oil reduced breeding success.[15] Avian pox-like lesions have been observed since 1996 at Maui and Molokini.[8] Because shearwaters associate with the tuna schools, by-catch and overfishing may pose significant threats.

Recommended Actions

- Eradicate cats and rats at Wake. Eradicate all introduced predators and herbivores on Lehua and islets off the main Hawaiian Islands. Control introduced animals at colonies on the main Hawaiian Islands (*e.g.*, Black Pt., Kaena Pt., Malaekahana, and Mokapu, O`ahu; Ho`okipa, Maui; Kilauea Pt., Kaua`i).
- Investigate and monitor the levels and effects of contaminants.
- Investigate the cause and effects of the pox-like lesions on WTSH breeding at Maui and Molokini.
- Research into the ecology of seabirds, their prey, and schooling predatory fish that drive prey to the surface. Model the system to predict the effects of overfishing on seabirds.

Regional Contacts

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References: 1. Carboneras 1992a; 2. Harrison 1990; 3. Whittow 1997; 4. USFWS unpubl. data; 5. Rauzon in prep.; 6. Stinson 1995; 7 Reichel 1991; 8. F. Duvall unpubl. data; 9. King 1974; 10. Shallenberger 1973; 11. Harrison *et al.* 1983; 12. Fry *et al.* 1986; 13. Byrd *et al.* 1983; 14 Byrd and Moriarty 1980; 15. Fry *et al.* 1983; 16. VanderWerf *et al.* 2004; 17. Smith *et al.* 2002.

Christmas Shearwater (black shearwater) *Puffinus nativitatis*

Status

Federal: BCC 67,68 **State: None** **IUCN: None** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	52d	100d	Mar-Oct	under vegetation	pursuit plunge	pelagic

Distribution, Population Status and Trends

Christmas Shearwaters (CHSH) range throughout the tropical and subtropical central Pacific. They breed on small, remote islands in the Hawaiian, Line, Phoenix, Samoan, Marquesas, Marshall, Pitcairn, Tuamotu, and Austral islands; and islands off Chile and Easter Is. in the eastern Pacific.[2,3] Extirpated from the Bonins (Ogasawara), Minami Torishima (Marcus) and Wake.[2] At sea they are most abundant offshore of the breeding islands.[6] It is assumed that juveniles, non-breeders and most adults disperse after breeding to tropical and subtropical waters, although some breeding adults in the tropics may be sedentary.

Maura Naughton, USFWS

Global population size is not known but probably numbers in the several tens of thousands pairs.[7] In the USPI they breed on the Hawaiian Islands from Lehua to Kure (a few pair also nest on islets off the main Hawaiian Islands), and at Johnston, Jarvis and American Samoa. In Hawai`i, the total population is probably <3,000 pairs; the largest colonies are on Laysan (1,500-2,000) and Lisianski (400-600).[2] Global population trends are unknown but several known colonies are declining. For example, Christmas Is. supported large colonies numbering about 6,000 pairs in the 1980s but populations in 2002 were probably less than 3,000.[5] In USPI, populations suffered historic declines due to introduced predators but appear to be stable to increasing because of active predator eradication programs on remote islands (*e.g.*, Kure, Midway, and Jarvis).

Ecology

CHSH nest under vegetation or in rock crevices. Birds return to the colony at night and are most active in early evening and early morning.[8] CHSH are monogamous but mates are not always retained in subsequent years.[2] Breeding birds return to the colonies in Feb and a single egg is laid in Mar-Jun (slightly earlier phenology at Johnston).[2] Both parents participate in incubation with shifts lasting ~5days.[9] One or both parents returned almost every night to feed chicks at Laysan in 1979.[9] Fledglings are almost indistinguishable from adults at fledging and are probably independent of parents once they depart the colony; adults continue to visit the nest site after chicks have left.[9]

CHSH feed far offshore, in mixed species flocks over predatory fish that drive prey to the surface.[4,10] The diet of CHSH in Hawai`i is split almost equally between fish and squid, caught by pursuit-plunging, pursuit-diving and occasionally surface-seizing.[4] Goatfish, flyingfish and scad were the most common fish in the diet.[4]

Conservation Concerns and Activities

Worldwide, populations at many island groups are declining due to feral cats and rats (*e.g.,* Kiritimati).[1] In the USPI, colonies at Midway, Kure, Jarvis, and Johnston all suffered significant declines after predators were introduced but are now rebounding.[11,12] The colony at Wake was extirpated but one individual was observed after cat control was initiated.[13] Invasive plants and invertebrates degrade nesting habitat in the Hawaiian Islands (*e.g.*, golden crown-beard and scale insects).

Recommended Actions

- Control exotic vegetation and invertebrates at Pearl and Hermes, Midway and Kure and restore native vegetation.
- Eradicate predators and herbivores from Lehua and work with DOD and other partners to eradicate rats and cats from Wake.
- Support Kiribati in efforts to control/eradicate cats at Kiritimati.

Regional Contacts

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References: 1. Haley 1984; 2. Seto 2001; 3. Amerson *et al.* 1982; 4. Harrison *et al.* 1983; 5. M. Rauzon, pers. comm. 6. King 1967; 7. Carboneras 1992a; 8. Harrison 1990; 9. USFWS 1983c; 10. Ballance and Pitman 1999; 11.USFWS unpubl. data; 12. Rauzon *et al.*2002; 13. Rauzon *et al.* in prep.

Newell's Shearwater (`A`O) *Puffinus auricularis* Newell

Status

Federal: T **State: HI-T** **IUCN: CR** **NAWCP:HI/HI**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	62d	92d	Jun-Nov	burrow	pursuit plunge	pelagic

Distribution, Population Status and Trends

Newell's Shearwater (NESH), a subspecies of Townsend's Shearwater, is endemic to the Hawaiian Islands. The largest colonies are on Kaua`i,[1] the only island without introduced mongoose. Smaller colonies exist on Hawai`i and Moloka`i; recent reports of nesting on O`ahu, Maui and Lāna`i are unconfirmed. NESH were discovered nesting on Lehua (an islet near Ni`ihau) in 2003.[13] Their marine range extends principally south and east of the Hawaiian Islands to the eastern tropical Pacific, especially near the Equatorial Counter Current and the Inter-tropical Convergence Zone.[4] During the breeding season, some birds forage west and north of the Hawaiian Islands and the central part of their marine range moves northward.[1] During the nonbreeding season they are absent from the waters within several hundred kilometers of the Hawaiian Islands.[5]

NESH have experienced significant population declines. Apparently abundant at the time of Polynesian colonization, the species was thought to be extinct by 1908.[1] Subsistence hunting by Polynesians and predation by introduced rats, pigs and dogs were the likely causes of decline. They were rediscovered at sea in 1947 and confirmed breeding on Kaua`i in 1967.[5] They began to make a comeback, but since then the species has suffered continual declines. Recent demographic models estimated a population of 84,000 birds (range 57,000-115,000) in the late 1980s and early 1990s.[2] Hurricane Iniki in Sep 1992 caused considerable damage to the forests on Kaua`i and occurred when chicks were near fledging. Ornithological radar data from 1993 and 2001 indicated a 62% decline.[11] The Save Our Shearwaters Program (SOS), which has operated since 1978, may also provide an index of population size and fecundity.[7] Numbers of birds recovered by SOS have declined steadily since reaching a peak in 1987; numbers in 2000 were 21% of what they were in 1987.[7]

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Ecology

(from Ainley et al. 1997 unless otherwise noted)
Highly pelagic, year-round. Most NESH on Kaua`i are thought to nest high (160-1200m) on steep, densely vegetated mountain slopes but substantial numbers of birds also nest on dry sparsely vegetated cliffs on the Na Pali cost of Kaua`i and on Lehua.[10,13] A smaller breeding population also occurs on forested cinder cones in the Puna District, Hawai`i.[6] Radar studies indicate that significant numbers may nest in other parts of Hawai`i Islands with the largest concentration in Waipio Valley. In Apr, adults return to renovate or dig new burrows. Egg laying is very synchronous in early Jun. NESH lay a single white egg that is incubated by both parents. The chick is fed a diet of regurgitated squid and fish by parents that forage hundreds of kilometers offshore, returning in darkness to the colony. Feeding NESH are often associated with tuna. Young fledge in the fall and fledglings visually orient by following river valleys to the sea, where they spend three years at sea before returning to land. Fledglings are independent of parents.

Conservation Concerns and Activities

Street and resort lights concentrated near the coast disorient or blind fledglings, which then fall to the

ground and are unable to regain flight.[3,11,12] Each year, thousands of fledglings are grounded and many are killed by cars, cats and dogs.[8] Others succumb to starvation and dehydration. Rapidly expanding coastal development has changed the Kaua`i skyline significantly since the 1980s. The conservation project Save Our Shearwaters began recovering and releasing downed shearwaters in 1978.[8,9] Since then, nearly 30,000 shearwaters have been recovered and released. Efforts to reduce fallout by shading lamps at resorts were effective.[3,12] In the early 1980s, Kaua`i Electric Co. began installing hoods on streetlights in areas with heavy fallout and recently a project was completed to convert all public street light on Kaua`i to shielded designs. Adults do not appear to be as vulnerable to lights as fledglings, but they do collide with utility wires that intersect their flight paths to the sea. The proposed construction of a Kaua`i Electric powerplant and associated lines in a known NESH "flight corridor" poses a potential additional threat and the Service is working with Kaua`i Electric to reduce this threat.

Over the past 150 years, >75% of the forests on Kaua`i have been lost. Large tracts of remaining forest are protected but habitat degradation by introduced plants and herbivores are a threat. Habitat in colonies at the privately owned Pu`ulena and Heiheiahulu colonies in Puna on the island of Hawai`i is lost to cinder mining. Introduced predators are a major concern; Kaua`i is the only main island without mongooses, but there are periodic unconfirmed sightings of this predator. Rats, cats, pigs and other introduced mammals are serious threats. Lehua could potentially provide important nesting habitat if rabbits and predators were removed. Hurricanes, fishery interactions and disease may also play a role in population decline and recovery.

Recommended Actions

- Evaluate colonies for conservation measures. Compile a GIS database of NESH locational data (*e.g.*, colony, flyway) and conduct a structured ranking for restoration projects based on estimated probability of increasing productivity and survival.
- Initiate or maintain predator control and habitat conservation measures (*e.g.*, trapping, toxicants, fencing) at key colonies on Kaua`i, Hawai`i and Lehua. Research/monitoring to evaluate the effects of control.
- Refine and expand radar studies to monitor population trends, locate colonies, and investigate behavior. Evaluate and standardize an island-wide monitoring program.
- Work with Kaua`i Electric to minimize the effects of powerlines (*e.g.*, burial, different spatial arrangement, strategic tree planting).
- Reduce fallout of fledglings due to bright lights. Work with partners to shield lights and reduce light output especially during critical periods. Identify fallout areas on other islands where light shielding may be needed.
- Research into light attraction (*e.g.*, colors, flashing patterns) to minimize this threat.
- Continue Save Our Shearwater program.
- Develop partnerships with private landowners focused on NESH conservation.

Regional Contacts

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References: 1. Ainley *et al*. 1997a; 2. Ainley *et al*. 2001; 3. Day *et al*. 2003b; 4. Harrison 1990; 5. King and Gould 1967; 6. Reynolds and Ritchotte 1997. 7. Day and Cooper 2001; 8. T. Telfer, pers. comm.; 9. J. Sincock, pers. comm.; 1984; 10. E. Flint, pers. comm.; 11. USFWS 1983a; 12. Reed *et al*. 1985; 13. VanderWerf *et al*. 2004.

Audubon's Shearwater *Puffinus lherminieri*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HI/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	50d	62-75d	Jul-	burrow	pursuit diving	pelagic

Distribution, Population Status and Trends

Widespread and abundant, Audubon's Shearwaters (AUSH) are pantropical breeders found throughout the Atlantic, Indian and Pacific Oceans. Several (9-10) subspecies are recognized; *P. l. dichrous* breed in the central Pacific.[2,5] Detailed genetic analysis of *P. lherminieri/assimilis* may show that the taxonomy of this group requires revision. In USPI, AUSH breed in the Line Islands and American Samoa. At sea, birds are usually within 160 km (100 mi) of breeding islands and migration is not known to occur.[6]

The global population may be several tens of thousands of breeding pairs.[2] Although this species is widespread and locally abundant, populations have declined from historical levels, including extirpation from many breeding sites. Colonies in American Samoa are located on Ta`u and Tutuila; estimates for Ta`u were 100 pairs[8] and the size of the Tutuila population is unknown.[4] Numbers are increasing at Jarvis (approximately 100 pairs) in response to cat eradication;[9] elsewhere in the Line Is. populations are decreasing at Kiritimati (possibly 2,000 pairs) where the long-term future is not secure.[3,4]

Ecology

AUSH nest in a variety of habitats. In American Samoa they nest on steep cliffs and at Jarvis in sandy loam under *Sesuvium*.[4] Very little is known of the life history of this species from the USPI. Elsewhere they are colonial, nesting in rock crevices or burrows.[2] Incubation is 49-51 days with individual shifts of 2-10 days.[2] Chicks are brooded for 3-7 days and fledged in 62-75 days.[2] In the Galapagos sexual maturity is attained at 8 years.[2,3]

AUSH have been recorded diving 6-35 m deep at the Seychelles, contradicting the hypothesis that tropical shearwaters do not specialize in underwater foraging.[1] Birds off Samoa typically feed on the surface but they will dive for prey; they are usually seen feeding in mixed-species flocks.[7] Diet consists of fish, squid and crustaceans.[2] They sometimes forage near fishing boats.

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Conservation Concerns and Activities

Historically, Samoans hunted AUSH.[7] Pigs, dogs, rats and cats on nesting islands threaten the survival and reproductive success of these small birds. Many colonies vulnerable to extinction. Norway rats likely limit birds at Ta`u, American Samoa. The establishment of a colony on Jarvis in 1995 was only possible through cat removal.[4]

Recommended Actions

- Monitor growth of the colony at Jarvis.
- Conduct systematic surveys to identify location and size of colonies in American Samoa.
- Work with NPS and the Government of American Samoa to implement predator control at Samoan colonies.
- Support international efforts in Kiribati to implement predator control (*e.g.*, cats and rats at Central Lagoon, Kiritmati).

Regional Contacts

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References: 1. Burger 2001; 2. Carboneras 1992a; 3. Jones 2000; 4. M. Rauzon, pers. comm; 5. Clements 2000; 6. King 1967; 7. Muse and Muse 1982; 8. Amerson *et al.* 1982; 9. Rauzon *et al.* 2002.

Band-rumped Storm-Petrel (`ake`ake, Harcourt's and Madeiran Storm-Petrel) *Oceanodroma castro*

Status

Federal: C, BCC **State: HI-E** **IUCN: None** **NAWCP: HI/HI**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	?	1	42d	64-73d	Apr-Oct	crevice	pattering	pelagic

Distribution, Population Status and Trends

Band-rumped Storm-Petrels (BANP) are a widespread species with breeding sites in the Atlantic and Pacific Oceans. They breed in three archipelagoes in the Pacific: Japan, Galapagos and Hawai`i.[1] Colonies in Japan and Galapagos may consist of many thousands of birds[2] but the size of the Hawaiian population is unknown.[3] Highly pelagic, BANP are regularly observed at sea off Kaua`i and Hawai`i in the breeding season and their marine range extends from the main islands through the NWHI and tropical Pacific, especially near the Equatorial Counter Current. There is little mixing of Pacific breeding populations.[3] Birds are highly pelagic during the non-breeding season but some individuals at other colonies are sedentary, visiting colonies irregularly throughout the year.[1]

Historically, BANP were abundant and widespread in Hawai`i judging from numbers in midden sites and lava tubes on O`ahu, Hawai`i and Moloka`i.[7] The Hawaiian population is now a tiny remnant judging from the paucity of recent encounters.[2] BANP are known from 12 sites on Kaua`i at elevations around 610 m, and from Hawai`i and Maui at elevations >1,200 m, and from Lehua.[4,6,10] Population size and trend are unknown but suspected to be critically low. The breeding population on Kaua`i was estimated at 171-221 pairs in 2002,[6] but observations at sea suggest larger populations.[2,8]

Ecology

Very little is known about BANP in Hawai`i and most of the data presented here are from other populations. BANP remains the only Hawaiian breeding bird whose nest is undescribed. Nesting habitat includes the very steep hanging valleys of Kaua`i vegetated with shrubs and grasses and the barren lava flows high on the volcanos of Maui and Hawai`i.[4,6] (Confirmation of nesting on Kaua`i was made in 2001-2001 during visits to the hanging valley of Pohakuao.[6]) Birds excavate burrows or nest in natural cavities.[4] Recovery of downed fledglings in Oct indicates that eggs are laid in May-Jun, chicks hatch in Aug and fledge in Oct.[4] BANP are long-lived (15-20 years) and probably do not breed until 3-7 years.[1,2,5]

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Diet information is not available for Hawaiian birds but elsewhere they eat small fish and squid and some crustaceans.[4] Solitary feeders, BANP are most frequently observed alone or in the company of other BANP. Foraging in the Atlantic is often associated with upwellings.[9]

Conservation Concerns and Activities

BANP need predator-free environments to survive. Introduced rats, mice, cats, mongoose, pigs and owls are all potential predators. Predator control at Haleakala National Park and Mauna Loa in Hawai`i Volcano National Park should reduce predation pressure. Eradication of rats from Lehua could provide an important predator-free site that will allow that population to increase.[10] Power lines at high elevations are suspected to cause some mortality.[4] Street lights concentrated near the

coastlines disorient fledglings, which fall to the ground and are unable to regain flight. Colonies require protection and possibly management. Assessment of BANP status in Hawai`i is needed. The Hawaiian population is potentially isolated from other breeding populations and recolonization, if island populations are extirpated, may be difficult.

Recommended Actions

- Control predators in nesting areas, particularly Lehua.
- Determine size, status, and distribution of Hawaiian BANP population.
- Locate and describe nests and conduct basic life history investigations to assess needs and conservation status.
- Identify factors limiting populations, determine the impacts of predation and formulate conservation and recovery actions.

Regional Contacts

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References: 1. Carboneras 1992a; 2. Harris 1969; 3. Harrison *et al.* 1990; 4. Slotterback 2002; 5. Ainley 1984; 6. Wood *et al.* 2002; 7. Olson and James 1982; 8. L. Spear, pers. comm.; 9. Haney in Slotterback 2002; 10. VanderWerf *et al.* 2004.

Tristram's Storm-Petrel (Sooty Storm-Petrel) *Oceanodroma tristrami*

Status

Federal: BCC **State: None** **IUCN: NT** **NAWCP: MC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	40-45d	85-90d	Dec-May	burrow	pattering	pelagic

Distribution, Population Status and Trends

Tristram's Storm-Petrels (TRSP) nest on islands in Hawai`i and Japan.[1] In Japan they nest on the Volcano, Izu and possibly Bonin island groups; in Hawai`i they nest in the NWHI.[1] No colonies are located in the main Hawaiian Islands and their bones have not been found in archeological excavations on the main islands.[4,2,7] TRSP are rarely seen south of Hawai`i away from breeding islands. They range across the subtropical central and western Pacific into waters off Japan.

The Hawaiian population was estimated at <10,000 pairs with the largest colonies located at Nihoa (2,000-3,000 pairs), Laysan (500-2,500 pairs) and Pearl and Hermes Reef (1,000-2,000 pairs).[4,9] Smaller colonies exist at Necker, French Frigate Shoals and possibly Lisianski.[5] Historically colonies existed on Midway and Kure but were probably extirpated by rats; individuals have been recorded on these islands and TRSP may recolonize now that rats have been eradicated from both atolls.[2,4] TRSP populations are likely below historic levels with the extirpation of colonies at Midway and Kure, but more recent population trends are unknown.[2]

Ecology

TRSP are winter breeders and are nocturnal at the colonies. Nest sites are colonial, in recesses in rock scree, under piles of mined guano, or burrows that they excavate under vegetation.[2,4] Information on breeding phenology is limited but birds return to the colonies in Nov, eggs are laid between Dec-Feb and both sexes incubate the egg.[4,2] Egg neglect is probably minimal at most of the large colonies where finches would quickly find and eat unattended eggs. The chick is fed by regurgitation until May and most adults and young are gone by Jun.[2,4] There is no information on age at first breeding but storm-petrels often begin breeding at 3-5 years.[3] TRSP may live approximately 15-20 years.[1]

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Diet information is limited. In Hawai`i they eat mainly small fish and squid and occasionally planktonic insects and crustaceans.[6] Prey is caught by pattering and snatching from the surface. TRSP rarely approach land except to breed and typically feed alone or with conspecifics.[8]

Conservation Concerns and Activities

Because they are small ground nesters, the introduction of cats or rats results in high levels of mortality and rapid extirpation of colonies. Rats are responsible for a population decline on the Torishima and Izu Is., Japan. Black rats probably caused the extirpation of TRSP from Midway and Polynesian rats their extirpation from Kure. Recently TRSP have been caught in mist nets on Sand Is., Midway and have responded to audio recordings but nesting has not been documented. TRSP habitat on Pearl and Hermes Reef and Kure may become limited if golden crown-beard continues to expand uncontrollably.[5] The effects of house mice are unknown. Introduced ants have been noted on dead chicks but it is unknown if they had any role in the mortality.

Recommended Actions

- Eradicate mice from Midway and establish attraction programs if TRSP do not recolonize naturally.
- Determine population size, status and trends of TRSP in Hawai`i. Design and implement reliable population monitoring program.
- Eradicate golden crown-beard at Pearl and Hermes Reef, Midway, and Kure.
- Determine the effects of introduced ants.
- Research into basic life history traits, demography, and limiting factors.

Regional Contacts

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References: 1. Carboneras 1992a; 2. Slotterback 2002; 3. Ainley 1984; 4. Rauzon *et al.* 1985; 5. E. Flint, USFWS, pers. comm.; 6. Harrison *et al.* 1983; 7. Olson and James 1982; 8. Crossin 1974; 9. Harrison *et al.* 1984.

Polynesian Storm-Petrel (White-throated Storm-Petrel) *Nesofregetta fuliginosa*

Status

Federal: BCC68 **State: None** **IUCN: VU** **NAWCP: HI/HI**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	no	1	?	?d	year-round	crevice	dip, patter	pelagic

Distribution, Population Status and Trends

Polynesian Storm-Petrels (POSP) have a fairly limited distribution confined to the central Pacific. They breed in the Line, Phoenix, Austral, Society, Gambier and Marquesas island groups; historically they bred, and may still breed, in Samoa, Vanuatu, and Fiji.[1] POSP is one of the largest storm-petrels in the Pacific.[9] The genus is monotypic but several color morphs have been described. An all dark morph was described from Samoa[4] and is often referred to as the Samoan Storm-Petrel. At sea POSP are widely distributed along the equator with the majority of birds between 10°N and 10°S.[9] Most abundant south of the equator to about 8° S along the northern edge of the South Equatorial Current and east to the Marquesas.[3] Concentrations occur around the breeding islands (*e.g.,* the Line and Phoenix islands).[2]

POSP historically nested on all of the islands of American Samoa and were most abundant on the Manua Islands, but the population may now be extirpated.[5] Twenty years ago fairly large flocks were still observed at sea between Western and American Samoa and occasionally a bird is still seen flying over the islands, so they may still breed there in very low numbers.[9] Although they nest in the Line and Phoenix groups, nesting has not been recorded for the U.S. islands in these groups (although a single bird was recorded on Howland in the 1960s). However, 3 birds were seen on Jarvis in 2000 following rat and cat eradication.[8] The world population is very small and declining at many locations. POSP may recolonize and flourish on Howland, Baker and Jarvis now that these islands are free of introduced predators.

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Ecology

POSP nest in the shade of coral rock and under vegetation on atolls and islands. They also nest in burrows, rock crevices on island cliffs in Samoa, and under the trunks of trees, but they do not excavate their own burrows.[2,5] In the Line and Phoenix islands they nest in vegetated areas with an abundance of loose rocks.[2] Breeding occurs year-round with a peak of nesting that varies between islands. Even on a single island the peak of nesting activity can vary quite significantly between years.[2] Little is known about the life history of this species. Birds are generally nocturnal on the colony with the greatest activity occurring around dusk.[2] However, birds have been observed flying into the island in the middle of the day to feed a chick.[2]

POSP are usually solitary or associated with their own species; typically they do not occur in mixed-species feeding flocks.[2] POSP exhibit a unique flight behavior at sea, wherein birds "kick off" a wave, glide, and then "kick off" again.[2] Diet is poorly known but likely includes small squid,

fish and crustaceans.[7] A strong upwelling occurs around Jarvis and this may promote availability of planktonic food resources attractive to POSP.[6]

Conservation Concerns and Activities

Historically, Samoans hunted POSP with dogs.[5] Human consumption and introduced predators are probably the reason POSP no longer breed here. POSP could still occur on remote cliffs in American Samoa. Norway rats have been recorded at the summit of Mt. Lata, Ta`u, but the vertical cliffs may provide a refuge, like the Waimea Canyon cliffs on Kaua`i do for Band-rumped Storm-Petrel.[6] Prospecting birds have been observed at Jarvis following cat and rat eradication and colonies may flourish at these locations. The effects of introduced house mice are unknown but they could limit colonization at Jarvis.

Recommended Actions

- Eradicate mice from Jarvis and support efforts by NPS and the Government of American Samoa to control predators in historical nesting sites.
- Conduct systematic surveys of all potential and former nesting islands to determine current status and abundance.
- Coordinate with and support international conservation efforts, especially at Kiribati and Gambiers.

Regional Contacts

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References: 1. Carboneras 1992a; 2. Crossin 1974; 3. L. Spear, pers. comm.; 4. Pratt, *et al.* 1987; 5. Amerson 1982; 6. M. Rauzon, pers. comm.; 7. BirdLife 2000; 8. USFWS unpubl. data; 9. Muse and Muse 1982.

Mt. Lata, Ta'u, American Samoa offers potential habitat for storm-petrels on the 2000' cliff face that may be more secure from Norway rats than the summit where Tahiti petrels nests.

Masked Booby (Blue-faced Booby, `A) *Sula dactylatra*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2	yes	1	44d	120d	aseasonal	scrape	plunge dive	pelagic

Distribution, Population Status and Trends

Masked Boobies (MABO) have a pantropical distribution.[1,2] There are four subspecies; *S. d. personata* breeds on islands in the central and western Pacific.[3] Within the USPI, the largest colonies are on Howland, Baker and Jarvis, but a significant portion of the population nests on the NWHI. Birds forage in offshore and pelagic waters.[4] They are most abundant in the vicinity of breeding islands, but they can be encountered far out at sea.[4] During nonbreeding periods, adults may visit sites 1,000-2,000 km from breeding colonies.[2,6,8]

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The world population is widely distributed, and therefore difficult to estimate but is thought to be several hundred thousand birds.[1] Within the USPI, there are approximately 8,300 breeding pairs with 1,200 pairs on Jarvis and over 1,500 pairs each on Howland and Baker.[9] Approximately 2,500 pairs nest in the Hawaiian Islands, most in the NWHI.[10] In the Marianas, approximately 600 pairs breed on Farallon de Medinilla (FDM), Maug, Uracas, and Guguan.[11,12] Small colonies also occur in American Samoa and Palmyra[2,4,5] and Wake was recently recolonized by bird banded at Johnston.[14] Population trends in the USPI appear stable with increasing numbers on Wake, Howland and Baker.[13,14]

Ecology

MABO breed on oceanic islands and atolls. They tend to nest on open ground often near a cliff edge or on low sandy beaches or rocky ground.[1,15] They also form "clubs" or aggregations of non-breeding birds on the fringe of breeding colonies.[2] Breeding is fairly synchronous but timing varies depending on locality.[15] MABO are sexually dimorphic; females weigh slightly more than males and the bill of males is a richer, brighter yellow than that of females during breeding.[1,15] Sexes are most easily distinguished by voice, with males producing a thin whistle and females a loud honk.[1,2] MABO are monogamous and at least 45% of pairs on Kure retained their mates through a second breeding season.[16] Two eggs are laid but broods are typically reduced to one chick by siblicide.[1] Adults continue to feed young after they fledge, up to six months in extreme cases.[15] Juveniles remain in immature plumage until full adult plumage develops at 20 months.[2] Sexual maturity begins around 3-4 years and most birds return to their natal colony to breed.[1,7,16] Adults sometimes skip a year between breeding attempts.[2,15]

MABO feed by plunge-diving and can be found feeding more than 150 km from land.[15] They forage singly or in mixed-species flocks associated with schooling tuna.[4,10] In Hawai`i, fish constituted >97% of the diet and squid <3%; flyingfish and jacks were the most important prey.[17] The oldest-known bird was 25 years. On Kure, annual adult mortality was <8.6%; mortality between independence and age four was 72%.[17]

Conservation Concerns and Activities

Habitat destruction, invasive weeds, disturbance, and introduced predators limit populations. MABO breed on a few islands with human populations but they are vulnerable to human disturbance.[1] Introduced predators such as rats and cats have negatively impacted populations.[15] Eradication of feral cats from Howland and Baker resulted in the

rebound of populations.[14] Invasive weeds such as golden crown-beard have displaced populations and limited nesting habitat.[17] Navy bombing operations have undoubtedly killed MABO on Farallon de Medinilla but the creation of open habitat may have allowed populations to increase.[12] Overfishing of tuna could potentially have an impact on the availability of prey.[15] Commercial-size mackerel scad were important in the diet of MABO at some locations, and potential effects of commercial fisheries are unknown.[15] El Niño-Southern Oscillation conditions can cause breeding failure in the Central Pacific.[18]

Recommended Actions

- Eradicate golden crown-beard at Midway, Kure, Pearl and Hermes and elsewhere in the NWHI.
- Eradicate cats and rats on Wake and Palmyra and elsewhere in USPI where MABO occur.
- Limit human disturbance to colonies.

Regional Contacts

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References: 1. Anderson 1993; 2. Woodward 1972; 3. Clements 2000; 4. King 1967; 5. Anderson *et al.* 1982; 6. Clapp and Wirtz 1975; 7. Nelson 1978; 8. O'Brien and Davies 1990; 9. Forsell 2002; 10. Harrison *et al.* 1984; 11. Reichel 1991; 12. Lusk *et al.* 2000; 13. Rauzon *et al.* in prep.; 14. Rauzon *et al.* 2002; 15. Harrison 1990; 16. Kepler 1969; 17. Harrison *et al.* 1983; 18. Schreiber and Schreiber 1984.

Brown Booby (`A) *Sula leucogaster*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2	yes	1-2	43d	85-105d	aseasonal	surface	plunge dive	nearshore

Distribution, Population Status and Trends

Brown Boobies (BRBO) have a pantropical distribution.[1] There are four subspecies; *S. l. plotus* breeds on islands in the central and western Pacific.[2] In the USPI, BRBO occur in the greatest numbers in the Hawaiian Islands. Breeding adults are mostly sedentary and immatures disperse throughout the tropical seas.[4,5] At-sea they occur more nearshore than Masked or Red-footed Boobies and they are rarely seen >80 km from the nearest land.[3] Little is known of movements during nonbreeding periods but adults have been found up to 2,900 km from breeding sites.[1]

USFWS

Worldwide, the number of BRBO is estimated at 221,000 - 275,000 pairs; 50,000 - 70,000 pairs of *S. l. plotus*.[1] About 3,700 pairs nest in the USPI: approximately 1,400 in Hawaii[12,13], 750 in the Marianas[14,15] and 700 in American Samoa[9]. (The largest colony in Hawai`i was just recently documented at Lehua.[13]) Smaller colonies exist on Palmyra, Howland, Baker, Jarvis, Wake and Johnston.[11] The world population has declined dramatically over the past 200 years and possibly only 1-10% of historic populations remain.[1] Currently, the USPI population appears stable with populations on Wake, Howland and Baker gradually rebounding following eradication or control of feral cats.

Ecology

BRBO breeding range overlaps with that of Masked and Red-footed Boobies on oceanic islands and atolls.[4,5] Nesting occurs on flat ground, often on cliff ledges, but they will also nest on sandy islands and bare coral atolls.[1] Nests vary from a scrape in the sand to a fairly well-formed pile of twigs and grasses. Breeding is synchronous but timing varies depending on locality and occurs throughout the year.[1] Sexes are dimorphic; females are significantly larger than males and skin color around the eye is blue-gray in males and yellow-green in females.[1,4] Sexes are also distinguishable by voice; males produce a high-pitched whistle and females a low honk.[1] BRBO are monogamous but maintenance of long-term pair bonds varies by location.[1] Pairs lay 2 (very rarely 3) eggs but brood is often reduced to 1 chick as a result of siblicide.[1] Post-fledgling care varies considerably from a little over a month, up to 37 weeks.[1,6] Juveniles remain in immature plumage for 2 years. Age of first breeding is typically 4-5 years.[1,5]

BRBO feed by plunge-diving and feeding is often solitary, but they may be found in feeding flocks with other species.[1,5] They forage in nearshore waters, ranging from 8-70 km from land, and feed mostly on flyingfish, squid, mackerel scad, juvenile goatfish, and anchovy.[5,7] The oldest-known bird was 26 years, but they probably live to at least 30 years.[1,8] Adult survivorship was 93.2% at Kure.[10] On Johnston, survival from fledging to breeding ranged from 30-40% in an 18-year study.[1]

Conservation Concerns and Activities

Habitat destruction, disturbance, introduced predators and feral ungulates limit populations. A major threat to BRBO has been the loss of habitat to development and human disturbance; newer pairs are especially vulnerable at the beginning of the breeding season.[1] Introduced predators such as feral cats and rats have negatively impacted populations.[5]

The recent eradication of feral cats on Baker, Howland, and Jarvis will hopefully result in long-term increases. Birds are subjected to live bombing exercises conducted by the military on Farallon de Medinilla, CNMI.[15] At Johnston, birds were killed in the recreational troll fisheries during the period of military occupation but this ended in 2004. In American Samoa, hunting pressure on BRBO was high during historic times and this may still occur.[9] El Niño-Southern Oscillation events can cause breeding failure in the Pacific.[1]

Recommended Actions

- Eradicate feral cats and rats on Wake, Palmyra and elsewhere in the USPI.
- Limit human disturbance to colonies.

Regional Contacts

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References: 1. Schreiber and Norton 2002; 2. Clements 2000; 3. King 1967; 4. Carboneras 1992b; 5. Harrison 1990; 6. Nelson 1978; 7. Harrison *et al*. 1983; 8. Simmons 1967; 9. Amerson *et al*. 1982; 10. Tershy 1998; 11. Rauzon *et al.* 2002; 12. Harrison *et al.* 1984; 13 VanderWerf *et al.* 2004; 14. Reichel 1991; 15. Lusk *et al.* 2000.

Red-footed Booby (White Booby, `A) *Sula sula*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	45d	100-140d	aseasonal	stick	plunge	pelagic

Distribution, Population Status and Trends

Red-footed Boobies (RFBO) have a pantropical distribution that overlaps Masked and Brown Boobies.[1,2] There are three subspecies; *S. s. rubripes* breeds in the central and western Pacific.[3] RFBO nest throughout the USPI. At-sea distribution is pelagic; feeding flocks occur hundreds of kilometers from land.[4] Breeding adults are mostly sedentary but immatures roost near colonies on islands other than their natal island.[1,4] Little is known about adult movements outside of the nesting season.[1]

The world population was estimated at <300,000 pairs in 1996.[1] In the USPI, there are approximately 19,000 pairs. The largest colonies occur on Palmyra (6,250 pairs) and the Hawaiian Islands (>7,000 pairs).[5,21] A large colony of >1,200 pairs was recently documented at Lehua.[21] Approximately 2,500 and 2,000 pairs nest in the Marianas and American Samoa, respectively.[6,7] Smaller colonies exist on Howland, Baker, Jarvis, Johnston and Wake.[8,18] The world population has been severely reduced over the last two centuries.[1] The USPI population appears relatively stable with an increasing trend for Hawai`i. Numbers have decreased in the Marianas, particularly on Farallon de Medinilla.[14,15]

Ecology

RFBO, the smallest booby species, breeds on oceanic islands and atolls.[1,2] Unlike Masked and Brown Boobies, they roost and nest on shrubs and trees but they will utilize bare ground or low piles of vegetation.[1,2,4] Nests are made of twigs, grass and other vegetation. Breeding is fairly synchronous but occurs throughout the year and timing varies by locality.[1,4] Several color phases exist, ranging from all brown to all white.[1,11] In the Hawaiian Islands, RFBO are almost exclusively white morphs. On other islands in the USPI, they are also mostly white morphs although intermediate plumages do occur.[4,11] RFBO are sexually dimorphic; females tend to be larger than males and males have a lime green or bluish patch near the eyes prior to breeding. They

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are monogamous and generally retain their mates throughout subsequent breeding seasons.[1] They lay 1 egg and continue to feed the young 1-2 months after fledging.[1,2] Sexual maturity begins around 3-4 years and most birds return to their natal colony to breed.[1,4] Adults usually breed every year but sometimes take a "rest" year.[1,4]

In Hawai`i, RFBO feed mainly on flyingfish and squid, taking a larger proportion of squid than other boobies.[9] Other prey items include mackerel scads, saury, and anchovies.[4] RFBO often depart the colony to feed well before daylight but most return to roost on the colony at night.[2,4] RFBO feed by plunge-diving and may feed solitarily or in mixed-species foraging flocks.[10] They forage further from land than other boobies except possibly the Masked Booby.[11] Annual adult survival was estimated at 90% in a 2-year study at French Frigate Shoals.[12] On Johnston, survival of chicks to breeding ranged from 27-52% depending on year.[1] The oldest-known bird was 22 years.[13]

Conservation Concerns and Activities

Habitat destruction, disturbance, introduced predators and feral ungulates limit populations. Introduced predators such as the mongoose, cats and rats have negatively impacted populations.[1,2,4]

A major factor affecting populations is habitat loss and disturbance due to development and introduced species (*e.g.,* ungulates). The large areas of mangrove forests destroyed in the Marianas and American Samoa may have once been important habitat for RFBO. Military bombing of Farallon de Medinilla, CNMI has killed birds and contributed to the destruction of nesting habitat.[14,15] On Maug, CNMI, the exotic woodrose vine is overwhelming nest sites.[16] Introduced scale insects at Rose and Palmyra are destroying the Pisonia forests. Research will be initiated in 2004 at Palmyra to look at potential mechanisms for control or eradication. On the main Hawaiian Islands, habitat has been restored and protected at several locations and RFBO numbers are increasing. Eradication of rats and feral rabbits from Lehua is expected to reduce predation and enhance nesting habitat.[21] At Marine Corps Base Hawai`i (Kaneohe, O`ahu) populations have increased but nesting sites are subject to wild fires fueled by invasive vegetation.[17] Human predation on adults, chicks and eggs occurs in the Marianas and American Samoa.[16,7] El Niño-Southern Oscillation conditions can cause total or partial breeding failure in some locations.[19,20]

Recommended Actions

- Eradicate or control feral cats, dogs, rats and other introduced predators at or near colonies. Control feral ungulates where they destroy RFBO habitat. Eradicate rabbits and predators from Lehua, Hawai`i.
- Investigate techniques to eradicate or control invasive species that affect RFBO habitat (*e.g.*, woodrose vine, scale insects and ants, grasshoppers, etc).
- Protect colonies from disturbance.

Regional Contacts

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References: 1. Schreiber *et al*. 1996; 2. Carboneras 1992b; 3. Clements 2000; 4. Harrison 1990; 5. Harrison *et al*. 1984; 6. Reichel 1991; 7. Amerson *et al*. 1982; 8. Forsell 2002; 9. Harrison *et al*. 1983; 10. Au and Pitman 1986; 11. Nelson 1978; 12. Hu 1991; 13. Clapp *et al*. 1982; 14. Whistler 1996; 15. Lusk *et al*. 2000; 16. Pratt 1985; 17. Rauzon and Drigot 1999; 18. Rauzon *et al*. in prep.; 19. Schreiber and Schreiber 1989; 20. Schreiber 1994; 21 VanderWerf *et al.* 2004.

Great Frigatebird (`Iwa, Man o' War Bird) *Fregata minor*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	55d	168d	aseasonal	stick	surface dipping	pelagic

Distribution, Population Status and Trends

Great Frigatebirds (GRFR) have a pantropical distribution that overlaps with Lesser Frigatebirds.[1] There are five subspecies; *F.m. palmerstoni* breed on isolated islands in the western and central Pacific.[2] GRFR nest throughout the USPI and the largest colonies are located in Hawai`i. At sea, birds can be found any distance from land but they are most abundant within 80 km of breeding and roosting sites.[3] Adults are mostly sedentary but immatures and nonbreeders disperse widely throughout the tropical seas.[9]

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The world population is estimated at 500,000-1,000,000 birds.[1] Approximately 20,000 birds nest in Hawai`i, with the largest colonies on Nihoa (3,500-4,500 pairs) and Laysan (2,000-2,500).[4] Substantial numbers roost on islands off the main Hawaiian Islands (*e.g.*, Moku Manu and Lehua) but no evidence of nesting has been found.[14,15] Smaller colonies exist on the other USPI islands including two small colonies in the Marianas on Maug and Farallon de Medinilla.[5,6] On Howland, Baker and Jarvis, populations rebounded after the eradication of feral cats.[7]

Ecology

GRFR breed on small remote islands building stick platform nests in bushes, mangroves, or on low vegetation.[1] They nest on the ground at Howland, Baker and Jarvis. Breeding occurs throughout the year depending on locality with egg laying primarily in the dry season.[1] GRFR are sexually dimorphic; females tend to be 25% heavier than males and males have a scarlet gular pouch that they inflate during courtship displays.[1] GRFR are monogamous but it is extremely rare for pairs to remain together for subsequent breeding attempts.[1] Females breed biannually, sometimes every 3-4 years.[1] Post-fledging care, which continues for 5-18 months, is provided by females. Sexual maturity begins around 8-10 years and most birds return to the natal colony to breed.[1]

Frigatebirds are highly specialized for aerial existence; their tiny feet and reduced legs are useless for walking or swimming.[3] They have extremely low wing-loading and are extremely maneuverable in flight.[10] They do not rest on the water or plunge in pursuit of prey but they can spend extended periods "on the wing".[1,10] They usually feed in mixed-species flocks over tuna schools.[1,3] Their diet consists mostly of flyingfish and squid which they capture at or above the water's surface.[11] Frigatebirds are notorious for kleptoparasitism, but most of their food is obtained by fishing.[11]

Conservation Concerns and Activities

Habitat destruction, disturbance and introduced predators limit populations.[12] Introduced predators such as rats and feral cats can have devastating effects.[9] In the past, Polynesian rats have caused total nest failures on Kure[9] but rats have since been eradicated from Kure and Midway. The eradication of feral cats from Howland, Baker and Jarvis resulted in a rebound of both GRFR and LEFR populations.[7] GRFR were extirpated as a breeding species from Wake by feral cats but if efforts to eradicate cats are successful they may return as a breeding species.[8] Frigatebirds, mostly females and immatures, have been documented roosting on the

island since 1996.[8] Rats and feral rabbits negatively impact populations on Lehua and eradication of rabbits and all introduced predators is expected to decrease predation and enhance nesting habitat, and may encourage GRFR to begin nesting.[14] The small colony on Farallon de Medinilla has been negatively impacted by live bombing conducted by the U.S. military.[13] Over-fishing of tuna could potentially have an impact on the availability of prey.[12]

Recommended Actions

- Eradicate cats and rats from all current and potential nesting islands (*e.g.*, Wake and Lehua).

Regional Contact

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References: 1. Orta 1992a; 2. Clements 2000; 3. King 1967; 4. Harrison *et al*. 1984; 5. Stinson 1995; 6. Lusk *et al*. 2000; 7. Rauzon *et al.* 2002 8. Rauzon *et al.* in prep.; 9. Harrison 1990; 10. Weimerskirch *et al.* 2003; 11. Harrison *et al.* 1983; 12. Metz and Schreiber 2002; 13. T. deCruz pers comm.; 14. VanderWerf *et al.* 2004; 15. VanderWerf *et al.* pers comm.

Lesser Frigatebird *Fregata ariel*

Status

Federal: BCC 68 **State: None** **IUCN: None** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	45d	140d	aseasonal	stick	surface dipping	pelagic

Distribution, Population Status and Trends

Lesser Frigatebirds (LEFR) have a pantropical distribution that coincides with, but is smaller than, that of Great Frigatebirds (GRFR).[1,2] LEFR comprise three subspecies; *F. a. ariel* breed in the western and central Pacific. Within the USPI, the largest colonies occur on Baker and Howland.[3] At sea, birds are most abundant within 80 km of breeding and roosting islands although they can be found any distance from land.[4] Immatures and non-breeders disperse throughout tropical seas.[5]

The world population is estimated at several hundred thousand birds.[1] Within the USPI, there are at least 10,000 pairs with the largest colonies on Howland (~2,000 pairs) and Baker (~8,000 pairs).[3] Smaller colonies exist at Jarvis and American Samoa.[6] LEFR are absent as a breeding subspecies from the Marianas, Johnston and Wake. Nonbreeding birds have been recorded as rare visitors in Hawai`i[7]; they do not breed there except for a bird that hybridized with a GRFR at Tern Is. Within the USPI, LEFR populations declined significantly on islands after the introduction of cats, but post eradication, populations have been increasing.[3]

Ecology

Breeding takes place on small remote tropical islands. Nests are stick platforms on trees and bushes but when suitable vegetation is not available birds nest on bare ground.[1] LEFR are sexually dimorphic; females tend to be heavier than males and males have a scarlet gular pouch that is inflated during courtship displays.[1] They are monogamous but it is unlikely that pairs remain together for future breeding attempts.[1] If successful, females can only breed successfully every 2-3 years since post-fledging care is provided by the female and can last 4-6+ months.[1] Age to sexual maturity is unknown[1] but probably similar to GRFR at 8-10 years.

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Frigatebirds are highly specialized for aerial existence, with low wing-loading that enables them to be among the nimblest of fliers.[1,8] Their legs and feet are tiny and useless for walking or swimming.[4] They do not rest on the water or plunge in pursuit of prey but can spend long periods "on the wing".[8,9] They feed in pelagic waters, usually in mixed-species flocks over tuna schools.[1,4] Their diet consists primarily of flyingfish and squid that they capture at or above the water's surface.[9] Frigatebirds are notorious for kleptoparasitism but obtain most of their food by direct capture.[9] El Niño-Southern Oscillation conditions can cause partial or total breeding failure.[1]

Conservation Concerns and Activities

Feral cats decimated LEFR breeding populations on Howland and Baker and cat eradication programs implemented by the Service have resulted in the recovery of frigatebird populations on these islands. Cats and rats remain on Wake and the presence of roosting LEFR indicates that they would likely breed if predators were removed.[10] Over-fishing of tuna could potentially have an impact on the availability of prey.[1]

Recommended Actions

- Eradicate cats and rats on USPI where LEFR occur or could potentially breed *e.g.,* Wake and Palmyra.

Regional Contacts

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References: 1. Orta 1992c; 2. Clements 2000; 3. USFWS unpubl. data (Forsell 2002); 4. King 1967; 5. Harrison 1990; 6. Amerson *et al.* 1982; 7. Pratt *et al.* 1987; 8. Weimerskirch *et al.* 2003; 9. Nelson 1976; 10. Rauzon *et al.* in prep.

Red-tailed Tropicbird (Silver Bo'sunbird, Koa`e ula) *Phaethon rubricauda*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	42-46d	67-91d	year-round	scrape	plunge dive	pelagic

Distribution, Population Status and Trends

Red-tailed Tropicbirds (RTTR) have an Indo-Pacific distribution that coincides with, but is smaller than that of White-tailed Tropicbirds, ranging between 35° N and 30° S.[1,2,3] There are four subspecies; *P. r. melanorhynchos* breed in the central and western Pacific.[4] Breeding adults are mostly sedentary; however, they avoid land when not breeding and are among the most pelagic and solitary of seabirds.[1,5,6] At sea, RTTR are evenly distributed throughout their range.[1,7] Little is known about their movements outside the breeding season.

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The world population is estimated at 17,000-21,00 pairs; with an estimated 12,000-14,000 pairs in the Pacific.[1,3] The largest USPI breeding colonies occur in the Hawaiian Islands, primarily in the NWHI.[5] Approximately 9,000-12,000 pairs nest in Hawai`i with large concentrations on Midway and Laysan.[5] There are approximately 1,900 pairs on Johnston.[8] Smaller colonies exist in American Samoa, Palmyra, Wake, Jarvis, Howland, Baker, the Marianas and the main Hawaiian Islands. The world population seems stable in many areas and may be increasing in some areas, but there is a lack of information on past population estimates so comparisons are difficult.[1] Within the USPI, RTTR populations appear stable overall with increasing populations on Johnston and possibly Midway.

Ecology

RTTR breed mainly on oceanic islands and coral atolls. They nest on the ground under vegetation in the understory of trees and less commonly in cavities of cliff faces.[1,2] Nests are scrapes that vary from a shallow depression in the sand to more elaborate structures consisting of twigs and leaves.[1,5,9] Breeding occurs annually, but timing varies depending on locality.[1,5] RTTR are monomorphic, but males tend to be slightly larger than females.[1,6] They are monogamous and pairs stay together for years, especially if they breed successfully.[5] RTTR lay a single egg.[1,2] Chicks are semi-altricial (unique among Pelecaniformes) and covered with down when they first hatch.[1,10] Adult feeding of chicks usually takes place midday between 1000 and 1400; none occur between dusk and dawn.[1] There is no post-fledgling care. Juveniles remain in immature plumage (white with black bars and spots except on the throat and belly) until two years old.[1] First breeding usually occurs around 2-4 years.[1,5] The oldest-known living bird was 23 years.[11]

RTTR feed by plunge-diving. They feed singly most of the time but are occasionally seen with flocks of Sooty Terns or shearwaters.[3,5] RTTR are attracted to ships, presumably because flyingfish, their main prey, are scattered by ships.[6] In Hawai`i, other prey include squid, mackerel scad, dolphinfish, truncated sunfish and balloonfish.[5,6] El Niño-Southern Oscillation conditions can cause breeding failure in the Pacific.[14]

Conservation Concerns and Activities

Habitat destruction, introduced predators, and feral ungulates limit populations. Introduced predators such as rats have severely impacted populations

throughout USPI. Most RTTR that bred along the coast of Kaua`i have been eliminated, except for those that nest on cliffs that are inaccessible to rats.[5] On Kure and Midway rats preyed upon RTTR and destroyed native vegetation that provided nesting habitat.[12] Rats were eradicated from both islands and restoration efforts on Midway to improve habitat for RTTR include removing invasive vegetation and restoring native vegetation. On Howland, Baker and Jarvis cats were eradicated and local RTTR populations are expected to increase. Cat eradication on Wake is nearing completion.[15] In the Marianas, feral ungulates such as pigs uproot vegetation and have contributed to the reduction of nesting habitat for RTTR and other ground-nesting seabirds.[13]

Recommended Actions

- Eradicate or control introduced predators on USPI where RTTR occur (*e.g.*, Wake, Palmyra, Lehua, and NWRs on the main Hawaiian Islands.)
- Limit feral ungulate disturbance to colonies.

Regional Contacts

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References: 1. Schreiber and Schreiber 1993; 2. Orta 1992a; 3. Gould *et al.* 1974; 4. Clements 2000; 5. Harrison 1990; 6. Harrison *et al.* 1983; 7. King 1970; 8. Hayes, pers. comm.; 9. Fleet 1974; 10. Baicich and Harrison 1997; 11. Klimkiewicz and Futcher 1989; 12. Tyler 1991; 13. Reichel 1991; 14. Schreiber and Schreiber 1989; 15. Rauzon *et al.* in prep.

White-tailed Tropicbird (Bo'sunbird, Koa`e kea) *Phaethon lepturus*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	41d	77d	year-round	tree, cliff	plunge dive	pelagic, near-shore

Distribution, Population Status and Trends

White-tailed Tropicbirds (WTTR) have a pan-tropical distribution but are absent from the eastern Pacific and northeastern Atlantic.[1,2] There are six subspecies; *P. l. dorothea* breed in the central and western Pacific.[3] Breeding adults are mostly sedentary and forage widely over the pelagic seas, often at distances up to 120 km from nesting sites. Nonbreeding adults are rarely found on land and tend to disperse widely but distances and direction of dispersal are largely unknown.[1,4]

The world population is difficult to estimate because of the remoteness of many nesting islands, but probably is less than 200,000 breeding pairs.[4] The largest USPI breeding colonies occur on American Samoa and the Hawaiian Islands. Most Hawaiian birds (~1,800 pairs) breed in the main islands; a few pairs nest annually on Midway.[2] Approximately 1,900 pairs breed in American Samoa.[9] Smaller colonies exist on Palmyra, Wake and the Marianas. The world population is considered generally stable or slightly declining.[4] Population trends in the USPI are unknown.

Ecology

WTTR breed on oceanic islands and offshore islets.[1,2,4] They prefer to nest in inaccessible spots on cliffs, but they also nest in caves and tree hollows.[4] Nests have little to no material. Breeding occurs annually but timing varies depending on locality.[4] WTTR are monomorphic. They are monogamous and partners stay together for years, especially if they breed successfully.[2,4] Clutch size is one egg; chicks are semi-altricial (unique among Pelecaniformes) and covered with down when they hatch.[1,5] There is no post-fledgling care. Juveniles remain in immature plumage (yellow bill and head- and body-feathers primarily white with black barring) until the third year.[1,6] Few data are available on age of first breeding but may occur at four years old.[2] Their life span is unknown, but

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probably similar to the closely related Red-tailed Tropicbird at approximately 23 years.[4,7]

WTTR feed primarily by plunge-diving but sometimes catch prey "on the wing".[2,4] They are highly pelagic and solitary feeders but they sometimes congregate in small feeding groups.[4] WTTR tend to follow ships in pursuit of flyingfish, their main prey item, that are scattered by ships. Diet of WTTR in the USPI is poorly known but is probably similar to that of Red-tailed Tropicbirds.[2]

Conservation Concerns and Activities

The main threats to WTTR are introduced predators and possibly disease. Introduced predators such as rats have severely impacted populations throughout the USPI and the availability of predator-free nest sites appears to be the single most important factor regulating WTTR populations.[4] On Guam, populations were probably extirpated due to predation by the brown tree snake.[8] Disease may be the cause of a dramatic population decline on O`ahu, however, more research is needed to confirm this.[2] WTTR nesting in Kilauea Crater on Hawai`i are sometimes overcome by fumes during eruptions and fall into the molten lava.[2] Because WTTR primarily nest on inaccessible cliffs, monitoring and research of this species is difficult.

Recommended Actions

- Eradicate or control rats and other introduced predators where WTTR currently or potentially could nest.
- Develop and implement survey protocols to assess population status and monitor trends.

Regional Contacts

None known.

References: 1. Orta 1992a; 2. Harrison 1990; 3. Clements 2000; 4. Lee and Walsh-McGehee 1998; 5. Baicich and Harrison 1997; 6. Plath 1913; 7. Klimkiewicz and Futcher 1989; 8. G. Wiles, pers. comm.; 9. Amerson *et al.* 1982.

Sooty Tern (`Ewa `ewa) *Sterna fuscata*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	30d	50d	aseasonal	scrape	surface dipping	pelagic

Distribution, Population Status and Trends

Sooty Terns (SOTE) have a pantropical distribution.[1,2,3] There are eight subspecies; *S. f. oahuensis* breed in the central and south Pacific.[1,2] Breeding adults remain relatively close to colonies and forage up to 500 km from breeding islands.[5,6] During nonbreeding periods, they are highly pelagic and tend to avoid regions with cold-water upwelling.[1,3] Immatures disperse widely after fledging and remain at sea, sometimes not touching land for several years.[3]

The worldwide population is estimated to range from 60-80 million birds with 18-23 million pairs breeding each year.[3] In the USPI, there are approximately 3.2 million pairs. The largest colonies are at Baker (~800,000 pairs); and Jarvis, Laysan and Lisianski, with approximately half a million pairs each.[8,13] Other large colonies (≥100,000 pairs each) are found on Rose (American Samoa), Johnston and Uracas (CNMI).[14,15,16] Trends in Hawai`i appear relatively stable.

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Ecology

SOTE nest on oceanic islands and atolls in large dense colonies.[1,3] A colony usually consists of several subcolonies and each subcolony breeds very synchronously. SOTE nest on the ground in sandy substrate with sparse vegetation.[3] Clutch size is one egg and if the egg is lost early in the breeding season they will renest.[3] Both adults incubate the egg and feed the chick.[3] SOTE continue to feed their young at least 2 weeks after fledging.[3,6] Immature plumage is dark and immatures probably do not acquire adult plumage until their fourth year.[3] Sexual maturity begins around 4-10 years.[3,9] The oldest-known bird was 32 years.[4]

SOTE, the most pelagic of the tropical terns,[10] feed mainly by aerial-dipping, contact-dipping and aerial capture, although occasionally they will plunge-dive.[1,3,4] They rarely settle on water because their plumage quickly becomes waterlogged.[3] SOTE tend to feed in large flocks with other species in association with predatory fishes, such as yellowfin and skipjack tunas.[3,4,7] In Hawai`i, they feed mainly on squid, goatfish, flyingfish and mackerel scad.[11] El Niño-Southern Oscillation conditions can cause breeding failure in the Pacific.[12]

Conservation Concerns and Activities

Introduced predators such as rats and cats have negatively impacted populations.[4] The eradication of cats and rats from Midway, Kure, Jarvis, Howland and Baker should result in population increases at these locations. At French Frigate Shoals and Midway, Cattle Egrets take chicks.[7,16] Native

predators such as Great Frigatebirds, Black-crowned Night Herons, Ruddy Turnstones and Laysan Finches take chicks and eggs.[3,4] SOTE is vulnerable to oil pollution from tankers and spills. Over-fishing of tuna could potentially have an impact on the availability of prey.[3]

Recommended Actions

- Eradicate introduced rats, mice and cats on USPI (*e.g.,* Palmyra, Wake and islets off the main Hawaiian Islands).

Regional Contacts

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References: 1. Gochfeld and Burger 1996; 2. Clements 2000; 3. Schreiber *et al.* 2002; 4. Harrison 1990; 5. Flint 1991; 6. Gould 1974; 7. USFWS 1983c; 8. Harrison *et al.* 1984; 9. Harrington 1974; 10. King 1967; 11. Harrison *et al.* 1983; 12. Schreiber and Schreiber 1989; 13. Forsell 2002; 14. Amerson *et al.* 1982; 15. Reichel 1991; 16. USFWS unpubl. data.

Gray-backed Tern (Spectacled Tern, Pakalakala) *Sterna lunata*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	30d	50d	aseasonal	scrape	hover dipping	pelagic

Distribution, Population Status and Trends

Gray-backed Terns (GRAT) are endemic to the tropical and subtropical Pacific but are most common in the central Pacific.[1,2] Breeding adults are mostly sedentary and forage up to 370 km from land.[2,3] During nonbreeding periods, they are highly pelagic and occur far from breeding colonies, but their range is unknown.[1] At sea, GRAT are found in highly saline waters.[4] There is limited data on movements but immatures travel great distances after leaving the natal colony.[1]

The world population size is unknown but possibly on the order of 70,000 pairs.[1] Lack of adequate information on breeding phenology in many areas complicates estimates.[1] In the USPI there are approximately 48,000 pairs, with 44,000 in Hawai`i (largest colonies on Lisianski, Nihoa and Laysan).[12] Colonies with approximately 1,000 pairs each occur in the Marianas, Howland and Baker[8,13] Smaller colonies occur on Johnston, Wake and Jarvis.[8,14] A new colony on Tutuila represents a range expansion.[16] The global population trend is difficult to assess, but probably has declined since some colonies have been extirpated.[1] In the USPI, the population appears stable or increasing, but historical declines occurred at Howland, Baker, Jarvis, Wake and Midway due to introduced predators. Trends in the USPI may be increasing with the removal of predators from many islands.

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Ecology

GRAT breed on remote islands and atolls, on rocky ledges or sandy beaches often along vegetated edges bordering open areas.[5,6] On Midway and Kure, GRAT also nest along airport runways.[7] Their nests are shallow depressions in sand or gravel. Breeding occurs throughout the year.[8] The clutch is 1 egg and chicks are semi-precocial when hatched.[1] Both birds incubate and feed the chick and parental feeding of fledged young continues for an unknown period of time.[1] Fledglings may remain at the colony up to 6 weeks after first flight.[2] Juveniles resemble adults but have a mostly gray dorsal surface, white underparts and forehead, and they often appear "scaly" because of light fringes on their gray feathers.[1] The oldest-known GRAT was 25 years.[1]

GRAT feed mainly by plunge-diving or contact/hover-dipping. They are described as an inshore, offshore, or pelagic feeder due to the geographical and seasonal differences in foraging habitat.[1] In Hawai`i, their main prey is fish: five-horned cowfish, juvenile flyingfish, goatfish, herring, and dolphinfish.[2] GRAT also eat squid, crustaceans, mollusks, and marine and terrestrial insects.[2] GRAT can be found foraging in mixed-species flocks, especially with Sooty Terns and sometimes with Wedge-tailed Shearwaters.[9]

Conservation Concerns and Activities

Habitat destruction, disturbance and introduced predators limit populations. In the USPI, their gravest threat is predation by introduced mammals such as rats and cats.[2,7,10] Populations are recovering on Howland, Baker, Jarvis and Midway after the eradication of rats and cats.[8,15] GRAT are sensitive to disturbance, leaving their eggs when humans approach.[2] Unattended eggs and chicks are vulnerable to predators such as Great Frigatebirds, Ruddy Turnstones, Bristle-thighed Curlews, Laysan and Nihoa Finches.[1] GRAT tend to nest near the

surf zone and nests are often lost to storm tides.[1,2] Collisions with antenna guy wires caused mortality at Kure and Johnston in the past[11] but these obstacles are being removed.

Recommended Actions

- Eradicate introduced rats, mice and cats on USPI (*e.g.*, Palmyra, Wake, and islets off main Hawaiian Islands).
- Protect colonies from human disturbance.

Regional Contacts

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References: 1. Mostello *et al.* 2000; 2. Harrison 1990; 3. Dixon and Starrett 1952; 4. Ainley and Boekelheide 1983; 5. Amerson 1971; 6. Ely and Clapp 1973; 7. Woodward 1972; 8. USFWS, unplubl. data 9. Gould 1971; 10. Harrison *et al.* 1983; 11. Udvardy and Warner 1964; 12. Harrison *et al.* 1984; 13. Reichel 1991; 14. Rauzon *et al.* in prep.; 15. Rauzon *et al.* 2002; 16. M. Rauzon pers. comm..

Black Noddy (Hawaiian Noddy, Noio) *Anous minutus*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	30d	60d	aseasonal	tree	surface dipping	nearshore

Distribution, Population Status and Trends

Black Noddies (BLNO) have a pantropical distribution.[1,2] There are seven recognized subspecies and at least three breed in the USPI: *A. m. melanogenys* in the main Hawaiian Islands; *A. m. marcusi* in the NWHI, Wake, and throughout Micronesia; and *A.m. minutus* in Samoa.[1,3] There is some debate whether the birds nesting in the NWHI are *melanogenys* or *marcusi*.[1] Breeding adults are mostly sedentary remaining at colonies year-round and foraging within approximately 80 km of nesting islands.[1,4,5] Immatures probably remain at breeding colonies or travel to nearby roosting sites.[1] In Hawai`i, adults and immatures exhibit inter-island movement, but it is unknown what proportion of the population is involved and whether birds return to their natal colony.[1]

The world population is estimated to be 1-1.5 million pairs.[1] In the USPI, there are approximately 22,400 pairs. An estimated 12,000 pairs nest in the Hawaiian Islands; the largest colonies are at Midway (6,000 pairs) and Nihoa (5,000 pairs).[11] Smaller colonies exist in American Samoa, Palmyra, Johnston, Wake and the Marianas. Worldwide population trends are unknown.

Ecology

BLNO nest on oceanic and offshore islands.[1] In the main Hawaiian Islands they nest on sea cliffs and in caves; at other locations they nest on trees and bushes.[6,7] Breeding is asynchronous and aseasonal; in Hawai`i, egg laying occurs year-round, is synchronous in some years and asynchronous in others, and the peak(s) of egg laying can occur in different seasons in different years.[13] Birds are monogamous, mate retention is high, and pairs retain their territory from year to year, often reusing the same nest.[1,8] BLNO are capable of producing more than one brood per year and some lay a second egg while still tending the first chick.[1,9] BLNO feed their young up to 17 weeks after fledging.[1] Juvenile plumage is similar

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to adult plumage but the white cap is more sharply demarcated.[1] Age at which adult plumage is attained is unknown. Sexual maturity begins around 2-3 years.[1] The oldest-known bird was 25 years.[1]

BLNO feed by hover-dipping and contact-dipping, and typically forage in multi-species flocks over schools of predatory fish, especially tunas and jacks.[4] They feed mainly inshore (<10 km from shore) and sometimes within a few meters of the shoreline.[7,1] BLNO eat fish almost exclusively and very small amounts of squid and crustaceans.[1] In Hawai`i, they are opportunistic and juvenile and larval goatfish, lizardfish, herring, flyingfish and gobies are important components of the diet.[7] Elsewhere in the central Pacific flyingfish, blennies, mackerel and anchovies are important.[1]

Conservation Concerns and Activities

Predation by introduced mammals limits populations and commercial fisheries exploiting coastal predatory species such as skipjacks and tuna may reduce BLNO foraging opportunities.[1] Zodiac/kayak tours of sea caves in the main Hawaiian Islands flush nesting BLNO. Removal of exotic ironwood trees at Midway could reduce nesting habitat for BLNO. The maturing ironwood forest on Wake is probably aiding recolonization.[13] Nesting populations have increased on Tern and Kure since

the mid-1990s, probably because of increased shrub and tree nesting habitat and decreased human disturbance.[1] Introduced scale insects at Kure are threatening the native shrubs at this island and golden crown-beard (an unsuitable structure for nesting) is invading. Because of their tendency to concentrate nearshore, BLNO could potentially be more affected than other seabirds by oil spills and oceanic dumping of waste.[11] There have been repeated sightings of BLNO contaminated with oil in the NWHI.[12]

Recommended Actions

- Eradicate or control scale insects and golden crown-beard at nesting islands.
- Eradicate or control introduced predators on all current or potential nesting islands.
- Determine the source of oil affecting BLNO in the NWHI.
- Determine the significance of disturbance from recreational activities (*e.g.*, kayaking and cave exploration) on the main Hawaiian Islands and examine approaches to minimize this disturbance if deemed necessary.

Regional Contacts

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References: 1. Gauger 1999; 2. Clements 2000; 3. Gochfeld and Burger 1996; 4. Ashmole and Ashmole 1967; 5. King 1967; 6. Howard and Moore 1984; 7. Harrison 1990; 8. Schreiber and Ashmole 1970; 9. USFWS unpubl. data; 10. Diamond 1978; 11. Harrison *et al.* 1984; 12. Fefer *et al.* 1984; 13. Rauzon *et al.* in prep.

Brown Noddy (Common Noddy, Noio koha) *Anous stolidus*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: NCR/NCR**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	35d	60d	aseasonal	scrape	surface dipping	pelagic

Distribution, Population Status and Trends

Brown Noddies (BRNO) have a pantropical distribution.[1] There are five subspecies; *A.s. pileatus* breed in the central and western Pacific.[2] Within the USPI, a significant portion of the population occurs in the Hawaiian Islands. Breeding adults remain within sight of the colony, foraging in waters several tens-of-kilometers from the colony.[3,4] During nonbreeding periods, BRNO generally stay within 100 km of colonies.[5,6] Little is known of the movements of immatures.[1]

The world population is estimated at 500,000-1,000,000 pairs.[1] Within the USPI, there are about 135,000 pairs, which includes 112,000 pairs distributed throughout the Hawaiian Islands.[9] The largest colonies are on Nihoa and Kaula with 35,000 and 20,000 pairs, respectively.[9] Approximately 9,000-11,000 pairs (each) nest in American Samoa, the Marianas and Johnston.[10,11,12] Smaller colonies exist on Howland, Baker, Jarvis and Wake.[12,13] Population trend is probably stable, but increasing at islands where predators were removed (*e.g.,* Midway, Kure).[1]

Ecology

BRNO nest on the ground, often on open slopes or under vegetation but they also nest on cliffs and in trees, especially where introduced mammalian predators are present.[6,7] In the Hawaiian Islands, breeding is fairly synchronous with peaks occurring in both spring and summer.[6] Sexes are similar in appearance, but males are larger in size than females.[1] BRNO pairs stay together throughout the year, but there is little information on mate retention in subsequent years.[1] Adults continue to feed their chicks for several weeks after they fledge, up to 3 months in some cases.[6] Juvenile plumage is similar to that of adults except the white caps are smaller.[6] Sexual maturity begins around 3-7 years and it is unknown whether birds return to their natal colony to breed.[1,6] The oldest- known bird was 25 years.[1]

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BRNO feed by hover and contact-dipping in near-shore and off-shore waters.[8] They often feed in association with tuna schools and can be found in mixed-species feeding flocks. In Hawai`i, two-thirds of the diet is fish (goatfish, lizardfish, mackerel scad and flyingfish) and one-third is squid.[8]

Conservation Concerns and Activities

The greatest threat is introduced predators, and where there are predators, BRNO often nest in trees (*e.g.,* Midway, Wake, American Samoa).[1,9] BRNO formerly nested on Lehua but were extirpated due to predation by introduced Barn Owls and Polynesian rats.[14] Disturbance of the colonies can lead to increased predation by native predators: unprotected eggs are taken by Laysan and Nihoa finches and Great Frigatebirds take BRNO chicks.

Recommended Actions

- Eradicate introduced predators from current and potential colony sites (*e.g.,*Palmyra, Wake, Lehua).

Regional Contacts

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References: 1. Chardine and Morris 1996; 2. Harrison and Stoneburner 1981; 3. Morris and Chardine 1992; 4. Clements 2000; 5. Clapp *et al.* 1983; 6. Harrison 1990; 7. USFWS 1983c; 8. Harrison *et al.* 1983; 9. Harrison *et al.* 1984; 10. Amerson *et al.* 1982; 11. Reichel 1991; 12. USFWS unpubl. data; 13. Rauzon *et al*. in prep.; 14. VanderWerf *et al*. 2004.

Blue-gray Noddy (Blue Noddy, Necker Island Tern)
Procelsterna cerulea

Status

Federal: BCC 67, 68 **State: None** **IUCN: None** **NAWCP: HC/HC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	35d	50d	Dec-Jun	crevice	surface dipping	nearshore

Distribution, Population Status and Trends

Blue-gray Noddies (BGNO) are widely distributed throughout the Pacific.[1,2,3,4] Once considered conspecific with Gray Noddies, there are five subspecies of "Blue Noddies" and two occur in the USPI: *P. c. saxatilis* in the north Pacific and *P. c. nebouxi* in the south Pacific.[1] Within the USPI, most BGNO nest in the NWHI, with the largest colonies on Necker and Nihoa.[15] Breeding adults are mostly sedentary and seldom encountered far at sea.[5,6] In Hawai`i, adults are year-round residents but may exhibit inter-island movement.[6] Little is known of movements of immatures.

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The world population is approximately 100,000 breeding pairs, although it is difficult to get an accurate count because BGNO nest on inaccessible sea cliffs.[7] In the USPI, there are about 3,600 pairs with approximately 3,500 pairs on Necker and Nihoa, combined.[15] Elsewhere in the NWHI, La Perouse Pinnacle, French Frigate Shoals and Gardner Pinnacles have very small colonies. Colonies also occur on the high islands in American Samoa[16] and birds have recolonized Howland, Baker and Jarvis.[17] Birds once nested on Kaula[8] and there is some evidence that they once nested on Rota (CNMI).[9] Worldwide population trends are unknown.

Ecology

BGNO, the smallest of the world's terns, occur on remote islands and atolls.[6] They nest on exposed sea cliffs, sea stacks, rocky outcrops, or sometimes in vegetation.[6] In Hawai`i, BGNO avoid isolated cavities and instead form loose nesting aggregations among clustered cavities within ancient lava flows.[6] At Nihoa, breeding takes place from early Dec-Mar but occasionally extends into summer during years of inclement weather.[10] At La Perouse, French Frigate Shoals BGNO breeds from Mar-Jun.[11] Little is known of breeding behavior. The oldest-known bird was 11 years but BGNO probably have greater longevity.[6]

BGNO feed by hover-dipping and surface-dipping and sometimes will forage with mixed flocks.[10] They are an inshore feeder.[10] They capture the smallest prey of any Hawaiian seabird, mainly larval lizardfishes, flounders, goatfishes and flyingfish; they also take squid and crustaceans.[12] Depending on the season, their diet may consist of significant amounts of insects (*e.g.,* sea striders).[10,12,13] BGNO were observed feeding off Jarvis in association with a rich upwelling of the Equatorial Undercurrent.[18]

Conservation Concerns and Activities

Introduced predators such as cats and rats have negatively impacted populations.[7] The recent eradication of feral cats on Baker, Howland, and Jarvis (cat eradication at Wake is underway) will hopefully lead to long-term population increases. The Jarvis population was estimated at >500 birds in 2004, up from "a few birds" prior to rat and cat eradication.[18] The effect of mouse predation on this diminutive species is unknown. Native predators such as Nihoa and Laysan Finches can cause considerable egg loss.[14] The colony on Kaula was possibly eliminated when the island was used as a

bombing range by the U.S. military; breeding has not been confirmed there for fifty years.[3,6]

Recommended Actions

- Eradicate introduced predators at active and historic BGNO colony sites (*e.g.*,Rota, Palmyra, Kaula and Baker).
- Develop and implement standardized survey protocols to determine current population size and status.
- Monitor the recovery of this species post predator eradication.

Regional Contacts

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References: 1. Clements 2000; 2. Murphy 1936; 3. King 1967; 4. Edgar *et al.* 1965; 5. USFWS 1983c; 6. Harrison 1990; 7. Gochfeld and Burger 1996; 8. Caum 1936; 9. Steadman 1992; 10. Rauzon *et al.* 1984; 11. Amerson 1971; 12. Harrison *et al.* 1983; 13. Ashmole and Ashmole 1967; 14. Ely and Clapp 1973; 15. Harrison *et al*. 1984; 16. Amerson *et al*. 1982; 17 Rauzon *et al*. 2002; 18. Rauzon pers. comm..

White Tern (Fairy Tern, Manu-o-Ku) *Gygis alba*

Status

Federal: None **State: T** **IUCN: None** **NAWCP: MC/MC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	36d	49-75d	year-round	none	surface diving	nearshore

Distribution, Population Status and Trends

White Terns (WHTE) have a pantropical distribution.[1,2] There are four subspecies; *G. a. alba* breed in the central and western Pacific.[2,3] Breeding adults remain close to colonies, foraging primarily inshore in shoals and banks but sometimes in offshore waters.[1] During nonbreeding periods they disperse from breeding grounds to sea but their range is unknown.[1] Some adults are year-round residents on the colony.[4] Little is known of immature movements.

World population is unknown but probably exceeds 100,000 pairs.[2] In the USPI, there are about 17,000 pairs with a large portion in the NWHI. In the main Hawaiian Islands WHTE occur only on O`ahu where the population has exhibited remarkable growth from 1 pair to >250 pairs from 1961-2002.[9] Populations in the NWHI total approximately 15,000 pairs.[6] The largest colonies at Nihoa and Midway have 5,000 and 7,500 pairs, respectively.[6] Large colonies exist in American Samoa (3,900 pairs)[10] and the Marianas (1,250 pairs)[11], and small colonies occur at Johnston, Wake and Howland.[12] World and USPI population trends are unknown, however, populations appear stable within the NWHI.[1,2]

Ecology

WHTE nest on volcanic pinnacles, cliffs, rocky slopes, in large bushes or trees, or on artificial substrates.[1,5] WHTE do not build nests but lay a single egg wherever they find a suitable depression.[4] In Hawai`i, they breed year-round but most eggs are laid from Feb-Jun.[1,6,9,14] WHTE are monomorphic, monogamous, and partners remain together for several seasons, often returning to the same nest site.[1,4] Clutch size is one and some breeding pairs may successfully raise two or even three broods within a nesting season.[1,9,13] Post-fledging care can last up to 2 months.[7] Immature plumage is similar to that of adults, except body- and wing- feathers are fringed with varying amounts

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of brown, the base of the bill is black, and fledglings may have a dark spot behind the eye.[1] There is no information on the age adult plumage is attained. At Tern Is., age at first breeding was 5 years.[1] The oldest-known bird was 42 years.[1]

WHTE feed primarily by dipping- and surface-diving.[1] They often occur in mixed feeding flocks and usually in association with predatory fish.[1,4] In Hawai`i, WHTE eat mainly juvenile goatfish and flyingfish.[8] Other prey items include squid, needlefishes, halfbeaks, dolphinfishes and blennies.[1,8]

Conservation Concerns and Activities

Although WHTE exhibit lower vulnerability to introduced predators than most seabirds because of their ability to utilize remote (*e.g.*, sheer cliffs) nesting sites, introduced predators such as rats and cats have been the primary factor affecting populations.[1] On O`ahu the population has increased despite the abundance of introduced predators.[9] On Midway, introduced ants have been recorded attacking pipped eggs and incubating birds.[1,4] Scale insects have been introduced to Kure, Rose and Palmyra where they attack native vegetation and on Rose and Palmyra they are decimating the native forest; the effects on WHTE nesting populations are not known. Overfishing of large predatory fish

stocks that drive prey to the surface may reduce foraging opportunities for WHTE.[1,2]

Recommended Actions

- Investigate the impacts of introduced invertebrates on nesting habitat and WHTE populations and support research to control and eradicate these invasive species.
- Eradicate introduced predators where WHTE occur.
- Determine current size and trends of the American Samoan population.

Regional Contacts

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Little Tern *Sterna albifrons*

Status

Federal: None **State: None** **IUCN: None** **NAWCP: HC/LC**

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	2-3	65d	140d	spring	scrape	plunge dive	inshore

Distribution, Population Status and Trends

Little Terns (LITE) have a pantropical distribution.[1,2] There are six subspecies; *S. a. sinensis* breed throughout the Pacific.[1,2] LITE recently expanded their range into the USPI and are present in small numbers on islands in Hawai`i and the Marianas.[3,4,5] Breeding adults remain close to colonies and forage within 3 km of the colony.[2] During nonbreeding periods LITE may frequent tidal creeks, coastal lagoons and are sometimes found far out to sea.[2] Movement patterns by adults and immatures are not fully understood.

The world populations is estimated to be 70,000-100,000 pairs.[2] Recently, they were found nesting in small numbers at Pearl and Hermes and Midway (<10 pairs each).[3] LITE were documented migrants in the Marianas and were found breeding on Saipan in 1988.[4] Worldwide population trend is unknown.[2]

Ecology

LITE occur in coastal areas and oceanic islands.[2] They tend to breed on sparsely vegetated sandy, rocky or barren ground, but they also nest on spits in estuaries and lakes, salt-marshes, rivers, and on reefs.[2] LITE breed synchronously during the spring. Clutch size is 2-3 eggs. Adults are similar and juveniles resemble adults but have paler wings and black chevrons on mantle.[2] Age at first breeding is 3 years.[2] The oldest-known bird was 21 years.[2]

They feed by plunge-diving in shallow water, usually at the edge of advancing tides.[2] LITE sometimes feed in groups, synchronously diving into the water to capture prey.[2] Diet consists of small fish, crustaceans, insects, annelids, and molluscs.[2]

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Conservation Concerns and Activities

Worldwide LITE face many threats, especially habitat loss and disturbance.[2] LITE are sensitive to human disturbance, including birdwatchers, which can cause nest failures.

Recommended Actions

- Monitor changes in distribution and abundance associated with range expansion.

Regional Contacts

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