

Bald Eagle Restoration on the California Channel Islands
January — December 2009
8th Annual Report



Restoring Natural Resources
harmed by DDTs and PCBs

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Prepared by:

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

Prepared for:

National Park Service
Channel Islands National Park
1901 Spinnaker Drive
Ventura, CA 93001

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EXECUTIVE SUMMARY

Bald eagles (*Haliaeetus leucocephalus*) once nested on all the California Channel Islands off the coast of southern California, but disappeared by the early 1960s. Human persecution contributed to the population decline, but the introduction of DDT into the Southern California Bight, starting in the late 1940s, is thought to have led to their ultimate extirpation from Southern California.

The Institute for Wildlife Studies (IWS) began bald eagle restoration efforts on Santa Catalina Island in 1980, but DDT residue continued to impact the birds and successful reproduction was inhibited. In 2002, IWS initiated a 5-year bald eagle restoration feasibility study on Santa Cruz Island, in cooperation with the National Park Service, to determine whether the eagles could reproduce successfully if located further from the primary DDT source off the Palos Verdes Peninsula. IWS released 61 eagles on Santa Cruz Island from 2002-2006. In 2006, the first known nesting attempts occurred on the northern Channel Islands. Two pair of eagles successfully fledged one chick each from nests at Pelican Harbor and Malva Real on Santa Cruz Island. Both pairs attempted nesting again in 2007 and 2008, but only the Pelican Harbor pair was successful and a single chick was fledged during those two years.

In 2009, there were six known nesting attempts on Santa Catalina Island, two on Santa Cruz Island, and one on Santa Rosa Island. A total of 10 chicks hatched in nests (8 on Catalina, 2 on Santa Cruz). On Santa Catalina Island, we left eggs in all nests, but the Rattlesnake nest failed within a couple weeks of laying eggs. Single chicks were produced at the Pinnacle Rock and Seal Rocks nests. Two chicks were produced at the Twin Rocks, Two Harbors, and West End nests. All Santa Catalina chicks successfully fledged.

On Santa Cruz Island, the Saucers nest failed after about a month of incubation and the Pelican Harbor nest hatched two chicks about 3 days apart. The two chicks died at about 3 days of age from unknown causes. Food was delivered and the adults attempted feeding. It is possible that the chicks succumbed to domoic acid poisoning, as measurements of the diatom *Pseudonitzschia* that produces domoic acid were high in March and April in Santa Barbara and Ventura Counties. The Trap Canyon nest on Santa Rosa Island had at least one egg that was

incubated past its hatch date. One egg was recovered and showed no signs of development.

As of the end of December 2009, there are approximately 44 known bald eagles on the California Channel Islands. There are 27 known eagles on the northern Channel Islands, including four originally released on Santa Catalina Island. Fifteen known eagles are on Santa Catalina Island, including one bird originally released on Santa Cruz Island. These are minimum numbers, as it is likely that there are others that were not documented in 2009. Two other eagles released from Santa Cruz Island are being tracked on the mainland via their GPS transmitters, and an additional three that have dropped their transmitters were sighted on the mainland.

Bald eagles have continued to use Santa Rosa Island, especially from the fall through spring, where they have been seen feeding on carcasses and gut piles of mule deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus canadensis*) left from the guided hunts and culling activities, and on marine mammal carcasses on the beaches. The number of birds moving to West Anacapa during the spring and summer, which corresponds with the marine bird breeding season, decreased in 2009, as compared to previous years.

The successful hatching of bald eagles on Santa Cruz and Santa Catalina islands in 2009, coupled with the high survival and retention rates of bald eagles on the Channel Islands, are reason for optimism regarding the success of the bald eagle restoration program. The eagles are moving freely among the islands (they are known to have been on all but San Nicolas Island in 2009), so as the population grows there is a good possibility that bald eagles will eventually be found on all the California Channel Islands, as they were historically. Although there were no successful nests on the northern Channel Islands in 2009, we monitored nine pairs this season and expect more nesting attempts in 2010. It is possible that we could see nesting attempts by the first two naturally produced chicks from the 2006 season, as they will be four years old in 2010.

ACKNOWLEDGMENTS

IWS thanks the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), California Department of Fish and Game, National Oceanic and Atmospheric Administration (NOAA), The Nature Conservancy, the U.S. Navy, and the Ventura County Office of Education. We also would like to thank this year's field crew: S. Jijon, S. Eyes, C. Villasenor, A. Wilhelm, D. Roth, R. Bowdry, and S. Whitney. Funding for the project was made available by the Montrose Settlements Restoration Program.

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INTRODUCTION

Bald eagles (*Haliaeetus leucocephalus*) were extirpated from the Channel Islands by the early 1960s as a result of human persecution and the introduction of the organochlorine pesticide DDT into the Southern California Bight (Fig. 1). DDE (a metabolite of DDT) levels have been found to be inversely correlated with eggshell thickness and productivity in bald eagles (Hickey and Anderson 1968, Wiemeyer et al. 1984). The decline in bald eagle populations in southern California was concurrent with declines in seabird breeding success in the Southern California Bight and with continent-wide declines in bald eagle populations, much of which was also attributed to the impacts of DDT (Risebrough et al. 1971, Anderson et al. 1975, Grier 1982, Wiemeyer et al. 1984).



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

The Institute for Wildlife Studies (IWS), in cooperation with the United States Fish and Wildlife Service (FWS), California Department of Fish and Game, and the Santa Catalina Island Conservancy, initiated a program to reintroduce bald eagles to Santa Catalina Island, California (Catalina; Fig. 1) in 1980. Between 1980 and 1986, 33 eagles were released on the island from hacking platforms (Garcelon 1988). Many of these birds matured and formed breeding pairs on the island, but all the eggs produced by the initial breeding pairs broke in the nest. Concentrations of DDE in the remains of eggs removed from failed nests implicated this contaminant as the causal agent of the lack of productivity (Garcelon et al. 1989). Eggs removed

from nests on Catalina exhibited thinning of the shell (L. Kiff, Expert Report) and areas of gross structural abnormalities of the eggshell that resulted in rapid water loss and a weakening of the eggshell (Risebrough 1998). Mean levels of DDE in egg remains removed from nests in 1987 and 1988 were twice as high as that which has been shown to cause complete reproductive failure (Wiemeyer et al. 1984), indicating that there was still a large amount of DDE in the food chain.

From 1989 through 2006, the reintroduced population on Catalina Island was maintained through manipulations of eggs and chicks at each nest site and through additional hacking of birds. In the egg manipulation process, artificial eggs were substituted for the structurally deficient eggs laid by the birds affected by DDE. The adult eagles continued to incubate the artificial eggs while the removed eggs were relocated and artificially incubated. Chicks that hatched from these removed eggs, or those produced by captive adults at the Avian Conservation Center (ACC) at the San Francisco Zoo, were then fostered into the nests. In 2007, we began leaving eggs in some nests on Catalina and have had natural hatching at most nests at which eggs were left.

From 1989 through 2009, adult bald eagles on Catalina successfully reared 75 of 86 chicks that were either fostered into nests (66 chicks), hatched from two of three healthy eggs that were placed into nests, or hatched from eggs left in the nest (18 chicks). Four of these 86 birds were removed from the nest prior to fledging because of injuries and seven died due to accidents, predation, or unknown causes. An additional 21 eagles were released through continued hacking activities between 1991 and 2001 (20 chicks and a 1-year-old bird).

IWS began a similar reintroduction program on the northern Channel Islands in 2002, releasing 61 eagles from hacking towers from 2002-2006. In 2006, two separate pairs on Santa Cruz Island (Santa Cruz) successfully hatched and fledged one chick (Sharpe 2007). These were the first known bald eagle chicks to hatch naturally in the wild on the California Channel Islands since 1950. In 2007, only one of the two nests was successful at hatching and fledging an eaglet. In 2008, four chicks hatched in two nests on Santa Cruz, but two chicks died at the nest and two others were knocked out of the nest by a subadult eagle. These last two chicks were rescued and later hacked onto the island.

Because of the recent successes on the northern Channel Islands and Catalina, and the movement between the islands by the eagles, the Montrose Settlements Restoration Program combined the two bald eagle restoration projects into a single program at the end of 2007. In 2009, we monitored all known bald eagle nests on the Channel Islands and left the eggs in all nests. In this report we summarize the results of the 2009 bald eagle season.

STUDY AREA

Our 2009 monitoring was conducted primarily on Catalina, Santa Cruz, and Santa Rosa Island (Santa Rosa). Catalina is located 34 km south of Long Beach, California. The island is 34 km long, 0.8 to 13.0 km wide, and covers 194 km² (Fig. 2). Elevations range from sea level to 648 m. Mean annual temperatures range from 12 to 20° C near the coast, and yearly precipitation averages 31 cm (NOAA 1985).

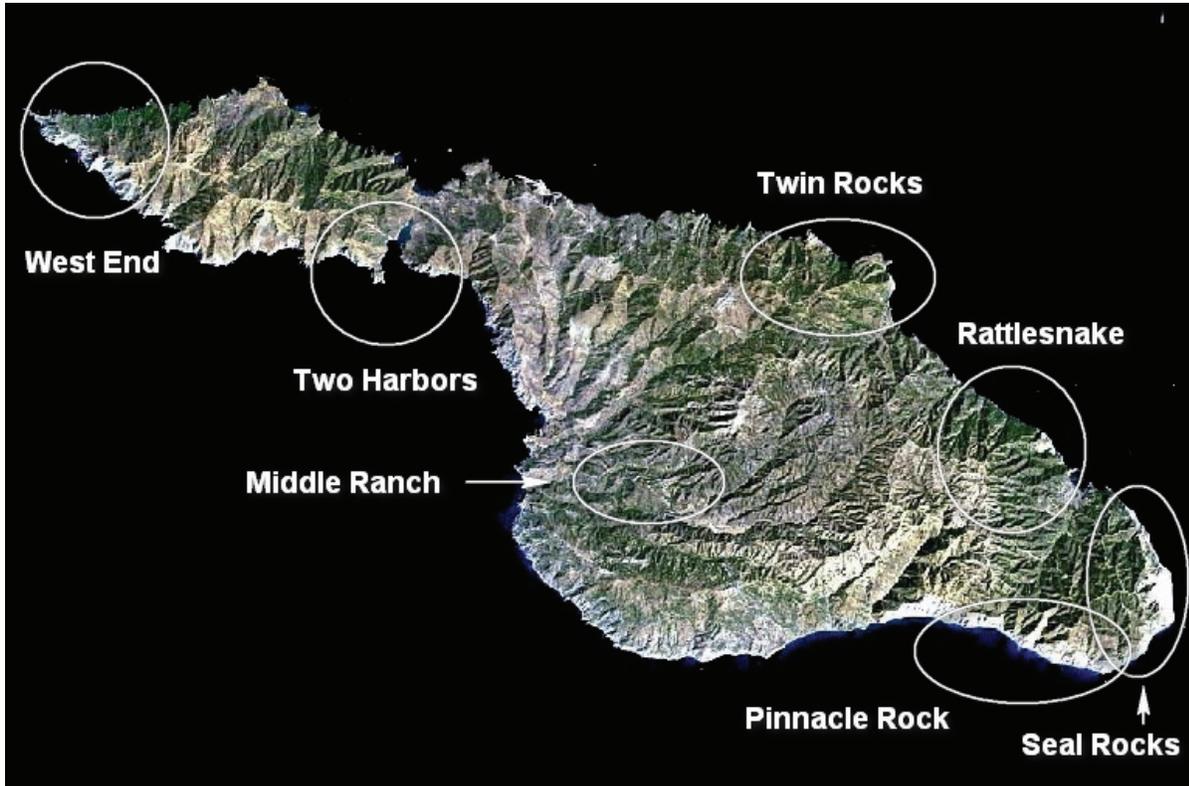


Figure 2. Santa Catalina Island, CA and the active bald eagle breeding territories in 2009.

The northern Channel Islands, which are composed of San Miguel Island (San Miguel), Santa Rosa, Santa Cruz, and Anacapa Island (Anacapa; west to east), are located approximately 19 to 44 km off the coast of Ventura and Santa Barbara counties (Fig. 1). Santa Cruz is the largest of the eight California Channel Islands, measuring about 38 km in length and 12 km wide at its widest point (Fig. 3). The land area is approximately 249 km² with a maximum elevation of 753 m. Santa Cruz is the most rugged and topographically diverse of the northern Channel Islands and has a Mediterranean climate, with mean monthly temperatures ranging from 11.7 - 20.9° C and a mean annual rainfall of 50 cm (Junak et al. 1995). The NPS owns and manages the

eastern 24% of the island and The Nature Conservancy (TNC) owns and manages the western 76% of the island.

Santa Rosa is the second largest of the Channel Islands and is owned by the NPS. The island encompasses approximately 214 km² and is less topographically diverse than Santa Cruz. A central mountain range reaches an elevation of 484 m and the coastal habitat varies from gentle slopes and sandy beaches to sheer cliffs (Channel Islands National Park website, <http://www.nps.gov/chis>).



Figure 3. Santa Rosa (left) and Santa Cruz (right) Islands and the active bald eagle territories in 2009.

METHODS

Permitting

IWS has the required Federal Fish and Wildlife Permit (Permit TE744878-8) and a Memorandum of Understanding with the California Department of Fish and Game to conduct bald eagle research on the California Channel Islands. IWS has a banding permit from the United States Geological Survey's Bird Banding Laboratory allowing us to band and radio-tag eagles.

Surveying and Nest Monitoring

Observations of adult eagles began in January 2009 at each of last year's nest sites. We also conducted weekly ground surveys of Catalina, Santa Cruz, and Santa Rosa to locate new nesting pairs. In addition, we conducted a helicopter survey of the northern Channel Islands on

16 March. Once we confirmed nesting eagles we set up observation blinds or found partially hidden locations from which to observe the nests. We monitored the chronology of nesting through incubation and chick-rearing. We had established video cameras prior to the nesting season at three nests on Catalina (West End, Twin Rocks, and Two Harbors nests) and one nest on Santa Cruz (Pelican Harbor nest), which enabled close, remote observations of nesting activity. Most nests with cameras were available for live viewing on our website (<http://www.iws.org>).

We used radio-telemetry (all islands) and GPS transmitters (northern Channel Islands only) to locate and observe fledged eagles every 1-3 days during their first month of flight. We attempted to observe, or at least determine that the birds were moving, at least once per week through December, or until they left the islands. For eagles banded on Catalina, we used a VHF transmitter (Communications Specialists, Inc., Orange, CA) that transmitted a signal once per second, but also transmitted a unique identifier once per hour that could be received by remote telemetry towers on Catalina and San Nicolas Island. When a tower received a signal, the data were transmitted to Communications Specialists, where they were integrated into a web page that we could access to determine which birds were identified and which tower(s) received the signal. If the transmitter failed to move for 2-6 hours, then it switched to mortality mode (2-3 pulses/second) and indicated a mortality signal in its hourly transmission.

Marking and Sampling

We entered each nest when the eagle chicks were approximately 8 weeks old to equip them with federal leg bands, wing markers (orange on Catalina, blue on NCI), and a backpack-style GPS and/or VHF radio-transmitter. At this time we also collected a blood sample (~10 cc) for future contaminant analyses and made morphological measurements to determine sex (Bortolotti 1984, Garcelon et al. 1985). Sex was confirmed later with a blood sample sent for DNA analyses (Avian Biotech International, Tallahassee, FL).

Monitoring of Previously Released Eagles

We closely monitored the status of all GPS-tagged eagles fledged in previous years. Data were retrieved daily via computer from Argos, Inc. (Largo, Maryland). Any bird that had not

moved more than 50 m in a day was located as soon as possible to determine its status. We radio-tracked 1-2 days/week on Catalina to search for previously released eagles that had stayed on or returned to the island. During monitoring we searched for other eagles that were no longer carrying functioning transmitters. We also kept records of reported sightings from observers around the islands and on the mainland.

Trapping

We attempted to trap bald eagles on Santa Cruz to collect blood samples for contaminant analyses and to replace their transmitters. All trapping efforts were made from a boat using the floating fish noose technique (Cain and Hodges 1989, Jackman et al. 1993).

RESULTS

Surveying and Nest Monitoring

Santa Catalina Island

Nests were located in February and March 2009 in all six previously active territories on Catalina (Twin Rocks, Pinnacle Rock, Seal Rocks, West End, Two Harbors, and Rattlesnake; Fig. 2). In addition, the Middle Ranch pair (K-93 and A-32) built a nest, but did not lay eggs.

Twin Rocks Territory. The territory was used by the same pair that used it from 1998-2008. The male (K-33) was a bird that hatched from a Catalina egg in 1992 and the female (K-17) was a bird released at the Bulrush hacktower in 1984. The birds used their 2008 nest on an inaccessible cliff face and were seen at the nest several times during January and February. Based upon observed incubation behavior the first egg was laid around 24 February. At least one more egg was laid, but we were never able to see the eggs in the nest from our nearest observation point, which was nearly a 1.5 km away. On 26 March, we were able to put in a camera that gave us a slightly better view of the nest.

On 3 April, we observed an adult feeding at least one chick. Two chicks were confirmed on 11 April. We climbed to the nest on 30 May and removed two eaglets from the nest temporarily and equipped them with leg bands, transmitters, and wingmarkers, and we obtained blood samples (Table 1; Fig. 4). We continued to observe the eaglets in the nest until they fledged between 16 and 22 June. Eagle K-96 was seen floating in the ocean about 4 km north of Emerald Bay on Catalina on 14 August and washed up at Laguna Beach the next day. Eagle K-94 is believed to have left Catalina around 26 August.



Figure 4. The Twin Rocks chicks in the nest following banding, Santa Catalina Island, CA.

Table 1. Biographical data for bald eagle chicks hatched at nests on Santa Catalina Island, CA during 2009.

Federal Band	Sex	Wing Tag	Date Fledged	Nest	Status ^a	Comments
629-52448	M	K-90	6/11/09	Seal Rocks	Unknown	Left Catalina around 8/26
629-52449	F	K-87	~6/18/09	Two Harbors	Alive	Seen on Catalina in April 2010
629-52450	F	K-91	6/16/10	Two Harbors	Unknown	
679-03426	M	K-96	~6/16/09	Twin Rocks	Dead	Seen floating in ocean near Catalina on 8/14
679-03427	M	K-94	~6/22/09	Twin Rocks	Unknown	Left Catalina around 8/26
679-03428	F	K-99	~6/27/09	Pinnacle Rock	Dead	Found dead in ocean 9/2
679-03429	F	K-97	7/2/09	West End	Unknown	Transmitter malfunctioned
679-03430	F	K-98	7/8/09	West End	Dead	Found dead 8/19 on beach at Camp Pendleton, CA

^a As of 12/31/09

West End Territory. The West End pair used the same nest that has been used since 1991. The male, K-01, was produced by captive birds at the ACC and fostered into the Pinnacle Rock nest in 2000. The female was not marked with patagial tags, but is believed to be a bird released at the Sweetwater hacktower in 1986. This nest was monitored primarily via our live web cam and birds were regularly seen at the nest throughout February. The first egg was laid on 28 February and the second on 2 March.

The eggs hatched on 7 and 8 April. We entered the nest on 5 June to equip the birds with leg bands, transmitters, and wingmarkers, and to obtain blood samples (Fig. 5, Table 1). We continued to monitor the birds until they fledged between 2 and 8 July. K-97's transmitter malfunctioned while it was still in the nest, so we were unable to track the bird. Eagle K-98 was found dead on a beach at Camp Pendleton in southern California on 18 August.



Figure 5. The West End chicks at the time of banding, Santa Catalina Island,

Pinnacle Rock Territory. The Pinnacle Rock pair used the same nest as in 2008. The female, K-56, was hatched from a Seal Rocks egg and fostered into the Seal Rocks nest in 2005. The male, K-65, was hatched at the Bulrush tower in 1986. We observed the birds sitting on their first egg on 27 February. They laid a second egg on or around 2 March. One egg disappeared around 2 April, but the remaining egg hatched on 5 April.

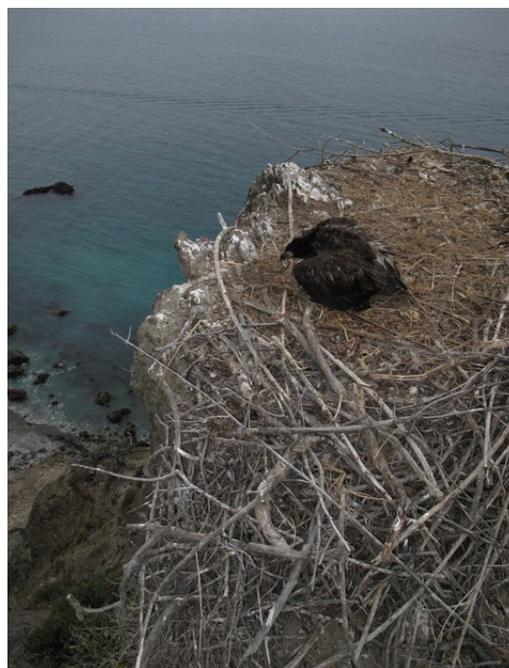


Figure 6. The Pinnacle Rock chick at the time of banding, Santa Catalina Island, CA.

We climbed to the nest on 31 May and equipped the eaglet with a leg band, wingmarkers, and a transmitter, and collected blood for contaminants analyses (Fig. 6; Table 1). The eaglet fledged around 27 June and moved around the island until it was found dead in the ocean off of White's Landing on 2 September.

Seal Rocks Territory. The Seal Rocks pair made a new nest about 200 m down the canyon from their previous nest. The female, K-34, is from the captive ACC eagles and was hatched at the Bulrush tower in 1993. The male, K-25, hatched from an egg from the West End territory and was fostered into the Pinnacle Rock nest in 1992. We discovered the new nest on 28 February, at which time the birds had one egg. A second egg was seen on 2 March. One of the eggs hatched

around 26 March and the remaining egg disappeared by 6 April.

We entered the nest on 20 May to equip the bird with a leg band, transmitter and wingmarkers and to collect blood for contaminants analyses. We continued to monitor the nest until the bird fledged on or around 11 June (Fig. 7, Table 1). The bird remained on the island until approximately 26



Figure 7. The Seal Rocks chick at the time of banding, Santa Catalina Island, CA.

August, at which time we no longer picked up its signal. On 21 October we did receive its signal via a remote receiver on the west end of Catalina. The bird could have been on Catalina, San Clemente, Santa Barbara, or San Nicolas Islands, or on the mainland.

Two Harbors Territory. The Two Harbors pair used the same nest as last season. The male, K-81, is an ACC-produced eagle that was fostered into the West End nest in 1998. The female, K-82, hatched from an egg removed from the West End nest in 1998 and was fostered into the Pinnacle Rock nest. The nest was monitored primarily via our live web cam. Activity was noted at the nest throughout February and the female laid her first egg around 1645 hrs on 17 February. A second egg was laid on 21 February. The eggs hatched on 26 and 28 March.

We entered the nest on 22 May to install a leg band, transmitter, and wingmarkers on each chick, and to obtain blood samples (Fig. 8, Table 1). Eagle K-91 fledged on 16 June and K-87 fledged between 18 and 23 June. We continued tracking K-87 until 17 November, after which we were no longer able to locate the bird. We tracked K-91 until 30 September, after which we could not locate the eagle. However, our remote receiver picked up its signal until 13 October.



Figure 8. The Two Harbors chicks at time of banding, Santa Catalina Island, CA.

Rattlesnake Territory. The Rattlesnake pair moved their nest to Toyon Canyon, one canyon north of their previous nest site. The male, K-80, was produced by eagles at the ACC in 1998 and was fostered into the West End nest. The female, K-47, was produced by eagles at the ACC in 2004 and was fostered into the Seal Rocks nest. We received a call from the Catalina Island Marine Institute on 10 March indicating that the eagles were on a nest in a eucalyptus tree near their camp. We found the nest and there appeared to be a single egg present. We continued to monitor the nest until it failed around 17 March. No other nesting attempts were made.

Santa Cruz Island

Pelican Harbor Territory. The Pelican Harbor pair remained together for a fourth breeding season. The male, K-10, was produced by the ACC and fostered into the Twin Rocks nest on Catalina in 2001. The female, K-26, also was produced by the ACC and fostered into the West End nest on Catalina Island in 2002. Monitoring via a live web cam established with the cooperation of the Ventura County Office of Education indicated that the first egg was laid on 25 February and a second egg was laid on 28 February. The first egg hatched on 3 April, but the chick died on 6 April. The second egg hatched on 8 April, but it died on 11 April. The cause of death is unknown and the chicks were not recovered because it would have been a minimum of 2 days before we could have gotten a climber to the nest, by which time the carcasses would have been either removed or in too poor of a condition for a necropsy.

Malva Real Territory. There was no known nesting activity by the Malva Real pair, which consists of a 2003 Alaskan female, A-17, hatched on Santa Cruz in 2002, and a male, K-11, produced at the ACC and fostered into the West End nest on Catalina in 2001. Eagle A-17 replaced the previous female in the territory after her death in April 2008.

Sauces Territory. The Sauces birds used the same Sauces Canyon nest as in 2008. The female, A-02, was produced by birds at the ACC and was hatched on Santa Cruz in 2002. The male, A-28, was collected from Alaska and hatched on Santa Cruz in 2004. The birds were confirmed to be incubating on 25 February and A-02's GPS data indicate the first egg was laid around 24 February. We were unable to see into the nest, so we do not know how many eggs were in the clutch. The nest failed around 30 March for unknown reasons. No eggs were recovered.

Santa Rosa Island

Trap Canyon Territory. The Trap Canyon pair used the same nest as in 2008. Female A-22 and Male A-08, released on Santa Cruz in 2004 and 2002, respectively, were found nesting in an old golden eagle nest on 24 February. The pair continued incubation into late April, but began spending more and more time away from the nest, and eventually abandoned it. We entered the nest on 27 April and removed one egg. We opened the egg to process it for chemical analyses and the egg was either infertile or the chick had died early in development.

Nesting Summary

Based upon our observations and the number of chicks that hatched in nests on the Channel Islands, we estimate that the eagles laid 15-22 eggs this season, of which 10 (45-67%) hatched (Table 2). Eight chicks (80%) fledged and 3-5 (37.5-62.5%) of the fledged eaglets survived until the end of the year (3 known alive, 3 known dead, 2 unknown status).

Table 2. Summary of nesting attempts by bald eagles on the California Channel Islands in 2009.

Island/Nest	Eggs	Chicks		Number Surviving Until End of Year
	Incubated	Hatched	Fledged	
Santa Catalina Island				
Twin Rocks	2-3	2	2	1?
West End	2	2	2	1
Pinnacle Rock	2	1	1	0
Seal Rocks	2	1	1	1?
Two Harbors	2	2	2	2
Rattlesnake	1-3	0	0	0
TOTAL	11-14	8	8	3-5
Santa Cruz Island				
Pelican Harbor	2	2	0	0
Sauces	1-3	0	0	0
TOTAL	3-5	2	0	0
Santa Rosa Island				
Trap Canyon	1-3	0	0	0
TOTAL	1-3	0	0	0
All Islands Combined	15-22	10	8	3-5

Monitoring of Previously Released Eagles

Besides monitoring this year's fledglings, we continued to monitor the eagles that had been released or hatched naturally on the Channel Islands prior to 2009. Twenty-eight bald eagles that were released on Catalina in previous years were seen during 2009 (Table 3).

Fourteen of the birds were on Catalina, four on Santa Cruz, two on other Channel Islands, and eight on the mainland.

Table 3. Status of bald eagles released or fledged from nests on Santa Catalina Island, CA prior to 2009 and known to have been alive in 2009.

FWS Leg Band	Sex ¹	Patagial Marker	Nest/Release Tower	Fledge Year	Status, Latest Location ²
629-16077	F	K-17	Bullrush Tower	1984	Alive, Twin Rocks pair, Catalina Is.
629-16085	F	NA	Sweetwater Tower	1986	Alive, West End pair, Catalina Is.
629-16089	M	K-65	Bullrush Tower	1986	Alive, Pinnacle Rock pair, Catalina Is.
629-19925	M	K-25	Pinnacle Rock	1992	Alive, Seal Rocks pair, Catalina Is.
629-19923	M	K-33	Seal Rocks	1992	Alive, Twin Rocks pair, Catalina Is.
629-19928	F	K-34	Bullrush Tower	1993	Alive, Seal Rocks pair, Catalina Is.
629-39815	M	K-80	West End	1998	Alive, Rattlesnake pair, Catalina Is.
629-39816	M	K-81	West End	1998	Alive, Two Harbors pair, Catalina Is.
629-39817	F	K-82	Pinnacle Rock	1998	Alive, Two Harbors pair, Catalina Is.
629-29497	M	K-93	Bullrush Tower	1999	Alive, Middle Ranch pair, Catalina Is.
629-29498	M	K-01	Pinnacle Rock	2000	Alive, West End pair, Catalina Is.
629-29499	F	K-02	West End	2000	Alive, Lake Hemet, CA
629-02780	M	K-10	Twin Rocks	2001	Alive, Pelican Harbor pair, Santa Cruz Is.
629-02782	M	K-11	West End	2001	Alive, Malva Real pair, Santa Cruz Is.
629-02790	M	K-23	Pinnacle Rock	2002	Alive, British Columbia 9/14/09
629-02793	F	K-26	West End	2002	Alive, Pelican Harbor pair, Santa Cruz Is.
629-47352	M	K-36	Two Harbors	2003	Alive, Gorman, CA 2/16/09.
629-47371	F	K-47	Seal Rocks	2004	Alive, Rattlesnake pair, Catalina Is.
629-47395	M	K-51	Pinnacle Rock	2005	Alive, San Clemente Is. 6/09
629-47398	F	K-56	Seal Rocks	2005	Alive, Pinnacle Rock pair, Catalina Is.
629-52403	F	K-63	Two Harbors	2006	Alive, Paso Robles, CA 4/16/09
629-52425	M	K-00	Pinnacle Rock	2007	Alive, Catalina Island 3/23/09
629-52428	M	K-73	West End	2007	Alive, Millerton Lake, CA 2/27/09
629-52432	M	K-78	Two Harbors	2007	Alive, near Redding, CA 7/20/09
629-52433	M	K-88	Twin Rocks	2008	Alive, Baker Beach, OR 7/22/09
629-52442	F	K-83	Two Harbors	2008	Alive, near CA/OR border 6/2/09
629-52443	M	K-88	Twin Rocks	2008	Alive, signal on San Clemente Is., 3/18/09
629-52446	F	K-67	West End	2008	Alive, Santa Cruz Is., 8/2/09

¹ Determined by karyotyping and/or morphometrics.

² As of 12/31/09 unless otherwise noted.

As of 31 December, 13 of the eagles previously released or naturally hatched on Santa Cruz are being monitored via GPS data and 17 others have been identified during our surveys or through sightings by other observers (Table 4). During 2009, we had 2 known mortalities of eagles released on the northern Channel Islands in previous years (Table 4).

Table 4. Status of bald eagles released or fledged from nests on Santa Cruz Island, CA in 2002-2008 and known to have been alive in 2009.

FWS Leg Band	Sex ¹	Patagial Marker	Source ²	Fledge Year	Status, Latest Location ³
629-02795	M	A-00	Zoo	2002	Alive, Cueva Valdez pair, Santa Cruz Is.
629-02798 [†]	F	A-02	Zoo	2002	Dead on Santa Cruz Is. Between 4/11 &-7/24/09
629-14045	M	A-08	Alaska	2002	Alive, Trap Canyon pair, Santa Rosa Is.
629-14048	F	A-11	Alaska	2002	Alive, Yellowbanks pair, Santa Cruz Is.
629-47359	F	A-16	Alaska	2003	Alive, Cueva Valdez pair, Santa Cruz Is.
629-47360 [†]	F	A-17	Alaska	2003	Alive, Malva Real pair, Santa Cruz Is.
629-47363	F	A-19	Alaska	2003	Alive, Forestville, CA 4/12/09
629-47356	M	A-21	Alaska	2003	Alive, Yellowbanks pair, Santa Cruz Is.
629-47366	F	A-23	Zoo	2004	Alive, central CA 2/10/09
629-47372	F	A-24	Alaska	2004	Alive, Frazier Point pair, Santa Cruz Is.
629-47375	F	A-27	Alaska	2004	Alive, Sauces pair, Santa Cruz Island
629-47376	M	A-28	Alaska	2004	Alive, Sauces pair, Santa Cruz Is.
629-47377 [†]	M	A-29	Alaska	2004	Alive, Santa Rosa Is. 11/09
629-47380	F	A-32	Alaska	2004	Alive, Middle Ranch pair, Santa Catalina Is.
629-47385 [†]	F	A-34	Zoo	2005	Alive, Santa Rosa Is.
629-47386	F	A-35	Zoo	2005	Alive, Pt. Mugu, CA 5/7/09
629-47387 [†]	F	A-36	Zoo	2005	Dead, Santa Rosa Is., 6/09.
629-47388	F	A-37	Zoo	2005	Alive, Santa Rosa Is., 6/09
629-47390 [†]	M	A-39	Zoo	2005	Alive, Santa Rosa Is., 6/09.
629-47391	M	A-40	Zoo	2005	Alive, Frazier Point pair, Santa Cruz Is.
629-47399	F	A-43	Zoo	2005	Alive, Santa Rosa Is. 12/3/09
629-02800	M	A-45	Zoo	2005	Alive, Willows pair, Santa Cruz Is.
629-52404 [†]	M	A-46	Zoo	2006	Alive, Mainland
629-52406 [†]	F	A-48	Zoo	2006	Alive, Santa Rosa Is.
629-52407 [†]	F	A-49	Pelican	2006	Alive, Santa Cruz Is.
629-52410	F	A-51	Zoo	2006	Alive, Willows pair, Santa Cruz Is.
629-52411 [†]	F	A-52	Zoo	2006	Alive, Pt. Conception.
629-52417 [†]	F	A-55	Zoo	2006	Alive, Mainland (dropped transmitter).
629-52420 [†]	M	A-58	Zoo	2006	Alive, Santa Rosa Is.
629-52421 [†]	F	A-59	Zoo	2006	Alive, Santa Rosa Is.
629-52422 [†]	M	A-60	Malva	2006	Alive, Santa Cruz Is.
629-52438 [†]	M	A-64	Pelican	2008	Alive, Santa Cruz Is.

¹ Determined by karyotyping for birds from San Francisco Zoo, and morphometrics for Alaskan birds.

² Bald eagles from the San Francisco Zoo (Zoo), wild nests near Juneau, Alaska (Alaska), the Pelican Harbor (Pelican) or Malva Real (Malva) nests on Santa Cruz, or a rehabilitation center in northern California (Rehab).

³ As of 12/31/09. unless otherwise noted.

[†] Carrying a GPS transmitter.

A-02 Movements

Eagle A-02 spent all of 2009 on Santa Cruz, primarily in the Saucos area on the west end of the island. Her GPS transmitter stopped functioning on 11 April and she was found dead in the Pozo area (southern end of her territory) in September (Fig. 9).

A-17 Movements

Eagle A-17 spent all year on either Santa Rosa or Santa Cruz (Fig. 10). She began the year on Santa Rosa and remained there throughout most of January and February, except for two trips to Santa Cruz on 5-12 February and 25 February - 2 March. She returned to Santa Cruz on 12 March and remained until 29 September. During that time she was often within the Malva Real territory and has probably replaced A-04. Between 29 September and 4 December she made four visits to Santa Rosa, each lasting from 6-11 days. She ended the year on Santa Cruz.

A-29 Movements

We did not receive any data from Eagle A-29 until 8 February, at which time he was on the mainland north of Ventura, CA (Fig. 11). He flew to Santa Cruz on 19 February and then to Santa Rosa on 9 March. He returned to Santa Cruz on 21 March, returned to Santa Rosa on 4 April, and flew

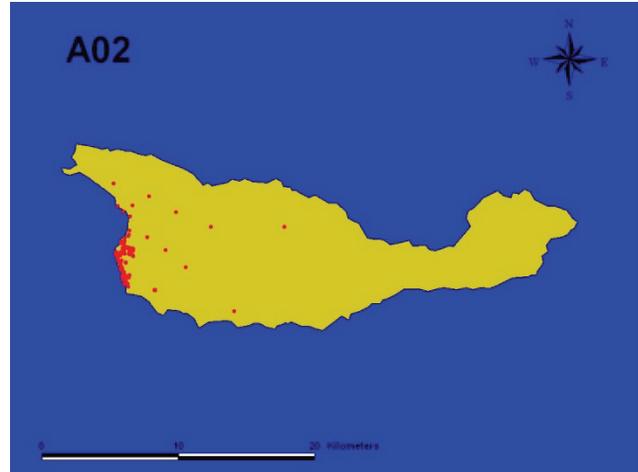


Figure 9. Movements of Eagle A-02 on Santa Cruz Island, CA in 2009.

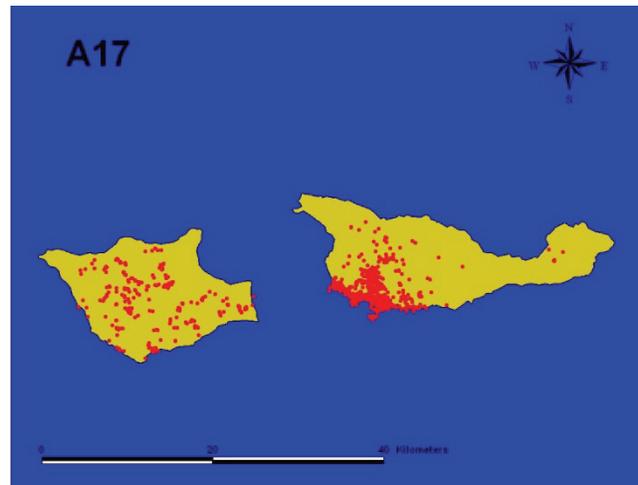


Figure 10. Movements of Eagle A-17 on the northern Channel Islands, CA in 2009.

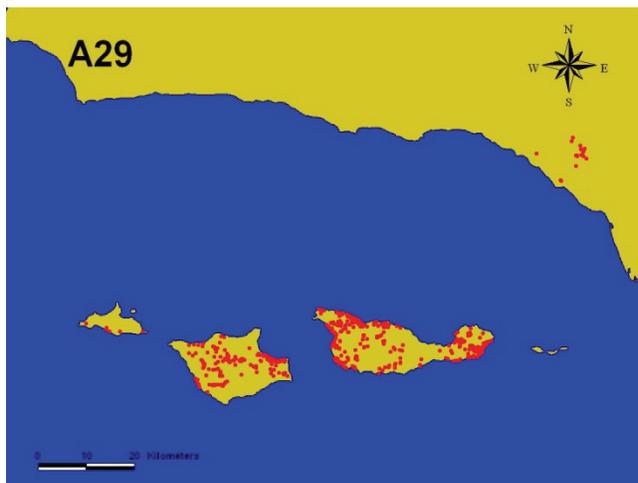


Figure 11. Movements of Eagle A-29 on the northern Channel Islands and mainland California in 2009.

to San Miguel for 2 days on 6 April. On 8 April he flew to Santa Cruz, where he remained through 5 May. On 6 May he returned to Santa Rosa, remaining there until mid-June. He spent 14 June through 24 September on Santa Cruz and 25 September through 22 November on Santa Rosa. We received no new data through the end of the year for this bird.

A-34 Movements

Eagle A-34 spent the majority of the year on Santa Rosa with brief visits to Santa Cruz on 8-14 February, 25 February - 1 March, 4-7 March, 18-27 March and 11-13 April. She also made a single trip to Anacapa on 2-3 March (Fig. 12).

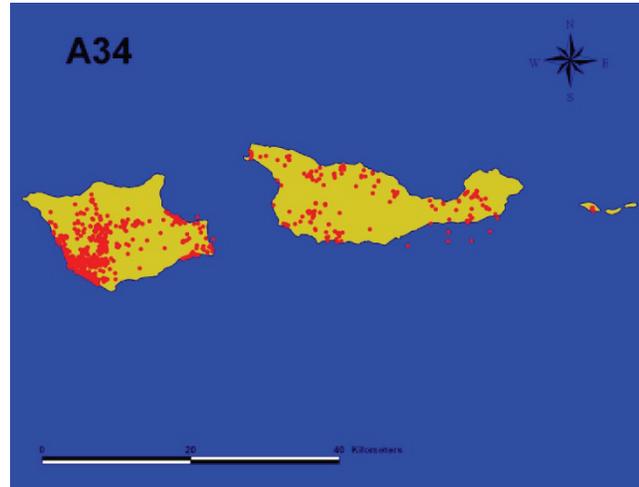


Figure 12. Movements of Eagle A-34 on the northern Channel Islands, CA in 2009.

A-36 Movements

Eagle A-36 began 2009 on Santa Cruz (Fig. 13). She flew to Santa Rosa for 6-24 January and then back to Santa Cruz from 26-28 January. She then returned to Santa Rosa from 28 January until 7 February. She flew to Santa Cruz again on 7 February and flew to the mainland on 8 February, via Anacapa. For the next 10 days she traveled between Point Hueneme and Point Conception. She returned to Anacapa on 19 February and then moved to Santa Cruz on 20 February. On 28 February she returned to Santa Rosa where she remained, except for one trip to Santa Cruz and Anacapa on 1-4 April. She was found dead on Santa Rosa in June.

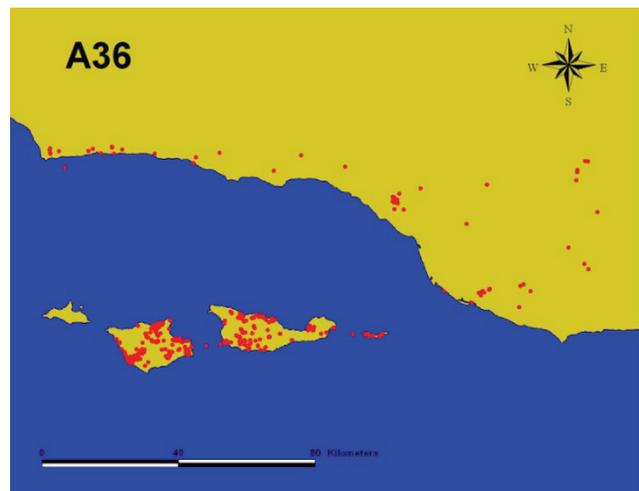


Figure 13. Movements of Eagle A-36 on the northern Channel Islands and mainland California in 2009.

A-39 Movements

Eagle A-39 spent most of the year on Santa Rosa, with brief visits to Santa Cruz. He was on Santa Rosa from the beginning of the year until 5 February. He made four 1-2 day visits to Santa Cruz in February and three one-day visits to Santa Cruz on 9 April, 1 May and 9 October (Fig. 14).

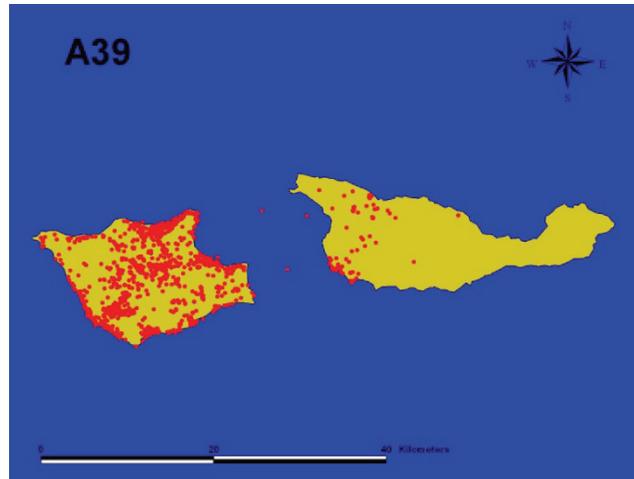


Figure 14. Movements of Eagle A-39 on the northern Channel Islands, CA in 2009.

A-46 Movements

Eagle A-46 began the year on the California/Oregon border (Fig. 15). He moved into northern California on 3 January and then started moving south on 26 January. He arrived along the Santa Barbara coast on 5 February and flew to Santa Cruz on 7 February. From 16 February through 29 April he moved among the islands frequently, visiting Anacapa 5 times, Santa Cruz 11 times, Santa Rosa 7 times, Santa Barbara once (6-7 March), and San Miguel once (4-18 April). The longest period spent on a single island was 29 April - 19 June on Santa Cruz. He then made three trips back and forth between Santa Cruz and Anacapa between 19 June and 29 July. On 3 August he returned to the mainland and crossed into Oregon on 13 August. He remained in Oregon through 10 December, when we stopped receiving data (this happens each year because of the lack of sun hitting the transmitter's solar panel in northern latitudes).

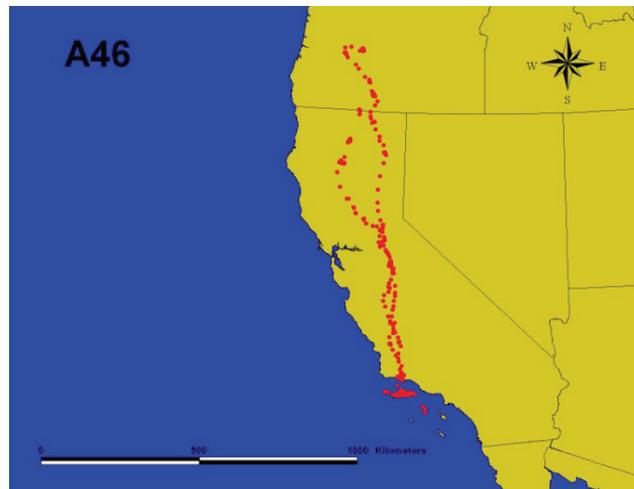


Figure 15. Movements of Eagle A-46 on the northern Channel Islands and mainland in 2009.

A-48 Movements

Eagle A-48 spent January on Santa Rosa, with the exception of a 2-day visit to Santa Cruz (Fig. 16). She returned to Santa Cruz on 6 February and was on Anacapa by 9 February (there were gaps in her data in 2009). She spent 11-12 February on the mainland, just north of

Fillmore, CA. Her data placed her back on Santa Rosa on 15-18 February and she was back on Santa Cruz by 21 February. She remained on Santa Cruz through April, with the exception of five 2-4 day trips to Anacapa (although there was a 10 day gap in data from 15-23 April). She flew to Santa Rosa for 3-11 May, then back to Santa Cruz for 12-13 May. She spent 15 May - 9 June on Anacapa, returning to Santa Cruz on 9 June. On 22 June she made her last recorded trip to Anacapa, but there was a gap in her data from 23 June - 30 July. She returned to Santa Cruz by 31 July, where she remained until 13 August. She returned to Santa Rosa on 14 August and remained there through the end of the year, with the exception of three 1-3 days visits to Santa Cruz.

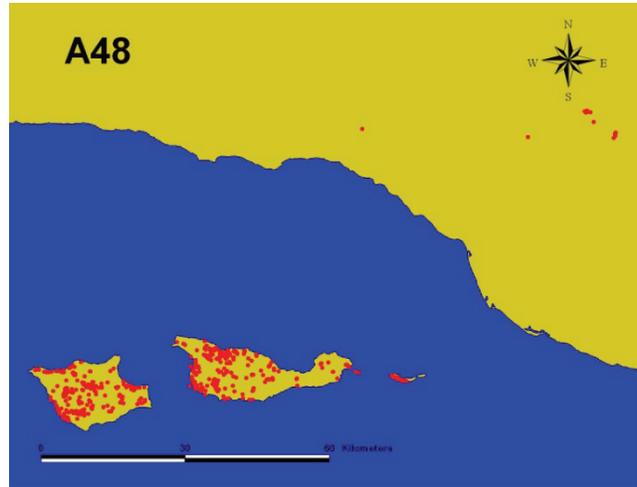


Figure 16. Movements of Eagle A-48 on the northern Channel Islands and mainland California in 2009.

A-49 Movements

Eagle A-49 (aka Cruz) was the first known eagle to hatch naturally on the California Channel Islands since 1950 (Pelican Harbor nest, 2006). A-49 spent 1-10 January on Santa Rosa (Fig. 17). She spent the next 5 days on Santa Cruz, before returning to Santa Rosa on 15 January. She remained there until 23 January, at which point she dropped her transmitter.

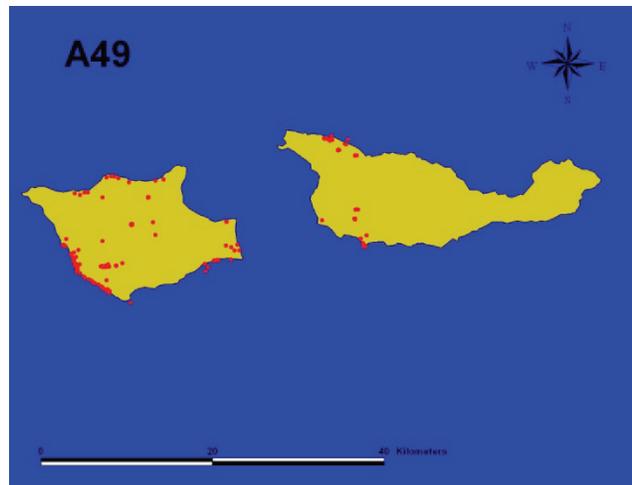


Figure 17. Movements of Eagle A-49 on the northern Channel Islands, CA in 2009.

A-52 Movements

Eagle A-52 spent time on all four northern Channel Islands and the mainland in 2009 (Fig. 18). She started the year on Santa Cruz, but spent two days on Anacapa starting on 4 January. She returned to Santa Cruz before flying to Santa Rosa on 10 January. She returned to

Santa Cruz on 8 February and then flew to the mainland on 10 February. On 22 February she flew to Anacapa, but returned to the mainland on 26 February. She returned to Santa Cruz on 23 February and moved back and forth to Santa Rosa a couple times before flying to San Miguel for the period from 5-25 April. She flew to Santa Rosa on 25 April and Santa Cruz on 28 April. She then made 3 round-trips between Santa Cruz and Anacapa through 27 May, never staying for more than 10 days on either island. On 27 May she returned to Anacapa and remained there until 17 August. She moved between Santa Cruz and Santa Rosa regularly through 7 December (<3 weeks on each island at a time), then flew to the mainland via San Miguel on 8 December, where she remained through the rest of the year.

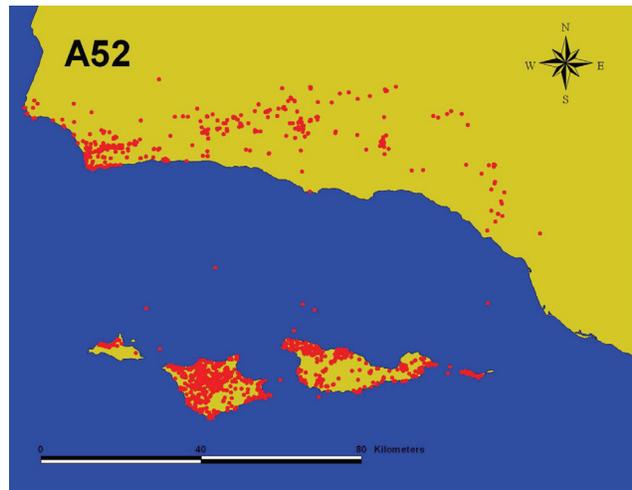


Figure 18. Movements of Eagle A-52 on the northern Channel Islands and mainland California in 2009.

A-55 Movements

Eagle A-55 spent most of January on Santa Rosa (Fig. 19). She visited Santa Cruz 25 January - 3 February and then returned to Santa Rosa until 10 February. On 10 February, she flew to Santa Cruz and the next day flew to the mainland, staying there until the end of March. From 28 March- 29 April, she spent most of her time on Santa Cruz, making trips to Anacapa on 3-4 April, 10-13 April, 24 April, and 25 April. On 29 April, she flew to the mainland where she remained until July, at which time she dropped her transmitter (transmitter was later recovered and sent to IWS).

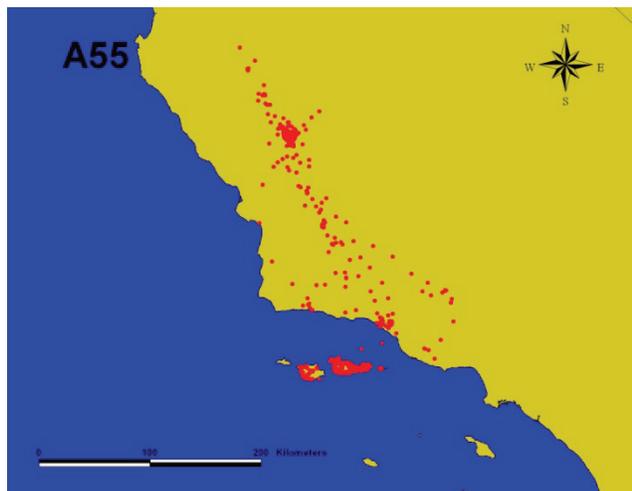


Figure 19. Movements of Eagle A-55 on the northern Channel Islands and mainland California in 2009.

A-58 Movements

Eagle A-58 visited all four northern Channel Islands and the mainland (4 times) in 2009. He spent most of January on Santa Rosa, with visits to Santa Cruz on 3-4, 18-20 and 26 January

and to Anacapa on 20-22 January. On 8 February he flew to Santa Cruz, and then flew to the mainland via Anacapa on 9 February. On 10 February he returned to Santa Cruz via Anacapa. He stayed on Santa Cruz until 19 February, when he flew to Santa Rosa. Between 25 February and 12 June, he moved frequently, visiting Santa Cruz 9 times, Santa Rosa 5 times, San Miguel once, Anacapa 3 times, and the mainland twice. The longest he stayed in one location was 19 days. On 12 June, he returned to the mainland and spent 22 July - 19 September in Oregon. He returned to Santa Cruz on 30 September and then spent 1 October - 25 November on Santa Rosa. He spent the remainder of the year moving back and forth between Santa Rosa and Santa Cruz, ending the year on Santa Rosa (Fig. 20).



Figure 20. Movements of Eagle A-58 on the northern Channel Islands and mainland in 2009.

A-59 Movements

Eagle A-59 spent the first two days of the year on San Miguel, her only visit to that island in 2009 (Fig. 21). She spent the rest of the month moving back and forth between Santa Rosa and Santa Cruz, with the exception of a visit to Anacapa on 28-29 January. She spent most of February - August moving between Santa Cruz (12 visits) and Anacapa (11 visits), except for 2 visits to Santa Rosa on 3-8 February and 3-10 March. On 20 August, she moved from Santa Cruz to Santa Rosa, where she remained through the end of the year, with the exception of 2 trips to Santa Cruz on 8-14 November and 24-26 December.

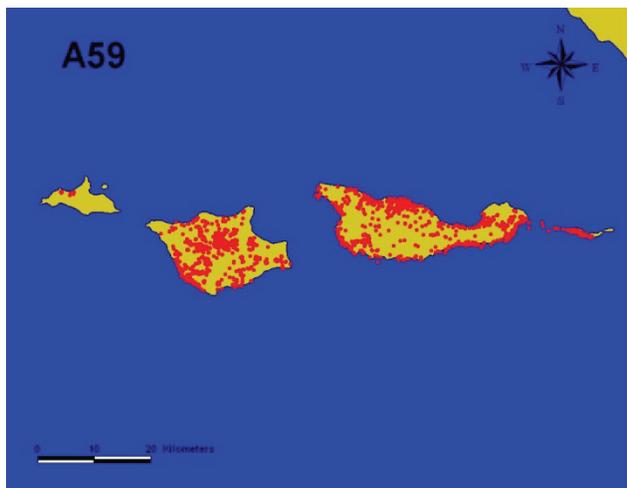


Figure 21. Movements of Eagle A-59 on the northern Channel, CA in 2009.

A-60 Movements

Eagle A-60, the 2006 Malva Real chick, spent most of the year on Santa Rosa (Fig. 22). He made 15 visits to Santa Cruz, lasting from 1-10 days each. He also made 4 visits to Anacapa on 24 February, 15 March, 4-8 June, and 25 July.

A-64 Movements

Eagle A-64 spent all year on either Santa Cruz or Santa Rosa, with the exception of a single visit to Anacapa (Fig. 23). He began the year on Santa Cruz and then flew to Santa Rosa on 18 January. He returned to Santa Cruz on 20 March and then returned to Rosa for the period of 5 April - 22 May. On 22 May he returned to Santa Cruz and remained there until 15 November, except for the visit to Anacapa on 5-6 October. On 15 November he returned to Santa Rosa and remained there through the end of the year.

Overall Island Use

The GPS units continue to be the most effective way to monitor the released birds because of their frequent movements among the islands and to the mainland. During 2009, we received 45,839 GPS locations on the islands from 15 different eagles that spent at least part of the year on the northern Channel Islands.

Santa Cruz and Santa Rosa were used more than any other islands. Time spent on Anacapa was highest from May - July. Use of Santa Rosa increased from September - December (Fig. 24).

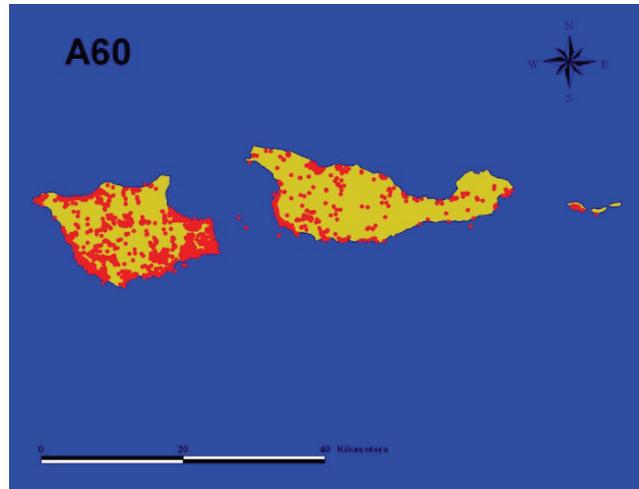


Figure 22. Movements of Eagle A-60 on the northern Channel Islands, CA in 2009.

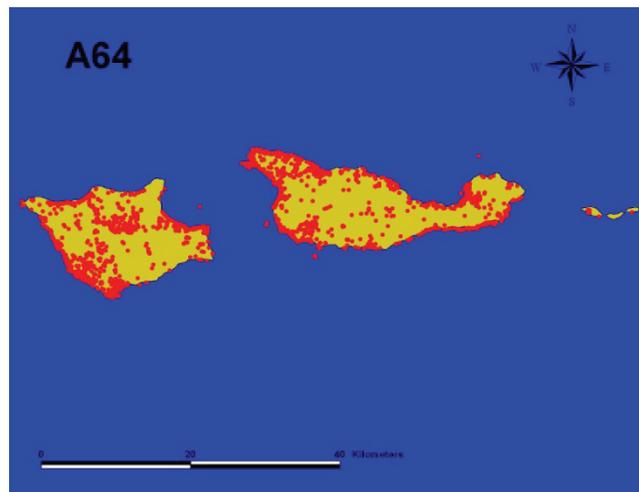


Figure 23. Movements of Eagle A-64 on the northern Channel Islands, CA in 2009.

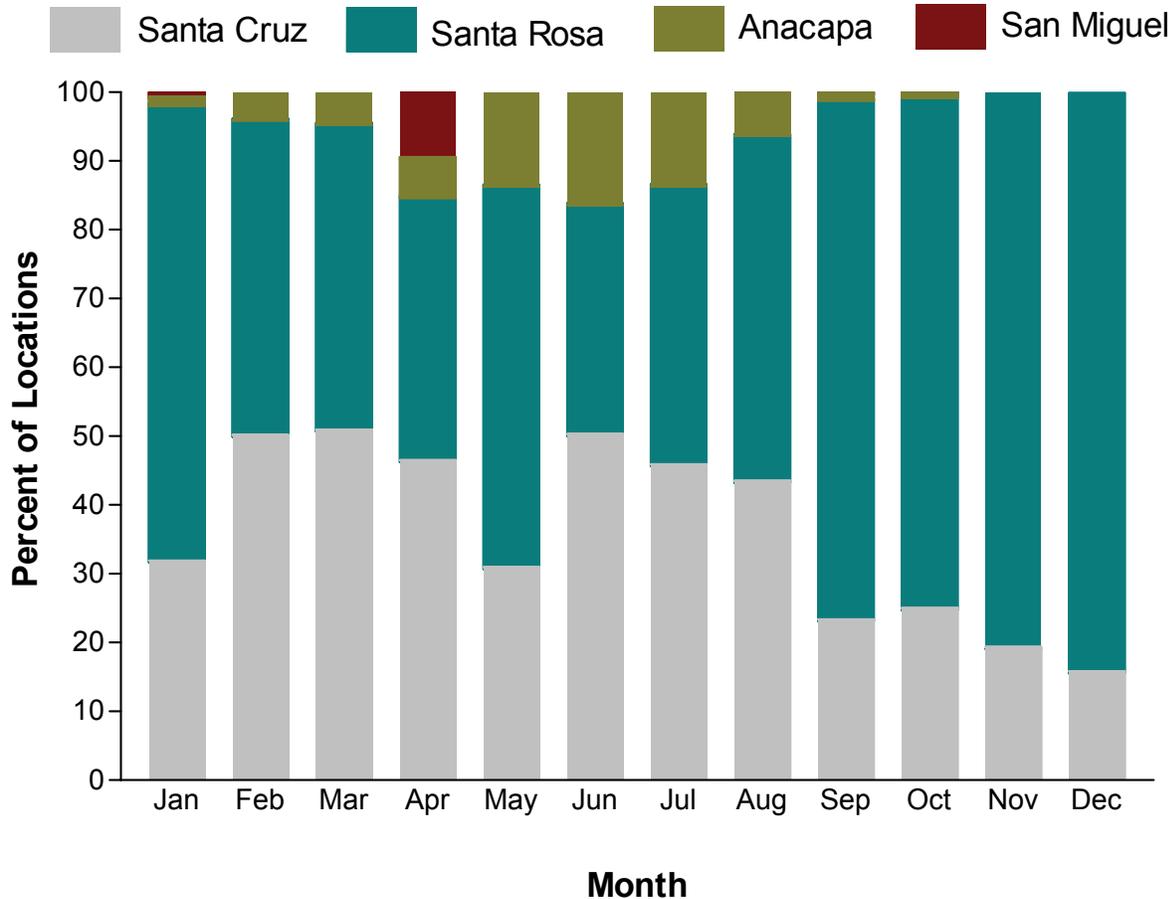


Figure 24. Use of the northern Channel Islands, CA by bald eagles during 2009. The bars represent the mean percent of time spent on each island as determined by GPS data.

Trapping

We used the floating fish noose to try to capture eagles at Sauces, Cueva Valdez, Yellowbanks, Willows, Frasier Point and Pelican Harbor on Santa Cruz on 13 days (1-3 July, 29-30 July, 1-3 August, 26-28 August, 30-31 August). Although we had many strikes at the bait, no birds were entangled in the nooses. Many eagles were rewarded with the fish and made multiple strikes at the bait.

DISCUSSION

All the eggs laid on Catalina in 2009 were left in the nests and eight of an estimated 11-14 eggs hatched. Five of six nesting attempts were successful in hatching at least one chick (only

the Rattlesnake nest failed). The continued natural hatching indicates that either environmental levels of DDE have declined or that the eagles can hatch eggs with higher contaminant levels than previously thought. Ironically, we cannot easily answer the question because we no longer have unhatched eggs to analyze.

As in 2008, the eagles on Santa Cruz and Santa Rosa were unsuccessful this year. Only 33% of nests hatched chicks, and none of the chicks successfully fledged from the nests. Although the cause of death is unknown for the two Pelican Harbor chicks, it is possible that they succumbed to domoic acid (DA) poisoning, as there were relatively high concentrations of *Pseudonitzschia*, the diatom that produces DA, in the waters of southern California in March and April (Marine Biotoxin Monitoring Program, 2010a and 2010b). DA poisoning was the likely cause of mortality among brown pelicans (*Pelecanus occidentalis*) and Brandt's cormorants (*Phalacrocorax penicillatus*) (Work et al. 1993) and California sea lions (*Zalophus californianus*) (Gulland 2000) in central California. Both outbreaks are believed to have been caused largely by feeding on northern anchovies (*Engraulis mordax*), which had high concentrations of DA in their tissues. Given the size of a bald eagle chick, we presume that they would be more susceptible to DA poisoning than a full-sized bird. Examination of the egg recovered from the Trap Canyon nest indicated that it was infertile. We do not know how many eggs were in the Saucers nest or the cause of failure. We plan to put a camera on the Saucers nest so that we are able to determine the number of eggs laid and get more information on potential causes of failure.

Patterns of island use changed in 2009, as compared to previous years (Sharpe 2007, 2008, 2009). In previous years, subadult bald eagles had spent a large proportion of their time on Anacapa in the spring and summer, but use of that island decreased in 2009. This may have been a result of older birds starting to establish territories on Santa Cruz and Santa Rosa. As in previous years, there was an increased use of Santa Rosa starting in late summer, corresponding with the start of fall hunting for mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) on that island. More eagles were on Santa Rosa in January than any other island, probably taking advantage of the marine mammal breeding season and the resulting carcass availability.

Although we have been successful using the floating fish noose in the past on Catalina, we have been unable to trap birds using this technique on the northern Channel Islands. Several factors may be contributing to the lack of success. First, this technique is usually used early in the morning before the sun can hit the monofilament and make it more visible to the eagles

(Jackman et al. 1993). Because we have to launch the boat each day and travel at least 45 minutes to reach most trapping locations, it is difficult to put out traps before sunrise. The ocean conditions around the northern Channel Islands are typically rougher than around Catalina, which may make the monofilament more obvious as the floating fish move around in the waves. Finally, there are many more gulls around the northern Channel Islands and nearly half of our sets are compromised as gulls either take the bait or pull the nooses. The gulls are often on the fish within seconds of us pulling away in the boat. We will continue to modify our techniques in an attempt to trap birds in the future.

We expect the number of nests to increase on Catalina, Santa Cruz, and Santa Rosa in 2010. There is a pair at Middle Ranch on Catalina comprised of a 1999 Catalina male (K-93) and a 2004 Santa Cruz female (A-32) that we expect to breed after being together for nearly two years. The pair built a nest in a eucalyptus (*Eucalyptus* sp.) this season, but did not lay eggs. Assuming all the other nesting pairs attempt to nest again, this will bring the number of breeding pairs on Catalina to at least seven. There are additional pairs that we observed on Santa Cruz in 2009 that did not breed (i.e., Frazier Point, Willows, Yellowbanks, Malva Real). Therefore, we could have 5-7 pairs on Santa Cruz in 2010. Although no other pairs were observed on Santa Rosa in 2009, we could have younger birds form pairs for the 2010 breeding season. Therefore, in 2009, we could have 15 or more breeding pairs on the California Channel Islands.

RECOMMENDATIONS

The last of our released birds, and the first natural hatches on Santa Cruz, will be old enough to breed for the first time in 2010, so we expect additional pairs to form and begin reproducing. Therefore, we recommend that continued efforts be made to search for nesting eagles on the Channel Islands. Personnel should spend February through May surveying Catalina, Santa Cruz and Santa Rosa. We recommend against doing a helicopter survey on the northern Channel Islands in 2010 because of the excessive cost and the fact that they have been unsuccessful in helping locate new nests to date. More time should be spent hiking to inaccessible portions of the islands and the boat should be used to increase surveys of the coasts. If feasible, a boat or helicopter survey should be made on Catalina, as much of the western coast is difficult to observe from land.

We recommend further attempts to trap eagles in 2010 for contaminants analyses and to apply new GPS units. When using the floating-fish noose method we suggest completing trapping activities before 0900 to reduce the impacts of gulls on the bait sets and to reduce the visibility of the monofilament line to the eagles. Birds that are not actively breeding can be targeted starting in June, when sea conditions may be better for navigating around the island on our small zodiac. Additional efforts should be made to trap eagles on Santa Rosa using a bownet and/or net launcher during the annual hunt in the fall, as this will be one of our last opportunities to use deer and elk as bait before they are removed from the island. If we can get transmitters on more adults, then we could reduce the personnel time needed to search for the nests in the 2011 season.

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