

Part II. Species Accounts

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California Current System Species Profiles



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Fork-tailed Storm-Petrel

Oceanodroma furcata

Status

Federal: None

State: CA-SC, OR-S

IUCN: None

NAWCP: NCR/NCR

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	60d	~56d	Mar-Nov	crevice/burrow	surface-seizing	pelagic

Distribution, Population Status and Trends

The Fork-tailed Storm-Petrel (FTSP) is widely distributed throughout the North Pacific, from Japan to the Aleutian Islands, and down the Pacific coast of North America to northern CA, with the core of the population in AK and decreasing numbers at lower latitudes.^{1,4} There are two subspecies recognized: *O. f. plumbea* breeds along the west coast of North America from southern AK to northern CA.¹ Post breeding *O. f. plumbea* tends to disperse to adjacent seas and ranges as far south as southern CA,¹ although infrequently observed.¹² Abundances at sea generally reflect abundances of breeding birds on land with a declining gradient of abundance from AK to CA.¹⁵ FTSP occur in highest abundance near the shelf break in summer and farther offshore during the non-breeding season.¹⁵

Population estimates for this species, as for other storm-petrels, are difficult to obtain due to their nocturnal attendance at colonies and their burrow/crevice-nesting habits.¹¹ There are an estimated 5,000 breeding birds in this Region, representing <1% of the North American population⁸: 3,900 in WA, hundreds in OR, and 400 in CA.^{10,11} There is little information on population trends of FTSP in this Region,^{11,14} although populations in CA have shown a decrease since historical times.¹¹

Ecology

As with other storm-petrel species, the FTSP is colonial and active in the colony at night.^{1,2} Adults breed in crevices, and natural or excavated burrows on rocky islands.² Long-term pair bonds are formed, although mate switching occurs more often when pairs are unsuccessful raising chicks.² Egg neglect is common, with eggs remaining unattended for several days, and surviving up to 28 days of neglect in some areas.^{2,5} Chicks are brooded up to 8 days and studies in AK indicate that nest attendance patterns during incubation and chick-rearing appear to be dependent on food availability.⁷ FTSP breeding



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in the Gulf of AK show variability in the initiation of egg-laying, egg size, chick growth rates, and chick mortality, which may also be adaptations to a variable environment, high predation rates, and climate.²

Diet consists of crustaceans, fish, and animal detritus from the ocean surface.¹⁰ FTSP are often seen feeding on dead or wounded marine mammals, even beached animals.³ Chicks are fed an oily regurgitant that consists of partially digested crustaceans or fish.² FTSP may forage closer inshore during the breeding season when feeding chicks.^{2,12}

Conservation Concerns and Activities

Threats include loss of nesting habitat, predation, oil spills, and contaminants. Changes in vegetation and soil, has led to the loss or reduction of several colonies in CA.¹¹ Whaler Is., the largest historical colony in CA, was destroyed when rock was quarried and a breakwater was constructed in the 1930s, connecting the island to the mainland and allowing introduction of rats. Other predators include gulls, ravens, eagles, owls, peregrine falcons, and occasionally mammals such as river otters.^{2,6} Plastic ingestion is common for storm-petrels that feed on neuston, and is potentially a concern for FTSP. Relatively high levels of DDE have been

found in the eggs of FTSP breeding on the Queen Charlotte Islands, Canada.⁹ Oil spills, both chronic and catastrophic, can have devastating effects on seabird populations,¹³ although documentation of FTSP mortality in oil spills is low.

Recommended Actions

- Investigate contaminant levels in FTSP eggs and determine the effects on reproductive performance.
- Develop standardized protocols to accurately assess and monitor population size and trends.

Regional Contacts

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References: 1. Harrison 1983; 2. Boersma *et al.* 1980; 3. Gill 1977; 4. Osborne 1985; 5. Boersma and Wheelwright 1979; 6. Harris 1974; 7. Simons 1981; 8. Kushlan *et al.* 2002; 9. Elliott *et al.* 1989; 10. Boersma and Silva 2001; 11. Carter *et al.* 1992; 12. Briggs *et al.* 1987b; 13. PRBO 1997; 14. Speich and Wahl 1989; 15. Briggs *et al.* 1992.

Leach's Storm-Petrel *Oceanodroma leucorhoa*

Status

Federal: None

State: None

IUCN: None

NAWC: LC/LC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	~42d	~67d	May-Oct	burrow/crevice	surface-seizing	pelagic

Distribution, Population Status and Trends

The Leach's Storm-Petrel (LHSP) is the most widespread procellariiform in the Northern Hemisphere, breeding in both the Atlantic and Pacific.^{1,8} In the Pacific, breeding colonies are found as far west as Japan, and as far south as Guadalupe Is., MX.^{1,2} Taxonomy is controversial, with 3-4 subspecies generally recognized; *O.l. leucorhoa* breeds in the north Atlantic and eastern north Pacific from the Aleutian Islands south to central CA.^{1,8} LHSP are pelagic during the non-breeding season, wintering primarily in central and eastern tropical waters,¹ although they are found year-round from the Gulf of AK, south. In the north Pacific, LHSP are rarely seen close to shore, preferring warmer, less productive oceanic waters. They are most abundant seaward of the continental slope, usually more than 75 km from shore.⁹ As the breeding season approaches, they move closer to shore.^{9,14}

Population estimates for this species, as for other storm-petrels, are difficult to obtain due to their nocturnal attendance at colonies and their burrow/crevice-nesting habits. The global breeding population estimate is greater than 16 million birds,¹³ with approximately 3% breeding in this Region: 36,000 in WA; 435,000 in OR; and, 12,500 in CA.^{10,15,16} Overall population trends are unknown, although many individual colonies have been extirpated by introduced animals or habitat changes (*e.g.*, Castle Rk, CA).^{1,10} The largest colonies in the Region (>50,000 birds) are in OR (North Crook Point, Goat, Saddle, and Whalehead islands).¹⁵ Trends are unknown.

Ecology

LHSP nest in burrows or crevices, and breeding chronology varies with location.^{1,2,7} Breeding begins at 5 or 6 years of age and once started, is annual.^{1,3} Breeding site fidelity is high, with pairs usually occupying the same burrow for many seasons.¹ Birds that return to natal colonies tend to nest in burrows



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close to their natal sites.¹ Incubation stints last 3 days, during which the incubating bird may lose 5% of its body weight.¹

Chicks are fed an oily regurgitant, averaging 20% of adult body weight⁴ and containing up to 60% lipid, every 1 to 3 nights.¹ Adults feed mostly at fronts or eddies, where prey is more concentrated and closer to the surface.⁹ Diet varies geographically and seasonally but primarily plankton and nekton, including fishes, squid, crustaceans, and jellyfish.^{1,5}

Conservation Concerns and Activities

Habitat degradation caused by changes in vegetation or soil have been a factor in the decline at some CA colonies. At some colonies, LHSP may be displaced by larger seabirds, such as Cassin's Auklets.¹ The main cause of mortality at breeding colonies in this Region is predation, and introduced mammals, especially foxes, cats, dogs, rats, and pigs have caused colony extirpations.¹ House mice may prey on newly hatched chicks and eggs.^{1,11,12} Native predators, such as river otters, gulls, raptors (especially owls), and corvids, and kleptoparasitism (by jaegers and other birds) also cause adult mortality.¹ Other potential threats include eggshell thinning due to organochlorine contamination from pesticides.⁶ While at sea, oil pollution or oil-dispersant emulsions may affect LHSP, as well as ingestion of plastics and other man-made products.¹

Recommended Actions

- Develop standardized protocols to accurately assess and monitor population size and trends.
- Investigate contaminant levels in eggs and determine the effects on reproductive performance.
- Investigate population dynamics by analyzing data from the long-term mark-recapture study at Saddle Rk, OR.

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References: 1. Huntington *et al.* 1996; 2. Harrison 1983; 3. Grubb 1973; 4. Ricklefs 1992; 5. Montevecchi *et al.* 1992; 6. Pearce *et al.* 1989; 7. Ainley *et al.* 1975; 8. Whittington *et al.* 2001; 9. Briggs *et al.* 1987b; 10. Carter *et al.* 1992; 11. Sydeman *et al.* 1998; 12. Ainley and Boekelheide 1990; 13. Kushlan *et al.* 2002; 14. Briggs *et al.* 1992; 15. USFWS in prep; 16. Speich and Wahl 1989.

Ashy Storm-Petrel *Oceanodroma homochroa*

Status

Federal: None

State: CA-SC

IUCN: EN

NAWCP: HI/HI

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	rare	1	~45d	~84d	May-Nov	crevice	surface-seizing	pelagic

Distribution, Population Status and Trends

The Ashy Storm-Petrel (ASSP) is a small pelagic seabird, endemic to the California Current System. The majority of the population breeds in coastal areas and islands off central and southern CA, with a few small colonies off northern CA.^{1,2,16} ASSP are non-migratory, exhibiting little post-breeding dispersal.² They are frequently seen on the edges of upwelling zones in the spring, summer, and fall and are found year-round in waters just seaward of the continental slope from Cape Mendocino, CA south to Baja California, with large fall concentrations in Monterey Bay, CA.^{2,10,14}

Except for a small colony at Los Coronados Islands, MX, the world population breeds within CA, and is estimated at approximately 10,000 breeding birds.² The largest breeding colonies are on the Farallon and Channel islands, which together support approximately 98% of the global population.^{2,3,16} On the Farallon Islands, the breeding population is estimated to have declined 42% between 1972 and 1992.³ This significant decline is mainly attributed to adult predation by Western Gulls, owls, and possibly mice.^{3,4,5} Population trends at other colonies are not known, although there is no apparent trend in the at-sea numbers in Monterey Bay.² ASSP reproductive performance on the Farallon Islands has decreased since the late 1980s.¹³

Ecology

ASSP are pelagic, only visiting land to court and breed.² Visits to breeding colonies can occur year-round, although are most frequent from Feb-Oct, with a long period of courtship that can last up to 3 months.^{2,7} ASSP are nocturnal at breeding colonies.² Compared to other storm-petrels, ASSP egg-laying is asynchronous, spread over several months.^{2,7} Both sexes share incubation equally and egg neglect is less frequent in this species than other storm-petrels, with average egg neglect of 2-4 days.² After hatching, chicks are initially brooded an average of 4 days.² ASSP are long-lived; one individual at the Farallon Islands was 30 years old.



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Diet consists of larval fish, squid, and zooplankton,^{2,7,13} and chicks are fed a meal of semi-digested, oily liquid every 1-3 nights.⁷ ASSP will scavenge and are frequently seen around fishing vessels.²

Conservation Concerns and Activities

Small population size, restricted distribution, concentration at a few colonies, extended chick-rearing period, and low reproductive rates make the ASSP especially vulnerable to threats. Rats at Anacapa likely had significant effects and the recent eradication of rats should result in a population increase. Predation of eggs and chicks by introduced house mice (Farallon Islands) and native deer mice (Channel Islands) occurs, although population effects are unknown.^{4,7,18} Various species of owls migrate to the Farallon Islands in the fall and are supported through the winter by the abundant mouse population. With decreasing food supplies in the late winter, owls may shift their diet from mice to ASSP returning to the island.^{5,6,11} Barn Owls prey on ASSP adults and chicks at Santa

Cruz Is.¹⁸ A study to quantify mouse, gull, and owl predation is underway at the Farallon Islands. Predation of adults by Western Gulls is believed to have increased in recent years on the Farallon Islands, as the gull colony has expanded into storm-petrel habitat.^{3,5,10} The Service has unsuccessfully experimented with gull exclusion zones to restrict gulls from ASSP habitat.¹⁷

A more recent conservation issue is the potential negative impacts of bright lights used by squid boats in the vicinity of the Farallon and Channel islands, which may disorient storm-petrels, affect their behavior, or enhance avian predation. A proposed liquid natural gas port off Los Coronados, MX could negatively impact this southernmost colony. Plastic ingestion is common for storm-petrels that feed on neuston, and is a potential threat.² Eggshell thinning was of concern in the early 1970s,⁸ and recently relatively high levels of DDT and PCB were found in birds nesting on Santa Cruz Is., CA.⁹ Oil spills can have devastating effects on seabird populations,¹² although documentation of ASSP mortality in oil spills is low.¹⁵

Recommended Actions

- Eradicate introduced predators from all breeding islands and evaluate the response of ASSP populations at Anacapa to rat eradication.
 - Work with partners at the state, national and international levels to minimize the negative impacts of fisheries activities and gas development.
- Conduct a Status Assessment to review population status and trends, limiting factors, and conservation recommendations.
 - Monitor contaminant levels in eggs and determine the source and the effects of contaminants on reproductive performance.
 - Develop standardized protocols to accurately assess and monitor population size and trends. Conduct surveys to locate all active colonies.

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References: 1. McChesney *et al.* 2000; 2. Ainley 1995; 3. Sydeman *et al.* 1998a; 4. Sydeman *et al.* 1998b; 5. Mills 2000; 6. Pyle and Desante 1994; 7. Ainley *et al.* 1990; 8. Coulter and Risebrough 1973; 9. Carter *et al.* 2000b; 10. Ainley *et al.* 1975; 11. Mills *et al.* 2002; 12. PRBO 1997; 13. Sydeman *et al.* 2001; 14. Briggs *et al.* 1987b; 15. Nur *et al.* 1999; 16. Carter *et al.* 1992; 17. Roth *et al.* 2000; 18. McIver 2002.

Black Storm-Petrel *Oceanodroma melania*

Status

Federal: None

State: CA-SC

IUCN: None

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	rare	1	40-53d	77-84d	Apr-Aug	crevice	surface-seizing	coastal pelagic

Distribution, Population Status and Trends

The Black Storm-Petrel (BLSP) has a limited breeding range from the Channel Islands, CA, to islands in the Gulf of California and off the west coast of Baja, MX.¹ After the breeding season, a portion of the population moves north to waters off southern and central CA.^{1,2} A larger portion moves south to waters off Central America and northern South America.^{1,2} BLSP have been recorded off CA in all months, but reach peak abundance in late summer/fall.³ They are most common in the warm coastal waters in the eastern half of the Southern California Bight and in central CA over the continental shelf, especially over the Monterey submarine canyon.³ Highest densities were recorded within 50 km of the mainland.³ During El Niño years, large numbers are seen as far north as Monterey Bay and Point Reyes in the autumn.¹ BLSP concentrations off CA have increased in recent decades, most likely because of rising sea-surface temperatures.¹

Little information is available on historical numbers or trends, but there has likely been population declines as a result of mammal introductions to breeding islands.¹ The total population is estimated at approximately 600,000 breeders, most of which breed on Islas San Benito, MX (approx. 95% of the world's population) (S. Wolf and B. Keitt, pers. comm.). Approximately 300 individuals breed at Santa Barbara Is. and associated Sutil Is., CA.⁴ Breeding is also possible at Prince (San Miguel), Anacapa, and San Clemente islands.⁴

Ecology

Similar to other storm-petrels, BLSP spend most of their time at sea, coming to land only to breed.¹ Breeding habitat is predominantly small, rocky islands or sloping terrain on larger islands.¹ BLSP nest in old burrows or crevices, often occupying previously used nesting cavities; rarely excavating their own cavity.² Birds return to the CA colonies in Apr/May and are active at colonies only at night.^{1,2}



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BLSP probably begin breeding around 5 years of age, but life span and survivorship are unknown.¹

Little is known about the diet of BLSP; probably small fish, crustaceans, and squid that occur near the surface.¹ They are also known to scavenge from large floating items.¹ BLSP forage closer to shore than congenics, in areas of high ocean productivity such as thermal fronts adjacent to upwellings, tide rips, and shelf-break fronts.¹

Conservation Concerns and Activities

Little information exists concerning the breeding biology of the BLSP.² Furthermore, population estimates are difficult because of their nocturnal habits at colonies and difficult terrain.¹ BLSP appears to be limited by the availability of suitable nesting habitat and introduced mammalian predators on Mexican islands; as a result, colonies have not fully recovered or have disappeared entirely from some islands.¹ Eradication of feral animals has occurred on several islands and is under way at other islands within the range.¹ Predation of eggs by native deer mice on Santa Barbara Is. is likely to occur. Owls and Peregrine Falcons are also likely predators at most breeding sites.¹ A more recent conservation issue is the potential negative impacts of bright lights used by squid boats in the vicinity of the Channel Islands, which may disorient storm-petrels, affect their behavior, or enhance

avian predation, although currently there is no data on the effects of this disturbance.¹

Storm-petrels are inherently vulnerable to ingestion of plastics and other marine debris,⁵ although it is unknown to what degree this occurs in BLSP. There is recent evidence of eggshell thinning caused by high levels of DDT and PCBs in Ashy Storm-Petrel eggs at Santa Cruz Is., CA.^{1,6} BLSP feed closer inshore, potentially increasing the chances of contamination.¹

Recommended Actions

- Support efforts to eradicate introduced predators from current and potential breeding islands within the range.

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References: 1. Ainley and Everett 2001; 2. Harrison 1983; 3. Briggs *et al.* 1987b; 4. Carter *et al.* 1992; 5. Ainley 1995; 6. Carter *et al.* 2000b.

Brown Pelican *Pelecanus occidentalis*

Status

Federal: E

State: CA-E, OR-E, WA-E

IUCN: None

NAWCP: MC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	1-2	~30d	~80d	Feb-Oct	surface stick	plunge-diving	nearshore

Distribution, Population Status and Trends

The Brown Pelican (BRPE) is found throughout the temperate and tropical regions of the Americas, along both Atlantic and Pacific coasts.¹² Six subspecies have been recognized; *P. o. californicus* breeds in western North America.¹² BRPE were listed as endangered in 1970. *P. o. californicus* breed primarily on islands off southern CA and western MX, including the Gulf of California. Large numbers disperse northward during summer and fall as far as British Columbia^{2,20} and inland to the Salton Sea (probably birds from the Gulf of California; F. Gress, pers. comm.). BRPE tend to aggregate at fronts with strong thermal gradients, foraging within 20 km of the coast, although they have been recorded up to 190 km offshore.²⁰

An estimated 12,000 BRPE breed in southern CA, comprising approximately 12% of the western subspecies (100,000 breeding birds) and approximately 6% of the North American populations.¹⁹ Currently, there are two colonies in CA, at Anacapa and Santa Barbara islands (formerly bred at Prince Is., San Miguel and Scorpion Rk., Santa Cruz).³ North American populations underwent dramatic declines during the 1960s and early 1970s due to eggshell thinning induced by pesticides.^{11,13,17} Although populations have recovered substantially from these declines,^{5,7,17} they continue to show considerable inter-annual variation in productivity as related to prey availability,⁶ disturbance at colonies, and disease outbreaks (F. Gress, pers. comm.). Breeding effort, productivity and survival are lower during El Niño events.²² Populations at CA colonies increased during the 1980s and were relatively stable through the 1990s.²

Ecology

BRPE build nests in low shrubbery or on the ground on islands or remote coastal areas. They breed primarily in the spring but breeding phenology can be quite variable and asynchronous with egg laying starting as early as Nov and as late



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as Jun: most nesting occurs Feb-Oct.^{2,3,4} Age of first breeding can be as young as 1-3 years¹² but 4-7 years is more typical.² Both sexes participate in incubation.^{12,16} Siblicide often occurs, and mean reproductive output is usually less than one,^{6,12,13,16} although it can occasionally be higher when food is plentiful. Maximum recorded age is 43 years.²¹ Young are altricial and may creche when several weeks old.²¹

Feathers of BRPE are not waterproof and therefore they feed close to shore and return regularly to roosting sites.²⁰ The diet of BRPE in western North America consists almost exclusively of small schooling fish, in particular, northern anchovy and Pacific sardine.^{4,6}

Conservation Concerns and Activities

BRPE are potentially at risk due to many human-related factors. Although DDE and other eggshell thinning contaminants were banned in the U.S. in the early 1970s, the long persistence of these chemicals in the environment and their continued use elsewhere may still cause problems, especially for colonies in the Gulf of California.^{5,13} Introduced mammals such as cats and possibly rats can affect reproductive success.⁹ Adult mortality occurs when birds become entangled in fishing gear, especially hook and line.¹⁴ Disturbance from bright lights

used in the squid fishery, is thought to cause nest abandonment and low reproductive success at CA colonies (F. Gress, pers. comm.). Populations may be affected by declines in prey stocks due to over-fishing or general environmental degradation off the CA coast.⁴ Disturbances to breeding colonies and critical roost sites by fisherman, researchers, or the general public could result in high levels of nest abandonment and roost disturbance.^{1,8} Loss of quality night roosts is of particular concern. The CA colonies are within the Channel Islands National Park, which offers some protection, although there is still human disturbance to these colonies. Oil pollution also causes adult mortality and reproductive failure.^{14,15} Die-offs of BRPE due to domoic acid intoxication from phytoplankton blooms,¹⁸ bacteriological outbreaks at sewage outflows,¹⁰ and botulism (*e.g.*, at the Salton Sea) contribute to local population declines.

Recommended Actions

- Reduce human disturbance at colonies and roost sites (*e.g.*, buffer zones, community outreach, signs, community outreach, restricted airspace) and enhance or create secure roost habitat in areas where this habitat is limited.
- Provide technical assistance to fisheries managers regarding anchovy, sardine, squid, and other fisheries to minimize impacts to pelicans. Work with partners to devise solutions to problems of entanglement in fishing gear and minimize negative impacts of disturbance due to fishing activities *e.g.*, squid boat lights.
- Support efforts by MX to remove introduced mammalian predators from major breeding colonies and roosting sites, and protect from future introductions.
- Determine the current distribution, abundance and status of *P. o. californicus* rangewide.
- Monitor contaminants levels and the effects on pelican populations.
- Research into the factors influencing productivity in CA and MX including investigations into diet and prey resources and the inter-relationships.

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References: 1. Anderson 1988; 2. Anderson and Anderson 1976; 3. Anderson *et al.* 1994; 4. Anderson and Gress 1984; 5. Anderson and Gress 1983; 6. Anderson *et al.* 1982; 7. Anderson *et al.* 1975; 8. Anderson and Keith 1980; 9. Anderson *et al.* 1989; 10. Ankerberg 1984; 11. Jehl 1973; 12. Johnsgard 1993; 13. Keith 1983; 14. Page *et al.* 1990; 15. Parnell *et al.* 1984; 16. Schreiber 1979; 17. Wilkinson *et al.* 1994; 18. Work *et al.* 1993; 19. Kushlan *et al.* 2002; 20. Briggs *et al.* 1987a; 21. Shields 2002; 22. Ainley *et al.* 1986.

Double-crested Cormorant *Phalacrocorax auritus*

Status

Federal: None

State: CA-SC

IUCN: None

NAWCP: NCR/NCR

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-5	yes	1-2	~28d	~42d	Mar-Jul	surface stick	pursuit diving	coastal

Distribution, Population Status and Trends

Double-crested Cormorants (DCCO) are widely distributed throughout marine, estuarine, and freshwater habitats of North America, with breeding colonies both inland and along the coast.¹ There are five subspecies recognized; the western subspecies (*P. a. albociliatus*) ranges from British Columbia to Baja California, MX.¹ *P. a. albociliatus* is the most marine and non-migratory of the subspecies⁹ but does not venture far offshore.¹³ Some migration does occur, but most birds remain in the area year-round; some inland birds migrate to coastal regions.¹

Historically, numbers and range of DCCO were greatly reduced due to reproductive failure caused by DDT, human destruction of nests and shooting of adults.¹ Populations have been recovering since the DDT ban in 1972^{1,2} and current trends in the Region are increasing, although numbers in southern CA have not yet fully recovered to historical levels.^{1,2} During 2001-2003 a complete census of coastal colonies in CA, OR, and WA was conducted. The breeding population has approximately doubled over the past 10-15 years (25,600 pairs compared to 12,200 pairs in 1989-91³). The greatest increase was in the Columbia River estuary (>40% of the total breeding birds). Populations in San Francisco and Humboldt bays, CA also increased, but colonies at the Farallon Islands were an order of magnitude smaller than in the mid 19th century.⁷ Colonies in British Columbia and Washington declined, apparently due to increased disturbance from eagles and boaters. Historically the largest DCCO colonies were in MX and surveys are needed to complete the current assessment of *P. a. albociliatus*. Pacific coast colonies fluctuate annually, with low reproduction and population numbers influenced by El Niño events.^{15,16}

Ecology

DCCO inhabit a variety of aquatic habitats and often roost on exposed rocks, sandbars, high-tension



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wires, and trees near their favorite fishing areas.¹ Along the coast DCCO are predominantly ground-nesters, mainly on cliffs and islands, however, a few colonies are located in trees.⁸ There has been increased use of artificial structures (*e.g.*, bridges in San Francisco Bay) and low estuarine islands (*e.g.*, East Sand Is. in the Columbia River estuary).¹ Adult males choose nest sites and display to females; both adults construct the nest.¹ Females lay 1-7 eggs but the average clutch size is typically 3-4 eggs.¹⁴ Young are altricial and form creches at 2-3 weeks. Although fully feathered at 3-4 weeks, the young are unable to fly for another 2-3 weeks.¹

DCCO mostly forage in shallow, open water, and the main prey includes schooling species that occur from the surface to near-bottom.^{1,2,4} Surfperch, sticklebacks, sandlance, and herring are species of importance in DCCO diets,^{2,4,5} but diet varies both temporally and spatially. Salmonids are an

important, but not dominant, part of the diet in Columbia River estuary.⁵ Cormorants have high wing loading, and feathers that are not waterproof; while these qualities increase underwater maneuverability and diving capabilities, they also restrict cormorant foraging distribution to nearshore waters, where they must return daily to dry their feathers.^{10,11,12}

Conservation Concerns and Activities

Recent recovery of DCCO populations can be attributed to bans on DDT, protection provided by the Migratory Bird Treaty Act, and the creation/enhancement of breeding and foraging habitat.^{2,3,8} Commercial and sports fisheries often view DCCO as a pest species and a competitor.⁶ The colony at East Sand Is. has been studied extensively for predation on endangered juvenile salmonids.⁵ Most studies on the impacts of the DCCO on fish species are inconclusive, as the dynamics between fish populations and responses to predation are not well understood.² Disturbance at breeding sites can be devastating, causing eggs and young to be exposed to predation and inclement weather.¹ Aquaculture activities are expanding and are likely to become of increasing importance in estuaries. Given ongoing conflicts between DCCO and aquaculture in other areas, attention must be paid to this potential conflict.

Recommended Actions

- Protect colonies and important roost sites from human disturbance and mammalian predators.
- Research into the relationship between DCCO predation and fisheries stocks including predator-prey interactions, fish population fluctuations, and foraging competition.
- Technical assistance to industry and regulators regarding minimization of conflicts between seabirds and aquaculture.
- Coordinate with Mexico to complete a rangewide survey of *P. a. albociliatus*. Conduct regular standardized surveys to monitor changes in population size and distribution.
- Monitor contaminant levels in DCCO, especially organochlorines.

Regional Contacts

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Gerry McChesney - USFWS, San Francisco Bay NWR Complex, Newark, CA

References: 1. Hatch and Weseloh 1999; 2. Wires *et al.* 2001; 3. Carter *et al.* 1995b; 4. Ainley *et al.* 1981a; 5. Roby *et al.* 1998; 6. Duffy 1995; 7. Capitolo *et al.* 2004; 8. Carter *et al.* 1992; 9. Harrison 1983; 10. Boekelheide *et al.* 1990; 11. Johnsgard 1993; 12. Grémillet *et al.* 1998; 13. Briggs *et al.* 1987b; 14. Anderson 2002; 15. Ainley and Boekelheide 1990b; 16. Ainley *et al.* 1986.

Brandt's Cormorant *Phalacrocorax penicillatus*

Status

Federal: None

State: WA- C

IUCN: None

NAWCP: HC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
3-5	yes	3-4	~30d	~35d	Feb-Aug	surface, veg	pursuit diving	coastal

Distribution, Population Status and Trends

Brandt's Cormorants (BRAC) are endemic to the west coast of North America, where they inhabit nearshore marine and estuarine environments.² The breeding range extends from southeast AK to Baja California. Breeding and winter distribution overlap as birds disperse from the colonies post-breeding and move back to the colonies in the spring.^{9,11} BRAC are rarely seen far offshore, most commonly foraging within 25 km of their island or mainland colonies and rarely >10 km from shore.⁷

The most recent surveys indicate a total breeding population of <100,000 birds, approximately 75% of which breed in OR and CA. A complete census of breeding colonies in CA, OR and WA was conducted in 2001-2003 and approximately 37,000 nests were counted (USFWS unpubl. data).¹⁷ This represents 10% and 25% declines compared to censuses conducted during 1975-1981 and 1989-1991, respectively.^{6,11} Surveys of colonies in MX are needed. There has also been a regional shift in abundance. Historically, the Farallons supported the largest BRAC colony with 23,800 breeding birds in 1974;² however, there has been a steady decline at this colony and a concomitant increase at other colonies along the central CA coast and the Channel Islands.^{2,5,16} There was no well documented population decline during the 1960s and 1970s due to eggshell thinning. Individual colony size^{3,5} and productivity^{2,8,12} vary interannually in response to changing oceanographic conditions (*e.g.*, El Niño).^{2,12,13}

Ecology

BRAC nest in dense colonies on islands and occasionally at mainland sites along rocky promontories.¹¹ Nests are constructed of vegetation on flat or sloping areas and on ledges of steep cliffs.² The breeding season begins earlier and is more protracted with decreasing latitude; egg-laying occurs from late Feb- Jun in the Channel Islands versus May-Jun in WA.⁹ BRAC will relay if eggs are



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lost early in the breeding season, and usually raise only one brood per year.² Chicks from neighboring nests form small creches at 10-20 days old and later join larger subcolony creches.¹¹ BRAC are monogamous but show low mate and site fidelity⁴ and will occasionally switch mates during the season after a failed breeding attempt.²

BRAC, like other cormorants, are foot-propelled pursuit-divers. They feed on both schooling and non-schooling fish at or near the bottom, as well as squid and other invertebrates.¹¹ Primary prey include rockfish and anchovy in the northern portion of their range, while blacksmith (*Chromis* spp.) are predominant prey items in the south.¹ BRAC often forage in large mixed-species feeding flocks along with Pelagic and Double-crested Cormorants, Brown Pelicans, gulls, shearwaters, and alcids. BRAC are believed to be deep divers, capable of achieving depths greater than 100 m,² although they commonly forage in shallower waters. Cormorants have high wing loading, and feathers that are not waterproof. While these qualities increase underwater maneuverability and diving capabilities, they also restrict their foraging distribution to nearshore waters, where they can return to land daily to dry their feathers.^{2,9,11,14}

Conservation Concerns and Activities

The most serious conservation concern for BRAC is human disturbance at dense breeding colonies, resulting in increased predation by gulls and ravens and nest abandonment.^{2,4,11,17} Exploitation of the prey base by human fisheries³ is also an important concern. Relatively small numbers of BRAC are killed as a result of oil contamination and gillnet fisheries, though the impacts of these events on populations are not well-studied.¹⁰ Organochlorine concentration in BRAC collected at the Farallon Islands in 1993 were relatively high but is unknown if contaminants currently pose a serious threat.¹⁵ If aquaculture activities increase in protected marine waters there could be a potential conflict.

Recommended Actions

- Protect breeding colonies and roost sites from human disturbance.
- Investigate the relationships among factors affecting population trends to determine the cause of recent declines (*e.g.*, El Niño, prey resources, oil spills, disturbance, fisheries, etc.).
- Assess contaminant levels and determine the effects on BRAC.
- Complete inventory of all BRAC colonies; support efforts to survey colonies in Mexico.

Regional Contacts

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Ulrich Wilson - USFWS, Washington Maritime NWR Complex, Port Angeles, WA
Gerry McChesney - USFWS, San Francisco NWR Complex, Newark, CA

References: 1. Ainley *et al.* 1981a; 2. Boekelheide *et al.* 1990b; 3. Ainley *et al.* 1994; 4. Boekelheide and Ainley 1989; 5. Carter *et al.* 1995c; 6. Carter *et al.* 1992; 7. Briggs *et al.* 1992; 8. Hodder and Graybill 1985; 9. Johnsgard 1993; 10. McChesney *et al.* 1998; 11. Wallace and Wallace 1998; 12. Sydeman *et al.* 2001; 13. Wilson 1991; 14. Grémillet *et al.* 1998; 15. Pyle *et al.* 1999; 16. Warzybok *et al.* 2002; 17. Capitolo *et al.* 2004.

Pelagic Cormorant *Phalacrocorax pelagicus*

Status

Federal: None

State: None

IUCN: None

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
3-4	yes	2-4	~30d	~45d	Mar-Aug	surface, veg	pursuit diving	coastal

Distribution, Population Status and Trends

Pelagic Cormorants (PECO) breed along the coast and on islands from the Chukchi and Bering Seas south to Japan and northern Baja California, MX.^{6,8} There are two recognized subspecies; *P. p. resplendens* is distributed from British Columbia to Baja California.^{6,8,11} PECO disperse throughout their range during the non-breeding season and reach as far south as southern Baja California.¹¹ They forage relatively close to shore, usually within 10 km from land, during both the breeding and non-breeding seasons.^{5,12}

Breeding sites are generally dispersed along the coast and complete surveys are more difficult than for the other cormorant species. The global population is estimated at approximately 400,000 birds⁶ of which 69,000 breed in North America.¹³ Approximately 29,000 PECO breed in WA (6,100), OR (8,400), and CA (14,300), representing >40% of the North American population.^{4,14,19,20} Overall numbers in the Region have been relatively stable^{4,6,14} although colony size and reproductive success appear to be sensitive to El Niño conditions and year-to-year variability is high.^{2,4,7,15,18}

Ecology

PECO are the smallest of the North American cormorants and the least gregarious.⁸ They nest on steep cliffs of the mainland and offshore islands, where they form loose colonies, generally fewer than 100 birds per colony.¹⁶ They will also utilize artificial structures such as bridges and buoys. Young birds return to breed at 3 years of age^{2,6} and both sexes participate in nest building and incubation. Timing of clutch initiation varies with latitude and food availability.^{2,6} PECO are only capable of raising one brood per season, but will occasionally lay a replacement clutch if the entire clutch is lost early in the breeding season.^{2,6}

PECO are foot-propelled pursuit divers, generally feeding on small to medium-sized non-schooling fish



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as well as invertebrates.^{1,8,17} Foraging is primarily in shallow, intertidal waters over rocky substrate,¹ but PECO have been recorded diving to more than 100 m.² Sculpins and rockfish are important components of their diet in southern and central CA,¹ whereas sandlance becomes more important to northern populations.^{1,6} Numbers of breeding birds and breeding success decline dramatically during warm water El Niño events, when food resources are depleted.^{3,7,18}

Conservation Concerns and Activities

PECO are highly sensitive to human disturbance at breeding colonies and will readily abandon nests if disturbed.^{2,3} There is a history of mortality from pesticides and oiling events^{6,10} but the species' vulnerability to oiling is considered moderate.⁹ Organochlorine contaminants may still be an issue, especially in CA.⁶ Mortality in gillnet fisheries is a

concern,⁶ although it does not appear to be a major threat. Significant declines have been noted recently in AK populations but not in WA or OR where colonies were surveyed in 2003. The last inventory of PECO colonies in CA was conducted in 1989-1991 and should be repeated.⁴

Recommended Actions

- Resurvey CA colonies and establish a standardized program to monitor trends in population size and distribution.
- More research is needed on factors that affect PECO inter-annual reproductive variability and survival, and potential interaction with commercial fisheries.

Regional Contacts

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Gerry McChesney - USFWS, San Francisco Bay
NWR Complex, CA

References: 1. Ainley *et al.* 1981a; 2. Ainley and Boekelheide 1990; 3. Ainley *et al.* 1994; 4. Carter *et al.* 1992; 5. Briggs *et al.* 1992; 6. Hobson 1997; 7. Hodder and Graybill 1985; 8. Johnsgard 1993; 9. King and Sanger 1979; 10. Piatt *et al.* 1990; 11. Harrison 1983; 12. Briggs *et al.* 1987b; 13. Kushlan *et al.* 2002; 14. Carter *et al.* 1995c; 15. Warzybok *et al.* 2002; 16. Sowls *et al.* 1980; 17. Sydeman *et al.* 1997b; 18. Sydeman *et al.* 2001; 19. Speich and Wahl 1989; 20. USFWS in prep.

Ring-billed Gull *Larus delawarensis*

Status

Federal: None

State: None

IUCN: None

NAWCP: MCR/MCR

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	1-3	~25d	~45d	Apr-Aug	ground scrape	opportunistic	coastal

Distribution, Population Status and Trends

The Ring-billed Gull (RBGU) is primarily an inland breeder, distributed across North America, in the northern U.S. and southern Canadian provinces.¹² Wintering range is throughout North America. Along the Pacific coast they are found from southern British Columbia to southern MX.¹² RBGU are common birds on mainland beaches, but are rarely seen more than 1 km from shore.¹

The population is estimated at 1,700,000 breeders, with <1% breeding along the Pacific coast.⁹ RBGU were recorded nesting in Willapa Bay, WA in 1976.¹³ In 2003, RBGU did not nest along the WA coast but about 300 pairs nested on two islands in the Columbia River estuary (D. Roby, pers. comm.). As with other gull species, overall populations of RBGU have increased throughout the mid-1900s in response to increased man-related food availability and decreased harvest of eggs and feathers.^{2,8,12,14,19} However, western populations of RBGU may be leveling off at the turn of the 21st century due to changes in dumping practices,¹⁰ especially on the wintering grounds along the coast.^{11,14}

Ecology

RBGU migrate from the coast to inland breeding colonies between Mar- May. Age of first breeding is 3-5 years^{5,7,8,16} but probably can be as late as 6-8+ years in some individuals. Non-breeding individuals spend their first summer on the winter grounds and subsequent summers in the vicinity of breeding colonies.

At inland colonies, chicks are fed a variety of foods including fish, arthropods, garbage from dumps, earthworms, bird chicks (including those of conspecifics), small mammals, and vegetative matter.^{6,15,19} Little is known about the diet of the RBGU that breed or winter along the Pacific coast. Migration to the wintering grounds occurs in Aug-Oct. Annual survival of adults is likely between 75% and 90%^{8,18} with longevity ranging up to 27-30 years.¹⁷



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Conservation Concerns and Activities

The most serious threat is disturbance to breeding colonies, resulting in increased intra-specific predation of chicks.^{3,4} Other conservation concerns include ingestion of plastics and other toxins from garbage dumps, contaminants, and oil spills.

Recommended Actions

- Monitor changes in population size and distribution.
- Minimize disturbance to breeding colonies.

Regional Contacts

Daniel Roby - USGS, Oregon Cooperative Research Unit, Corvallis, OR

References: 1. Briggs *et al.* 1987b; 2. Conover 1983; 3. Conover and Miller 1978; 4. Emlen *et al.* 1966; 5. Haymes and Blokpoel 1980; 6. Kirkham and Morris 1979; 7. Kovacs and Ryder 1983; 8. Ludwig 1974; 9. Kushlan *et al.* 2002; 10. Patton 1988; 11. Pyle and DeSante 1994; 12. Ryder 1993; 13. Penland and Jeffries 1977; 14. Shuford and Alexander 1994; 15. Welham 1987; 16. Southern 1968; 17. Southern 1975; 18. Southern 1977; 19. Vermeer 1970.

California Gull *Larus californicus*

Status

Federal: None

State: CA-SC

IUCN: None

NAWCP: MC/LC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	1-3	~25d	~50d	Apr-Aug	ground scrape	opportunistic	coastal

Distribution, Population Status and Trends

California Gulls (CAGU) breed primarily on predator-free islands in interior lakes throughout the Great Basin and prairie states and provinces of North America, as far north as the central taiga. They winter along the west coast of North America from British Columbia to central MX.¹² Two subspecies have been recognized; the smaller and darker *L. c. californicus* breeds in the west.^{3,15} CAGU are numerous in nearshore and offshore waters of CA in the fall and winter, with densities being highest within 50 km offshore.¹⁴

The North American breeding population was estimated at 276,000 birds in 1980.¹ The overall population estimate was 500,000 - 1,000,000 individuals during the early 1990's.¹² CAGU began breeding in coastal CA in 1981 and the colony complex in San Francisco Bay is now one of the largest in the U.S. Approximately 4,800 CAGU nested at three colonies within San Francisco Bay in 1989-1990.¹⁵ In 2002, they bred at five sites; approximately 9,500 nests (19,000 breeders) (C. Strong, pers. comm.). Continental populations of CAGU likely increased throughout the mid-1900s in response to increased man-related food availability and decreased harvest of eggs and feathers.^{1,11,13} Populations may be leveling off at the turn of the 21st century due to changes in dump management.^{9,13} Population size at the San Francisco colonies continues to increase.

Ecology

CAGU migrate from the Pacific coast to inland breeding colonies in late Feb through May. The age of first breeding can be as early as 3 years in males and 4 years in females^{5,7} and probably as late as 8-10+ years in some individuals. Non-breeding individuals spend their first 1-2 summers on the winter grounds and subsequent summers in the vicinity of breeding colonies.¹²



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At inland colonies, chicks are fed a variety of opportunistically-gained diet items, including brine flies and shrimp, other arthropods, fish, garbage from dumps, bird chicks (including those of conspecifics), carrion, and vegetative matter;^{2,12} there is little information on diet at coastal colonies. Winter diet data are limited but include anchovies, Pacific saury, squid, and other invertebrates.^{16,17} Migration to coastal wintering grounds occurs in Aug-Oct at which time the diet switches to fish and crabs.¹² Annual adult survival is between 75% and 90%^{8,12} with longevity ranging up to 30 years.⁸

Conservation Concerns and Activities

The most serious threat to coastal CAGU is disturbance of breeding colonies, resulting in increased intra-specific predation of chicks.^{4,10,13} Other threats include non-native predators, ingestion of plastics and other toxins from garbage dumps, contaminants, and oil spills.^{11,12} There is some concern that the rapidly increasing gull colony may be adversely affecting other colonial waterbirds nesting in the bay. CAGU are considered pests at fish hatcheries.⁶

Recommended Actions

- Protect breeding colonies in San Francisco Bay from disturbance and introduced predators.
- Assess the relationship between CAGU and other colonial waterbirds breeding in San Francisco Bay.

Regional Contacts

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References: 1. Conover 1983; 2. Greenhalgh 1952; 3. Jehl 1987; 4. Jehl and Chase 1987; 5. Johnston 1956; 6. Pitt and Conover 1996; 7. Pugsek and Diem 1983; 8. Pugsek *et al.* 1995; 9. Pyle and DeSante 1994; 10. Shivik and Crabtree 1995; 11. Vermeer 1970; 12. Winkler 1996; 13. Winkler and Shuford 1988; 14. Briggs *et al.* 1987b; 15. Carter *et al.* 1992; 16. Baltz and Morejohn 1977; 17. Wahl 1977.

Western Gull *Larus occidentalis*

Status

Federal: None

State: None

IUCN: None

NAWCP: LC/LC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	2-3	~30d	~45d	Apr-Jul	surface, veg	surface, scavenging	coastal

Distribution, Population Status and Trends

The Western Gull (WEGU) is endemic to the west coast of North America, ranging between British Columbia, and the southern tip of Baja California, MX.^{7,9,10} There are two recognized subspecies: *L. o. occidentalis* (British Columbia to central CA), and *L. o. wymani* (central CA to Baja).⁶ The yellow-footed gull (*L. livens*) was once considered a subspecies. Extensive hybridization occurs with Glaucous-winged Gulls (GWGU) in the northern part of the range.^{7,9} During the non-breeding season, WEGU are distributed throughout the breeding range, although at greater distances from the colonies than during the breeding season.^{6,12} WEGU forage in inshore and coastal waters and are rarely seen seaward of 25 km from the shelf break.^{12,21} During El Niño events, at-sea WEGU abundance declines, with a possible redistribution of birds to other sites such as more coastal and inland areas, as well as a greater concentration at garbage dumps.¹²

The total population is estimated between 80,000 and 126,000 breeding birds,^{10,14} with the majority of the population in CA (50-77%).^{4,13} The largest single colony is found on Southeast Farallon Island, CA, with approximately 16,000-20,000 birds.^{4,11} Historically, WEGU populations were reduced as a result of human efforts to reduce gull numbers in the 1800s.¹ However, populations appear to have increased during the past century due to the restriction of human activity at important breeding sites⁵ and increased food availability at dumps⁷ but may be leveling off at the turn of the 21st century due to changes in dump management.⁸ California population trends indicate a 39% increase between the late 1970s and 1989-1991 (~62,800 breeding birds in 1990), with the greatest increases in the San Francisco Bay and Channel Islands.⁴ Population sizes and trends are not well known in OR and WA, and are further complicated by the high degree of hybridization with GWGU^{9,22} (see population discussion in GWGU species profile).



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Ecology

WEGU breed primarily on offshore rocks and islands.^{2,7,9} Males typically arrive at breeding colonies first, where they defend territories and build up to 3 nests.¹ Females then choose a nest and will lay a single clutch of up to 3 eggs (less in poor food years).^{1,7} WEGU are capable of replacing a clutch if it is lost early in the season, but replacement clutches are generally smaller and less successful.¹ WEGU are generally monogamous and female-female pairs that lay supernormal clutches of 4-6 eggs have been documented.^{1,2,17} Reproductive performance at the Farallons and Santa Barbara Is. have shown a steady decline since the 1970s and 1980s.³ During El Niño events, increased adult mortality and low reproductive rates are typical.^{1,18}

WEGU are generalist predators, feeding predominantly on fish, marine invertebrates and human refuse.⁷ They are also opportunistic scavengers and will feed on eggs, chicks and adult birds.^{1,7} Diet studies have been conducted at several sites throughout the range and composition varies geographically, seasonally, at different stages of the breeding cycle, and in response to large scale oceanographic conditions, such as El Niño. Some major prey items include anchovy, rockfish, Pacific whiting, jack mackerel, Pacific saury, midshipman,

white croaker, euphausiids, squid, gooseneck barnacles, pelagic red crabs, sea urchins, clams, limpets and mussels.⁷

Conservation Concerns and Activities

Human impacts on WEGU are limited due to remote breeding localities and the resilience of gull individuals and populations. However, the relatively small population size and limited range make WEGU vulnerable to threats such as introduced predators, human disturbance, oil, pesticide contamination, other toxins, and the spread of avian diseases. Disturbance to breeding colonies can result in lowered reproductive success and increased intra-specific predation of chicks.¹⁶ Female-female pairing was recorded at several of the Channel Islands in the 1970s, and resulted in decreased reproductive success.¹⁷ Female-female pairing was linked to exposure to DDT.^{19,20} Organochlorine concentrations in central CA eggs have decreased since the 1970s¹⁵ and there has been a concurrent decrease in female-female pairing and recovery of the Southern California Bight WEGU population. Increased abundance of anchovies may also have been a factor fueling the recovery of WEGU populations (G.L. Hunt pers. comm.). Other concerns include the spread of avian botulism within colonies.

Recommended Actions

- Protect major breeding colonies from human disturbance and introduced predators.
- Assess and monitor contaminant levels.
- Resurvey colonies in Oregon and Washington to determine population trends and document changes in distribution.
- Monitor the WEGU x GWWG hybridization zone at regular intervals to track changes.

Regional Contacts

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References: 1. Ainley and Boekelheide 1990; 2. Bent 1921; 3. Sydeman *et al.* 2001; 4. Carter *et al.* 1992; 5. Carter *et al.* 1995c; 6. Harrison 1983; 7. Pierotti and Annett 1995; 8. Spear 1993; 9. Speich and Wahl 1989; 10. Sowls *et al.* 1980; 11. Warzybok *et al.* 2002; 12. Briggs *et al.* 1987b; 13. Kushlan *et al.* 2002; 14. Martin and Sydeman 1998; 15. Pyle *et al.* 1999; 16. Carney and Sydeman 1999; 17. Hunt and Hunt 1977; 18. Ainley *et al.* 1986; 19. Fry and Toone 1981; 20. Fry *et al.* 1987; 21. Briggs *et al.* 1992; 22. USFWS in prep.

Glaucous-winged Gull *Larus glaucescens*

Status

Federal: None

State: None

IUCN: None

NAWCP: LC/NCR

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-3	yes	1-3	~28d	31-52d	Apr-Aug	surface, stick	surface dipping	coastal

Distribution, Population Status and Trends

Glaucous-winged Gulls (GWGU) breed along the Pacific rim, from the Commander Islands, Russia, to AK and south to northwestern OR, where they hybridize extensively with Western Gulls (WEGU).¹ Hybrid gulls breed as far south as central CA.²⁰ During the non-breeding season, many GWGU are resident, while others disperse along the Pacific coast, as far south as the tip of Baja California, MX.^{14,21} GWGU are most common along coastal areas and waters over the continental shelf and as far out as 150 km or more.²²

The North American population is estimated at 380,000 breeding birds.¹⁹ Because of extensive hybridization with WEGU in WA and OR, estimating population size in this Region is difficult and most colony surveys have not distinguished between the two species. In WA, approximately 37,000 GWGU/WEGU (combined) were estimated during the last complete inventory, in the early 1980s.¹¹ In OR, the estimate is 36,000 breeding GWGU/WEGU: 13,800 gulls (6,900 nests) along the outer coast from the 1988 inventory¹⁸ and 22,500 breeding birds (predominantly hybrids) estimated in the Columbia River estuary in 2001 (D. Roby pers. comm.). As with other gull species, continental populations of GWGU increased throughout the mid-1900s in response to increased man-related food availability and decreased harvest of eggs and feathers, but may be leveling off at the turn of the 21st century.^{8,9,14} Numbers in the Columbia River estuary continued to increase through the 1990s from 1,750 birds in 1981.¹¹ In Puget Sound there appears to be a shift in distribution as numbers decline at island colonies but increase in urban and industrial habitats and the Columbia River (J. Galusha pers. comm., R. Woodruff pers. comm.).

Ecology

Breeding occurs in small to large colonies (and even isolated pairs) on coastal islands and artificial structures.^{2,4} The mean age of first breeding in one



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colony was 5.4 years with a range of 4-7 years,¹⁰ although it probably can be as late as 8-10 years in some individuals. Non-breeding individuals spend their first summer along the coast and subsequent summers in the vicinity of breeding colonies. Annual survival of adults is 83-87%^{3,10,15} and average life expectancy of adults is 9.5 years¹⁵ with longevity ranging up to 32 years.¹⁴

GWGU feed in marine, estuarine, intertidal and terrestrial (*e.g.*, dumps, farm fields) environments. Specific diet studies are generally lacking in WA, OR and CA but it is known that GWGU are omnivorous, eating a wide variety of marine organisms including intertidal invertebrates and fish, terrestrial invertebrates such as earthworms, garbage, chicks (including conspecifics), and a variety of other food items.^{7,11,12,13,16}

Conservation Concerns and Activities

Minor impacts on the population include ingestion of plastics and other toxins from garbage dumps⁵ and the effects of contaminants and oil spills on

the wintering grounds. The most serious potential impact involves disturbance to breeding colonies, resulting in increased intra-specific predation of chicks⁶ although effects on the overall population appear to be minimal.^{10,13,17} There are increasing conflicts and demands for population control, as the number of gulls nesting in urban and industrial habitats increases, especially in Puget Sound.

Recommended Actions

- Protection of island breeding colonies from human disturbance and introduction of non-native predators.
- Complete survey of Oregon and Washington colonies to determine population status and trends and document changes in distribution.
- Monitor the WEGU x GWWG hybridization zone at regular intervals to track changes.

Regional Contacts

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References: 1. Bell 1996; 2. Binford and Johnson 1995; 3. Butler *et al.* 1980; 4. Conover and Thompson 1984; 5. Fry *et al.* 1987; 6. Gillet *et al.* 1975; 7. Irons *et al.* 1986; 8. Pyle and DeSante 1994; 9. Reid 1988a; 10. Reid 1988b; 11. Speich and Wahl 1989; 12. Trapp 1979; 13. Verbeek 1986; 14. Verbeek 1993; 15. Vermeer 1963; 16. Vermeer 1982; 17. Vermeer and Irons 1991; 18. USFWS in prep.; 19. Kushlan *et al.* 2002; 20. Carter *et al.* 1992; 21. Harrison 1983; 22. Briggs *et al.* 1987b.



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Glaucous-winged x Western Gull hybrid.

Gull-billed Tern *Sterna nilotica*

Status

Federal: BCC

State: CA-SC

IUCN: None

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	2-3	~22d	~30d	Mar-Aug	ground scrape	surface seizing	coastal

Distribution, Population Status, and Trends

Gull-billed Terns (GBTE) are found on all continents except Antarctica.¹ There are 6 recognized subspecies: *S.n. vanrossemei* breeds in southern CA and northwest MX.^{1,11,12} A rangewide survey in 2003 documented 10 active *S.n. vanrossemei* colonies (2 in the U.S. and 8 in MX). California colonies are located at the Salton Sea and San Diego Bay and the Mexican colonies are in the Gulf of California and the Pacific coast of Baja.^{1,8,11,12,13} The non-breeding distribution is not well documented but appears to extend from Baja, south along the coasts of Central and South America.^{1,7} There is little information on at-sea distribution, but they presumably remain in inshore waters.

In 2003, USFWS coordinated with Mexican and U.S. biologists to conduct an inventory of all *S.n. vanrossemei* colonies. About 1,100 breeding birds (550 pairs) were documented at 10 locations and the 2 small U.S. colonies accounted for approximately 35% of the birds. South San Diego Bay was colonized in the 1980s and currently 80-120 birds (40-60 pairs) breed there annually (R. Patton pers. comm.).^{3,4,9} Pemberton² estimated the Salton Sea population at 500 pairs in 1927; approximately 300 birds (150 pairs) currently nest.¹⁴ The CA population declined significantly over the past century but recent trends appear relatively stable.¹⁴ Population trends in MX are unknown.

Ecology

GBTE historically nested in marshes, but now seem restricted to gravel, sand, or shell beaches.¹ Birds migrate to breeding sites by mid-Mar and breed on eroded earthen levees and small islets.¹ GBTE nest in colonies or singly, often in proximity to other terns such as Caspian, Least, and Elegant Terns.¹ Breeding begins at 5 years of age,¹ and they have monogamous long-term pair bonds⁵ but low site fidelity.¹ Chicks make their first flight at ~1 month of age, but may be fed by their parents for another



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2-3 months, through the beginning of migration.¹ Most birds have departed southern CA by the beginning of Sep.¹⁰

GBTE are opportunistic feeders, preying on insects, lizards, crustaceans, fish and occasionally chicks of other birds and small mammals.¹ This species does not plunge-dive, as do most other terns, but feeds during flight.¹

Conservation Concerns and Activities

Extremely small population size and limited breeding distribution is a major concern for this subspecies. As with many species of terns along the Pacific coast, GBTE suffer from loss of nesting habitat, predation, human disturbance, and organochlorine contamination.¹ GBTE seem more vulnerable to disturbance than other terns, and during the breeding season disturbance can cause chick and adult mortality from predation, and early dispersal of young.⁶ A preliminary analysis of eggs from the Salton Sea suggests possible contamination by selenium and DDE.¹ GBTE prey upon endangered California Least Terns and Western Snowy Plovers which are federally listed as endangered and threatened, respectively. This has resulted in management conflicts in CA.

Recommended Actions

- Complete a status assessment of *S.n. vanrossemei* which identifies the limiting factors and major threats and implement actions to address these threats. Repeat the rangewide survey in support of this status assessment.
- Coordinate with MX to protect existing breeding habitat, restore historic habitat, and initiate regular monitoring programs of breeding populations.
- Investigate chemical contaminants and their effects on survival and reproductive success.

Regional Contacts

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Brian Collins - USFWS, Sweetwater Marsh NWR, San Diego, CA

References: 1. Parnell *et al.* 1995; 2. Pemberton 1927; 3. Carter *et al.* 1992; 4. Molina 2001; 5. Moller 1981; 6. Sears 1978; 7. Harrison 1983; 8. Molina and Garrett (in press); 9. McCaskie 1991; 10. Garrett and Dunn 1981; 11. Palacios and Mellink 1993; 12. Danemann and Carmona 2000; 13. Xico Vega, pers. comm. 2002; 14. Molina and Erwin in prep.

Caspian Tern *Sterna caspia*

Status

Federal: BCC (5)

State: WA-SM

IUCN: None

NAWCP: LC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-3	yes	1-2	~27d	~35d	Apr-Jul	surface scrape	plunge diving	coastal

Distribution, Population Status and Trends

Caspian Terns (CATE) are widely distributed in scattered colonies on all continents (except Antarctica and South America) along coastlines, and inland along rivers, lakes and marshes.¹ In this Region, CATE breed on the coast as well as inland from WA south to the MX border.¹ Pacific birds winter primarily from southern CA throughout western MX and south to Guatemala.^{1,5,6} CATE favor estuarine habitats and secondarily inshore marine waters when foraging and migrating along the coast.⁵

In North America there are an estimated 32,000-34,000 breeding pairs.⁴ Approximately 12,200 pairs (37%) nested in Pacific coastal areas in 2002; the majority concentrated at one colony in the Columbia River estuary - East Sand Is. (ESI), OR.¹² This is the largest CATE colony in the world (9,933 pairs in 2002),¹³ supporting almost 70% of the U.S. Pacific coastal population. Smaller colonies include Brooks Is., CA (825 pairs); and South San Diego Bay, CA (379 pairs).¹² There has been a general increase in the Pacific population of CATE since the 1960s, which is probably due, in part, to colonization of human-enhanced nesting sites on the coast in close proximity to abundant fish resources.^{2,5} There was a dramatic increase in the Columbia River estuary colony in the 1990s, which was probably influenced by numerous anthropogenic and natural factors (*e.g.*, abundant hatchery salmon, creation of dredge spoil islands and loss of habitat elsewhere).⁵ Concomitant with this general increase and shift to the Columbia River estuary has been a decline in the number of colonies in the west, over the past 20 years.⁵

Ecology

CATE are the largest of all terns, generally breeding on open, flat areas, dredge-material islands, and salt pond dikes. They often nest in colonies adjacent to gulls and other tern species and while most nest in colonies of at least 100 pairs, some nest singly.¹ Attempts to attract CATE to new



Dan Roby, USGS

sites using decoys and taped vocalizations have been very successful.¹⁰ CATE begin breeding at 3 years of age and are generally monogamous.¹ Chicks fledge at approximately 5 weeks, although parents continue feeding young for several months post-fledging.⁷

CATE forage in estuarine and inshore coastal waters, and their diet is comprised almost exclusively of fish acquired through shallow plunge dives.⁵ Composition varies by location but main prey items included jacksmelt, topsmelt, shiner perch, staghorn sculpin, northern anchovy, Pacific sardine, and salmonids.¹ In the Columbia River estuary, salmonids were the dominant prey item at Rice Is., OR (74-90%), however, when the birds moved to ESI, closer to the mouth of the estuary, the proportion of salmon in the diet fell by approximately 50% and anchovy, herring, shiner perch, sandlance, sculpins, smelt and flatfish increased.³

Conservation Concerns and Activities

CATE colonies are highly susceptible to habitat loss and degradation. This can be natural (*e.g.*, vegetative succession, erosion, or inundation) or human-caused.⁵ The greatest conservation concern for CATE in this Region is the concentration of breeding birds at one colony. This results in increased risk from stochastic events such as disease, contaminant and fuel spills, natural disasters, introduced predators, and human disturbance. Additionally, there have been conflicts with management for endangered salmonids in the Columbia River. Mammalian predation, especially red foxes, has been a problem at CA colonies. Human activity (including researcher disturbance) at or near nesting sites can greatly reduce reproductive success.¹

There is evidence that contaminants may be impacting CATE reproduction in San Francisco Bay, CA and Commencement Bay, WA.¹¹ High concentrations of organochlorine pollutants, such as PCB and DDE, were identified in the mid 1980s and more recent studies indicate that PCB concentrations have not declined in recent decades.^{8,9,11} CATE eggs from San Francisco Bay had high concentrations of mercury; 85-90% of eggs had mercury concentrations above the level expected to have an adverse effect.¹¹

Recommended Actions

- Protect, enhance, or create nesting areas, distributed throughout the Region to provide multiple suitable nesting sites along the coast.
- Coordinate with other agencies to manage CATE colonies in the Columbia River estuary including continued research of the impact of CATE relocation on productivity and population size. Monitor populations throughout the Pacific Coast/Western Region.
- Develop public education programs on CATE natural history and the negative effects of human disturbance.
- Continue to monitor contaminant levels and document the effects on reproduction.

Regional Contacts

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David Craig - Willamette University, Salem, OR
David Shuford - PRBO Conservation Science, Stinson Beach, CA
Nanette Seto - U.S. Fish and Wildlife Service, Regional Office, Portland, OR

References: 1. Cuthbert and Wires 1999; 2. Gill and Mewaldt 1983; 3. Roby *et al.* 1998; 4. Kushlan *et al.* 2002; 5. Shuford and Craig 2002; 6. Harrison 1983; 7. Wires and Cuthbert 2000; 8. Ohlendorf *et al.* 1985; 9. Ohlendorf *et al.* 1988; 10. Roby *et al.* 2002; 11. Schwarzbach and Adelsbach 2002; 12. USFWS 2004; 13. CBR 2003.

Royal Tern *Sterna maxima*

Status

Federal: None

State: CA - SC

IUCN: None

NAWCP: MC/LC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-2	yes	1-2	~30d	~31d	Apr-Aug	surface scrape	plunge diving	coastal

Distribution, Population Status, and Trends

Royal Terns (ROTE) breed in North and Central America, the Caribbean, and west Africa.⁶ Two subspecies are recognized; *S. m. maxima* breeds along the Pacific coast from southern CA along the west coast of MX and the Gulf of Mexico.^{1,2} Post breeding, Pacific ROTE depart the colonies and migrate north, as far as northern CA, followed by a southern migration, reaching as far south as southern Peru.^{1,6} ROTE are found primarily along the coast and estuaries, and rarely seen more than 1 km offshore.⁷

Approximately 125,000 ROTE breed in the Americas and West Indies.³ ROTE are peripheral breeders in this Region. They were first reported breeding on the salt ponds of San Diego Bay in 1959.⁵ A small group of 70 birds bred in 1999.^{3,10,11} Breeding was also documented at Bolsa Chica Ecological Reserve, CA in 1988-1990 (4-20 birds).⁴ ROTE were once more common in CA⁸ but numbers declined over the past half century, possibly as a result of the sardine crash in the 1950s or range expansion of Elegant Terns.^{9,12}

Ecology

In CA, ROTE nest on salt pond dikes and dredge spoil islands. They frequently nest with other terns, *e.g.*, Caspian and Elegant.¹² Age of first breeding is 3-4 years.¹⁴ Birds often remain at wintering grounds their first year.¹⁴ Chicks form creches at 2-3 days and adults recognize their chicks by their response to the adult's calls.¹⁴

ROTE are opportunistic feeders in other areas but the diet of southern CA breeders is unknown, although there is evidence that Pacific sardines were historically important.^{12,14} ROTE plunge-dive after hovering, and feed singly or in small flocks.¹⁴ ROTE feed close to shore in marine, estuarine, and even freshwater areas.^{7,13}



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Conservation Concerns and Activities

CA colonies are small and at the northern extent of the range. These breeding populations are vulnerable to disturbance from humans and animals. Colonies are often destroyed by natural events *e.g.*, high tides and storms.³ Analysis of band recovery records indicated that ROTE, especially <1 year old birds, are captured or entangled in fishing lines or hooks.¹³

Recommended Actions

- Protect breeding colonies at San Diego NWR and Bolsa Chica Ecological Reserve, CA.
- Monitor range expansion to determine where future habitat conservation may be warranted.
- Provide outreach materials to fishers to minimize take and the proper handling of captured birds.

Regional Contacts

Robert Patton - San Diego Zoo, San Diego, CA
Charlie Collins - California State University, Long Beach, CA

References: 1. Clapp *et al.* 1993; 2. Everett and Anderson 1991; 3. McCaskie 1988; 4. Collins *et al.* 1991; 5. Gallup and Bailey 1960; 6. Briggs *et al.* 1989; 7. Briggs *et al.* 1987b; 8. Grinnell and Miller 1944; 9. Cogswell 1977; 10. Garrett and Dunn 1981; 11. Unitt 2000; 12. Schaffner 1986; 13. Buckley and Buckley 1974; 14. Buckley and Buckley 2002.

Elegant Tern *Sterna elegans*

Status

Federal: BCC

State: CA-SC

IUCN: LR/nt

NAWCP: MC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-2	yes	1-2	~26d	~35d	Apr-Jul	surface scrape	plunge diving	coastal

Distribution, Population Status and Trends

Elegant Tern (ELTE) breeding distribution is restricted to southern CA and the northern Gulf of CA, MX.¹⁴ Historically, colonies also occurred along the Pacific Coast of Baja and further south in the Gulf.¹ There is a post-fledging northward migration of juveniles and adults, primarily along the coast, resulting in peak numbers from Jul - Sep in CA coastal waters (common as far north as San Francisco).¹¹ By the end of Oct, most birds leave CA and disperse south to wintering grounds from Guatemala to Chile.⁶ ELTE forage close to shore (usually within 4 km) in marine and estuarine habitats (including near shore lagoons and harbors).^{10,16}

Total breeding population is estimated at <30,000 pairs (60,000 birds), with an estimated 90% located at one colony on Isla Rasa, MX.¹⁵ Only five colonies are currently active: two in MX and three in southern CA.¹ Birds first began breeding in the U.S. in 1959, in San Diego Bay, CA;^{3,4} since then, ELTE have expanded their breeding range to Bolsa Chica and Los Angeles Harbor. Approximately 10,000 birds bred at these three U.S. colonies in 2003 (Brian Collins, pers. comm.), constituting ~10% of the global population, although these numbers are highly variable among years.¹⁷ There has been a general range expansion into southern CA, although attendance at these breeding sites fluctuates among years in response to El Niño conditions, habitat changes, and disturbance events. Population size at Isla Rasa increased following the establishment of the island reserve in 1964, but recent trends are unclear.¹³

Ecology

This coastal tern arrives at southern CA sites to begin breeding activities in early Mar.¹⁴ Breeding pairs form tight groups and nest among more aggressive birds, such as Caspian and Forster's Terns, and Black Skimmers. Habitat generally has little vegetation and is on low, flat, and sandy areas.¹



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San Diego and Los Angeles sites are on dredge-filled dikes and Bolsa Chica nests are on two sand-filled islands. ELTE lay one, rarely two, eggs and both parents incubate.¹ Chicks form creches at an average age of 6 days.¹ Dependence on parents is protracted and feeding can continue for 6 months after the young are able to fly.¹

Primary prey is northern anchovy and other schooling fish.^{1,5,7,8} Studies reported strong associations in ELTE breeding success and dispersal with anchovy availability.^{2,8,12,13} Feeds in marine and estuarine habitats, and rarely in freshwater.⁵

Conservation Concerns and Activities

ELTE breeding range and population size have not recovered to known historical levels, when colonies were more widespread than at present.^{1,2} The world population is vulnerable due to its restricted range, concentration of >90% of the population at one colony, sensitivity to disturbance, and major loss of breeding habitat. Urban development threatens sites in San Diego and Los Angeles,⁵ although several groups such as the Bolsa Chica Land Trust and the Amigos de Bolsa Chica, are actively involved in preserving this wetland and preventing urban

development. Predation by dogs and cats has caused loss of chicks in San Diego.⁹ Continued northern expansion is potentially limited due to dense human development along most of the coast. In addition, colonization may require prior establishment of other breeding gulls or terns. Contaminant concerns include oil-spills and other chemical pollutants at breeding sites and wintering areas. Organochlorine compounds were present in ELTE eggs in San Diego Bay in 1985, although hatching success at this colony was, and continues to be, high.^{10,18} Entanglement with fishing gear, degradation of habitat, and disturbance at breeding colonies and roost sites are all issues of conservation concern for this species.

Recommended Actions

- Protection of all occupied breeding sites from disturbance and non-native predators.
- Develop a U.S. and Mexico partnership to begin joint recovery programs and integrate conservation with bilingual education and outreach.
- Investigate historic breeding sites and evaluate the potential for restoration.
- Investigate population dynamics through long-term demographic studies with marked individuals.
- Assess fishery threats (both direct and indirect) at breeding and wintering areas.

Regional Contacts

Kathy Molina - Natural History Museum, Los Angeles, CA
Charles Collins - California State University, Long Beach, CA
Enriqueta Velarde - Isla Rasa Biosphere Reserve, Mexico
Brian Collins - USFWS, Sweetwater Marsh NWR, San Diego, CA

References: 1. Burness *et al.* 1999; 2. Clapp *et al.* 1993; 3. Collins *et al.* 1991; 4. Gallup and Bailey 1960; 5. Horn *et al.* 1996; 6. Howell and Webb 1995; 7. Loeffler 1996; 8. Schaffner 1986; 9. Schaffner 1985; 10. Schaffner 1982; 11. Small 1994; 12. Velarde *et al.* 1994; 13. Velarde and Anderson 1994; 14. Harrison 1983; 15. Kushlan *et al.* 2002; 16. Briggs *et al.* 1987b; 17. Carter *et al.* 1992; 18. Ohlendorf *et al.* 1988.

Arctic Tern *Sterna paradisaea*

Status

Federal: BCC (5)

State: WA - SM

IUCN: None

NAWCP: HC/LC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-3	unk	1-3	~22d	~24d	May-Aug	surface scrape	plunge diving	offshore

Distribution, Population Status, and Trends

Arctic Terns (ARTE) have an arctic circumpolar breeding distribution.^{1,4} In North America ARTE breed as far south as Puget Sound, WA on the Pacific coast and to Massachusetts on the Atlantic.³ ARTE have one of the most impressive migrations, breeding in the arctic and wintering in Antarctic and sub-Antarctic waters.^{1,3} During migration in the Pacific, ARTE are most numerous seaward of 25 km offshore,⁵ with spring densities usually much lower than those in the fall.⁶ ARTE concentrations are found primarily in clear waters over the continental slope.⁵

Population estimates from 1980 suggest that more than 30,000 ARTE pairs breed in south to south-central AK and in the Russian Far East.¹ ARTE are peripheral breeders in this Region. A small colony (20-40 birds) nested on Jetty Is. in the Puget Sound, WA in 1977 and 1978^{2,4} and small numbers present in 2001 indicate that they still nest in the area (R. Milner pers. comm.).

Ecology

In WA, ARTE nest on Jetty Is., a dredge spoil island in Everett Harbor, Puget Sound near the Glaucous-winged Gull colony.⁴ Nesting habitat is grass and sedge vegetation surrounded by bare ground.² Although ARTE can lay 1-3 eggs, they generally lay 2.^{4,8} ARTE are monogamous, with long-term pair bonds and strong nest site fidelity.⁹

ARTE are surface feeding plunge-divers, eating primarily fish as well as crustaceans, and occasionally scavenging or pirating food,⁴ although prey choice appears to be site-specific.⁸ Little is known about the breeding biology or foraging ecology of ARTE in WA.



Kathy Kuletz, USFWS

Conservation Concerns and Activities

The small breeding population in this Region, which has been completely absent at times,⁴ is extremely vulnerable to impacts from human disturbance.

Recommended Actions

- Protection of breeding colonies from disturbance and non-native predators.

Regional Contacts

David Manuwal - University of Washington, Seattle, WA

References: 1. Clapp *et al.* 1993; 2. Manuwal *et al.* 1979; 3. Harrison 1983; 4. Speich and Wahl 1989; 5. Briggs *et al.* 1987b; 6. Briggs *et al.* 1992; 7. Hatch 2002; 8. Robinson *et al.* 2001; 9. Suddaby and Ratcliffe 1997.

Forster's Tern *Sterna forsteri*

Status

Federal: None

State: WA- SM

IUCN: None

NAWCP: MC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2-3	yes	2-3	~21d	~35d	May-Aug	surface	plunge diving	coastal

Distribution, Population Status, and Trends

Forster's Terns (FOTE) breed primarily at scattered inland locations throughout North America.^{1,9} In the coastal area of this Region, FOTE breed in CA at San Francisco Bay, San Diego Bay and Bolsa Chica.⁹ Prior to 1980, they also nested in Monterey Bay. Non-breeding distribution of FOTE is along the southern Pacific and Atlantic coasts to northern Central America,^{1,10} out to 15 km offshore in CA.³

Spendelow and Patton¹³ compiled an estimate for the Pacific coast of 8,100 FOTE breeding at 15 colonies in 1979-1980. This represented approximately 22% of the total U.S. coastal breeding population; 6,000 (74%) of these birds nested in San Francisco Bay.¹³ More recent estimates (1989-1991) of 3,550 breeding birds at 21 colonies in the San Francisco Bay area and the loss of the Monterey colonies indicate a decline in central CA.⁹ Declines were attributed to human disturbance and predation.⁹ Numbers nesting in San Diego Bay are quite variable but relatively stable since 1991, fluctuating between 600-1,200 breeding birds (R. Patton pers. comm.). FOTE also nest at Seal Beach NWR, Bolsa Chica, and Upper Newport Bay in southern CA (L. Hays pers. comm.).

Ecology

FOTE breed in freshwater and saltwater marshes, and along the borders of ponds and lakes;¹ in San Francisco Bay they nest on salt pond levees.⁹ FOTE form monogamous pair bonds and typically breed in small, loose colonies of 2-100 nests^{1,5} Both adults care for the young.¹ FOTE breed annually, starting at age 2 years, though few demographic data are available for this species.¹

The FOTE surface-feeds during flight, primarily in shallow water; on small fishes,¹ though most information on diet is anecdotal. There is some evidence that Pacific coastal birds feed on shiner perch and anchovies.¹¹



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Conservation Concerns and Activities

Organochlorine pollutants (DDE) have been correlated with eggshell thinning in CA and PCB concentrations in birds nesting at San Francisco Bay showed no significant decline in recent decades and were at or near adverse effects levels.^{7,12} Approximately 75-80% of FOTE eggs collected from the San Francisco Bay area in 2000 also had high levels of mercury, above the level of adverse effects.¹² As an upper trophic predator in the littoral zone, FOTE can serve as a biomonitor of potentially harmful chemicals.⁸ Development in wetland areas can degrade breeding habitat through draining, filling, or flooding riparian areas.^{1,9} Nests are vulnerable to wave action and a suite of mammalian, avian, and reptilian wetland predators.¹ Colonies have been displaced or reduced in numbers because of human disturbance and predation by introduced red fox.⁹

Recommended Actions

- Protection of FOTE breeding sites from disturbance and non-native predators.
- Monitor contaminant levels and their effects on reproductive success.
- Long-term demographic data in the CA coastal populations is needed to determine status and dynamics of FOTE populations.

Regional Contacts

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Michael Horn - California State University,
Fullerton, CA
Robert Patton - San Diego Zoo, San Diego, CA

References: 1. McNicholl *et al.* 2001; 2. Kushlan *et al.* 2002; 3. Briggs *et al.* 1987b; 4. Moynihan 1959; 5. McNicholl 1971; 6. Hall 1989; 7. Ohlendorf *et al.* 1988; 8. Harris *et al.* 1985; 9. Carter *et al.* 1992; 10. Harrison 1983; 11. Gochfeld and Burger 1996; 12. Schwarzbach and Adelsbach 2002; 13. Spendelow and Patton 1988.

Least Tern *Sterna antillarum*

Status

Federal: E

State: CA-E, OR-E

IUCN: None

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-3	yes	1-2	~20d	~25d	Apr-Jul	surface scrape	plunge diving	coastal

Distribution, Population Status and Trends

Least Terns (LETE) nest along both the Atlantic and Pacific coasts and up major rivers of North and South America. Three subspecies are recognized; the Pacific coast subspecies, California LETE *S. a. browni*, breeds from central CA to Baja California, MX and winters along the coast of southern MX¹ (the rest of this account refers to this subspecies). While migrating, LETE remain near the coast, although they have been observed foraging in multispecies feeding flocks 2-30 km off the western coast of Baja California in late Apr and early May.¹²

The LETE population in CA averaged ~4,300 pairs between 2000-2002 (CDFG, unpubl. data), representing 10% of the North American population.² Current significant breeding sites, include Camp Pendleton (584 pairs), Naval Air Base Coronado (534 pairs), Alameda Pt. in San Francisco Bay (300 pairs), Los Angeles Harbor (287 pairs) and Huntington State Beach (316 pairs) (CDFG, unpubl. data). The population has contracted remarkably from historical distribution due to loss of habitat, predation, and some losses due to shooting and egg collecting.¹⁶ There are no reliable historical estimates, but qualitative reports from the late 1800s and early 1900s indicated that LETE were abundant in southern CA.⁶ LETE were federally listed in 1970⁶ and the CA population has increased almost 8-fold from a low of 600 pairs in 1973-1975.

Ecology

LETE arrive at breeding sites in mid- to late-Apr and nest in open, non-vegetated habitat along coastal beaches and rivers.¹ Prior to incubation birds roost at night on open sandy beaches, departing at first light.⁵ They are monogamous, colonial, and defend territories.¹ Birds lay 1-4 eggs but 2 egg clutches are the most common.⁸ Young are capable of flight at approximately 3 weeks but parents continue to feed them until sometime after they depart from the breeding grounds.⁸ In southern CA, LETE had



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high rates of site fidelity, returning to their natal site to nest.¹⁰ First breeding occurs at 2-3 years of age and the oldest bird was 21 years old.¹¹

Important prey include small surface-swimming fishes such as northern anchovy, topsmelt, jacksmelt, killifish, shiner perch and other surfperch species, deep-body anchovies, and slough anchovies.¹³ Foraging habitat includes coastal areas, bays, lagoons, estuaries, and any shallow water habitat (such as lakes, ponds, streams, etc.).¹ El Niño conditions can significantly effect reproductive success and adult survival.⁴

Conservation Concerns and Activities

Major conservation concerns include habitat loss, predation, contaminants and human disturbance.^{7,8,9} Non-native plants, such as iceplant, invade colony sites and can render habitat unsuitable if not managed. Analysis of failed LETE eggs collected at Alameda indicated that PCB contamination may be a factor in reduced reproductive performance at this site.¹³ Mercury levels were also elevated but appear to be below the level of adverse effects.¹³ The potential of domoic acid poisoning from contaminated prey (D. Robinette, pers. comm.) is also of concern.

A recovery goal of at least 1,200 pairs, in at least 20 managed areas, was established in 1977.⁶ These goals may change when the latest revision of the recovery plan is finalized (in prep.). To date, monitoring programs have been implemented at most of the CA LETE sites and active management and protection of colonies has helped reduce human disturbance and other threats at many of these sites. In 2001 and 2002, Gull-billed Tern (GBTE) predation on LETE chicks was identified as a significant factor at some San Diego colonies. Resolution of this problem, however, is difficult given that the western GBTE may actually be more vulnerable to extinction than the LETE. (See GBTE species profile.)

Recommended Actions

- Manage, maintain, and protect current breeding sites and protect, restore, and enhance new breeding sites to meet recovery goals.
- Investigate solutions to the Least/Gull-billed Tern conflict that do not adversely affect either species.
- Control non-native plants and animals that adversely affect LETE.
- Continue monitoring contaminants and research the effects on reproductive success.
- Investigate LETE movement and migration to help to define wintering areas and potential threats at these sites.
- Maintain surveys to monitor population trends and reproductive success.

Regional Contacts

Patricia Baird and Charles Collins - California State University, Long Beach, CA
Jack Fancher and Loren Hays - U.S. Fish and Wildlife Service, Carlsbad FWO, CA
Lyann Comrack - California Department of Fish and Game, San Diego, CA
Kathy Keane - Keane Biological Consulting, Long Beach, CA
Dan Robinette, Meredith Elliott, and William Sydeman - PRBO Conservation Science, Stinson Beach, CA

References: 1. Thompson *et al.* 1997; 2. Kushlan *et al.* 2002; 3. Atwood and Kelly 1984; 4. Massey *et al.* 1992; 5. Atwood 1986; 6. U.S. Fish and Wildlife Service 1985; 7. Collins 1992; 8. Massey 1974; 9. Hothem and Powell 2000; 10. Atwood and Massey 1988; 11. Massey and Atwood 1981; 12. Howell and Engel 1993; 13. Schwarzbach and Adelsbach 2002.

Black Skimmer *Rynchops niger*

Status

Federal: BCC

State: CA-SC

IUCN: None

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
3	yes	1-2	~23d	~24d	May-Sep	surface scrape	tactile skimming	coastal

Distribution, Population Status, and Trends

Black Skimmers (BLSK) breed in the Americas, along both coasts, from southern CA to Ecuador (Pacific) and from Massachusetts to Brazil (Atlantic).⁴ BLSK belong to their own subfamily (Rynchopidae) within the Laridae, and 3 subspecies are recognized; *R. n. niger* is the subspecies found in this Region, breeding along both Atlantic and Pacific coasts.^{1,4} Pacific birds winter from southern CA south to Chile.^{1,4} CA breeders are resident year-round (K. Molina, pers. comm.). At-sea distribution is close to shore and migration is along the coast, in flocks of dozens to hundreds.¹

The estimated North American breeding population is between 65,000 and 70,000 individuals.⁷ The first CA breeding record was in 1972, at the Salton Sea¹¹ and since then, their range has expanded. Currently, there are small, isolated colonies along the CA coast from San Francisco to San Diego. Breeding was first recorded at Bolsa Chica Ecological Reserve in 1985, San Francisco Bay in 1994, and nesting was attempted in Monterey County in 2000.^{5,6,8,9} The San Diego colony contains 300-400 pairs, the Los Angeles Harbor had 100 nest attempts in both 1999 and 2000, and the number of nest attempts at Bolsa Chica was 295.^{5,10} In 1995 the state total was estimated at 1,200 pairs.⁵ Reproductive success at many of the southern CA colonies is poor.

Ecology

BLSK breed territorially on beaches, islands, or in salt marshes, often with other terns, gulls, and plovers.¹ The colony at Los Angeles Harbor is on a dredged fill site that will be developed in the future. Re-laying can occur up to 3 times if the nest fails.¹ Chicks hatch asynchronously and fledglings depend on parents for food for at least 14 days after their first flight.¹ Most birds begin breeding at 3 years of age and can live up to 20 years.²

This unique bird uses tactile foraging, skimming the water surface in flight, with its laterally compressed



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bill.¹ Adult BLSK feed on small fish and possibly crustaceans^{1,3} in the calm, shallow waters of bays, estuaries, harbors, ponds, and lagoons. In San Diego Bay, the diet studies in the mid 1990s found a diverse diet, with Pacific sardine, northern anchovy, California halfbeak, topsmelt, California grunion and California killifish the most abundant prey.¹² Ocean warming associated with El Niño and other events has a significant effect on prey abundance and diet. BLSK spend more time feeding during the night than during the day, although foraging is mainly during the day during chick rearing.¹

Conservation Concerns and Activities

Current threats are those common to all of the coastal terns nesting in southern CA: flooding of nest sites, predation, human disturbance, and potential loss of habitat due to development. The proximity of colonies to urban areas makes them especially vulnerable to disturbance by humans, pets, and feral animals that can disrupt breeding of these southern CA colonies and may have contributed to low reproductive success in the past.

Recommended Actions

- Protect the breeding habitat from human disturbance, development, and non-native predators.
- Investigate the causes of low reproductive success in this Region.

Regional Contacts

Kathy Molina - Natural History Museum, Los Angeles, CA

Charles Collins - California State University, Long Beach, CA

Kathy Keane - Keane Biological Consulting, Long Beach, CA

References: 1. Gochfeld and Burger 1994; 2. Clapp *et al.* 1982; 3. Leavitt 1957; 4. Harrison 1983; 5. Collins and Garrett 1996; 6. Layne *et al.* 1996; 7. Kushlan *et al.* 2002; 8. Roberson 2000; 9. Carter *et al.* 1992; 10. Patton 1999; 11. McCaskie *et al.* 1974.; 12. Horn and Dahdul 1998.

Common Murre *Uria aalge*

Status

Federal: None

State: WA-C

IUCN: None

NAWCP: MC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	~32d	~20d	Apr-Jul	surface, none	pursuit diving	coastal/pelagic

Distribution, Population Status and Trends

Common Murres (COMU) have a circumpolar distribution in the Northern hemisphere.¹⁹ In the Pacific, the breeding range extends from Korea, through AK and south to central CA.^{3,14} There are seven recognized subspecies; *U. a. californica* breeds from northern WA south to CA.⁵ Year-round, COMU usually remain within 50 km of shore,¹⁴ but are more pelagic in the winter and often form large rafts of up to 250,000 birds.¹³

The total Pacific breeding population is estimated at 4.3 million birds,¹⁵ although these numbers are confounded due to range overlap with Thick-billed Murres.^{3,5} The core of the COMU breeding population in this Region is in OR (712,000 breeders, 66% of total). CA has approximately 352,000 breeders (34%), and WA, 7,000 (<1%).^{2,16} In recent decades, the central CA population was drastically reduced (by at least 50%) due to gillnet fisheries and oil spill mortality,^{9,16} but has started to recover. In OR and northern CA, populations appeared relatively high and stable between 1979 - 1995.¹⁶ Since 1995, disturbance by increasing numbers of Bald Eagles in OR has resulted in colony abandonment and redistribution at some colonies (D. Pitkin pers. comm.) Populations in WA suffered a major decline after the 1983 El Niño and a combination of anthropogenic and natural factors have contributed to a lack of recovery.^{16,17}

Ecology

COMU are highly social and breed in extremely dense colonies on cliff ledges, flat low-lying islands and the tops of offshore stacks.^{3,5} Birds exhibit high site and mate fidelity^{1,5,6} and begin breeding at age 4-5 years.¹ Females lay a single egg on bare rock or soil, and both sexes incubate.³ COMU are only capable of raising a single chick each year, but will lay one or more replacement clutches.^{1,4,5} Egg laying dates are variable between years and colonies, with median lay date approximately 5 days later for every 1°C change in sea surface temperature.³



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Chicks are cared for continuously until they depart for sea at 18-25 days.¹ Chicks are not able to fly when they leave the colony; they scramble to the sea, usually accompanied by the male parent.^{1,3,5} Prior to winter dispersal, adult COMU are flightless during molt.¹³ After chicks fledge, adults continue to feed the chicks for 1-2 months, while chicks learn to dive and feed themselves.¹⁶ Reproductive success is fairly consistent, except during warm-water El Niño events when prey availability is reduced.^{12,17,18}

COMU are wing-propelled pursuit divers capable of deep dives.⁵ Adult COMU feed on pelagic zooplankton during the non-breeding season,⁷ but feed their chicks whole fish or squid. Midwater schooling fishes such as herring, sandlance, smelt, anchovy, and juvenile rockfish, are important in the chick diet.^{1,3,7}

Conservation Concerns and Activities

While the widespread global distribution of COMU makes them less susceptible as a species, local populations can be significantly impacted by oil contamination, gillnet mortality, and disturbance. COMU are highly susceptible to oiling and are especially susceptible during the period from Jul - Oct, when chicks fledge and adults may be flightless. COMU are the most numerous species affected in many spills.^{6,8} Populations in central CA, that declined due to gillnet and oil spill mortality, have started to recover since the adoption of tighter fishery restrictions and active restoration at colonies.^{9,10,11} Social attraction has been a successful tool for restoring historic colonies in central CA.⁹ Human disturbance (*e.g.*, boats and low flying aircraft) and natural disturbance (*e.g.*, Bald Eagles) can both cause serious consequences. Efforts to reduce human disturbance (*e.g.*, seasonal buffer zones to exclude boat traffic, outreach to military and civilian pilots) have benefitted nesting murre. The current population monitoring program for this important species is very expensive and labor intensive. New methods need to be developed.

Recommended Actions

- Reduce disturbance around major colonies through the use of buffer zones, marine reserves, marine protected areas or other means. Reduce disturbance from aircraft overflights.
- Restore colonies decimated by disturbance, oil pollution, and fisheries bycatch.
- Support efforts to minimize the incidence of fuel spills near breeding and wintering areas.
- Work with state and federal agencies and fisheries councils minimize the negative impacts of fisheries interactions and review plans for emerging fisheries, to identify potential problems and solutions.
- Develop and implement an accurate and efficient population monitoring program.

Regional Contacts

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Gerry McChesney - USFWS, San Francisco Bay NWR Complex, Newark, CA
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References: 1. Boekelheide *et al.* 1990a; 2. Carter *et al.* 1992; 3. Gaston and Jones 1998; 4. Harris and Wanless 1988; 5. Johnsgard 1987; 6. King and Sanger 1979; 7. Matthews 1983; 8. Page *et al.* 1990; 9. Parker *et al.* 1997; 10. Sydeman *et al.* 1997a; 11. Takekawa *et al.* 1990; 12. Sydeman *et al.* 2001; 13. Harrison 1983; 14. Briggs *et al.* 1987b; 15. Kushlan *et al.* 2002; 16. Manuwal *et al.* 2001; 17. Wilson 1991; 18. Hodder and Graybill 1985; 19. Ainley *et al.* 2002.

Pigeon Guillemot *Cephus columba*

Status

Federal: None

State: None

IUCN: None

NAWCP: MC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-2	yes	1-2	~30d	~35d	May-Aug	crevice	pursuit diving	coastal

Distribution, Population Status and Trends

Pigeon Guillemots (PIGU) are endemic to the north Pacific where they breed along rocky coasts and offshore rocks and islands from the Kurile Islands to southern CA.^{5,7,8} There are five recognized subspecies, two of which breed in this Region: *C. c. adianta* (central Aleutians to WA) and *C. c. eureka* (OR and CA).^{5,8} During the non-breeding season, PIGU are widely dispersed throughout sheltered, inshore waters, south to CA.^{5,8,13} Migration is not well studied, but OR and WA birds do not appear to move great distances; CA PIGU migrate north after breeding and winter as far north as WA and British Columbia.^{13,16} Foraging in all seasons is close to shore and birds are rarely encountered >5 km offshore.^{13,16}

The global population estimate is 246,000 birds, with approximately 88,000 breeders in North America.^{6,12,18,19} The Farallon Islands are one of the largest breeding concentrations in the eastern Pacific.^{5,10} The breeding population in this Region is estimated at 38,000 birds, representing approximately 43% of the North American population: WA (18,000^{15,18}), OR (4,500¹⁹), and CA (15,500 birds²). Overall population trends are unknown, hampered by differences in census methodology and access to colonies;¹⁵ however, there has been growth and establishment of new colonies in the southern part of the range.² PIGU are extremely sensitive to changes in oceanographic conditions; breeding effort and reproductive success fluctuate greatly in response to warm and cold water events.^{1,3,11,17}

Ecology

PIGU typically nest in natural rock cavities^{4,5} but they also nest in artificial cavities and nest boxes.^{1,15} They are highly gregarious, in the water as well as on land.⁵ PIGU are generally monogamous, with high mate retention.⁴ Breeding begins in early May throughout most of the Region, although this is variable depending on latitude.^{1,4} PIGU are capable



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of producing replacement clutches if the first one is lost and clutch size on the Farallons varied with oceanographic conditions.¹ Young are independent after fledging.⁶

PIGU are shallow water, wing-propelled pursuit divers and feed close to the breeding colony on a wide variety of small benthic fish and invertebrates.⁵ Both sexes contribute to the feeding of young, capturing a single fish to carry back to the chicks. There is considerable spatial and temporal variation in diet, depending on local availability. Rockfish and sculpin are important prey in CA,^{1,2,11} and blennies, sculpin and flatfish (Bothidae) are important in British Columbia.^{4,5,6} Diet of OR and WA birds is unknown.

Conservation Concerns and Activities

PIGU's widespread distribution along the Pacific coast makes them less vulnerable as a species to threats from human disturbance and mortality from oil spills. Local and regional populations, however, can be significantly impacted by these threats.^{8,14} Vulnerability to oil contamination is considered high, since PIGU form large rafts on the water.⁹ Gillnet fisheries can cause significant local mortalities.² PIGU census techniques are not standardized between sites, making comparisons and trend

analysis difficult.²⁵ Application of standardized protocols during a 5 year survey of Washington's inland waters resulted in a population estimate of almost 16,000 PIGU at 425 colonies¹⁸ compared to 4,000 birds at 120 colonies documented previously.¹⁵ The increase in numbers is most likely attributable to intensive standardized surveys rather than any change in PIGU abundance (D. Nysewander pers. comm.).

Recommended Actions

- Protect breeding colonies from human disturbance and introduced mammals.
- Implement standardized survey protocols to assess population size and trends and research demographic parameters.
- Investigate the impacts of oil contamination and fishery related mortality.
- Determine important wintering areas.

Regional Contacts

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Harry Carter - Carter Biological Consulting, Richland, BC, Canada
Daniel Roby - USGS, Oregon Cooperative Research Unit, Corvallis, OR

References: 1. Ainley and Boekelheide 1990; 2. Carter *et al.* 1992; 3. Carter *et al.* 1995c; 4. Drent 1965; 5. Ewins 1993; 6. Ewins *et al.* 1993; 7. Harrison 1983; 8. Johnsgard 1987; 9. King and Sanger 1979; 10. Warzybok *et al.* 2002; 11. Sydeman *et al.* 2001; 12. Kushlan *et al.* 2002; 13. Briggs *et al.* 1987b; 14. PRBO 1997; 15. Speich and Wahl 1989; 16. Briggs *et al.* 1992; 17. Hodder and Graybill 1985; 18. Evenson *et al.* 2002; 19. USFWS in prep.

Marbled Murrelet *Brachyramphus marmoratus*

Status

Federal: T

State: CA-E, OR-T, WA-T

IUCN: VU

NAWCP: HC/HI

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	rare	1	30-40d	~30d	Mar-Sep	tree, limb	pursuit diving	coastal

Distribution, Population Status and Trends

Marbled Murrelets (MAMU) breed in the northeastern Pacific Ocean, from the Aleutian Is., AK to central CA.^{1,2} MAMU tend to remain near breeding sites year-round in most areas, though many MAMU breeding on the outer shores of Vancouver Is. appear to move into more sheltered waters in the fall and winter, and MAMU numbers are known to decrease during winter in southeast AK.²⁴ MAMU have been documented as far south as southern CA and northern MX.^{1,3,6} MAMU tend to forage just beyond the surf zone, usually <5km offshore, and highest concentrations are in protected inshore waters.⁶

Most population estimates of MAMU have involved at-sea detection surveys,⁶ though the power of these surveys to detect trends is low.⁷ Rough estimates of the Region's population represent 3-7% of the North American population: 6,800 - 17,600 (ave. 9,800) in WA and 8,000 - 17,600 (ave. 12,800) in OR and CA.^{1,4,19} Demographic modeling using MAMU and other alcid parameters indicated declining populations in WA, OR and CA.^{11,20} MAMU are also thought to be declining in some areas of Alaska.¹¹

Ecology

This species, and the closely related Long-billed Murrelet, are unique among the Alcidae because they nest solitarily on the mossy limbs of mature trees in coastal forests.⁶ They also nest on the ground in the northern portion of their range.⁶ The farthest inland nests in OR were 50 km, although birds have been sighted in OR and WA as far as 129 km inland.⁶ Incubation shifts are 24 hrs and egg neglect is common.⁶ When chicks fledge, it is believed that they reach the water in a single flight.⁶ Breeding ecology remains poorly known.¹²

MAMU are wing-propelled, pursuit divers, foraging both day and night.⁶ In AK and British Columbia, primary diet items include sandlance, anchovy,



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herring, capelin, and smelt, among others.^{1,6} Euphausiids, mysids, amphipods, and osmerids form a large proportion of adult diet in the non-breeding and pre-breeding periods.^{6,9,10} Adults usually return to the nest with a single fish and chicks are fed 1-8 times a day.⁶ MAMU feed close to shore in small groups or individually (larger groups in AK and BC), generally in shallow waters.⁶

Conservation Concerns and Activities

The key conservation concern is past and current loss of breeding habitat from timber harvest and the loss of breeding habitat is most evident in the southern range.^{1,4,6,12} Management actions to preserve habitat on federal lands are in place according to the Northwest Forest Plan. However, there is extensive vulnerable murrelet habitat on non-federal lands that need protection for population maintenance and recovery. Nest site predation by large raptors, corvids and small mammals reduces nesting success.⁶ Forest fragmentation has been thought to increase levels of nest predation by the creation of forest edge.⁶ Human activities in murrelet habitat also attracts predators.^{11,13} Threats in the marine environment include oil pollution¹⁵ and bycatch in gillnets.¹⁶ Population trend data from at-sea surveys have low power and conventional mark-recapture and radio telemetry studies are costly and logistically difficult; however, radar monitoring

has emerged as a powerful, relatively inexpensive new tool to monitor breeding populations.^{17,18} As a federally (U.S. and Canada) and state-listed species, the MAMU has some degree of protection. For a more detailed discussion of threats and conservation actions, see the Recovery Plans.^{14,23}

Recommended Actions

- Complete landscape management strategies for each of the six Marbled Murrelet Conservation Zones. Identify and protect areas of terrestrial and marine habitat, on private and public land, essential for recovery.
- Many aspects of breeding ecology, habitat selection, and foraging ecology are still unknown. Expand research studies of MAMU demography and ecology to guide conservation decisions. Conduct standardized monitoring to determine abundance and trends.
- Monitor and protect central CA breeding populations and breeding habitat. This small population at the southern edge of the species' breeding range is likely limited by habitat availability and is thus the most vulnerable to localized extinction from lack of nesting sites.
- Reduce human activities near potential breeding habitat that might attract nest predators.

Regional Contacts

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Eric Cummins - Washington Department of Fish and Wildlife, Olympia, WA
Esther Burkett - California Department of Fish and Game, Sacramento, CA
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References: 1. Gaston and Jones 1998; 2. SOWLS *et al.* 1978; 3. Erickson *et al.* 1995; 4. Ralph *et al.* 1995; 5. Piatt and Naslund 1995; 6. Nelson 1997; 7. Jodice *et al.* 2001; 8. Cam *et al.* 2003; 9. Burkett 1995; 10. Becker 2001; 11. McShane *et al.* 2004; 12. Cooke 1999; 13. Marzluff *et al.* 2000; 14. Kaiser *et al.* 1994; 15. Carter and Kuletz 1995; 16. Carter *et al.* 1995a; 17. Burger 2001; 18. Cooper *et al.* 2001; 19. Kushlan *et al.* 2002; 20. U.S. Fish and Wildlife Service 1997.

Xantus's Murrelet *Synthliboramphus hypoleucus*

Status

Federal: C, BCC

State: CA-T

IUCN: VU

NAWCP: HC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1-2	yes	1-2	~34d	1-3d	Feb-Aug	crevice, shrub	pursuit diving	pelagic

Distribution, Population Status and Trends

Xantus's Murrelet (XAMU) breeding distribution is restricted to approximately 12 offshore islands of southern CA and Baja California, MX.^{3,6} Two subspecies are currently recognized: *S. h. scrippsi*, nesting primarily in southern CA (Channel Islands), and *S. h. hypoleucus*, nesting on Guadalupe Is. and the San Benito Is., MX.³ Limited information on non-breeding distribution indicates that individuals of both subspecies disperse offshore, moving northward from the breeding colonies as far as British Columbia.³ During the fall, XAMU are more widely dispersed, although in some years they congregate.¹³ XAMU forage in pairs or small groups over the continental slope and shelf^{4,5} and recent studies during the breeding season found them foraging in cool, upwelled waters.¹¹

XAMU's nocturnal habits, concealed nests, and the inaccessibility of much of their nesting habitat make estimation of population size difficult. There are likely fewer than 7,000 breeding birds, with 30-35% occurring in southern CA.^{9,14} The majority nest on Santa Barbara Is. (approximately 60% of the CA population).^{1,3} A population viability analysis indicated that the size of the population on Santa Barbara Is. declined by 30-50% between 1977 and 1991, and that a continuing decline of this magnitude will cause the population to reach a critically low level by the year 2019.^{9,10} In addition, reproductive performance of this colony declined significantly between 1977-1985.¹⁵

Ecology

XAMU begin returning to staging areas offshore of colonies and visiting nest sites in late winter or early spring. Nests are typically in rock crevices or under shrubs on steep slopes, although they will also nest in burrows created by other species and under artificial structures.^{3,7} XAMU lay 2 eggs, approximately eight days apart. Both sexes incubate, with shifts of approximately 3 days beginning after the second egg is laid.^{3,7} During May



Darrell Whitworth

and Jun, chicks hatch synchronously and depart the island 1-3 nights after hatching, dispersing rapidly out to sea.^{3,7} Both parents remain with the chicks after they leave the nest, although it is unknown how long they remain together at sea.³ Annual estimates indicate that timing of breeding varies from year to year, probably reflecting food availability at the start of the breeding season.⁴

Limited information on diet indicates that XAMU rely primarily on larval anchovy, saury, and rockfish.^{4,5} Reproductive success fluctuates annually due to a combination of predation on eggs and adults, and variation in food supply.^{3,7,10} Changes in oceanographic conditions, including El Niño and regime shifts may affect XAMU food supply.^{8,10}

Conservation Concerns and Activities

The limited breeding distribution and small population make XAMU vulnerable to threats such as oil pollution, organochlorine contaminants, fishery bycatch, and bright lights.^{1,9} In the colonies, native predators, such as Barn Owls and Peregrine Falcons, can have a substantial impact on the population.^{2,12} Endemic deer mice prey on XAMU eggs, consuming an average of 46% of all eggs produced on Santa Barbara Is.¹⁰ Non-native predators include feral cats and rats.³ A liquid natural gas terminal is proposed off the Coronados

Is, MX.; light pollution, disturbance, potential fuel spills and predator introductions could all affect the murrelets nesting in this area. Bright lights associated with squid fishing operations could alter behavior and make XAMU more vulnerable to predation.

Feral cats have been removed from many of the Channel Islands, but they are still a problem at others.^{3,6} Removal of black rats from Anacapa Is. was undertaken as part of the American Trader Oil Spill Restoration Plan. The NGO, Island Conservation and Ecology Group, and the American Trader Trustee Council have initiated the removal of introduced predators on islands in MX. Channel Islands NP initiated a long-term monitoring program on Santa Barbara Is. in 1985 that continues today, with periodic monitoring occurring on other islands.

Recommended Actions

- Initiate U.S. and Mexico partnership to plan and implement joint protection, recovery, and education programs.
- Remove non-native predators from all active and potential nesting islands and protect islands from future introductions (*e.g.*, rats from San Miguel).
- Work with agencies and industry to determine the effects of bright lights (*e.g.*, lights associated with squid fishery) on murrelets and develop ways to reduce these effects.

- Restore/expand breeding populations on islands from which XAMU have been extirpated/reduced.
- Develop and implement standardized protocols to assess and monitor populations.
- Investigate demographic parameters such as adult and juvenile survival, age at first breeding, frequency of breeding, reproductive success, etc.

Regional Contacts

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NWR Complex, Newark, CA
William Sydeman - PRBO Conservation Science
Conservation Science, Stinson Beach, CA

References: 1. Carter *et al.* 2000a; 2. Drost 1989; 3. Drost and Lewis 1995; 4. Hunt and Butler 1980; 5. Hunt *et al.* 1979; 6. Keitt 1999; 7. Murray *et al.* 1983; 8. Roth and Sydeman 2000; 9. Sydeman and Nur 1999; 10. Sydeman *et al.* 1998b; 11. Whitworth *et al.* 2000; 12. Wolf *et al.* 2000; 13. Briggs *et al.* 1987b; 14. Kushlan *et al.* 2002; 15. Sydeman *et al.* 2001.

Ancient Murrelet *Synthliboramphus antiquus*

Status

Federal: None

State: None

IUCN: None

NAWCP: HC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
2	no	1-2	~30d	1-3d	Mar-Aug	crevice/burrow	pursuit diving	pelagic

Distribution, Population Status and Trends

Ancient Murrelets (ANMU) breed along the northern Pacific Rim, from China to WA.⁴ The southern extent of the eastern breeding range is a small colony in WA.^{13,14} Two subspecies are currently recognized; *S. a. antiquus* is the subspecies found in this Region.⁴ Post-breeding, ANMU move southward as far as southern CA.^{1,4} Based on frequent observations of ANMU in protected waters of WA and adjacent Canadian waters, it appears that these areas are important wintering habitat for this species.^{10,11} ANMU are also recorded in low numbers in OR and CA waters during winter and early spring.¹² Foraging is in small, scattered groups mostly over the continental shelf and shelf break.^{9,15}

Population estimates are difficult to obtain for this species, but the world population is likely between 1-2 million birds, with the core of the population in British Columbia and AK.⁴ The first documented breeding in this Region was in 1924, at Carroll Is., WA.¹³ It is not known if ANMU currently nest in WA, but is considered probable based on early Apr observations of staging adults between Carroll Is. and Jagged Is.¹⁴ (U. Wilson pers. comm.). Data indicate declines throughout the range primarily due to introduced mammalian predators on colony islands.^{2,4}

Ecology

ANMU begin returning to staging areas offshore of breeding colonies in Mar, approximately one month prior to egg-laying, and begin visiting nest sites 2-3 weeks prior to egg-laying.⁴ ANMU are nocturnal at the breeding colonies and usually exhibit nest site fidelity and long-term pair bonds.^{6,7} Nest sites are found on the steep slopes of densely forested or grass-covered islands^{4,6} and can be up to 400 m from sea.⁷ ANMU typically nest in burrows, but will nest in rock crevices or under human-made structures.⁴ Egg-laying occurs from early Apr through mid-May, becoming progressively later at more northerly latitudes.⁴ Incubation is shared equally by both



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sexes, and shifts of approximately 3 days begin after the second egg is laid, though a period of egg neglect prior to the onset of incubation is common.^{4,6} Chicks hatch synchronously, and family groups leave the nests 1-3 nights after the chicks hatch.^{4,6} The chicks remain with the parents for at least one month after leaving the colony.⁴

Diet data indicate ANMU feed primarily on euphausiids during the early part of the breeding season before shifting to a diet composed mainly of juvenile fish.^{4,5,8} Data from birds collected off Vancouver Is., B.C. indicate they feed almost entirely on euphausiids during the non-breeding season.^{4,5}

Conservation Concerns and Activities

The colony at Carroll Is. is vulnerable given its small size and location at the southern extent of the range. However, these traits also limit the importance of this colony to the health of the total population. Given the post-breeding southern dispersal, at-sea threats are the highest concern for this Region. At sea, ANMU may be negatively impacted by oil pollution and interactions with fisheries.^{3,4} An oil spill could be devastating if it occurred near a staging area during the breeding season or when chicks fledge and are flightless.^{3,4} During the 1950s and 1960s mortality of ANMU was linked to salmon-

fishing activities near Langara Is., B.C. due to attraction to vessel lights and drowning in gillnets.¹⁶ Currently, it is unknown what the magnitude of the interaction is between ANMU and fisheries, which may be especially important in the foraging habitat in the inshore waters of WA.

Recommended Actions

- Work with Canada to ensure recovery and protection of ANMU populations.
- Document current breeding status in WA.
- Evaluate the mortality of ANMU in commercial fisheries.

Regional Contacts

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Anthony Gaston - Canadian Wildlife Service,
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References: 1. Briggs *et al.* 1987a; 2. Gaston 1990; 3. Gaston 1994a; 4. Gaston 1994b; 5. Gaston *et al.* 1993; 6. Sealy 1976; 7. Gaston and Jones 1998; 8. Sealy 1975; 9. Vermeer and Rankin 1984; 10. Wahl 1975; 11. Wahl *et al.* 1981; 12. Briggs *et al.* 1992; 13. Hoffman 1924; 14. Speich & Wahl 1989; 15. Vermeer *et al.* 1985; 16. Bertram 1995.

Cassin's Auklet *Ptychoramphus aleuticus*

Status

Federal: BCC (32)

State: WA-C, CA-SC

IUCN: None

NAWCP: MC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	~40d	~45d	Feb-Oct	burrow/crevice	pursuit diving	offshore

Distribution, Population Status and Trends

Cassin's Auklets (CAAU) breed from the western Aleutians to central Baja California, MX.⁷ Two subspecies have been recognized, *P. a. aleuticus*, distributed throughout most of the species' range, and *P. a. australe*, limited to central Baja California.^{7,16} Post-nesting dispersal is variable, with southern populations mostly resident and northern populations (AK and British Columbia) migrating south.¹⁰ A greater number of CAAU are seen in CA waters in the fall and winter than nest in CA, OR, and WA combined.⁵ There are seasonal shifts in foraging locations, with post-breeding birds generally occurring farther offshore as dictated by variable distributions in prey resources.^{18,19} During the breeding season, CAAU are concentrated near their colonies and forage mostly over the outer shelf.¹⁹

Current population size is estimated at 3.6 million breeding birds.^{10,20} The core of the CAAU population is in British Columbia. The Pacific Region encompasses <5% of the global population: 63% in WA (87,600), 37% in CA (50,600), and <1% in OR (500).^{6, 10, 22} The largest colonies in this Region are on Alexander Is., WA (54,600) and the Farallons (20,000).^{10,15,22} The breeding population on the Farallons was estimated at 105,000 birds in 1971,²¹ 38,274 in 1989,⁶ and 20,000 currently.²² The largest colony in the world is at Triangle Is., B.C., Canada with approximately 1.1 million breeding birds (548,000 breeding pairs), although this population is declining.⁴ Populations of CAAU appear to be declining at several locations throughout the species' range and several historic colonies have disappeared, mainly due to introduced predators.¹⁰ Reasons for the declines include predation¹¹ and changes in prey resources.^{3,14,23,24}

Ecology

CAAU visit some breeding colonies year-round, although they may be absent for months in the fall.^{1,9} Nesting occurs in small and large colonies on coastal



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islands, and activity at the colonies is nocturnal.¹ CAAU breed in natural crevices or burrows, which they dig.¹⁰ Mean age of first breeding at the Farallon Is. colony is 3 years with a range of 2-10 years.¹⁴ The breeding season can be extended, with egg-laying occurring between Feb - Aug in CA. Production of two broods in a single breeding season can occur in CA and MX when the food supply is adequate,¹ but due to shorter breeding seasons does not occur in more northerly colonies. Both sexes participate in incubation.^{9,10}

Chicks are fed euphausiids, crustaceans, amphipods, decapods, copepods, mysids, larval squid and fish.^{3,5,17} Longevity ranges up to 23 years (PRBO unpubl. data).

Conservation Concerns and Activities

Annual survival of adults at Triangle Island, Canada and the Farallon Is. have been estimated at 67-70%, which is thought to be too low to sustain the population given other life-history parameters.^{4,12} In conjunction with low adult survival at some of the main breeding colonies, CAAU face several threats, including entanglement in gillnets and other fishing gear² and effects of oil spills.^{10,13} Predation by the introduced house mouse on eggs and small chicks may occur on the Farallons (K. Mills, unpubl. data). Predation of adults by Barn Owls occurs in the

Channel Islands and possibly the Farallons.²⁵ An indirect human effect is increased chick predation by gull populations that have been artificially inflated due to human practices.¹¹ A possible human-related effect relates to global warming and warming of the oceans, which appears to be correlated with declines in the prey resources of CAAU.^{3,8,14}

Recommended Actions

- Assess the impacts of contaminants and oil pollution.
- Investigate the effects of climate change on prey resources, CAAU diet and population dynamics.

Regional Contacts

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References: 1. Ainley and Boekelheide 1990; 2. Ainley *et al.* 1981b; 3. Ainley *et al.* 1996; 4. Bertram *et al.* 2000; 5. Briggs *et al.* 1987a; 6. Carter *et al.* 1992; 7. Gaston and Jones 1998; 8. Kitaysky and Golubova 2000; 9. Manuwal 1974; 10. Manuwal and Thorenson 1993; 11. Nelson 1989; 12. Nur *et al.* 1998; 13. Page *et al.* 1990; 14. Pyle 2001; 15. Speich and Wahl 1989; 16. Van Rossem 1939; 17. Vermeer *et al.* 1985; 18. Harrison 1983; 19. Briggs *et al.* 1987b; 20. Kushlan *et al.* 2002; 21. Manuwal 1972; 22. Warzybok *et al.* 2002; 23. Sydeman *et al.* 2001; 24. Abraham and Sydeman 2004; 25. McIver 2002.

Rhinoceros Auklet *Cerorhinca monocerata*

Status

Federal: None

State: CA-SC

IUCN: None

NAWCP: LC/HC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	~42d	~49d	Apr-Aug	burrow/crevice	pursuit diving	coastal

Distribution, Population Status and Trends

Rhinoceros Auklets (RHAU) breed from Japan, along the Aleutian Islands, to southern CA.^{5,8} RHAU are present in waters off WA, OR and CA throughout the year. However, birds move south in a post-breeding dispersal to important wintering areas off CA and numbers decline to low levels in the two northern states in winter (except the inland waters of WA).^{18,20} There is also a shift from waters over the continental shelf and at the shelf break during breeding^{7,18} to waters seaward of the shelf off CA in winter.²⁰

World population estimates are extremely rough at 1.5 million breeding birds, with approximately 1 million in the North American segment.⁵ Most (>95%) of the North American population breeds on islands in southeast Alaska (12%), British Columbia (73%) and WA (13%), with most birds concentrated at 8 colonies.⁵ Two of these key colonies are located in WA (~50,000 birds) at Protection and Destruction Islands.¹⁶ Less than 1,000 individuals are estimated to breed in OR¹⁹ and 2,000 in CA.² RHAU were extirpated from CA circa 1860, but over the past 30-40 years, population numbers have increased and birds have re-colonized the historic range.^{5,6} Populations at Protection Is. increased from 6,000 - 8,000 in the 1950s¹¹ to 40,600 in 1983.¹⁷ More recently, populations at this key WA colony appear to be declining⁵ and the population at the Farallons has shown a diminishing reproductive performance since 1986, although this was not significant.¹²

Ecology

Despite the name, RHAU are more closely related to puffins than to auklets. RHAU dig burrows, although when soil is limited they will nest in crevices. In WA, they nest predominantly on shrubby and grassy slopes that face the sea and to a lesser degree on cliffs and flat areas of islands.¹⁶ At most colonies, RHAU are nocturnal or crepuscular, although they are also diurnal at some colonies. Birds return to breed at 3-5 years and pairs often



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remain together in successive years.²¹ The breeding season is from Apr- Aug, and egg laying occurs earlier in CA than WA.⁵

RHAU are wing-propelled, pursuit divers and their diet consists mainly of schooling mid-water fishes and squid.¹² Prey composition is variable among colonies.^{9,12,15} On Destruction Is. in 1974-1981 main prey included anchovy, night smelt, sandlance, and herring, although they switched to Pacific Saury in 1983.¹⁶ On Año Nuevo Is. (ANI), between 1993-2000 main prey included anchovy, but they also switched to Pacific Saury in 1998. Saury are usually found farther offshore, and are lower in nutritional and energetic value than preferred prey items. In 2001-2002 RHAU chick diet on ANI consisted mostly of juvenile rockfish.

Conservation Concerns and Activities

Documented and potential threats to the RHAU populations in this Region include predation, oil contamination, fisheries interactions, and habitat degradation. Historically, extirpations were caused, at least in part, by introduced mammalian predators. RHAU did not return to Southeast Farallon Is. until introduced rabbits were eradicated in 1972; they may have competed with RHAU for nesting space.¹ Mortality has been documented at breeding colonies

from Peregrine Falcon, Bald Eagle, and other avian predators.^{4,13,16} Disturbance and trampling of burrows by humans, pinnipeds, surface nesting or roosting birds, or introduced animals can cause nest loss and lowered reproductive success. RHAU was the second most common species killed in the *Apex Houston* oil spill off central CA.¹⁰ Mortalities have been documented in the CA and WA gillnet fisheries^{3,14} and declines observed since the 1980s at some WA colonies may be due to gillnet mortality.⁵ Long-term foraging and population studies are currently maintained on Año Nuevo Is. and the Farallons (CA) and WA colonies.

Recommended Actions

- Assess population size and document trends at colonies throughout the Region. Investigate causal relationships for declines.
- Investigate the relationship between RHAU demographics, forage fish resources, and commercial fisheries and evaluate possible impacts.
- Coordinate with Canada, NOAA Fisheries, the states, and Tribes to minimize fishery bycatch. Observer programs are needed to quantify mortality of RHAU in gillnets.

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Tufted Puffin *Fratercula cirrhata*

Status

Federal: None

State: CA-SC, WA-C

IUCN: None

NAWCP: LC/MC

Egg	Relay	Young	Inc	Fledge	Breed	Nest	Feeding Behav	Marine Habitat
1	yes	1	~42d	~40d	May-Sep	burrow/crevice	pursuit diving	coastal/pelagic

Distribution, Population Status and Trends

Tufted Puffins (TUPU) are endemic to the North Pacific, breeding from Japan to CA, and as far north as the Chukchi Sea.^{6,8} The southeastern extent of its range is now thought to be the Farallon Is. in central CA,⁸ although historically it was documented breeding as far south as the Channel Islands.^{5,8} Recent evidence suggests that TUPU may be re-colonizing this area.¹⁰ Generally solitary at sea, TUPU disperse in offshore waters during the winter with a corresponding southerly expansion of their range¹¹ and are most common seaward of the continental slope up to 180 km offshore.¹² During the breeding season, TUPU are seen foraging in waters seaward of their colonies.^{4,12}

The total TUPU breeding population has been estimated at just under 3 million breeders,¹⁵ though accurate estimates are difficult, as in most crevice-nesting seabirds. Approximately 82% breed in North America and only 1% in this Region. During the 1980s, the largest breeding colonies in this Region were on Jagged Is. (7,800 birds), Alexander Is. (4,000 birds), and Carroll Is. (2,700 birds) in WA,¹³ and Three Arch Rk. (4,600 birds) in OR.⁵ However, based on data from numerous published and unpublished sources, declines of 3% - 21% per annum were estimated for CA, OR, and WA, over the past 15 years.¹⁵ Overall, population trends appear to be increasing in the Gulf of AK and westward, and declining throughout southeast AK and south through CA.¹⁵ It is hypothesized that these trends are in response to decadal changes in large scale ocean currents.¹⁵

Ecology

TUPU return to their colonies in Apr-May and excavate burrows⁵ though they also nest in rock crevices and nest boxes.⁸ Burrows are generally found in steep, sea-facing slopes with sparse vegetative cover.¹¹ They will nest in less-steep terrain, where they do not overlap with Rhinoceros Auklets.¹⁴ Pairs defend a territory that includes the



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burrow entrance, a path to the burrow and a landing area.⁸ TUPU are generally monogamous and will stay together through several seasons, usually using the same nest site.^{1,5,8} Egg-laying begins in early May,¹ but is delayed with an increase in latitude.⁵ Females often lay replacement eggs if the first egg is lost early in the breeding season.¹ Chicks are brooded for the first 5-7 days, after which they are left alone during the day while the parents forage.⁵

TUPU are wing-propelled pursuit divers, capable of reaching depths of over 100 m.¹ They feed on fish, squid, crustaceans and polychaetes, although chicks are fed almost exclusively fish.^{5,8} Adults can carry 12 fish or more, crosswise in their bills, when feeding chicks.¹³ Rockfish and anchovies are important prey

items off the coast of CA.¹ Parents range far from breeding colonies on foraging excursions^{5,8} and return to feed chicks three times daily.^{5,10}

Conservation Concerns and Activities

TUPU are vulnerable to oil pollution,⁹ entanglement in fishing gear,² and predation from introduced mammals.⁵ Introduced species, such as rabbits, may compete for burrow space.^{1,14} Populations may decline at some locations as a result of the re-establishment and recovery of Rhinoceros Auklets, where they compete with TUPU for available nesting habitat.¹ Competition with commercial fisheries⁷ and high losses in gillnet fisheries² has also contributed to their decline in some areas. There is a general lack of information available for TUPU nesting in the Region, because of the inaccessibility of nests and small populations at many locations.^{1,3}

Recommended Actions

- Develop and implement standardized protocols for determining population status and trends.
- Protect breeding sites from human disturbance and introduced mammal predation.

- Encourage development of Observer Programs on commercial fishing vessels to quantify TUPU entanglement and mortality in nets. Work with regulating agencies and industry to minimize bycatch.
- Continue or initiate long-term monitoring at key colonies throughout the Region to track population trends, other demographic parameters, and diet to investigate the relationship between large-scale oceanographic/ climate cycles, prey ecology, and TUPU trends.

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