PEREGRINE FALCON MONITORING ON THE CALIFORNIA CHANNEL ISLANDS, CALIFORNIA, 2016

Prepared by:

Peter B. Sharpe
Institute for Wildlife Studies
Post Office Box 1104
Arcata, California 95518

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EXECUTIVE SUMMARY

American peregrine falcons (*Falco peregrinus anatum*) historically were common residents on all the California Channel Islands, with an estimated 15-30 pairs. Peregrine numbers plummeted across much of the northern hemisphere starting in the late 1940s and the peregrine population on the Channel Islands was drastically reduced or extirpated by 1955, likely as a result of the effects of DDE on egg hatchability.

The Santa Cruz Predatory Bird Research Group began peregrine falcon restoration on the Channel Islands in 1983, releasing 37 peregrine falcons on the islands through 1998. The first known successful hatching occurred on Anacapa Island in 1989. There were 9 occupied territories on the islands in 1992, 27 in 2007, 45 in 2013, and 48 in 2014, and 48 in 2015.

In 2016, the Institute for Wildlife Studies surveyed 50 historic peregrine territories on the Channel Islands using a combination of passive and call-broadcast surveys, of which 44 (88%) were occupied. We located 2 new territories (1 on Santa Cruz, 1 on San Nicolas) and there was at least 1 occupied territory on each island. There were 8 occupied territories on San Miguel Island, 11 on Santa Rosa Island, 15 on Santa Cruz Island, 4 on Anacapa Island, 3 on San Nicolas Island, 3 on Santa Barbara Island, 1 on Santa Catalina Island, and 1 on San Clemente Island. The northern Channel Islands continue to be the stronghold for Channel Island peregrine falcons, likely due to more suitable nesting habitat and a larger prey base as compared to the southern Channel Islands. In addition, the northern Channel Islands are closer together, allowing peregrines to move more freely between the islands.

A minimum of 57 chicks are known to have hatched on the Channel Islands in 2016, of which 51 (89%) are known to have survived to ~28 days of age. The earliest and latest dates for the start of incubation of a first clutch were 27 February (MC72 North Signal Peak, Santa Barbara Island) and 28 April (MC21 West Anacapa), respectively, a span of 61 days. Nest success and productivity in occupied territories with known outcomes was 60% and 1.2 chicks/occupied territory, which was lower than 2014-2015.

We collected 143 prey items from 14 territories on 4 islands, of which 113 items (79%) were identified to species level, representing 32 different species. The most common species identified were California Gulls (n=22), Red-necked Phalaropes (n=17), and House Finch (n=11).

Measurements on eggshell fragments and/or addled eggs collected from 13 peregrine territories on 4 islands had average thinning of 22.6%, which is an increase from the 10% recorded in 2015. Eggshell thinning in 2016 ranged from 9.6% to 36.3% and was generally higher on Santa Rosa Island.

The peregrine population on the California Channel Islands has recovered to a level that is above predicted historic levels and current productivity appears sufficient to at least maintain the population. However, more study into basic population parameters, such as survival, emigration and immigration rates on the islands is required, as well as continued monitoring of the potential effects of DDE contamination on eggshell thickness and hatching success.

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INTRODUCTION

American peregrine falcons (*Falco peregrinus anatum*; hereafter peregrines) historically were common residents on all the California Channel Islands (Willett 1912, Howell 1917, Kiff 1980), although the highest number of reported nests in a single year was 15 (Kiff 1980, 2000). Because peregrines and their nests are less conspicuous to casual observers than are other raptors historically found on the Channel Islands, such as bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*), historical estimates of the number of peregrines on the islands were almost certainly too low (Kiff 1980) and could have been 30 or more pairs (Hunt 1994).

Peregrine numbers plummeted across much of the northern hemisphere starting in the late 1940s (Hickey and Anderson 1969). Peregrines were at their lowest numbers in the 1960s and early 1970s, at which time they were extirpated from the eastern United States and across the Midwest and reduced to a few hundred pairs in the western United States and Mexico (USFWS 2003). Approximately 100 peregrine eyries in California were producing young each year until at least the mid-1940s, with more than a third of the verified or suspected peregrine nest sites occurring within 10 miles of the ocean, including the Channel Islands (Herman et al. 1970). By 1970, the number of breeding peregrines had dropped by at least 95% in California (Herman et al. 1970, Herman 1971). It appears that nests along the southern coast suffered the earliest reductions and the peregrine population on the Channel Islands was drastically reduced or extirpated by 1955 (Herman et al. 1970), with the last reported sighting of a probable Channel Islands breeding adult occurring on Anacapa Island in 1949 (Kiff 1980).

Overwhelming evidence indicated that declines in peregrines and other bird species feeding higher on the food chain were a result of the effects of DDE, a metabolite of DDT, on egg hatchability (Kiff 1980, Mesta 1999, Kiff 2000). The apparent source of the DDT pollution in the Southern California Bight was eventually traced to the Montrose Chemical Corporation's manufacturing plant in Torrance, California. Between 1947 and 1961, an estimated 37 to 53 million liters of DDT-contaminated acid sludge, containing 348-696 metric tons of DDT, was disposed at an ocean dump site 16 km northwest of Catalina Island (Chartrand et al. 1985). In addition, an estimated 1800 metric tons of DDT was discharged from the Joint Water Pollution Control Plant outfall, 3.3 km offshore of Palos Verdes Peninsula (Chartrand et al. 1985).

Peregrines were listed as endangered in 1970 under the Endangered Species Conservation Act of 1969, and later under the Endangered Species Act of 1973 (Mesta 1999). Populations

rebounded following restrictions on the use of organochlorine pesticides in Canada and the United States (banned in 1970 and 1972, respectively) and successful management activities, including the reintroduction of captive-bred and relocated peregrines (Mesta 1999). Between 1983 and 1998, the Santa Cruz Predatory Bird Research Group (SCPBRG) released 37 peregrines on the Channel Islands (12 on San Miguel, 17 on Catalina, 4 on Santa Rosa, and 4 on Santa Cruz; Latta 2012). The first pairs with young were seen on Anacapa and Santa Cruz islands in 1989 and 1990, respectively (Hunt 1994). During a 1992 survey, Hunt (1994) located 9 active eyries on 4 of the Channel Islands. Peregrines were removed from the Endangered Species list in 1999, at which time breeding targets for the Channel Islands (5 pairs) and the Pacific Coast (185 pairs) had been greatly exceeded (Mesta 1999). Ten years later, peregrines were removed from the State of California's list of Endangered and Threatened Animals (California Department of Fish and Game 2011).

After a successful lawsuit against Montrose Chemical et al. for damage caused by the release of DDTs and PCBs into the Southern California Bight, the Montrose Settlements Restoration Program (MSRP) was created to implement restoration projects aimed at restoring natural resources that were directly or indirectly harmed by DDT and PCB contamination. The final consent decree for the Montrose case stated that "the Trustees will use the damages for restoration of injured natural resources, including bald eagles, peregrines and other marine birds, fish and the habitats upon which they depend" (Montrose Settlements Restoration Program 2012). The Montrose Settlements Trustee Council (MSTC) that was created to oversee the settlement monies is composed of representatives of Federal and State agencies that have interests in the Southern California Bight: the National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (FWS), National Park Service (NPS), California Department of Fish and Wildlife (CDFW), California State Lands Commission, and the California Department of Parks and Recreation.

Since the conclusion of peregrine survey efforts in the early 1990s, there were limited surveys conducted on the Channel Islands and the distribution and extent of breeding pairs was not known. Under Phase 1 of MSRP's Restoration Plan, the MSTC contracted with the SCPBRG to conduct a peregrine falcon survey and monitoring project in 2007. The goal of that monitoring effort was to assess the current status of peregrines on the Channel Islands and determine whether their recovery was still being affected by on-going contamination in the local food web

(Montrose Settlements Restoration Program 2005). The 2007 survey located 27 occupied territories on 5 of the 8 islands, but also found that DDE contamination still appeared to be reducing the reproductive success (Latta 2012).

Under Phase 2 of the MSRP Restoration Plan, peregrine surveys were to be conducted at 5-year intervals (Montrose Settlements Restoration Program 2012), although the survey scheduled for 2012 was delayed until 2013. After the Institute for Wildlife Studies (IWS) conducted surveys on all 8 Channel Islands in 2013, the MSTC agreed to our proposal to institute annual surveys through 2017 in order to gain more information on population demography and important population parameters, such as survival, immigration and emigration. As part of that effort, IWS located 45 occupied territories in 2013, 48 in 2014, and 48 in 2015 with at least 2 territories on each island in 2015. This report summarizes the results of the 2016 field season.

STUDY AREA

The California Channel Islands are composed of eight islands located off the coast of southern California (Fig. 1). All of the Channel Islands are subject to a Mediterranean climate

Figure 1. California Channel Islands located off the coast of southern California, USA.

regime characterized by cool, wet winters and warm, dry summers (Coonan and Schwemm 2009). The northern Channel Islands, which are composed of San Miguel Island, Santa Rosa Island, Santa Cruz Island, and Anacapa Island are located approximately 20 to 44 km off the coast of Ventura and Santa Barbara counties (Junak et al. 1995) and are a tightly clustered group with no more than 9.6 km separating adjacent islands (Moody 2000; Fig. 1). The southern Channel Islands, which are composed of San Nicolas Island, Santa Barbara Island, Santa Catalina Island, and San Clemente Island, are located 32-79 km from the mainland (Junak et al. 1995) and are more remote and scattered than the northern islands, with the closest islands (Santa Catalina and San Clemente Islands) separated by 34 km (Moody 2000; Fig. 1).

San Miguel Island (hereafter San Miguel) is owned by the U.S. Navy, but managed by the NPS (Fig. 1). It is approximately 13 x 6 km with a land area of approximately 37 km^2 and a maximum elevation of 253 m (Junak et al. 1995). The island is primarily a gently sloping plateau with long, sandy beaches that is fully exposed to the prevailing northwesterly winds (Coonan and Schwemm 2009).

Santa Rosa Island (hereafter Santa Rosa) is the second largest of the Channel Islands and is owned by the NPS (Fig. 1). The island is approximately 24 x 16 km and encompasses about 217 km^2 with a central mountain range reaching an elevation of approximately 475 m (Junak et al. 1995, Rick 2009). The central highland is dissected by drainages; a relatively gentle marine terrace occurs north of the highland, whereas steep, deeply incised drainages comprise much of the south portion of the island (Coonan and Schwemm 2009).

Santa Cruz Island (hereafter Santa Cruz) is the largest of the 8 Channel Islands and is owned by the NPS (eastern 24% of the island) and The Nature Conservancy (TNC; western 76% of the island). The island measures about 38 km long by 12 km wide at its widest point (Fig. 1), encompassing approximately 249 km^2 with a maximum elevation of 753 m (Junak et al. 1995).

Anacapa Island (hereafter Anacapa), which is composed of 3 islets (East, Middle, and West Anacapa; Fig. 1) is owned by the NPS. The island encompasses approximately 2.8 km^2, spanning about 8 km from end to end and reaching a maximum elevation of 283 m (Junak et al. 1995).

San Nicolas Island (hereafter San Nicolas), owned by the U.S. Navy, is the most remote of the Channel Islands. It is located 98 km from the mainland (Junak et al. 1995) and 45 km from

its nearest neighbor, Santa Barbara Island (Moody 2000; Fig. 1). It is approximately 13 x 5 km in size and has an area of about 58 km^2 and a maximum elevation of 277 m (Junak et al. 1995).

Santa Barbara Island (hereafter Santa Barbara), owned by the NPS, is located 62 km from the nearest point on the mainland and 38 km east of its nearest neighboring island, Santa Catalina Island (Fig. 1). With an area of only 2.6 km^2 it is the smallest of the Channel Islands. It has a series of low terraces, with small peaks at the north and south ends of the island (high point at 193 m) and is bound by sheer cliffs on much of the north, west, and part of the south sides of the island (Drost and Junak 2009).

Santa Catalina Island (hereafter Catalina), located 34 km south of Long Beach, California, is owned primarily by the Santa Catalina Island Conservancy (~90%). The island is 34 km long, 0.8 to 13.0 km wide, and has an area of 194 km^2, 80 km of coastline, and maximum elevation of 648 m (Junak et al. 1995; Fig. 1).

San Clemente Island (hereafter San Clemente), owned by the U.S. Navy, is the southernmost of the Channel Islands, located approximately 92 km off the coast of California (Fig. 1). The island is 143 km^2, about 34 km long, and has a high point of 610 m (Willey 1997). It is characterized by a series of marine terraces on the west side and a steep escarpment on the east side (Kaiser et al. 2009)

METHODS

Permitting

Our peregrine research activities were covered by multiple state and federal permits. IWS has a Memorandum of Understanding and Scientific Collecting Permits (Permit #s SC-2485 [Peter Sharpe] and SC-0932 [David Garcelon]) with the CDFW to conduct peregrine research on the Channel Islands, a banding permit (# 21564) from the United States Geological Survey's Bird Banding Laboratory (BBL) allowing us to band peregrines with both federal and auxiliary leg bands and draw blood, and research permits from the NPS (Permit # CHIS-2016-SCI-0012) and the Santa Catalina Island Conservancy (Permit 12-014) to allow us to conduct our research on Channel Islands National Park islands and Santa Catalina Island. Authorization for Migratory Bird Treaty Act (MBTA) permits were delayed, so IWS was added to the Region 8 FWS MBTA permit (Permit# MB164274-0) to allow collection of feathers, failed eggs, and eggshells at nests.

Survey Method

We used a survey method similar to that used by the National Park Units in the Northern Colorado Plateau Network (NCPN), as described by Daw et al. (2006). The protocol involved monitoring potential nesting areas for up to 4 hours, normally the maximum time between eyrie visits/exchanges at the ledge (Daw et al. 2006), with a minimum of 3 visits to each known territory between February and June. The NCPN protocol allows for the use of recorded vocalizations to elicit vocal or behavioral responses from territorial birds, which has been found to increase the likelihood of detection and decrease the amount of time required to detect many bird species (Johnson et al. 1981, Anderson 2007, Barnes et al. 2012). Although call broadcast surveys have typically been used for forest-dwelling raptors (Kimmel and Yahner 1990, Watson et al. 1999), they have also been used for non-forest raptors (Balding and Dibble 1984).

The call-broadcast technique we incorporated into our survey protocol was developed by Barnes et al. (2012) to survey for peregrines in the Lake Mead National Recreation Area. The 10-minute survey protocol begins with a 3-min passive observation period, followed by a 30-sec broadcast period, a 1-min observation period, a second 30-sec broadcast period, and a final 5-min passive observation period. We loaded recorded peregrine vocalizations (Stokes Field Guide to Bird Songs: Western Region; Time Warner Trade Publishing, New York, NY), which were converted to mp3 format to be compatible with a digital game caller (FOXPRO NX4, FOXPRO Inc., Lewiston, PA). The vocalizations consisted of 5 sec of the 'cack' alarm call, immediately followed by 10 sec of the 'eechup' call from an adult female peregrine (described in Linthicum 1996), which were looped to produce 30 sec of continuous calling. During the call-broadcast a surveyor rotated up to 360° (depending on terrain, habitat, and broadcast location) in order to evenly project the sound around the broadcast point and the broadcast was discontinued immediately when a responding peregrine was detected.

We used the 4-hr passive observation and/or the 10-min call-broadcast protocol, depending on where and when we were conducting the survey, as described below. We did not conduct surveys or monitoring during periods of heavy rain, heavy fog, or severe cold. The general protocol called for not conducting surveys or monitoring during periods of sustained high winds greater than 25 km/h (~15 miles/hour). However, the Channel Islands, especially San Miguel, Santa Rosa, San Nicolas, and Santa Barbara, can have long periods of high winds, which would have made it impossible to conduct any surveys for a week or more. Therefore, when

there were high winds we attempted to conduct most surveys/monitoring on leeward sides of the islands. If it was necessary to survey during high winds, we did not include the survey in the minimum of 3 surveys required to determine that a territory was unoccupied.

Surveying Historic Nesting Areas

IWS biologists began surveying territories for activity in February 2016. All known territory locations on the Channel Islands reported by Latta (2012), the CDFW's database (provided by Carie Battistone), and our 2013-2015 surveys (Sharpe 2014, 2015, 2016) were uploaded into Garmin eTrex 20 GPS units (Garmin International Inc., Olathe, KS) to assist in locating the known territories on each island. We added satellite imagery (BirdsEye Satellite Imagery™, available through Garmin Basecamp™) onto each GPS unit for ease of orienting in relation to geographic features.

Initial surveys at each historic territory included a 10-min call-broadcast survey, followed by up to 4 hours of passive observations if no peregrines were detected. For each visit to an historic territory we completed a Peregrine Falcon Monitoring Occupancy and Productivity Data Form (Appendix I). If any peregrines were detected, we would return at approximately 10-14 day intervals for further monitoring (see Monitoring Active Territories below). If no pair was detected, we usually returned at least 2 more times at approximately 1-month intervals to verify that the territory was inactive.

Surveying for New/Unknown Territories

We used the 10-min call-broadcast method to conduct ground-based and boat surveys for new or unknown peregrine territories on the islands. Although peregrine habitat typically contains tall cliffs (50+ m) to serve as perching and nesting sites (Johnsgard 1990), we did not assume that those were the only places that peregrines would nest on the islands. In other studies, peregrines have been found nesting on the ground (Hickey and Anderson 1969, Pagel et al. 2010) and in tree nests of other raptors and in tree cavities (Campbell et al. 1977). Because peregrine nests have historically been found far inland in canyons on Santa Rosa (Pemberton 1928), we surveyed for peregrines both along the coastal bluffs and cliffs and in interior portions of the islands. Call-broadcast locations during a single day were generally ~1 km apart, although they could be more closely spaced if required for adequate coverage in areas of high topographic

relief that may have minimized the distance at which the broadcast could be heard by peregrines (e.g., opposite sides of a steep ridge, along a coastline with many harbors or prominent points) or where ocean noise impacted our ability to hear responding peregrines. We used GPS units to record our daily survey routes, call-broadcast locations, and sightings of peregrines. At each call-broadcast location we completed a Call-Broadcast Survey Form (Appendix II). We revisited areas with potential peregrine habitat at approximately monthly intervals to determine whether birds had gone undetected or had occupied an area after a previous survey.

Monitoring Active Territories

A primary goal of peregrine monitoring under Phase 2 of the MSRP Restoration Plan was to determine breeding chronology and outcome, including egg-laying and incubation periods, reproductive success/failure, recycling attempts, and number of young produced and fledged (Montrose Settlements Restoration Program 2012). We attempted to visit occupied territories at 10-14 day intervals to estimate the chronology of the breeding season. We were able to refine estimates of lay and hatch dates by aging the chicks using photos and descriptions in Clum et al. (1996) and Moritsch (1983) with an assumed incubation period of 33 days (Linthicum 1996). We only used the 10-min call-broadcast about 1 time per month at active territories, if needed, to minimize the chance that the birds would become acclimatized to the recorded vocalizations. We observed peregrines and potential or known nest sites from a distance of 150-1500 m using 20-60x spotting scopes and binoculars. Distances to peregrines or nest sites were estimated using a distance measuring function on our GPS units.

On each visit to an active territory we recorded data on weather conditions, time, observer location, peregrines observed, and behavior of any adult and chicks on the Peregrine Falcon Monitoring Occupancy and Productivity Data Form (Appendix I). To standardize behavioral observations made during these visits, we used the definitions and descriptions in Linthicum (1996). At each territory we took digital photos of the general area where peregrine activity was observed, the eyrie (if known and visible), and the adult birds, if possible. For territories with chicks, we made our last visits when chicks were $\geq$ 28 days of age to determine success (see Terminology below).

Nest Entry and Banding

We entered active nests either when the chicks were approximately 21-28 days of age (recommended age range is 21-35 days; Heinrich 1996). We lowered the upper age limit to minimize the likelihood of chicks jumping from the eyrie. We evaluated each eyrie prior to entry to determine the safest anchoring technique(s) and route of entry. For eyries that were only visible from a distant location, a biologist remained at the observation point and used a handheld radio to help direct the climbing team to the eyrie. Chicks were placed in a small duffle bag and carried to the top of the nest cliff for processing.

Peregrines exhibit reverse size dimorphism and sex can be determined accurately based upon their size and appearance (Burnham et al. 2003). We determined the sex of each chick primarily based on weight, overall size, and the breadth of the tarsi (Burnham et al. 2003, J. Barnes, personal communication). We attempted to band chicks when they were at least 21 days old, at which time they had developed sufficiently so that differences in the size of the tarsus was evident (Craig and Enderson 2004). Males were fit with a USFWS lock-on #6 band on the left leg and a black anodized aluminum band with silver alphanumerical characters (Acraft Sign & Nameplate Co., Edmonton, Alberta, Canada) on the right leg, and females were banded with a USFWS lock-on #7A band on the right leg and an Acraft band on the left leg. If there was any question as to the sex of the birds, then we used the female bands (Heinrich 1996, Gustafson et al. 1997). We collected approximately 0.5 cc of heparinized whole blood from most chicks for future DNA and/or contaminants analyses. We recorded banding and morphological information for each chick on a banding form (Appendix III).

During nest entries we collected eggshell fragments and prey remains. Samples were labeled and delivered to the Western Foundation of Vertebrate Zoology (WFVZ, Camarillo, CA) for determination of shell thickness (addled eggs and fragments) and prey identification. We enhanced nest ledges, if necessary, by removing sharp stones or adding suitable substrate to reduce the chance of eggs breaking in the nest in the future.

Prey Remains

Prey remains delivered to the WFVZ were analyzed by N. John Schmitt. He keyed out prey items using a reference collection and determined the minimum number of individuals

(MNI) based upon duplicate feathers or body parts (e.g., 2 left feet of a species would indicate a minimum of 2 individuals).

Eggshell Measurements

René Coronado (WFVZ) measured the thickness of eggshells using 2 methods. Method 1, referred to as the René Coronado "RC" method, used a measuring device consisting of a thin gauge wire mounted to a digital gauge (Starrett Gauge; 0.00005 mm resolution) fixed to a mounting bracket with a moveable bottom plate. For whole eggs, 10 shell measurements were taken around the equator of each egg (not at the poles because more calcium is deposited at the ends), where there is no visible debris, both with and without the membrane, as applicable. If a membrane was no longer attached to the shell at the equator, then measurements were taken without membrane, but an average membrane thickness was measured separately and provided. For samples that contain only eggshell fragments, usually only 1-2 measurements were taken on each fragment. To ensure that the egg fragments actually belong to the species in question, only those fragments that could be clearly identified as peregrine eggshells were measured.

Method 2, referred to as the Sam Sumida "SS" method, used a mechanical gauge (Federal Gauge; 0.01 mm resolution) attached to the same mounting bracket and pin used in Method 1, to allow for comparison with historical measurements taken by Sam Sumida and the WFVZ prior to 2003. Method 2 used the same procedure as described for Method 1, except for the change in the gauge, and a tapping of the raising and lowering arm of the mounting bracket.

Percent eggshell thinning was calculated by comparing measured eggshell thickness with the standard pre-DDT peregrine eggshell thickness in California of 0.364 mm (Kiff 1994) using the equation N% = [1-(thickness/0.364)] x 100 (Latta 2012).

Terminology

Different states and groups have used various definitions to describe peregrine occupancy and nesting success, but we followed the guidelines in the 2003 Monitoring Plan for the American Peregrine Falcon (U.S. Fish and Wildlife Service 2003), as defined below.

Occupied Territory: a territory where either a pair of peregrines is present (2 adults or an adult/subadult mixed pair), or there is evidence of reproduction (e.g., incubation, brooding,

eggs or young, food delivery to an eyrie). We considered a territory occupied if there was evidence of occupancy on 2 or more visits to a territory.

Nest Success: the proportion of occupied territories on the Channel Islands in which 1 or more young ≥ 28 days old was observed, using the aging guidelines in Clum et al. (1996).

Productivity: the number of young observed at ≥ 28 days old per occupied territory, averaged across the Channel Islands.

We further categorized occupied territories based upon the following breeding stages (see Linthicum 1996 for further descriptions).

Courtship: behavior indicative of pair bonding, such as cooperative hunting, adult prey exchanges, copulation, or ledge courtship displays.

Incubation: adult observed in incubation posture (low horizontal position) or inferred to be incubating based upon behavior (for eyries that were not visible). The female does the majority of incubation, but the male will bring her food several times per day and relieve her at incubation. During incubation there is generally an adult present at the eyrie at all times, except when disturbed or for short periods on warm days.

Nestling: chick(s) present. May be able to see chicks, hear begging, or see adults in what appears to be feeding. Generally, only females brood and feed nestlings. An adult brooding young nestlings (< 7 days old) can look a lot like incubation, so we waited for a prey delivery to the eyrie to confirm that chicks were present.

Fledgling: when young reach ≥ 28 days old.

We classified the breeding activity of occupied territories as either successful, unsuccessful, or none as described below.

Successful: A pair produced 1 or more nestlings that survived until at least 28 days of age.

Unsuccessful: A pair that engaged in prolonged courtship or copulating that either did not produce eggs or failed during the incubation or nestling stage (chicks < 28 days old).

None: Pair present, but no or minimal signs of courtship observed.

Data Management

Data from the Peregrine Falcon Monitoring Occupancy and Productivity Data Forms (Appendix I) were entered into island-specific Excel files that were shared via the cloud-based

file storage program Dropbox. Dr. Sharpe combined the weekly data into a master database and the datasheets were kept on each island as backup records. We downloaded data from our GPS units daily to the free Garmin Basecamp™ program, which allowed us to evaluate which areas needed additional surveys and to share data among our biologists. Information from each Call-Broadcast Survey Form was entered for each corresponding point in Basecamp™ so that we could easily find the results of previous surveys.

RESULTS

Surveying and Nest Monitoring

We surveyed 50 historic peregrine territories on the Channel Islands and located 2 previously unknown territories (Table 1). We confirmed occupancy in 46 territories, with at least 1 occupied territory on each island (Figs. 2 and 3, Table 1, Appendix IV). Survey summaries for each island and territory are provided below.

San Miguel Island

Surveys began on San Miguel on 2 March and continued every other week through 27 June. We surveyed 10 previously known territories on San Miguel, of which 8 (80%) were confirmed occupied (Fig. 4, Table 1). We were unable to attempt banding at any nests on San Miguel in 2016 due to Navy restrictions and scheduling conflicts.

MC17 Hoffman Point: We confirmed a pair in the historic Hoffman Point territory (Fig. 4) on 6 March, the second of 11 visits to the territory. The pair was categorized as being in the courtship stage through 1 April and was incubating by 13 April. The birds were still incubating on 13 May, but had failed by our next visit on 25 May. During most visits to the territory, there was also a second-year bird present, in addition to the breeding pair.

MC28 Bat Rock: We confirmed a pair in the historic Bat Rock territory (Fig. 4) during our fourth visit on 2 April. The pair was first classified in the courtship stage on 18 April and we confirmed

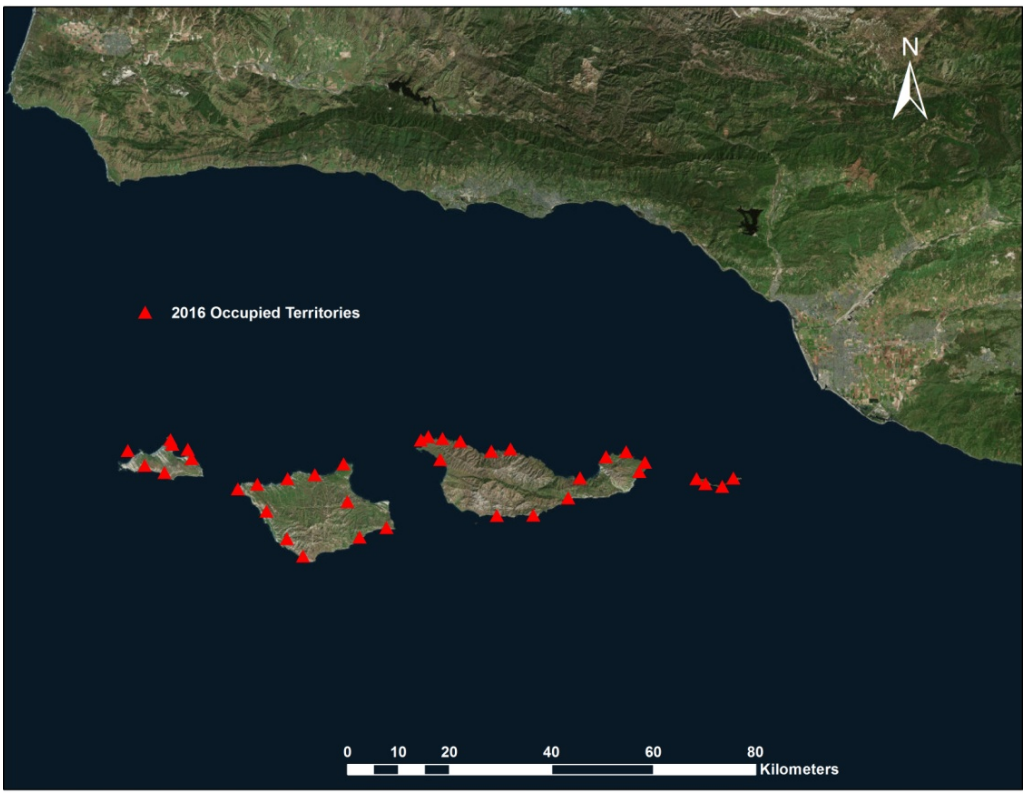

Figure 2. Occupied peregrine territories on the northern Channel Islands in 2016.

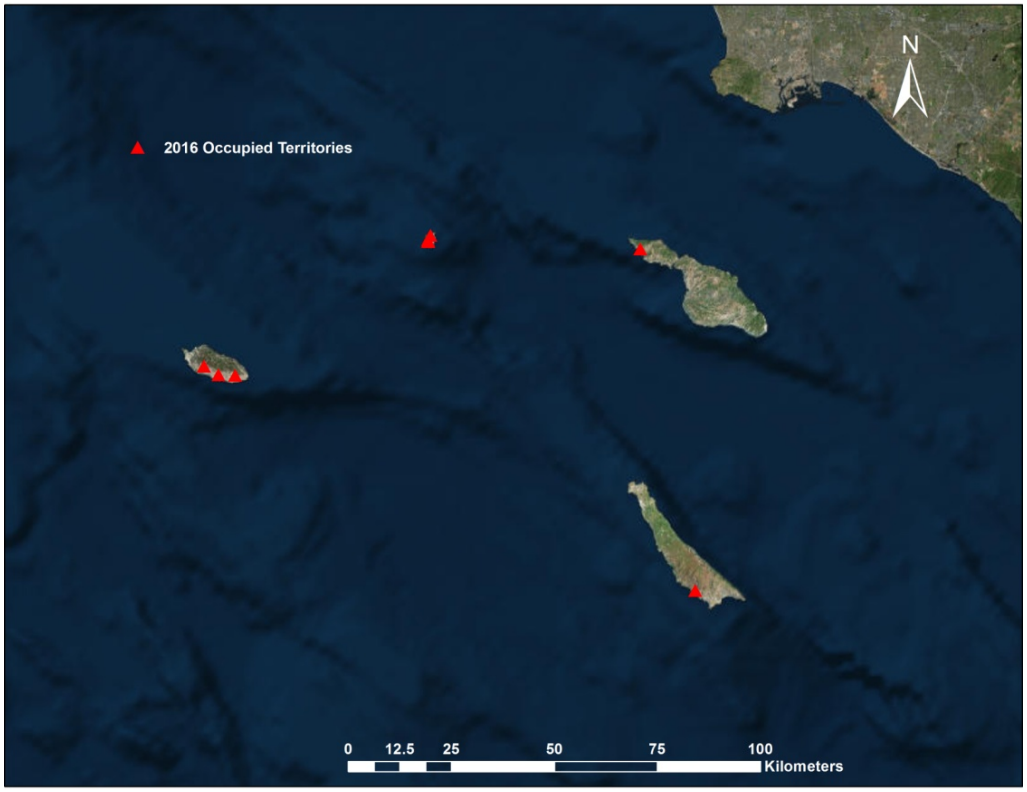

Figure 3. Occupied peregrine territories on the southern Channel Islands in 2016.

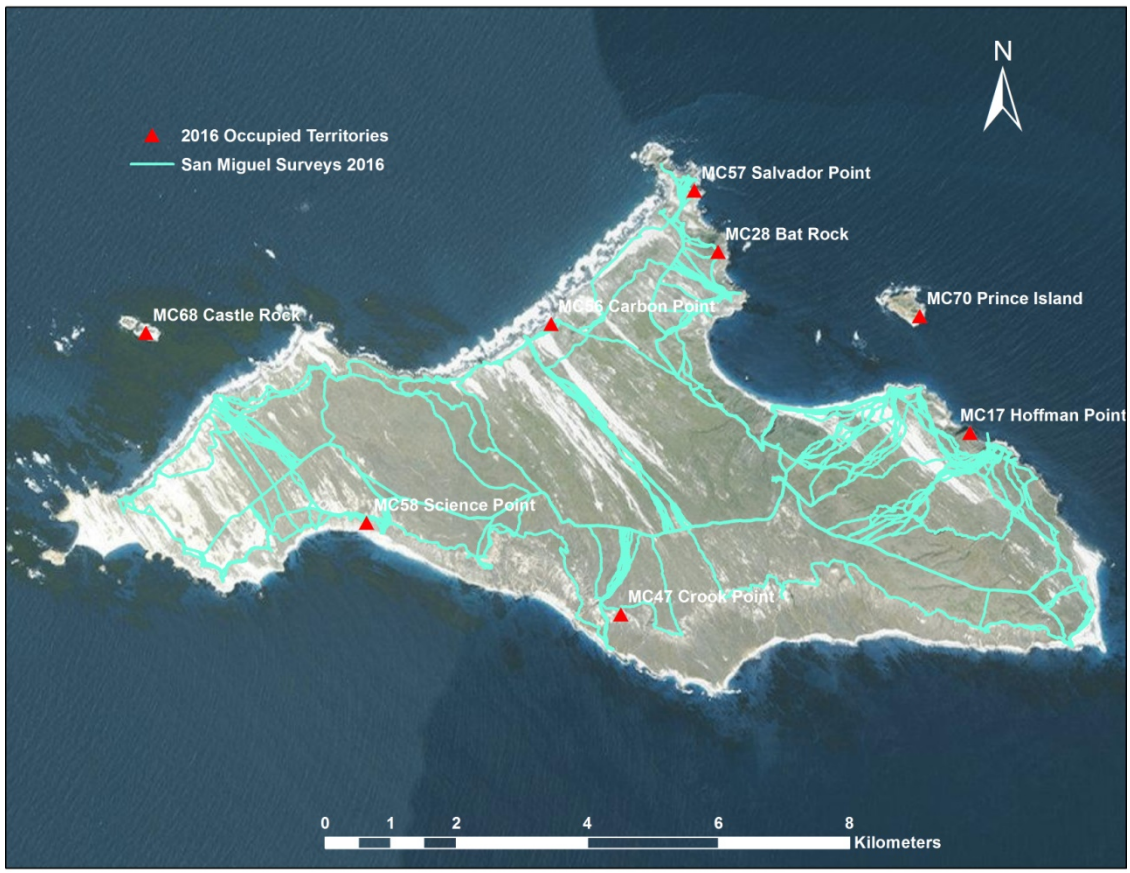

Figure 4. Peregrine falcon survey routes and territories on San Miguel Island, CA, 2016.

that the male was a second-year bird on 30 April. There was continued courtship through 17 May, but no evidence of nesting.

MC44 Cardwell Point: We were unable to confirm the presence of a pair in the historic Crook Point territory (Fig. 4) during 9 visits this season. Our only sightings of peregrines were on 6 March (adult male, second-year female), 14 April (adult male and an unidentified peregrine), and 27 April (1 unidentified bird).

MC47 Crook Point: We confirmed a pair in the historic Crook Point territory (Fig. 4) on 3 March, at which time they were in the courtship stage. They were confirmed incubating on 31 March and at least 2 chicks had hatched by 28 April. Four chicks were confirmed on 14 May and 4 fledglings were present on 10 June (Table 1).

MC56 Carbon Point: We confirmed a pair in the historic Carbon Point territory (Fig. 4) on 3 March. They were confirmed to be incubating on 31 March and there was at least 1 nestling present on 28 April. We confirmed a single fledgling on 10 June.

MC57 Salvador Point: We confirmed a pair in the historic Salvador Point territory (Fig. 4) on 4 March, at which time they were exhibiting courtship behavior. Based upon behavior, they were incubating on 12 May and we believe that nestlings were present on 12 June. However, the nest had failed by our next visit on 25 June.

MC58 Science Point: We confirmed a pair in the historic Science Point territory (Fig. 4) on 17 March, at which time they were classified as in courtship. Incubation began by 17 April and nestlings were believed to be present on 28 May, 30 May, and 11 June. The nesting attempt failed by 23 June, as there were no chicks/fledglings at or near the nest and no territorial behavior by the adults when the nest was approached.

MC68 Castle Rock: We confirmed a pair in the historic Castle Rock territory (Fig. 4) on 2 March. By 17 April, the adult female appears to have been replaced by a 2nd-year female. Courtship continued through 28 May, but there was no evidence of nesting.

MC69 Harris Point: We visited the historic Harris Point territory (Fig. 4) 9 times between 4 March and 25 June. At least 1 bird was seen on 7 visits, but the birds usually came from or returned to the Salvador Point territory, so we believe that the Salvador Point birds were using the Harris Point area for hunting and that there was not a separate territory this season.

MC70 Prince Island: We confirmed a pair exhibiting courtship behavior in the historic Prince Island territory (Fig. 4) on 5 March. The pair was incubating by 13 April and 2 chicks were present by 13 May. We observed 2 fledglings on 1, 9, and 24 June.

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Table 1. Status and breeding activity observed at peregrine falcon territories surveyed on the California Channel Islands in 2016.

Island/ Territory Name	State Code[b]	Territory Type	Occupancy Status	Breeding Activity	# Chicks Hatched	# of Fledglings	Notes (see report text for more details)
San Miguel							
Hoffman Point[a]	MC17	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Bat Rock[a]	MC28	Historic	Occupied	Unsuccessful	0	0	Courtship; 2nd year male
Cardwell Point	MC44	Historic	Unknown	Unknown	.	.	1-2 adults seen on 3/6, 4/14, 4/27.
Crook Point[a]	MC47	Historic	Occupied	Successful	4	4	Chicks were not banded.
Carbon Point[a]	MC56	Historic	Occupied	Successful	1	1	Chick was not banded.
Salvador Point[a]	MC57	Historic	Occupied	Unsuccessful	0	0	Failed during incubation/early brooding
Science Point[a]	MC58	Historic	Occupied	Successful	1	0	Failed during chick-rearing.
Castle Rock[a]	MC68	Historic	Occupied	Unsuccessful	0	0	Courtship; 2nd year female.
Harris Point	MC69	Historic	Unknown	Unknown	.	.	Suspected to be Salvador Point birds.
Prince Island[a]	MC70	Historic	Occupied	Successful	2	2	Did not band chicks.
Santa Rosa							
Carrington Point[a]	MC16	Historic	Occupied	Unsuccessful	0	0	Failed during incubation/early brooding
Lime Point[a]	MC27	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Water Canyon[a]	MC31	Historic	Occupied	Successful	3	2	Banded chicks on 6/13.
Bee Rock Canyon	MC34	Historic	Occupied	Unknown	.	.	Could not determine breeding status.
Orr's Camp	MC35	Historic	Occupied	Unknown	.	.	Could not determine breeding status.
Trancion[a]	MC50	Historic	Occupied	Successful	2	2	Chicks banded on 5/15.
Krumholtz	MC51	Historic	Occupied	Unknown	.	.	Could not determine breeding status.
Soledad[a]	MC55	Historic	Occupied	Successful	1	1	Chick banded on 6/11.
Bonn Point[a]	MC65	Historic	Occupied	Successful	3	3	Chicks were not banded.
Chickasaw Canyon	MC66	Historic	Unknown	Unknown	.	.	Could not determine occupancy.
Sandy Point[a]	MC67	Historic	Occupied	Successful	1	1	Banded chick on 6/12.
Gnoma[a]	MC76	Historic	Occupied	Successful	3	3	Banded chicks on 5/1.

Table 1. Continued.

Island/ Territory Name	State Code[b]	Territory Type	Occupancy Status	Breeding Activity	# Chicks Hatched[c]	# of Fledglings[c]	Notes (see report text for more details)
Santa Cruz							
Gherini Knife Edge[a]	MC18	Historic	Occupied	Successful	3	3	Chicks banded on 5/13.
Laguna[a]	MC19	Historic	Occupied	Successful	2	1	Could confirm only 1 chick at fledge.
West End[a]	MC20	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Sea Lion[a]	MC30	Historic	Occupied	Successful	3	3	Chicks were not banded.
Black Point[a]	MC38	Historic	Occupied	Successful	2	2	Chicks were not banded.
Arch Rock[a]	MC45	Historic	Occupied	Successful	3	2	Chicks banded on 5/28.
Valley Anchorage[a]	MC46	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Bowen Point[a]	MC53	Historic	Occupied	Successful	2	1	One chick dead on 5/12.
Cavern Point[a,d]	MC52	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Pelican Bay	MC60	Historic	Unknown	Unknown	.	.	Two adults seen on 4/15.
Punta Diablo[a]	MC61	Historic	Occupied	Unsuccessful	1	0	Failed during chick-rearing.
Punta Gorda[a]	MC62	Historic	Occupied	Successful	2	2	Banded chicks on 5/30.
San Pedro West[a]	MC63	Historic	Occupied	Successful	2	2	Banded chicks on 5/29.
West Point South	MC64	Historic	Occupied	Successful	2	2	Status unknown until fledge.
East Smuggler's[a]	MC77	Historic	Occupied	Unsuccessful	0	0	Failed during incubation.
Del Norte[a]	MC81	New	Occupied	Unsuccessful	0	0	Failed during incubation.
Anacapa							
West Anacapa[a]	MC21	Historic	Occupied	Successful	1	1	One fledgling seen on 7/15.
Middle Anacapa[a]	MC43	Historic	Occupied	Unsuccessful	0	0	Failed during incubation/early
Cathedral Cove[a]	MC54	Historic	Occupied	Successful	2	2	Fledglings seen on 7/15.
Camel Point	MC80	Historic	Occupied	Unknown	.	.	Could not determine nesting status.
San Nicolas							
Harrington[a]	MC73	Historic	Occupied	Successful	2	2	Banded chicks on 6/7.
Cattail Canyon[a]	MC74	Historic	Occupied	Successful	2	2	Banded 3 chicks on 6/8.
Midway[a]	MC82	New	Occupied	Unsuccessful	0	0	Not known to have nested.

Table 1. Continued.

Island/ Territory Name	State Code[b]	Territory Type	Occupancy Status	Breeding Activity	# Chicks Hatched[c]	# of Fledglings[c]	Notes (see report text for more details)
Santa Barbara							
Signal Peak[a]	MC33	Historic	Occupied	Successful	2	2	Did not band chicks
North Peak[a]	MC71	Historic	Occupied	Unsuccessful	0	0	Extended courtship, no nesting.
North Signal Peak	MC72	Historic	Occupied	Successful	2	2	Status determined near fledging.
Santa Catalina							
Silver Peak[a]	MC75	Historic	Occupied	Unsuccessful	0	0	Are not known to have nested.
Lone Tree	MC78	Historic	Unknown	Unknown	.	.	Only 1 adult seen at a time.
San Clemente							
Cave Canyon[a,d]	MC59	Historic	Occupied	Successful	3	3	Chicks were not banded.
Seal Cove	MC79	Historic	Unknown	Unknown	.	.	Could not confirm a pair was present.

[a]Territory included in calculations of productivity
[b] Designated by the California Department of Fish and Wildlife (CDFW)
[c]Minimum number
[d] State Codes switched between Cavern Point and Cave Canyon by CDFW in late 2016

Santa Rosa Island

Surveys began on Santa Rosa on 16 February and continued weekly through 27 June. We surveyed 12 previously known territories on Santa Rosa, 11 of which were occupied, and we did not locate any new territories (Fig. 5).

Figure 5. Peregrine falcon survey routes and territories on Santa Rosa Island, CA, 2016.

MC16 Carrington Point: We did not confirm the presence of a pair in the historic Carrington Point territory (Fig. 5) until our third visit on 20 March. We could not determine the breeding status of the birds until 1 May, when the adults' behavior indicated that there were chicks present. The nest failed by 9 June and we entered the eyrie and collected an unhatched egg on 11 June (Appendix V). The eyrie would be accessible to a fox.

MC27 Lime Point: We confirmed a pair in the historic Lime Point territory (Fig. 5) on 17 February. The birds were incubating by 30 March and 3 eggs were seen on 17 April. There were

only 2 eggs on 29 April and the nest had failed by 11 May. There was another egg laid as part of a second clutch by 16 May, but the nest had failed again by 28 May. The eyrie was located on a steep slope above a cliff and easily could have been entered by a fox.

Table 2. Summary of peregrine falcon banding on the California Channel Islands, CA, 2016.

Island/Territory Name	Sex	Age (days)	USGS Band #	Color Band	Wt. (g)
Santa Rosa					
MC31 Water Canyon	Male	~24	1156-16864	21/AE	460
MC31 Water Canyon	Male	25-27	1156-16865	16/AE	500
MC31 Water Canyon	Female	25-27	1947-21680	81/AE	695
MC50 Trancion	Male	~28	1156-16855	40/AC	680
MC50 Trancion	Female	~28	1947-21672	68/AE	915
MC55 Soledad	Male	~28	1156-16862	04/AE	730
MC67 Sandy Point	Male	~25	1156-16863	46/AE	.
MC76 Gnoma	Female	~20	1947-21668	67/AE	765
MC76 Gnoma	Female	~21	1947-21669	51/AE	920
MC76 Gnoma	Female	~21	1947-21670	55/AE	800
Santa Cruz					
MC18 Gherini Knife Edge	Male	20-21	1156-16853	13/AE	540
MC18 Gherini Knife Edge	Male	20-21	1156-16854	08/AC	575
MC18 Gherini Knife Edge	Female	21-22	1947-21671	76/AE	805
MC19 Laguna	Male	~18	1156-16860	11/AE	517
MC19 Laguna	Female	~18	1947-21676	63/AE	643
MC45 Arch Rock	Male	~24	1156-16856	12/AE	455
MC45 Arch Rock	Male	~24	1156-16857	15/AC	550
MC45 Arch Rock	Female	~21	1947-21673	79/AE	475
MC62 Punta Gorda	Male	~19	1156-16859	49/AE	445
MC62 Punta Gorda	Female	~16	1947-21675	88/AE	595
MC63 San Pedro West	Male	~32	1156-16858	35/AE	560
MC63 San Pedro West	Female	~32	1647-21674	85/AE	875
Anacapa					
MC54 Cathedral Cove	Male	~31	1156-16866	36/AE	740
MC54 Cathedral Cove	Female	29-31	1947-21681	59/AE	1055
San Nicolas					
MC73 Harrington	Female	33-35	1947-21677	57/AE	1180
MC73 Harrington	Female	33-35	1947-21678	99/AE	1085
MC74 Cattail Canyon	Male	25-27	1156-16861	09/AE	645
MC74 Cattail Canyon	Female	25-27	1947-21679	56/AE	995

MC31 Water Canyon: We confirmed a pair in the historic Water Canyon territory (Fig. 5) on 6 March. They exhibited courtship behavior on 21 March and were incubating by 18 April. There were nestlings present on 25 May and we entered the eyrie on 13 June and banded 3 chicks (Table 2, Appendix V). Only 2 chicks were visible on 3 subsequent visits through 27 June. However, only 2 chicks had ever been seen prior to banding, as the eyrie was only partially visible from observation points. This was the first season that we confirmed successful nesting in this territory.

MC34 Bee Rock Canyon: We surveyed the historic Bee Rock Canyon territory (Fig. 5) 14 times between 21 February and 26 June. We confirmed a pair was present on 4 April, and although they exhibited courtship behavior, we were unable to determine their nesting status.

MC35 Orr's Camp: We surveyed the historic Orr's Camp territory (Fig. 5) 11 times between 21 February and 25 June. The pair was present on 3 occasions and the adult female was seen on 4 additional visits, but we could not determine their nesting status.

MC50 Trancion: We confirmed a pair in the historic Trancion territory (Fig. 5) on 15 March. The birds were incubating on 1 April and there were 2 chicks present on 18 April. We entered the eyrie on 15 May and banded 2 chicks (Table 2, Appendix V). Two fledglings were present on 27 May, 13 June, and 24 June.

MC51 Krumholtz: We surveyed the historic Krumholtz territory (Fig. 5) 12 times between 22 February and 24 June. We confirmed a pair was present on 3 March, but were never able to determine their nesting status. No birds were seen on 13 April and only 1 bird was seen on 27 April, but both birds were present on 4 visits between 30 April and 10 June. It is possible they nested and failed at an unknown location in April.

MC55 Soledad: We confirmed a pair in the historic Soledad territory (Fig. 5) on 19 February. Incubation began by 14 April and at least 1 nestling was present on 12 May. We entered the eyrie on 11 June and banded a single chick that was about 28 days old (Table 2, Appendix V). The chick had fledged by our last visit on 25 June.

MC65 Bonn Point: We located a pair in the historic Bonn Point territory (Fig. 5) on 20 February, at which time they were exhibiting courtship behavior. The pair was incubating on 15 April and there were 3 chicks present on 12 May. We did not band the chicks because of scheduling conflicts, but all 3 chicks had fledged by the time of our last visit on 23 June.

MC66 Chickasaw Canyon: We surveyed the historic Chickasaw Canyon territory (Fig. 5) 6 times between 22 February and 27 April. The only peregrine we saw was an adult male on 2 March and 31 March. As we have never determined breeding within this territory, we will make a stronger effort to determine whether this is an actual territory during the 2017 season.

MC67 Sandy Point: We confirmed a pair in the historic Sandy Point territory (Fig. 5) on 2 March. They were incubating by 3 April and at least 1 chick was present by 25 May. We entered the eyrie on 12 June and banded a single chick (Table 2, Appendix V). The chick had fledged by our last visit on 27 June.

MC76 Gnoma: We confirmed a pair exhibiting courtship behavior in the historic Gnoma territory (Fig. 5) on 20 February. The pair was incubating by 8 March and there was at least 1 chick present on 12 April. Three chicks were seen on 18 April and we entered the eyrie on 1 May and banded all 3 birds (Table 2, Appendix V). All the chicks had fledged by 26 May and were still present during our last visit on 23 June.

Santa Cruz Island

Surveys began on Santa Cruz on 7 February and continued every other week through 26 June. We surveyed 15 historic territories, 14 (93%) of which were occupied, and located 1 previously unknown territory (Fig. 6).

MC18 Gherini Knife Edge: We confirmed a pair was present in the historic Gherini Knife Edge territory (Fig. 6) on 21 February. The pair was incubating by 19 March and 3 chicks were present on 27 April. We entered the eyrie on 13 May and banded all 3 birds (Table 2, Appendix V). All 3 chicks had fledged by our next visit on 11 June.

Figure 6. Peregrine falcon survey routes and territories on Santa Cruz Island, CA, 2016.

MC19 Laguna: We confirmed a pair exhibiting courtship behavior in the historic Laguna territory (Fig. 6) on 16 March. They were incubating by 30 March and there was at least 1 chick present on 12 May. We entered the eyrie on 31 May and banded 2 chicks (Table 2, Appendix V). We could only confirm that 1 chick was present on our last visit on 22 June, at which time the chick was about 40 days old. It is possible the other chick had fledged and was out of view.

MC20 West End: We confirmed a pair exhibiting courtship behavior in the historic West End territory (Fig. 6) on 16 March. They were incubating on 13 April, but the nest had failed by 14 May. There was no evidence of further breeding activity.

MC30 Sea Lion: We confirmed a pair in the historic Sea Lion territory (Fig. 6) on 2 March. They were exhibiting courtship behavior on 2 April and were incubating by 1 May. There were 3

nestlings approximately 1 week old on 26 May. We did not band the chicks because of scheduling conflicts. All 3 chicks were still in the eyrie, but near fledging, on 26 June.

MC38 Black Point: We first confirmed that a pair was present in the historic Black Point territory (Fig. 6) on 16 March. They were incubating by 29 April and there were 2 chicks present on 8 June. We did not band the chicks because of scheduling conflicts. Both chicks were still in the eyrie on 26 June.

MC45 Arch Rock: We confirmed a pair in the historic Arch Rock territory (Fig. 6) on 7 February. They were exhibiting courtship behavior on 17 March and were incubating by 3 April. At least 1 chick was present on 11 May and we entered the eyrie on 28 May and banded 3 chicks (Table 2, Appendix V). At least 2 chicks were present on 12 June and at least 1 fledging was seen in flight on 23 June.

MC46 Valley Anchorage: We observed a pair in courtship activity in the historic Valley Anchorage territory (Fig. 6) on 20 March. They were incubating by 12 May and were thought to have nestlings on 26 May. The nest failed by 11 June.

MC53 Bowen Point: We confirmed a pair exhibiting courtship behavior in the historic Bowen Point territory (Fig. 6) on 21 February. They were incubating by 14 April and were believed to have had nestlings by 1 May. However, when we entered the eyrie for banding on 12 May, there was 1 chick that was a few days old and another chick that was dead. We did not return later to band and will not band at this territory in the future because the adult female's aggressiveness is a danger to researchers and chicks in the eyrie. There was still 1 chick present on our last visit on 11 June, at which time it was about 30 days old.

MC52 Cavern Point: We confirmed a pair exhibiting courtship behavior in the historic Cavern Point territory (Fig. 6) on 3 March. We observed an adult incubating on 4 May. The birds were still incubating on 13 May, but had failed by 11 June. The eyrie was only visible from the water.

MC60 Pelican Bay: We conducted 4-hour surveys, including call-broadcast surveys, of the historic Pelican Bay territory on 18 February, 20 March, and 15 April. We only saw peregrines on our last survey, during which 2 peregrines flew in from the east and disappeared to the west. We could not classify the territory as occupied this season.

MC61 Punta Diablo: We confirmed a pair in the historic Punta Diablo territory (Fig. 6) on 4 March and they were incubating by 16 April. Based upon adult behavior, we believe they had at least 1 chick by 13 May. The nest had failed by 28 May, at which time we were able to enter the eyrie and collect egg shell fragments and prey remains (Appendix V). The adult female has leg bands, but we were unable to read either band. We will make attempts in 2017 to get a clear photo of her leg bands to determine her origin.

MC62 Punta Gorda: We confirmed a pair in the historic Punta Gorda territory (Fig. 6) on 17 March, at which time the female was incubating. The pair was incubating on each visit through 2 May, but we thought they had at least 1 chick on 11 May. We confirmed chicks were present on 27 May and entered the eyrie on 30 May to band the 2 chicks (Table 2, Appendix V). We confirmed that both chicks had fledged by 25 June. Because of the long period during which we classified this pair as incubating, it is likely that a first clutch failed and they laid a second clutch.

MC63 San Pedro West: We confirmed an incubating pair in the historic San Pedro West territory (Fig. 6) on 18 March, at which time they were exhibiting courtship behavior. They were incubating by 8 April and there were 2 nestlings present on 15 May. We entered the eyrie on 29 May and banded 2 chicks (Table 2, Appendix V), at which time we estimated them to be about 32 days old. Both birds had fledged by our last visit on 11 June.

MC64 West Point South: We confirmed a pair in the historic West Point South territory (Fig. 6) on 2 March, at which time they were exhibiting courtship behavior. Based upon adult behavior, we believe they were incubating by 2 April. We were unable to determine the outcome of any nesting attempt until 30 May, at which time we observed 2 fledglings.

MC77 East Smuggler's: We confirmed a pair in the historic East Smuggler's territory (Fig. 6) on 18 March. The pair was in courtship by 14 April and were incubating by 4 May. We could not determine their nesting status on 26 May and 9 June, but determined that they had failed by our last visit on 11 June. They used a different eyrie than the one used in 2015, which we had determined was unsafe to enter.

MC81 Del Norte: We located a previously unknown pair along the northeastern coast of the island in a territory we named Del Norte. The pair was already in incubation when we found them on 31 March. The nest had failed by 2 May.

Anacapa Island

We conducted 4 surveys of Anacapa from a charter boat (the *Retriever*) between 8 April and 15 July. We located pairs in each of the 4 historic territories (Fig. 7).

MC21 West Anacapa: We confirmed a pair in the historic West Anacapa territory (Fig. 7) on 8 April, at which time they were exhibiting courtship behavior. They were incubating on our next trip on 4 May and had at least 1 nestling on 1 June. The chick had fledged by our last survey on 15 July. We were unable to access West Anacapa to check the eyrie or band chicks because of breeding seabird activity.

MC43 Middle Anacapa: We confirmed a pair incubating in the historic Middle Anacapa territory (Fig. 7) on 8 April. They were still incubating on 4 May, but had failed by 1 June. We were unable to access Middle Anacapa to access the eyrie because of breeding seabird activity.

MC54 Cathedral Cove: We confirmed a pair in courtship in the historic Cathedral Cove territory (Fig. 7) on 8 April. They were incubating by 4 May and at least 1 chick was present on 1 June. We entered the eyrie on 14 June and banded 2 chicks (Table 2, Appendix V). Both chicks had fledged by our last visit on 15 July.

MC80 Camel Point: We confirmed a pair exhibiting courtship behavior on our first visit to the historic Camel Point territory (Fig. 7) on 8 April. They were still in courtship on 4 May, but we

could not determine their nesting status on 1 June, when we had a vocal response to our call broadcast, but could not locate the bird. On 15 July, we saw both adults soaring together and multiple hunting attempts by the male, but saw no indication that chicks/fledglings were present.

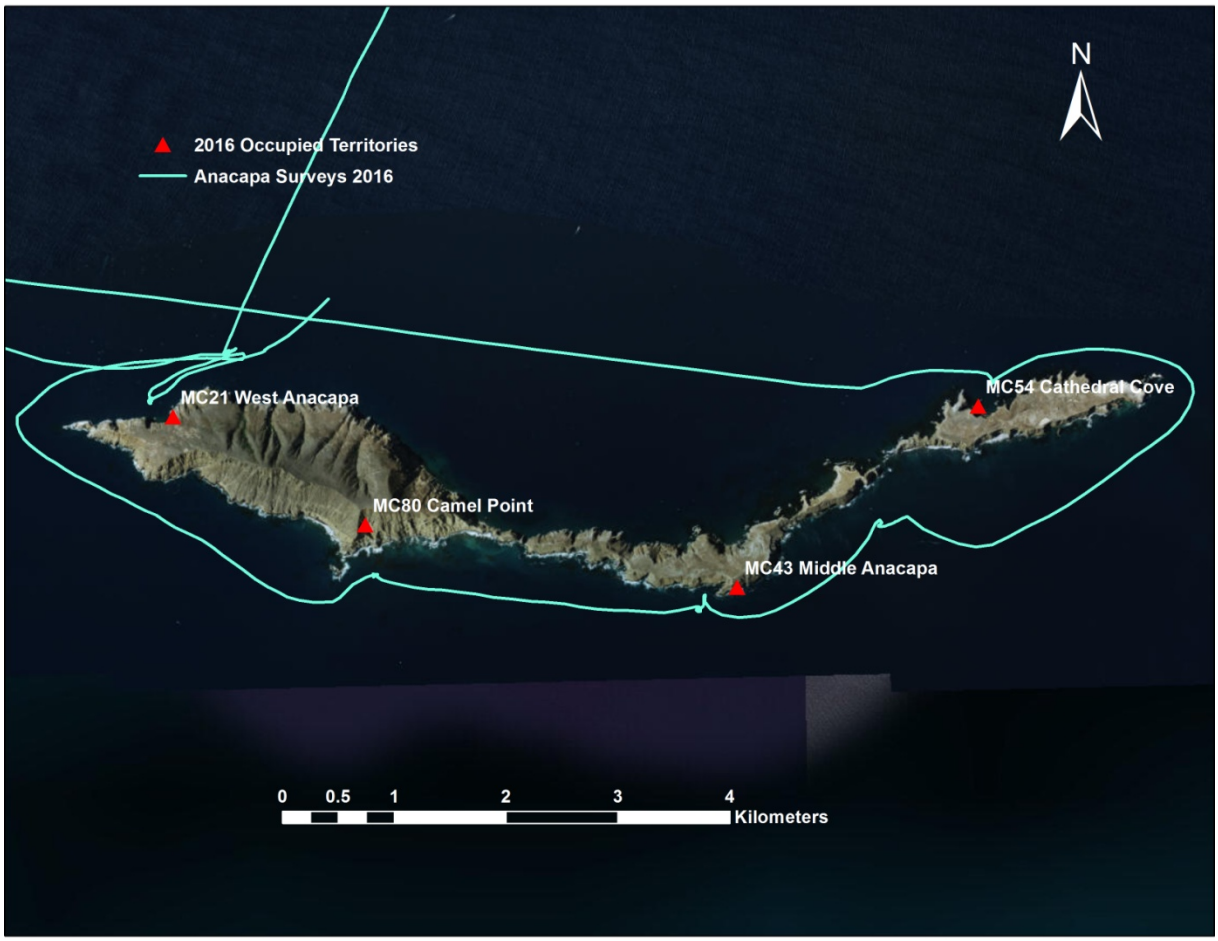

Figure 7. Peregrine falcon survey routes and territories on Anacapa Island, CA, 2016.

San Nicolas Island

We surveyed San Nicolas on 4-5 April, 26-27 April, 24 May, and 8 June. We located pairs in the 2 historic territories on the south side of the island and located a new territory between the 2 known territories, which we named the Midway territory (Fig. 8).

MC73 Harrington: The pair in the historic Harrington territory (Fig. 8) was already incubating on our first visit on 4 April. They were still incubating on 26 April and had nestlings by 24 May. We entered the eyrie on 7 June and banded 2 chicks that were about 33-35 days old (Table 2,

Appendix V). We did not return to confirm fledging, but assumed they survived another 7-10 days to fledging.

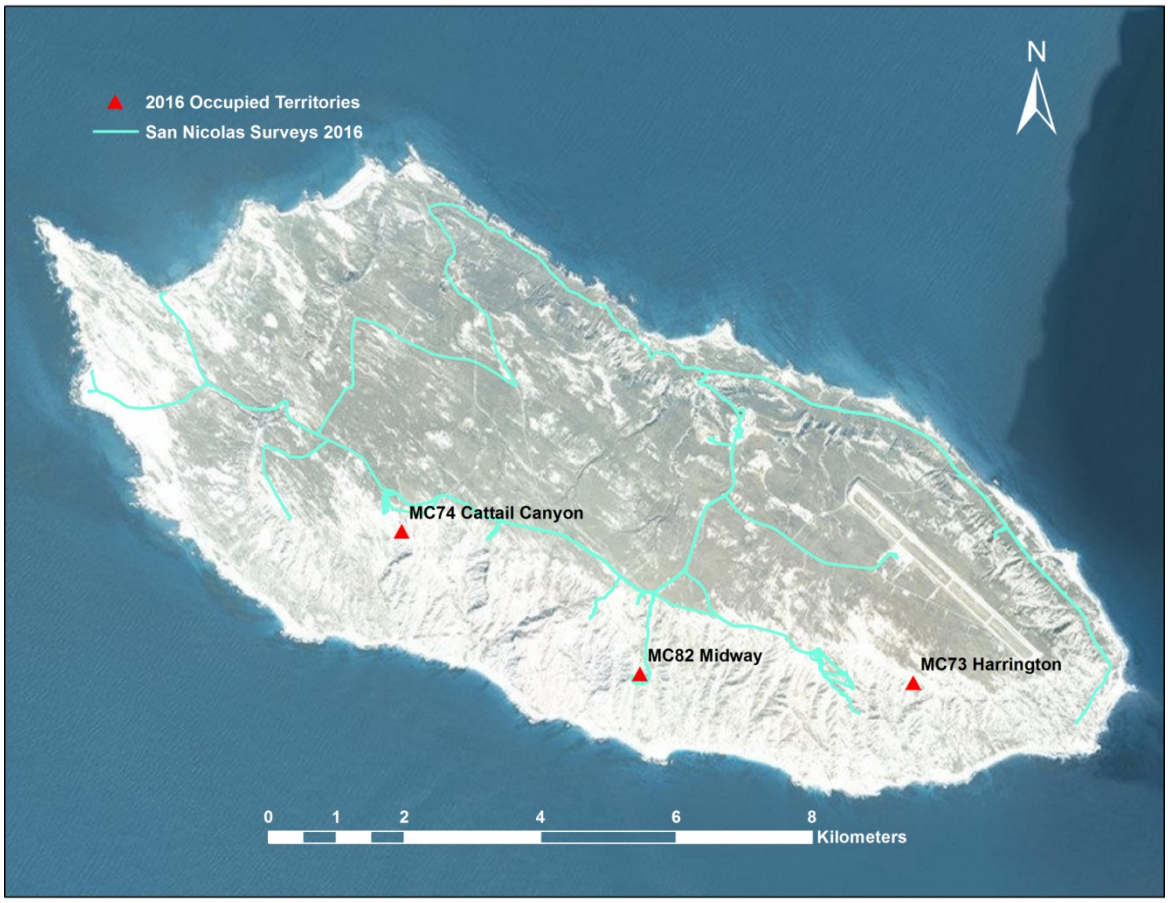

Figure 8. Peregrine falcon survey routes and territories on San Nicolas Island, CA, 2016.

MC74 Cattail Canyon: No peregrines were seen in the historic Cattail Canyon territory (Fig. 8) during our first visit on 4 April, but were found exhibiting courtship behavior on 5 April. They were incubating on 26 April and there were at least 2 chicks present on 24 May. We entered the eyrie and banded 2 chicks (Table 2, Appendix V) on 8 June. The chicks were 25-27 days at banding, which was 1-3 days younger than the 28 days of age at which we generally consider birds fledged for productivity calculations, but we are including these chicks in our calculations.

MC82 Midway: We located a pair in the previously unknown territory on the south side of the island that we named the Midway territory (Fig. 8). The pair was located on 5 April and were exhibiting courtship behavior on 27 April. We were unable to survey the territory on our 24 May

visit to the island, but they were present and showing no signs of nesting on 8 June. It is possible they nested and failed after 27 April.

Santa Barbara Island

Jim Howard and Peter Larramendy with the California Institute of Environmental Studies, conducted surveys of Santa Barbara for us this season because access to the island was limited by the destruction of the landing dock during winter storms. Pairs were located in each of the 3 historic territories and no new territories were discovered (Fig. 9).

MC33 Signal Peak: We confirmed a pair in the historic Signal Peak territory (Fig. 9) on 17 March. They were incubating by 22 April and had nestlings by 10 May. Two fledglings were confirmed on 7 June. We did not attempt to band on Santa Barbara this season.

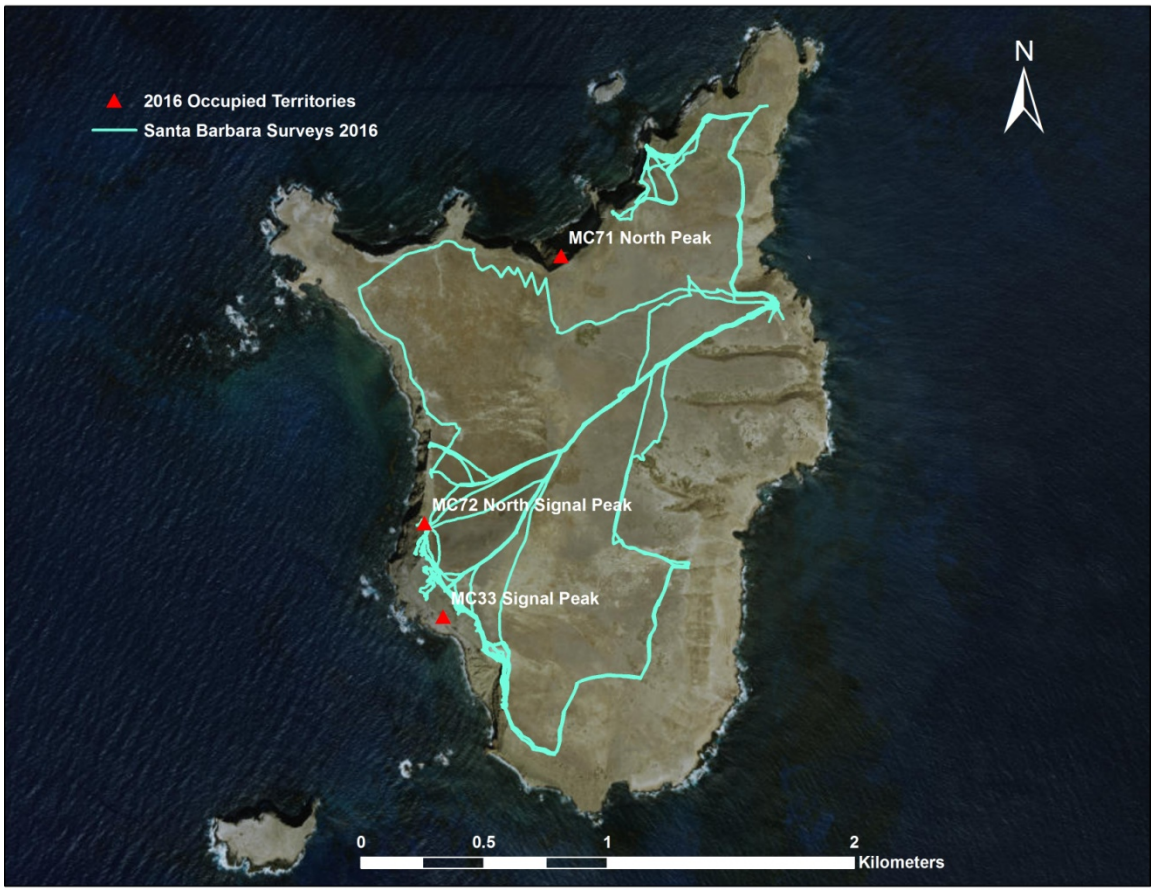

Figure 9. Peregrine falcon survey routes and territories on Santa Barbara Island, CA, 2016.

MC71 North Peak: We observed a pair exhibiting courtship behavior at the historic North Peak territory (Fig. 9) on 18 March, 23 April, and 7 May. There was no evidence of nesting this season.

MC72 North Signal Peak: We confirmed a pair in the historic North Signal Peak territory (Fig. 9) on 16 March. Their nesting status was unknown until 15 May, when we observed the pair with 2 fledglings. Based upon a 33-day incubation period and fledging at 42 days, eggs would have to have been laid by late February/early March.

Santa Catalina Island

We surveyed 2 previously identified territories on the island, only 1 of which was occupied by a pair (Fig. 10).

Figure 10. Peregrine falcon survey routes and territories on Catalina Island, CA, 2016.

MC75 Silver Peak: We located a pair exhibiting courtship behavior in the historic Silver Peak territory (Fig. 10) on 24 February. We could not determine their nesting status during the next 6 surveys and the only time we saw 2 adults was on 15 April. No peregrines were present on 6 June or 3 July. It is unlikely that the birds nested this season.

MC78 Lone Tree: We surveyed the historic Lone Tree territory (Fig. 10) for approximately 21 hours over 8 visits between 9 February and 28 June. We could only confirm 1 adult on six visits and no adults were seen on the first and last visits. A peregrine visited the 2015 eyrie several times, but there was no indication of nesting. Therefore, we cannot confirm that a pair was present in 2016.

San Clemente Island

We surveyed the 2 historic territories on the island, only 1 of which was occupied, and located no additional territories (Fig. 11).

MC59 Cave Canyon: We confirmed a pair exhibiting courtship behavior in the historic Cave Canyon territory (Fig. 11) on 9 March. They were incubating by 5 May and at least 3 chicks were present on 19 May. We attempted to access the island for banding on 2 June, but the plane could not land because of dense fog. All 3 chicks had fledged by 12 July.

MC79 Seal Cove: We conducted five surveys lasting 3-4 hours each in the historic Seal Cove territory (Fig. 11) between 15 February and 24 May. Two peregrines were seen only on 19 April and no peregrines were seen on our last visit on 24 May. Because 2 birds were seen only once, we cannot confirm a pair was present, as the female may have just been passing through the area.

RESIGHTINGS

In 2016, we received 2 reports of sightings of peregrines on the mainland that we had banded as nestlings on the islands in 2014.

On 3 August, a female banded in 2014 at the West Point South territory on Santa Cruz (Band #1947-21654) was seen at Piute Ponds, north of Lancaster, CA.

Figure 11. Peregrine falcon survey routes and territories on San Clemente Island, CA, 2016.

A male we banded in 2014 at the Carrington Point territory on Santa Rosa (Band #1156-16821) bred for a second year at the Point Arguello territory at Vandenberg Air Force Base. The pair successfully fledged 3 chicks.

We also had 2 sightings on Catalina of a bird that Joel Pagel had banded on 5/19/15 at Point Loma, CA. We spotted the bird above Catalina Harbor on 4 April and 13 December.

PREY REMAINS

We collected prey remains from 14 territories on 4 islands and N. John Schmitt (WFVZ) identified a total of 143 individual prey items, of which 113 items (79%) were identified to species level, representing 32 different species. Nine additional prey items could be identified only to genus, 14 to family level, 1 to order level, 5 as “passerine”, and 1 as “unknown bird” (Table 3). The most common species identified were California Gulls (*n*=22), Red-necked Phalaropes (*n*=17), and House Finch (*n*=11).

Table 3. Prey remains (minimum number of individuals) collected from peregrine falcon eyries on the California Channel Islands in 2016.

Family/ Scientific Name	Common Name	Island[a]				
		SRI	SCI	ANA	SNI	Total
Accipitridae						
Accipiter striatus	Sharp-shinned hawk		1			1
Alaudidae						
Eremophila alpestris	Horned Lark	2				2
Alcidae						
Cepphus columba	Pigeon Guillemot	2	1			3
Ptychoramphus aleuticus	Cassin's Auklet		6			6
Cerorhinca monocerata	Rhinoceros Auklet		1	1	1	3
Alcidae spp.	Unidentified Alcid		2	1	1	4
Apodidae						
Aeronautes saxatalis	White-throated Swift		1			1
Bombycillidae						
Bombacilla cedrorum	Cedar Waxwing		2			2
Caprimulgidae						
Chordeiles accutipennis	Lesser Nighthawk		1			1
Cardinalidae						
Pheucticus melanocephalus	Black-Headed Grosbeak		2	2		4
Piranga ludoviciana	Western Tanager		1		1	2
Pirange rubra	Summer Tanager		1			1
Charadriidae						
Charadrius spp.	Unidentified Plover			1		1
Columbidae						
Columba livia	Rock Pigeon		1			1
Streptopelia decaocto	Eurasian Collared Dove	3	3		1	7
Zenaida macroura	Mourning Dove	2				2
Columbidae spp.	Unidentified Columbidae		1			1
Corvidae						
Aphelocoma insularis	Island Scrub Jay		2			2
Emberizidae						
Pipilo maculates	Spotted Towhee	1				1
*Melospiz*a spp.	Unidentified Sparow	1				1
Falconidae						
Falco sparverius	American Kestrel		1			1
Falco peregrinus[b]	Peregrine Falcon				1	1
Fringillidae						
Carpodacus mexicanus	House Finch		8		3	11
Hirundinidae						
Hirundo rustica	Barn Swallow	1				1
Hirundinaidae spp.	Unidentified Swallow		1			1
Hydrobatidae						
Oceanodroma spp.	Storm-petrel spp.		1			1

Table 3. Continued

Family/ Scientific Name	Common Name	Island[a] SRI	SCI	ANA	SNI	Total
Icteridae						
Sturnella neglecta	Western Meadowlark	3			1	4
Sturnella neglect	Brown-headed Cowbird	2				2
Laridae						
Larus californicus	California Gull	3	17	2		22
Larus occidentalis	Western Gull	2		1		3
Sternula antillarum	Least Tern	1				1
Parulidae						
Parulidae spp.	Unidentified Warbler	2	4	1		7
Phasianidae						
Alectoris chukar	Chukar				3	3
Picidae						
Melanerpes formicivorus	Acorn Woodpecker		2			2
Colaptes auratus	Northern Flicker		1			1
Podicipedidae						
Podicipedidae spp.	Unidentified grebe	2	1			3
Scolopacidae						
Phalaropus lobatus	Red-necked Phalarope	3	14			17
Tringa incana	Wandering Tattler				1	1
Limnodromus spp.	Unidentified Dowitcher		1			1
Sturnidae						
Sturnus vulgaris	European Starling	2			1	3
Tyrannidae						
Empidonax spp.	Unidentified Flycatcher		2			2
Tyrannidae *spp.*	Unidentified Tyrannidae	2				2
Unidentified Passerine		2	2		1	5
Procellariiformes	Small Shearwater or Petrel				1	1
Unidentified Bird			1			1

[a] Santa Rosa (SRI), Santa Cruz (SCI), Anacapa (ANA), San Nicolas (SNI)
[b]Carcass of adult

EGGSHELL MEASUREMENTS

We collected eggshell fragments and/or an addled egg (2 total) from 13 territories on 4 islands in 2016 (Table 4, Appendix V). The eggshell measurements using the "SS" method were thicker, and thus had less eggshell thinning, than the "RC" method in 12 of 13 samples (Table 4). Percent eggshell thinning, compared to peregrine eggs from pre-1947 in California, ranged from 9.6% to 36.3% using the SS method, and 13.5% to 39.3% using the "RC" method (Table 4).

Table 4. Measurements of peregrine falcon eggs and eggshell fragments collected from nests on the California Channel Islands in 2016.

	Clutch Means (RC[a])		Clutch Means (SS[b])		
Island/Territory	Eggshell Thickness (mm)	% Thinning	Eggshell Thickness (mm)	% Thinning	Notes
Anacapa Island					
MC54 Cathedral Cove	0.315	13.5	0.329	9.6	3 measurements from 1 fragment with membrane
San Nicolas Island					
MC73 Harrington	0.297	18.4	0.320	12.1	Measured 5 fragments without membrane
MC74 Cattail Canyon	0.237	34.9	0.242	33.5	Measured from nearly whole egg with membrane
Island Mean	0.267	26.7	0.281	22.8	
Santa Rosa Island					
MC16 Carrington	0.269	26.1	0.272	25.3	10 measurements with membrane made on addled egg
MC50 Trancion	0.281	22.8	0.279	23.4	Measured 4 fragments without membrane
MC55 Soledad	0.221	39.3	0.232	36.3	Measured without membrane
MC67 Sandy Point	0.265	27.2	0.280	23.1	Measured from 10 fragments with membrane
MC76 Gnoma[c]	0.241	33.8	0.246	32.4	Measured from 6 fragments without membrane
Island Mean	0.259	28.9	0.266	27.0	
Santa Cruz Island					
MC18 Gherini	0.290	20.3	0.299	17.9	Measured from 10 fragments without membrane
MC19 Laguna	0.280	23.1	0.282	22.5	Measured from 2 fragments with membrane
MC61 Punta Diablo	0.295	19.0	0.311	14.6	Measured from 10 fragments without membrane
MC62 Punta Gorda	0.250	31.3	0.271	25.5	Measured from 10 fragments with membrane
MC63 San Pedro West[c]	0.252	30.8	0.255	29.9	Measured from 6 fragments without membrane
Island Mean	0.279	23.4	0.291	20.1	

[a]René Coronado Method
[b]Sam Sumida Method
[c]No membrane available to estimate thickness, resulting in higher thinning estimate. Value was not included in calculation of Island Means.

PRODUCTIVITY

At least 57 chicks are known to have hatched on the Channel Islands in 2016, of which 51 (89%) are known to have survived to ≥28 days of age. We calculated productivity based upon 40 pairs (see Table 1) that were monitored from early in the breeding season (i.e., courtship, incubation) and for which we know the outcome of the breeding season. Thirty-five pairs laid eggs, 25 pairs (71%) hatched at least 1 chick, and 23 pairs (66%) successfully produced at least 1 chick ≥28 days of age. Minimum productivity was 1.18 fledglings per occupied territory, or 2.04 fledglings per successful nesting attempt.

BREEDING CHRONOLOGY

We calculated the breeding chronology of pairs that produced chicks based upon estimated hatch dates and a 33-day incubation period (Linthicum 1996) and approximately 42 days of chick-rearing (Ratcliffe 1993). The earliest start of incubation was on Santa Barbara, where we estimate that the North Signal Peak (MC72) territory began incubating around 27 February (Fig. 12). The latest known incubation of a first clutch was at the West Anacapa territory (MC21), where we estimate incubation began on 28 April (Fig. 12). The estimated mean and median date of the start of incubation was 30 March and 1 April, respectively. The estimated mean and median dates of chicks hatching (first chick of clutch) was 2 May and 4 May, respectively.

DISCUSSION

The peregrine has exhibited an astonishing recovery on the Channel Islands, going from being absent from the 1950s through 1983, to a population size that exceeds Hunt's (1994) estimates for historical periods. The number of known occupied territories on the Channel Islands during the 2016 season dropped to 46, slightly lower than the 48 located in 2014 and 2015 (Figure 13).

The northern Channel Islands continue to be the stronghold for Channel Island peregrines. In other peregrine populations, density of peregrine territories appears to be positively correlated with availability of food resources, with higher densities generally

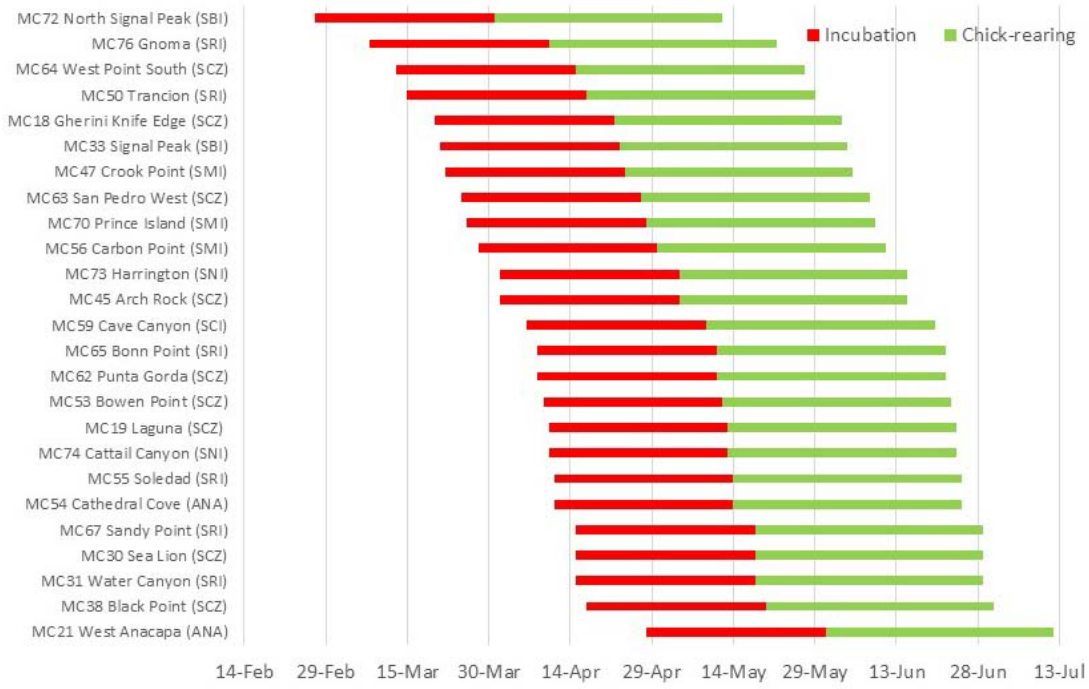

Figure 12. Breeding chronology of peregrine falcons on the California Channel Islands during 2016. Data are for nesting attempts that resulted in chicks that were aged at banding or when clearly visible in the eyrie so that we could estimate laying dates.

occurring in association with large seabird or shorebird colonies (Ratcliffe 1980). As compared to the southern Channel Islands, the northern Channel Islands generally have higher seabird diversity (Carter et al. 1992, Takekawa et al. 2004), as well as more cliffs with ledges and potholes for peregrine nesting (Hunt 1994; P. Sharpe, personal observations).

Nest success in occupied territories with known outcomes decreased from 2015 (74% in 2015 [Sharpe 2016], 66% in 2016), as did productivity (1.63 chicks/occupied territory in 2015 [Sharpe 2016], 1.18 chicks/occupied territory in 2016). Over the 4 breeding seasons that IWS has monitored peregrines on the Channel Islands (2013-2016), nest success has averaged 68% and productivity has been 1.48 chicks/occupied territory. Nest success and productivity on the Channel Islands is similar to that in the Pacific Region in 2003 (65% and 1.45 chicks/occupied territory), but slightly lower than the 2003 national average of 71% and 1.64 chicks/occupied territory (Green et al. 2003). More recent studies reported average nest success of 72-78% and 1.8 chicks/occupied territory found in Arizona, Colorado, Montana, Wyoming, Idaho, and Nevada (Enderson et al. 2012, Moulton 2012, Barnes et al. 2015). Nest success and productivity

can vary greatly between years, so continued monitoring will allow us to better estimate long-term reproductive averages and trends in the peregrine population on the Channel Islands.

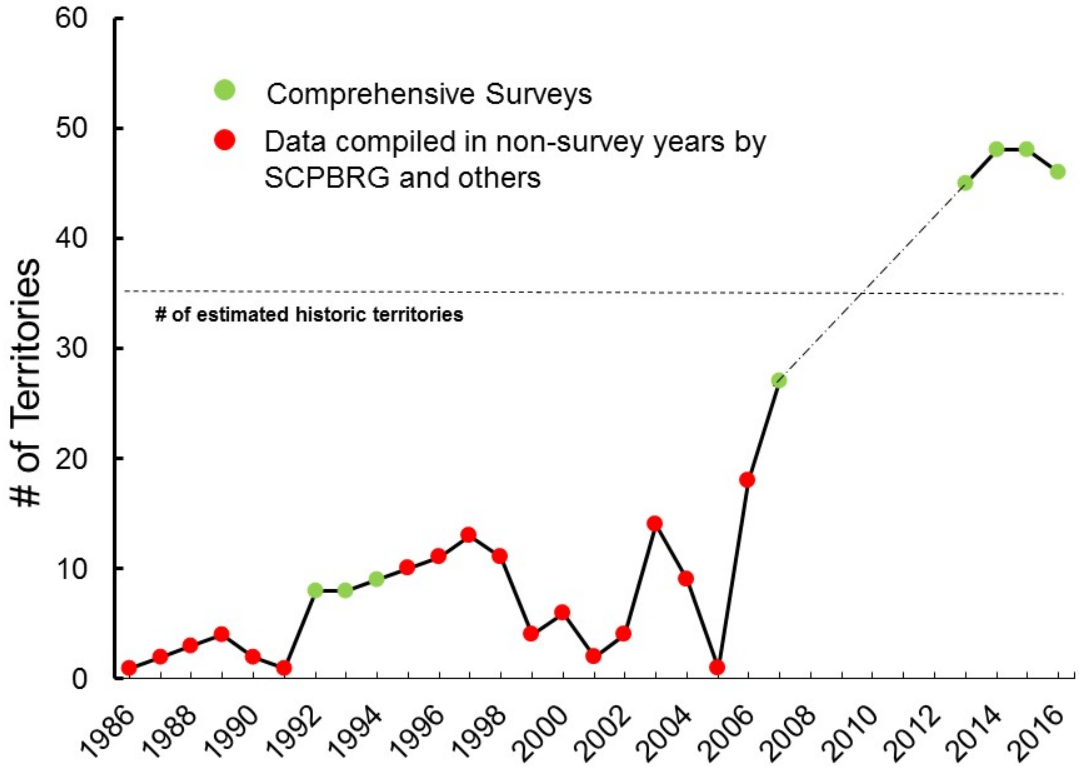

Figure 13. Number of known occupied peregrine falcon territories on the California Channel Islands from 1986 to 2016. Green points represent data from years when there were comprehensive surveys; red points are from years when there were no comprehensive surveys as reported in Appendix IV of Latta (2012).

The potential impact of DDE on the productivity of peregrines on the Channel Islands is a continuing concern. Historically, peregrine populations with eggshell thinning exceeding 17% were either declining or extirpated (Peakall and Kiff 1988), but populations with average thinning below 14.5% appeared normal (Fyfe et al. 1988). Average eggshell thinning across the islands in 2016 was 22.6%, which is higher than in any previous year, and could explain the lower productivity observed this season. Eighteen clutches collected on the Channel Islands from 1988-1993 had 19.8% thinning (Kiff 1994) and mean eggshell thinning was 18.3% in 2007

(Latta 2012), 12.4% in 2013 (Sharpe 2014), 14.4% in 2014 (Sharpe 2015), and 10% in 2015 using the "SS" method, which is the same method used in the previous Channel Island studies.

The increased eggshell thinning this season indicates that DDE likely is still in the food chain. Peregrines prey on a wide variety of species, as indicated by the prey remains collected in previous surveys (Latta 2012, Sharpe 2014, 2015, 2016). These prey collections may indicate the breadth of the diet, but not necessarily the proportional component of the diet because prey remains may blow out of the eyrie or be removed by adults. However, the data elucidate the potential pathways through which peregrines could acquire DDE. Enderson et al. (1982) reported that peregrines feeding on prey with 1.0 ppm DDE during the breeding season could be expected to lay eggs with 16% eggshell thinning. We would expect birds that feed largely on marine fish to have higher DDE body burdens than birds that feed on other food sources. Alcids and gulls, which made up ~32% of prey items we collected in 2016, have had DDE body burdens of 2 ppm or higher around the Channel Islands (Garcelon et al. 1989, Hunt 1994), so these species could be major sources of DDE to peregrines. These prey species could be acquiring contaminants by feeding closer to the major source of DDT contamination off the Palos Verdes Peninsula. In the case of gulls, they could also be ingesting DDE by feeding on dead marine mammals, which can have elevated DDE concentrations. During 2003-2005, we collected tissue samples from sea lions on Santa Cruz and they had a geometric mean of 7.95 ppm DDE (range 1.08-79.4 ppm) in their adipose tissue (MSRP, unpublished data).

We continue to locate new breeding territories on both the northern and southern Channel Islands and believe that the peregrine population will continue to expand into currently unoccupied breeding habitat. Although nesting density is high on the northern Channel Islands and the levels of productivity appear sufficient to maintain the population, factors such as juvenile/adult survival and emigration/immigration rates play an important role in population persistence. Annual population monitoring and banding of young could help us gain an understanding of these population parameters for the Channel Island peregrines and help determine whether contaminants or other issues are negatively impacting the population.

During the 2017 season, we will continue monitoring the known territories on all 8 islands and spend more time surveying areas that have received minimal survey effort in previous years, such as along the escarpments in the central valley of Santa Cruz and along the coast of San Clemente. We will rely primarily on the call-broadcast protocol for the rapid

assessment of areas with suitable habitat outside of known territories, as has been done in other studies (Klinger and Tomlinson 2010), and we recommend its use in peregrine population monitoring, especially when time and/or personnel are limited.

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Appendix I. Peregrine Falcon Monitoring Occupancy and Productivity Data

Peregrine Falcon Monitoring Occupancy and Productivity Data Form

Date:_____ Observer:_____

Territory Name and/or State Code:_____
Island: ANA SCI SRI SMI SBI SNI SCA SCL
Survey Method: Foot_____ Boat_____ Other_____
Survey Type: Passive_____ Call-Broadcast_____ Mixed_____
Observation Point: Latitude:_____ Longitude:_____
Observation Start Time:_____ Observation Stop Time:_____
Wind speed: : <5 6-15 >15 Cloud Cover (%):_____
Dominant Habitat Type within 0.5 km:_____

Occupancy Status: Are birds present? No Yes (fill in below if Yes)

# of Birds Present: **Male:** SY___ A___ Unk___ **Female:** SY___ A___ Unk___
Unidentified Bird: _____

Stage of Reproduction at time of visit: Unknown Courtship Incubation Nestling Fledgling

Activity/Behavior (Check those that apply)		
Territorial Defense	Pair Present	Courtship Display
Cooperative Hunting	Copulation	Vocalizing
Adult Prey Exchange	Individual Hunting	Young Present
Prey Delivery to Ledge	Brooding	Incubation
Feeding Young	Describe other behavior in Comments	

Signs of Productivity
Eggs Observed:_____ # of Young Observed:_____ Estimated Age of Young (Days):_____
Fledglings Confirmed:_____

If Nest is Identified: Distance to Nest_____m Bearing to Nest_____ Aspect of Nest_____
Approximate Nest Coordinates: Latitude:_____ Longitude:_____
Nest Location: Ledge on Cliff____ Stick Nest on Cliff____ Cavity/Pothole on Cliff____ Open Hillside____
Level Ground____ Other
(Describe)_____
Possible to view the nest site well enough to see eggs or young? Yes No
If unable to see nest site, please
explain:_____

COMMENTS:_____

Photos Taken (file
names)_____

Appendix II. Call-Broadcast Survey Form: Peregrine Falcons

Date:

<table>
<tr><td colspan="3">Island: ANA SCI SRI SMI SBI SNI SCA SCL</td></tr>
<tr><td colspan="2">Observers:</td><td>Survey Mode: Foot___ Boat___ Other _____</td></tr>
<tr><td colspan="2">Location Name/Description:</td><td>Latitude: Longitude:</td></tr>
<tr><td>Start Time:</td><td>End Time:</td><td>Wind Speed: <5 6-15 >15</td></tr>
<tr><td colspan="2">Peregrines Detected? (circle one) Yes No</td><td>Time to Detection (min):</td></tr>
<tr><td colspan="2">Response to Call-broadcast: Yes No</td><td>Type of Response:: Flight Vocal Both</td></tr>
<tr><td colspan="2">Duration of Response (min):</td><td>Distance to Responding Individuals (m)</td></tr>
<tr><td colspan="2"># Responding PEFAs[1]:
Male: N____ SY____ A____ Unk____
Female: N____ SY____ A____ Unk____
Unidentified:</td><td># Non-Responding PEFAs[1]:
Male: N____ SY____ A____ Unk____
Female: N____ SY____ A____ Unk____
Unidentified:</td></tr>
<tr><td>Young Present:
Y N Unk</td><td>Breeding Stage[2] (circle):
C I N F Unk</td><td>Interspecifics Present:</td></tr>
<tr><td colspan="3">Comments (include description of habitat quality and whether the area should be resurveyed):</td></tr>
</table>

[1]Age Class: Nestling (N) Second Year (SY) Adult (A)
[2]Courtship (C) Incubation (I) Nestling (N) Fledgling (F) Unknown (Unk)

Appendix III. Peregrine banding form.

Start Time:
End Time:

Peregrine Banding/Trapping Data Form

Date Banded/Trapped _____ Banding/Trapping Location _____

Trapping Method _____

FWS Band # _____ Leg _____ Acraft Band # _____ Leg _____

Blood Drawn _____ cc

Estimated Sex : M F Confirmed Sex: M F

****General Rule: Male: Band Size 6 fits with space around leg, weight < 700g**

Female: Band Size 7A fits with space around leg, weight >700g

Estimated Age _____ days

****Compared with aging guide**

Plumage Photographed: Y N

<u>Morphometrics</u>

Total Tail Length (center feather) _____ mm

Weight _____ g - Bag wt. _____ g = _____ g

Notes:

Appendix IV. Territory codes, as designated by the California Department of Fish and Wildlife, in numerical order and the island where they are located.

State Code	Territory Name	Island	Year of First Known Occupancy[a]
MC16	Carrington Point	Santa Rosa	1989
MC17	Hoffman Point	San Miguel	1986
MC18	Gherini Knife Edge	Santa Cruz	1991
MC19	Laguna	Santa Cruz	1991
MC20	West End	Santa Cruz	1989
MC21	West Anacapa	Anacapa	1989
MC27	Lime Point	Santa Rosa	1992
MC28	Bat Rock	San Miguel	1992
MC30	Sea Lion	Santa Cruz	1993
MC31	Water Canyon	Santa Rosa	1995
MC33	Signal Peak	Santa Barbara	1995
MC34	Bee Rock Canyon	Santa Rosa	1996
MC35	Orr's Camp	Santa Rosa	1996
MC36	Lost Hat	Santa Rosa	1998
MC37	Rat Trap	San Miguel	1999
MC38	Black Point	Santa Cruz	2000
MC42	Long Point	Santa Catalina	2002
MC43	Middle Anacapa	Anacapa	2003
MC44	Cardwell Point	San Miguel	2002
MC45	Arch Rock	Santa Cruz	2003
MC46	Valley Anchorage	Santa Cruz	2006
MC47	Crook Point	San Miguel	2006
MC49	Bullethead	Santa Catalina	2004
MC50	Trancion	Santa Rosa	2006
MC51	Krumholtz	Santa Rosa	2006
MC52	Cavern Point	Santa Cruz	2007
MC53	Bowen Point	Santa Cruz	2007
MC54	Cathedral Cove	Anacapa	2007
MC55	Soledad	Santa Rosa	2007
MC56	Carbon Point	San Miguel	2006
MC57	Salvador Point	San Miguel	2004
MC58	Science Point	San Miguel	2007
MC59	Cave Canyon	San Clemente	2011
MC60	Pelican Bay	Santa Cruz	2013
MC61	Punta Diablo	Santa Cruz	2013
MC62	Punta Gorda	Santa Cruz	2013
MC63	San Pedro West	Santa Cruz	2013
MC64	West Point South	Santa Cruz	2013
MC65	Bonn Point	Santa Rosa	2013

Appendix IV. Continued

State Code	Territory Name	Island	First Known Occupancy[a]
MC66	Chickasaw Canyon	Santa Rosa	2013
MC67	Sandy Point	Santa Rosa	2013
MC68	Castle Rock	San Miguel	2013
MC69	Harris Point	San Miguel	2013
MC70	Prince Island	San Miguel	2013
MC71	North Peak	Santa Barbara	2013
MC72	North Signal Peak	Santa Barbara	2013
MC73	Harrington	San Nicolas	2013
MC74	Cattail Canyon	San Nicolas	2013
MC75	Silver Peak	Santa Catalina	2013
MC76	Gnoma	Santa Rosa	2007
MC77	East Smuggler's	Santa Cruz	2014
MC78	Lone Tree	Santa Catalina	2014
MC79	Seal Cove	San Clemente	2014
MC80	Camel Point	Anacapa	2014
MC81	Del Norte	Santa Cruz	2016
MC82	Midway	San Nicolas	2016

[a]Data from California Department of Fish and Wildlife and Latta 2012 (Appendix IV)

Appendix V. Samples collected in 2016.

Sample ID	Island[a]	Territory	Sample Type	Collection Date	Notes
16-MC76-WB-1	SRI	Gnoma	Whole Blood	5/1/2016	Collected from 1947-21668
16-MC76-WB-2	SRI	Gnoma	Whole Blood	5/1/2016	Collected from 1947-21669
16-MC76-WB-3	SRI	Gnoma	Whole Blood	5/1/2016	Collected from 1947-21670
16-MC76-PR-1	SRI	Gnoma	Prey Remains	5/1/2016	Collected from eyrie
16-MC76-SF-1	SRI	Gnoma	Shell Fragments	5/1/2016	Collected from eyrie
16-MC18-SF-1	SCZ	Gherini	Shell Fragments	5/13/2016	Collected from eyrie
16-MC18-WB-1	SCZ	Gherini	Whole Blood	5/13/2016	Collected from 1156-16853
16-MC18-WB-2	SCZ	Gherini	Whole Blood	5/13/2016	Collected from 1947-21671
16-MC18-WB-3	SCZ	Gherini	Whole Blood	5/13/2016	Collected from 1156-16854
16-MC18-PR-1	SCZ	Gherini	Prey Remains	5/13/2016	Collected from eyrie
16-MC18-PR-2	SCZ	Gherini	Prey Remains	5/13/2016	Collected from eyrie
16-MC18-PR-3	SCZ	Gherini	Prey Remains	5/13/2016	Collected from eyrie
16-MC50-WB-1	SRI	Trancion	Whole Blood	5/15/2016	Collected from 1156-16855
16-MC50-WB-2	SRI	Trancion	Whole Blood	5/15/2016	Collected from 1947-21672
16-MC50-PR-1	SRI	Trancion	Prey Remains	5/15/2016	Collected from eyrie
16-MC50-SF-1	SRI	Trancion	Shell Fragments	5/15/2016	Collected from eyrie
16-MC45-WB-1	SCZ	Arch Rock	Whole Blood	5/28/2016	Collected from 1156-16856
16-MC45-WB-2	SCZ	Arch Rock	Whole Blood	5/28/2016	Collected from 1947-21673
16-MC45-PR-1	SCZ	Arch Rock	Prey Remains	5/28/2016	Collected from eyrie
16-MC61-SF-1	SCZ	Punta Diablo	Shell Fragments	5/28/2016	Collected from eyrie
16-MC61-PR-1	SCZ	Punta Diablo	Prey Remains	5/28/2016	Collected from eyrie
16-MC63-WB-1	SCZ	San Pedro West	Whole Blood	5/29/2016	Collected from 1156-16858
16-MC63-WB-2	SCZ	San Pedro West	Whole Blood	5/29/2016	Collected from 1947-21674
16-MC63-SF-1	SCZ	San Pedro West	Shell Fragments	5/29/2016	Collected from eyrie
16-MC63-PR-1	SNI	San Pedro West	Prey Remains	5/29/2016	Collected from eyrie
16-MC62-WB-1	SCI	Punta Gorda	Whole Blood	5/30/2016	Collected from 1156-16859
16-MC62-WB-2	SCI	Punta Gorda	Whole Blood	5/30/2016	Collected from 1947-21675

Appendix V. Continued

Sample ID	Island[a]	Territory	Sample Type	Collection Date	Notes
16-MC62-SF-1	SCZ	Punta Gorda	Shell Fragments	5/30/2016	Collected from eyrie
16-MC62-PR-1	SCZ	Punta Gorda	Prey Remains	5/30/2016	Collected from eyrie
16-MC19-WB-1	SCZ	Laguna	Whole Blood	5/31/2016	Collected from 1947-21676
16-MC19-WB-2	SCZ	Laguna	Whole Blood	5/31/2016	Collected from 1156-16860
16-MC19-SF-1	SCZ	Laguna	Shell Fragments	5/31/2016	Collected from eyrie
16-MC19-AE-1	SCZ	Laguna	Addled Egg	5/31/2016	Collected from eyrie
16-MC19-PR-1	SCZ	Laguna	Prey Remains	5/31/2016	Collected from eyrie
16-MC73-SF-1	SNI	Harrington	Shell Fragments	6/7/2016	Collected from eyrie
16-MC73-WB-1	SNI	Harrington	Whole Blood	6/7/2016	Collected from 1947-21678
16-MC73-WB-2	SNI	Harrington	Whole Blood	6/7/2016	Collected from 1947-21677
16-MC73-PR-1	SNI	Harrington	Prey Remains	6/7/2016	Collected from eyrie
16-MC74-PR-1	SNI	Cattail Canyon	Prey Remains	6/8/2016	Collected from eyrie
16-MC74-SF-1	SNI	Cattail Canyon	Shell Fragments	6/8/2016	Collected from eyrie
16-MC74-WB-1	SNI	Cattail Canyon	Whole Blood	6/8/2016	Collected from 1156-16861
16-MC74-WB-2	SNI	Cattail Canyon	Whole Blood	6/8/2016	Collected from 1947-21679
16-MC55-PR-1	SRI	Soledad	Prey Remains	6/11/2016	Collected from eyrie
16-MC55-WB-1	SRI	Soledad	Whole Blood	6/11/2016	Collected from 1156-16862
16-MC55-SF-1	SRI	Soledad	Shell Fragments	6/11/2016	Collected from eyrie
16-MC16-F-1	SRI	Carrington Point	Feather	6/11/2016	Collected from eyrie
16-MC16-AE-1	SRI	Carrington Point	Addled Egg	6/11/2016	Collected from eyrie
16-MC67-WB-1	SRI	Sandy Point	Whole Blood	6/12/2016	Collected from 1156-16863
16-MC67-SF-1	SRI	Sandy Point	Shell Fragments	6/12/2016	Collected from eyrie
16-MC67-PR-1	SRI	Sandy Point	Prey Remains	6/12/2016	Collected from eyrie
16-MC31-WB-1	SRI	Water Canyon	Whole Blood	6/13/2016	Collected from 1156-16864
16-MC31-WB-2	SRI	Water Canyon	Whole Blood	6/13/2016	Collected from 1156-16865
16-MC31-WB-3	SRI	Water Canyon	Whole Blood	6/13/2016	Collected from 1947-21680
16-MC31-PR-1	SRI	Water Canyon	Prey Remains	6/13/2016	Collected from eyrie

Appendix V. Continued

Sample ID	Island[a]	Territory	Sample Type	Collection Date	Notes
16-MC54-WB-1	ANA	Cathedral Cove	Whole Blood	6/14/2016	Collected from 1156-16866
16-MC54-WB-2	ANA	Cathedral Cove	Whole Blood	6/14/2016	Collected from 1947-21681
16-MC54-PR-1	ANA	Cathedral Cove	Prey Remains	6/14/2016	Collected from eyrie
16-MC54-F-1	ANA	Cathedral Cove	Feather	6/14/2016	Collected from eyrie
16-MC54-SF-1	ANA	Cathedral Cove	Shell Fragments	6/14/2016	Collected from eyrie

[a]AI=Anacapa Island, SRI=Santa Rosa Island, SCI=Santa Cruz Island, SNI=San Nicolas Island.