

Restoration and Management of Bald Eagles on Santa Catalina Island, California, 2004

A Report Prepared for:

Montrose Settlements Restoration Program

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INTRODUCTION

This season marks the 25th year of bald eagle (*Haliaeetus leucocephalus*) restoration on Santa Catalina Island, California. Bald eagles 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) and California Department of Fish and Game (CDF&G), initiated a program to reintroduce bald eagles to Santa Catalina Island (hereafter Catalina Island; 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 broke in the nest.

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), implicating this contaminant as the causal agent of the lack of productivity (Garcelon et al. 1989). Eggs removed from nests on Catalina Island 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 1993, 1998).

Since 1989, the reintroduced population has been maintained through manipulations of eggs and chicks at each nest site and through additional hacking of birds (Table 1). Because of the high DDE concentrations in the eggs, this active program of manipulation and augmentation is the only way to maintain the Catalina Island bald eagle population at this time. In the egg manipulation process, artificial eggs are substituted for the structurally deficient eggs laid by the birds affected by DDE. The adult eagles continue to incubate the artificial eggs while the removed eggs are relocated and artificially incubated at the Avian Conservation Center (ACC) at the San Francisco Zoo. Chicks that hatch from these removed eggs, or those produced by captive adults at the ACC, are then fostered into the nests. From 1989 through 2004, adult bald eagles successfully reared 40 of 49 chicks that were either fostered into nests (47 chicks) or hatched from two of three healthy eggs that were placed into nests (Table 1). Three of these 49 birds were removed from the nest prior to fledging because of injuries and six died due to accidents, predation, or unknown causes. An additional 21 eagles have been released through continued hacking activities since 1991 (20 chicks and a 1-year-old bird; Table 1).

The purpose of this project is to maintain the breeding bald eagles on Catalina Island in the interim between completion of the injury assessment studies and the full-scale environmental restoration program now being planned. Our restoration and management objectives were to (1) document the chronology of nesting for all breeding pairs on the island, (2) collect eggs from wild nests on Catalina Island for artificial incubation, (3) foster healthy chicks into active nests, (4) collect tissues (blood, non-hatching eggs and embryos) for analyses of contaminants, (5) quantify incubation behavior, (6) quantify the behavior of adults and chicks between the time of fostering and fledging, (7) identify food items and quantify the rate at which prey deliveries were made to the nest, and (8) monitor movement and behavior of all chicks fledged on the island. This report summarizes the results of the egg and chick manipulations and subsequent monitoring for the nesting season of 2004.

Table 1. Summary of Bald Eagle egg and chick manipulations on Santa Catalina Island, 1989-2004.

	Year															
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
# of Active Nests	1	2	2	3	3	2	3	3	2	3	4	3	4	4	5	5
# of Eggs Laid	2	2-3	3	5	5-6	3	5	5-6	6	7	8	7	8	8	9	11
# of Eggs Collected	1	1	3	5	4	3	5	4	5	6	6	4	7	7	8	11
# of Catalina Island Eggs Hatched ^a	0	0	1	2	0	0	0	0	1	1	1	2	0	2	1	3
# of Eggs Fostered Into Nests on Catalina Island	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
# of Chicks Fostered Into Nests on Catalina Island	1	0	0	3	2	2	1	5	1	4	3	4	5	7	4	5
# of Chicks Fledged From Nests on Catalina Island	1	0	2	3	1	1	1	2	1	3	2	4	5	6	3	5
# of Eagles Hacked Onto Catalina Island	0	0	2	0	2	0	2	5	0	4	2	0	4	0	0	0
# of Island-Produced Eagles Breeding on Island	0	0	0	0	0	0	0	0	1	1	2	1	2	2	3	3
# of Second Generation Eagles Fledged	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1

^a Hatched by the Santa Cruz Predatory Research Group (1991) or San Francisco Zoo (1992-Present)

STUDY AREA

Catalina Island 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).

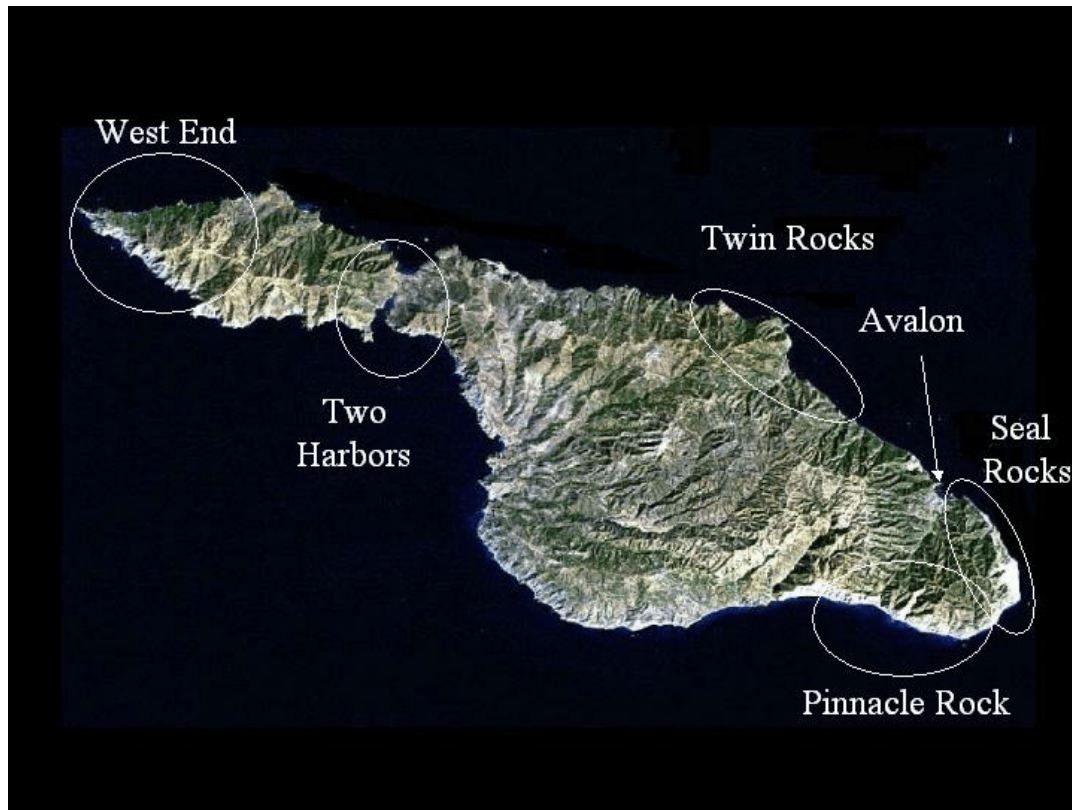


Figure 2. Active bald eagle territories and points of reference on Santa Catalina Island, California.

Nesting Territories

Five territories of nesting bald eagles have occurred on the island since 1984. A brief description of each territory is provided below.

The Twin Rocks territory is located 5 km northwest of Avalon, extending from Torqua Springs to Little Gibraltar (Fig. 2). This territory was first occupied in 1984 and contained active nests in 1985, 1987 and 1989. The female remained in the territory until January 1995 when she was joined by a 4-year-old male. The pair exhibited incubation behavior in 1996, but no eggs

were found in the nest (Phillips and Garcelon 1996). The first eggs were laid by the new pair in 1997, but the birds did not return to the nest after the egg switch. In 1998, the female was replaced by a 12-year-old female and the pair has nested every year through 2004.

The Seal Rocks territory is located 4.5 km SE of the city of Avalon (Fig. 2). The pair first nested in 1988, using several different nests through 1993. The female from this territory died on 5 May 1993 from DDE contaminant poisoning (Garcelon and Thomas 1997). In 1995, another adult female (the current Twin Rocks female) laid two infertile eggs. Because no male was observed in the territory, the eggs were removed to prevent excessive stress associated with incubation by only one adult. The female abandoned the nest and the territory remained unoccupied until a new pair moved into the Seal Rocks territory in 1997. There was no evidence of nesting in 1998. Prior to the 1999 breeding season the female was replaced by a 6-year-old bird. In 1999, the pair built a nest and laid one egg, but the nest blew out of the tree the following evening and there was no further nesting activity. The pair did not attempt to nest in 2000, but successfully fledged a fostered chick in each year from 2001 through 2004.

The Pinnacle Rock territory is located 4.3 km southwest of the city of Avalon, extending from Silver Canyon to approximately 1 km east of the East End Light (Fig. 2). It was initially occupied in 1990 by a 5-year-old female and a 4-year-old male, and this territory has contained active nests each year since 1990. The pair has remained intact and has used six different nest sites from 1990-2004.

The West End territory is located 0.5 km from the northwest end of the island (Fig. 2), and was established in 1991. The territory was initially occupied by a 10-year-old male and a 5-year-old female, but a second female has assisted in breeding activities since 1992. The nest is located on a rock pinnacle approximately 75 m above the water, and has been used since 1991.

The Two Harbors territory is located 2 km SW of the town of Two Harbors (Fig. 2) and was first occupied by a pair of 5-year-old birds in 2003. The nest was constructed on a rock outcrop on a narrow ridge about 50 m above the ocean. This pair fledged a single chick in both 2003 and 2004.

METHODS

Nest Manipulations

Observations of adult eagles began in January this year to determine the location of breeding pairs and their respective nest sites. When nest site locations were confirmed, we set up observation blinds from which to observe the nests. We monitored and quantified chronology of nesting, behavior during incubation, nestling and adult behavior during brood rearing, taxon of prey delivered to the nest, and rates of prey deliveries. At the West End, Seal Rocks, and Two

Harbors nests we had established video cameras prior to the breeding season that allowed close observations of nesting activity.

We replaced eggs laid by nesting pairs with artificial eggs within 4-6 days of the date that eagles were confirmed incubating. We replaced the artificial eggs with healthy chicks after the adults had incubated approximately 35 days and returned to the nests when chicks were 8-weeks-old to equip them with federal and colored leg bands, wingmarkers, and a backpack-style radio-transmitter. At this time we also collected a blood sample (~10 cc) for contaminant analyses and made morphological measurements to determine sex (Bortolotti 1984, Garcelon et al. 1985).

Incubation Behavior

We recorded incubation behavior at each nest for approximately 6 hours/day for 1-3 days/week. The identity of adult birds was determined by patagial wingmarkers or leg bands. We recorded the exact times that adults laid on and stood from the eggs, probed the nest, or rolled the eggs. Additionally, descriptive notes were recorded to summarize general behavior and interaction of adults during the incubation period.

We used the Mann-Whitney U-test to evaluate sex-specific differences in duration of complete incubation bouts. Complete incubation bouts were defined as those in which we observed the incubating bird both start and end its attendance at the nest (i.e., switch with its mate).

Chick-Rearing and Nestling Behavior

We monitored behavior of chicks and adults at all nests using interval sampling (Tacha et al. 1985) following the fostering of chicks. Postures and behaviors (see Appendix I) of chicks and any adults on the nest were recorded at 1-minute intervals, and sampling generally was conducted 2-3 days/week, up to 8 hours/day. Fog occasionally prevented or delayed sampling of behavior. We distinguished the roles of adult male and female eagles during the chick rearing period by comparing the proportion of time that each sex spent on the nest. We calculated the proportion of time that chicks spent in postures and behaviors for each day that birds were monitored. We evaluated the relationship of the age of the chicks to the proportion of time spent in each posture and behavior to document the onset of particular behaviors as chick development progressed. Changes in the frequency of occurrence of key postures and behaviors were plotted over time to demonstrate trends in behavior during the nestling period.

Prey Deliveries

Concurrent with interval sampling of behavior, we recorded date, time, and taxonomic information for all prey items delivered to the nests. We calculated mean rates of prey delivery for each nest as the number of items delivered divided by the amount of time the nests were observed.

Post-Fledging Behavior

We used radio-telemetry to locate and observe fledged eagles every 1-3 days during their first month of flight and then at least once per week through October, or until they left the island. We recorded each bird's location, behavior, and interaction with other eagles. The length of observations of each bird varied greatly, but generally lasted from 15-60 min.

Collection of Tissue Samples

We collected ~10 cc of blood for contaminant analyses during banding activities. The ACC also collected samples of egg shells and embryos from Catalina Island eggs that failed to hatch. Egg contents were placed in chemically clean jars and frozen.

RESULTS

Manipulations and Monitoring

Nests were located in February 2004 in five previously occupied territories: Twin Rocks, Pinnacle Rock, Seal Rocks, West End, and Two Harbors (Fig. 2).

Twin Rocks

The territory was used by the same pair that used it from 1998-2003. 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. In early February, the pair was seen working on the same nest that they used in 2003. The pair worked on the nest until 13 February, when they exhibited incubation behavior and one egg was confirmed. On 17 February, a second egg was observed and we entered the nest via helicopter and removed both eggs. The eggs were fertile and were artificially incubated at the ACC, but did not hatch.

On 9 April, we fostered a chick that hatched from an egg from the West End nest (see below) into the Twin Rocks nest. We returned to the nest on 19 May and equipped the eaglet with leg bands, transmitters, and wingmarkers and obtained a blood sample (Table 2; Fig. 3). We continued nest observations until the bird fledged around 15 June. The eaglet was tracked and remained on the island until at least 19 November.

Table 2. Biographical data for bald eagle chicks successfully fostered into nests on Santa Catalina Island, California during 2004.

Federal Band	Color Band	Wing Marker	Date Fledged	Foster Nest	Status ^a	Comments
629-47367	6/V	K-42	6/9/04	Twin Rocks	Alive	Hatched from West End egg. Still on Catalina Island.
629-47368	6/K	K-43	6/29/04	Pinnacle Rock	Unknown	Hatched from Two Harbors egg. Left island around 27 July.
629-47369	6/Y	K-45	6/26/04	West End	Alive	From captive pair at ACC. Left island around 19 August.
629-47370	7/G	K-46	6/28/04	Two Harbors	Dead	From captive pair at ACC. Found near Millville, California.
629-47371	5/T	K-47	7/14/04	Seal Rocks	Alive	From captive pair at ACC.

^a As of 12/31/04



Figure 3. Eaglet at Twin Rocks nest following banding.

West End Territory

The West End trio of birds used the same nest that has been used since 1991. The male has lost his wingmarkers, but is believed to be K-77, a 23-year-old bird released from a hacktower in 1981. The original female was not marked with patagial tags, but is believed to be an 18-year-old bird released at the Sweetwater hacktower in 1986. The second female, which joined the original pair in 1992, is an 18-year-old bird (K-69) that was also released at the Sweetwater hacktower in 1986. New nest material was first observed at the nest on 27 January and the first egg was seen on 19 February. On 23 February, a second egg was observed in the nest, and we observed the original female of the trio laying a third egg around 1400 hrs on the same day. We entered the nest on 24 February and removed three fertile eggs, replacing them with two artificial eggs. One egg hatched after incubation at the ACC.

By 4 March, only one of the artificial eggs remained in the nest. At 0945 hrs on 22 March there were no eggs visible in the nest and one of the adults was observed standing on the side of the nest for more than an hour. We entered the nest at 1224 hrs and could find no eggs. We placed two more artificial eggs in the nest and an adult returned at 1239 hrs and began incubating them.

One ACC-produced chick was fostered into the nest on 15 April. On 27 May, we returned to the nest to install leg bands, transmitters, and wingmarkers on the chick and to obtain a blood sample (Table 2). We continued monitoring the nest until the chick fledged on 26 June. We located the bird several times per week until it left the island around 19 August. The bird was reported near Roseburg, Oregon on 29 September.

Pinnacle Rock

The Pinnacle Rock pair used the same nest as in 2003. The 18-year-old male (K-65) was hacked at the Bulrush tower in 1986. The female, who has lost her wingmarkers, is believed to be a 19-year-old bird hacked at the Bulrush tower in 1985. The birds were first seen at the nest on 4 February. The first egg was seen in the nest on 18 February. We observed the female lay a second egg on 20 February, and a third egg was seen in the nest on 23 February. We removed the three eggs via helicopter on 24 February. Two of the eggs showed signs of development and one egg hatched, but the chick died five days later. This is the first egg to hatch from this territory since inception of the restoration program.

On 9 April, we introduced a chick that hatched from an egg removed from the Two Harbors nest (see below) into the nest. We returned to the nest on 21 May to install leg bands, transmitters, and wingmarkers on the eaglet and to obtain a blood sample (Table 2). The eaglet

was observed out of the nest for the first time on 29 June. We followed the bird via telemetry until it left the island around 27 July.

Seal Rocks Territory

The Seal Rocks pair used the same nest as in 2003. The 11-year-old female (K-34) is from the captive ACC eagles and was hacked at the Bulrush tower in 1993. The 12-year-old male (K-25) hatched from an egg from the West End territory and was fostered into the Pinnacle Rock nest in 1992. The first activity at the nest was on 1 February and the first sign of incubation behavior was on 20 February. We entered the nest on 24 February and removed two eggs, replacing them with two artificial eggs. Both eggs were fertile, but neither hatched.

A single ACC-produced chick was fostered into the nest on 24 April. We returned to the nest on 8 June to install leg bands, a transmitter, and wingmarkers on the chick, and to obtain a blood sample. We continued to monitor the nest until the bird fledged on 14 July (Table 2). We located the bird several times per week until it left the island around 13 August. This bird was reported near Ocean Shores, Washington on 10 September.

Two Harbors Territory

The Two Harbors pair used the same nest as last season. The 6-year-old male (K-81) is an ACC-produced eagle that was fostered into the West End nest in 1998. The 6-year-old female (K-82) hatched from an egg laid in the West End territory in 1998 and was fostered into the Pinnacle Rock nest. The birds were first observed incubating on 22 February. On 24 February we entered the nest and removed one egg, replacing it with two artificial eggs. The egg was fertile and hatched at the ACC.

A single ACC-produced chick was fostered into the nest on 15 April. We returned to the nest on 30 May to install leg bands, a transmitter, and wingmarkers on the chick, and to obtain a blood sample. On 28 June, the bird walked out of the nest along the ridge, but we did not observe evidence of flight until 5 July (Table 2). This bird left the island around 28 September and was reported at Lake Isabella, Kern Co., California on 1 October. We received a report on 6 December that the bird was found dead under some power lines near Millville, California.

Incubation Behavior

We monitored incubation behavior for 17 days at the Twin Rocks nest (17 February-8 April), 14 days at the West End nest (23 February-14 April), 13 days at the Pinnacle Rock nest

(19 February-9 April), 17 days at the Seal Rocks nest (25 February-23 April), and 15 days at the Two Harbors nest (22 February-14 April).

All adults took part in incubation duties. The mean bout length did not differ significantly between adults within a territory ($P > 0.0605$; Table 3), except for the Pinnacle Rocks birds, where the male spent more time incubating per bout than the female ($P = 0.0405$). The trio of adults in the West End territory had significantly shorter incubation bouts when compared to adults in other territories using Tukey's Studentized Range Test.

Table 3. Number (n), mean, and standard deviation (SD) of length of complete incubation bouts (hrs:minutes) for adult eagles observed during incubation at the Pinnacle Rock, Seal Rocks, Twin Rocks, Two Harbors, and West End nests on Santa Catalina Island, 2004.

Territory	Male			Female 1			Female 2 ^a		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Pinnacle Rock	8	2:28	0:57	7	1:22	0:41	.	.	.
Seal Rocks	11	1:43	0:56	12	2:34	1:41	.	.	.
Twin Rocks	4	1:41	1:32	4	1:56	1:31	.	.	.
Two Harbors	18	1:32	1:13	11	2:17	1:30	.	.	.
West End	20	0:59	0:38	29	0:58	0:49	23	0:39	0:29

^a Second female that was released from a hacktower with Female 1 in 1986 and joined the West End birds in 1992.

Chick-Rearing and Fledgling Behavior

We made behavioral observations for 23 days at the Pinnacle Rock nest (9 April-27 June), 14 days at the West End nest (15 April-28 June), 18 days at the Seal Rocks nest (24 April-14 July), 21 days at the Two Harbors nest (15 April-23 June), and 19 days at the Twin Rocks nest (9 April-10 June). All five chicks fostered into nests this year successfully fledged. Adult females spent a significantly greater portion of their time at nests than males at the Pinnacle Rock (69% vs. 32%, $P = 0.0007$), Seal Rocks (46% vs. 21%; $P = 0.0357$), and Twin Rocks nests (59% vs. 33%; $P = 0.0154$). The male at the Two Harbors nest spent more time at the nest than the female (31% vs. 22%), but the difference was not significant ($P = 0.4085$). At the West End nest there was no significant difference in the amount of time Female 1 and Female 2 spent at the nest (57% and 41%, respectively; $P = 0.2331$). The male was only at the nest 25% of the time, which differed significantly from Female 1 ($P = 0.0191$), but not from Female 2 ($P = 0.2245$). There was also a significant negative relationship between time spent at the nest and the age of the chick for all adults, except for the male at the Twin Rocks nest ($P = 0.1638$) (Fig. 4).

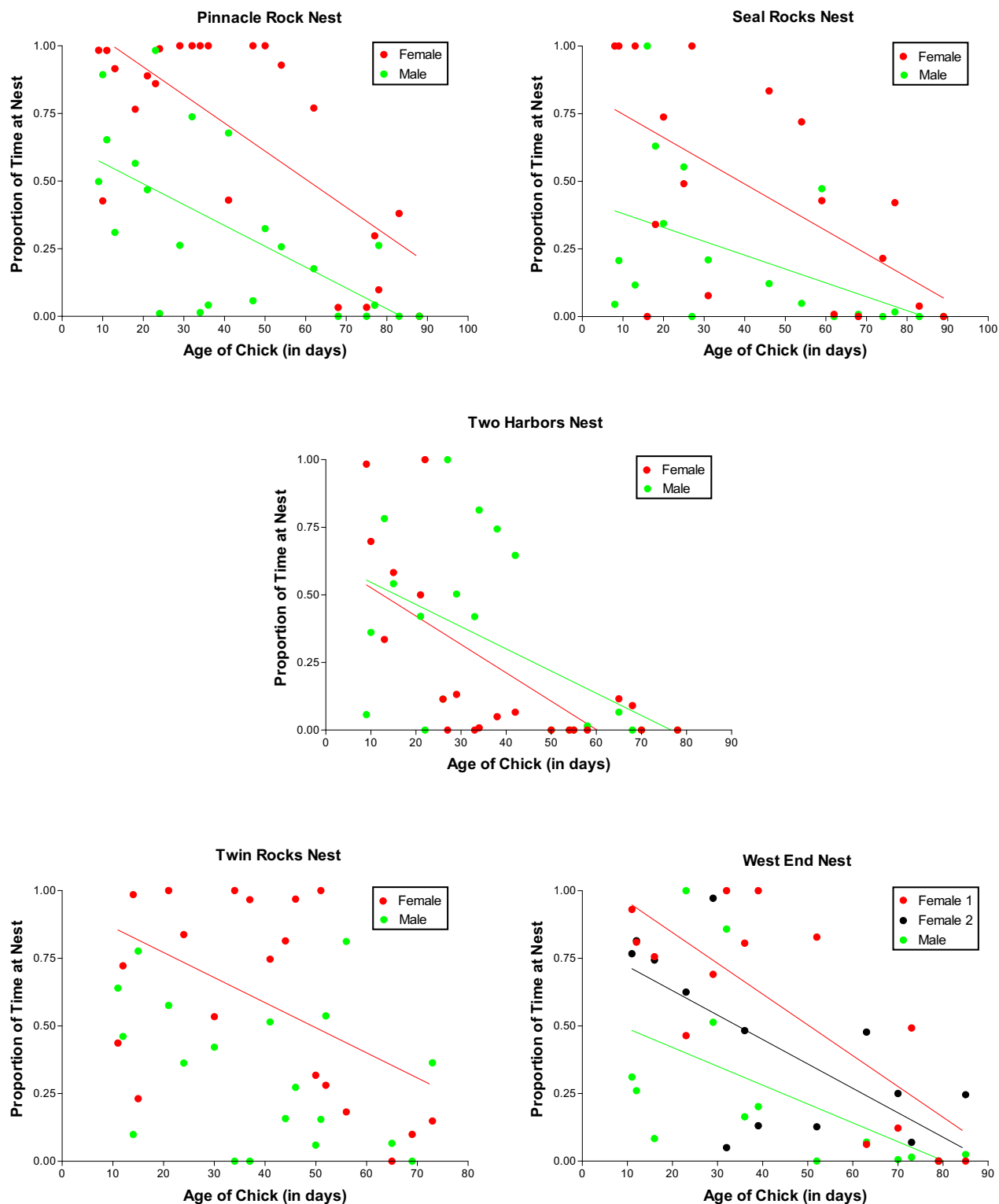


Figure 4. Proportion of time spent at five nests by adult bald eagles on Santa Catalina Island, California during 2004. The lines in the graphs are the significant lines of best fit for the female (—), male (—), and Female 2 at the West End nest (—).

The proportion of time the chicks spent standing increased rapidly at an age of about 45 to 50 days at all five nests (Fig. 5). Reported proportions are for periods the chicks were in view. During the first two to three weeks in the nest, the chicks were sometimes out of view for up to 95% of an observation period, primarily because they were being brooded. Self-feeding by the chicks did not increase substantially until they were at least 50 days of age (Fig. 6).

Prey Deliveries

We observed 18 prey deliveries at the Pinnacle Rock nest during 57.2 hours of observations (0.31 items/hr), 15 prey deliveries during 52.8 hours of observations at the West End nest (0.28 items/hr), 11 prey deliveries during 46.1 hours of observations at the Seal Rocks nest (0.24 items/hr), 20 prey deliveries during 62.4 hours of observations at the Two Harbors nest (0.32 items/hr), and 10 prey deliveries during 63.8 hours of observations at the Twin Rocks nest (0.16 items/hr). The males made more prey deliveries than the females at all nests, except for the Two Harbors nest (Fig. 7).

Fish made up the largest portion of prey items delivered to nests in all territories (90.9 – 100.0%). A variety of birds, including gulls, cormorants, and a banded homing pigeon were seen in nests during observations or removed during banding, but only two birds, both ravens, were seen delivered to nests (Table 4).

Additional Eagle Sightings

There were multiple sightings of Catalina-released eagles on the mainland or other Channel Islands during 2004, as well as three birds that returned to Catalina Island after spending time on the mainland.

K-10 (FWS Band # 629-02780), fostered into the Twin Rocks nest in 2001, was reported at Lake Cachuma, Santa Barbara Co., California on 15 January. The bird moved to Santa Cruz Island, California by 6 February, where it stayed until at least 9 August. On 12 October it was reported in Wasco Co., Oregon.

K-13 (FWS Band # 629-02783), fostered into the Pinnacle Rock nest in 2001, was seen many times in 2004. On 4 March it was soaring in the Twin Rocks territory on Catalina Island, after previously being reported near San Diego, California in November 2003. It then left the island again and was reported at Prado Regional Park, San Bernardino County, California on 10 March, perching along the Los Angeles River in Compton, California on 25 October, and along the Santa Ana River in Huntington Beach, California throughout November.

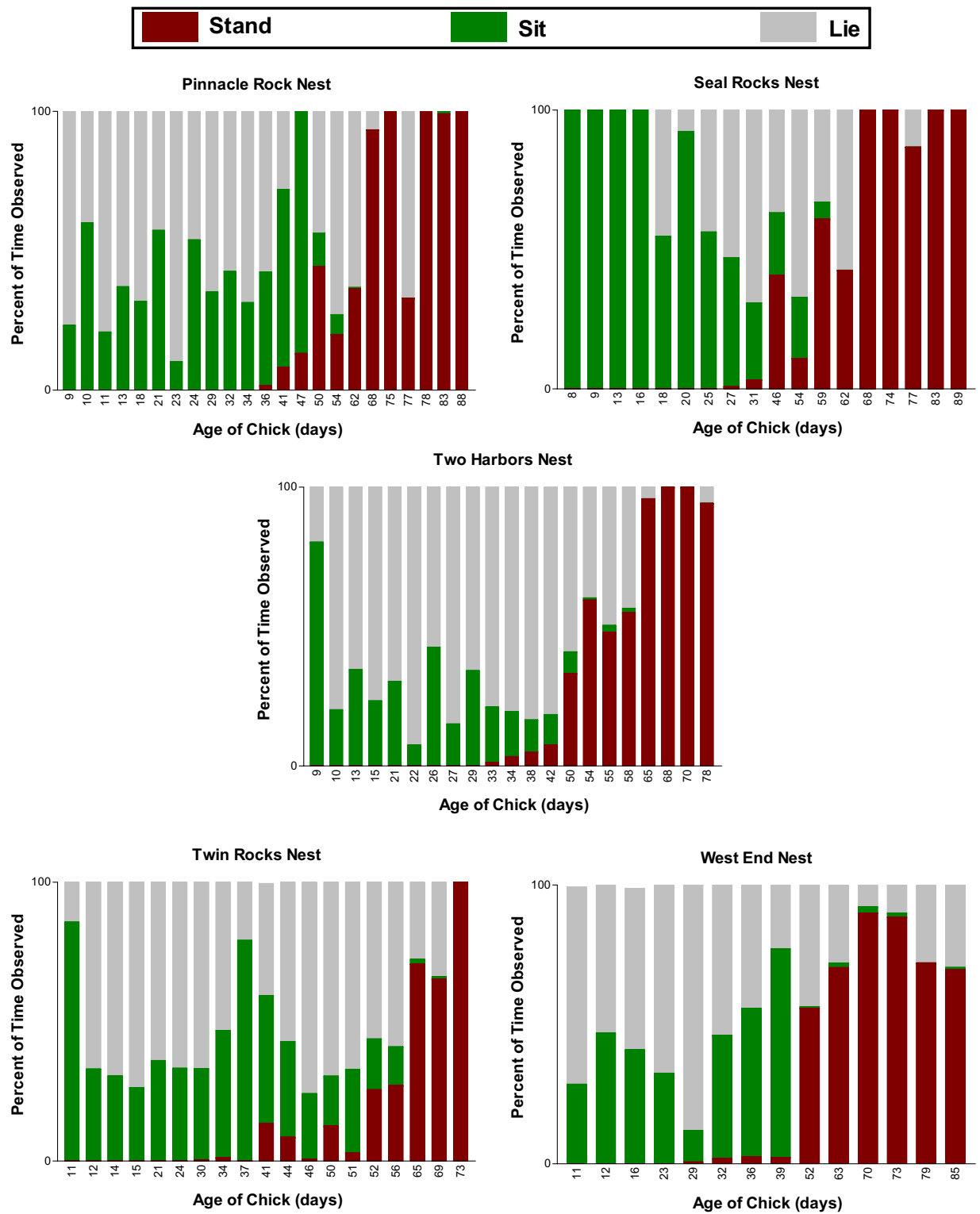


Figure 5. Percent of time that chicks spent in three different postures at five nests on Santa Catalina Island, California, 2004.

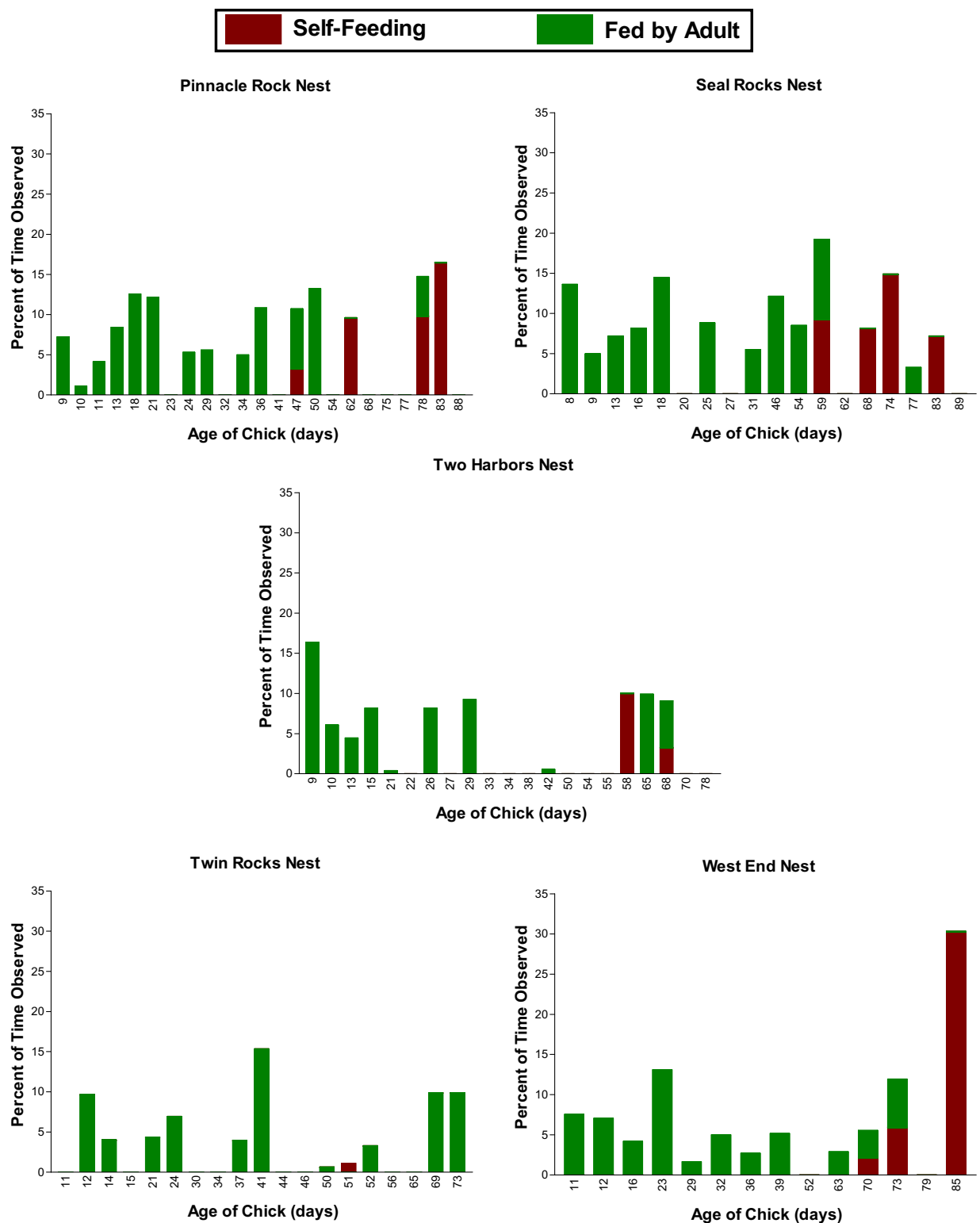


Figure 6. Percent of time that chicks were observed being fed by adults or self-feeding at nests on Santa Catalina Island, California, 2004.

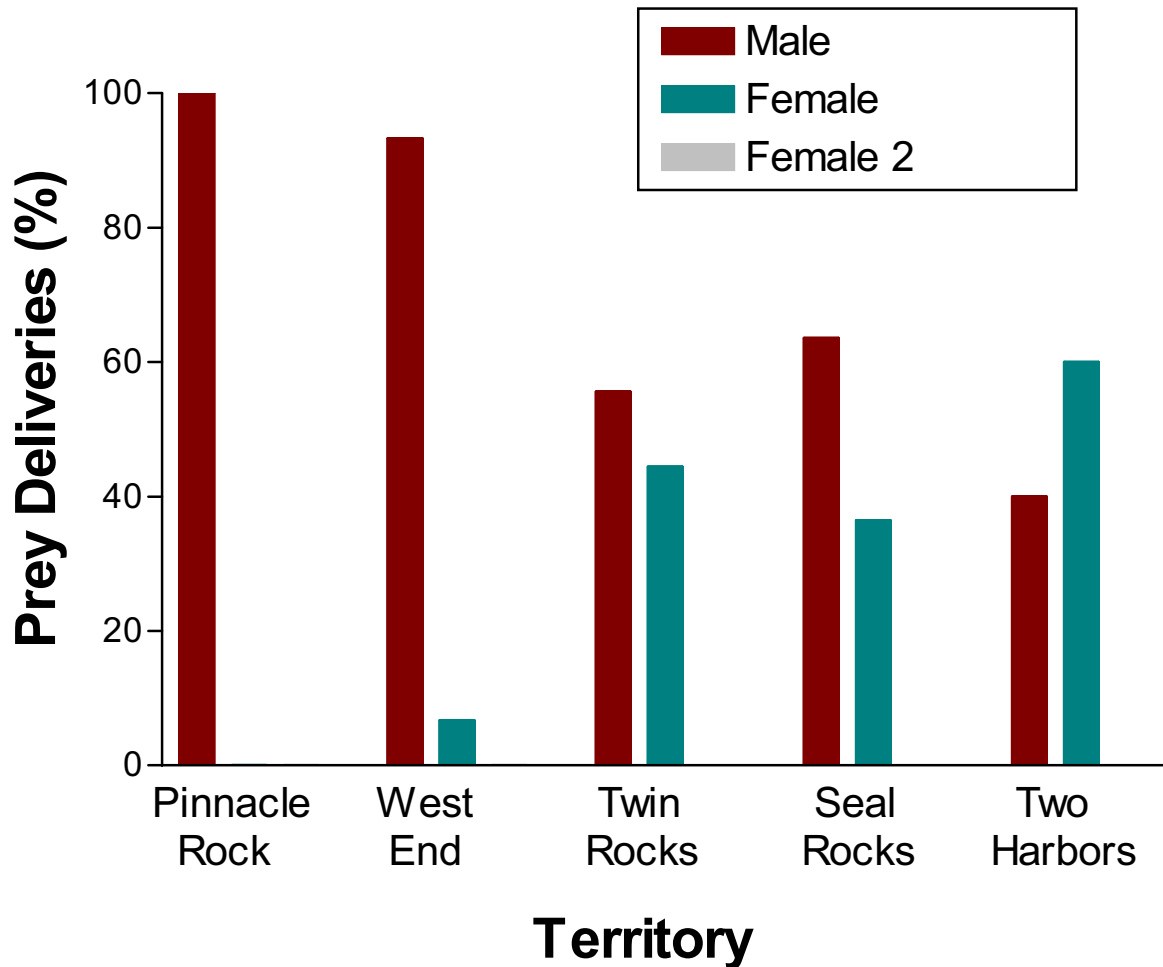


Figure 7. Percent of prey deliveries made by adults to nests in five territories in 2004. Female 2 at the West End was not observed making any deliveries.

K-16 (FWS Band # 629-02784), fostered into the Seal Rocks nest in 2001, was seen near Thompson Reservoir on Catalina Island on 27 January. K-16 had last been reported near Sheridan, California in January 2003. This bird, a female, remained on Catalina Island until at least 16 March, usually in the presence of male K-93 (FWS Band # 629-29497), a bird released from the Bulrush hacktower in 1999.

K-20 (FWS Band # 629-02789), released from the Bulrush hacktower in 2001, was seen in Avalon, California on 27 September and found dead in Bulrush Canyon on 1 December. This bird left Catalina Island in 2001 and had last been sighted at Lake Cachuma, California in February 2003.

K-26 (FWS Band # 629-02793), fostered into the West End nest in 2002, was seen at Whale Rock Reservoir, near Morro Bay, California in November. This eagle was reportedly seen with another unidentified adult bald eagle. K-26 was last seen in October 2002 on Catalina.

Table 4. Number and percent of food items delivered to the Pinnacle Rock, West End, Twin Rocks, Two Harbors and Seal Rocks nests during monitoring on Santa Catalina Island, California, 2004.

Food Item	Prey deliveries									
	Pinnacle Rock		Seal Rocks		Twin Rocks		Two Harbors		West End	
	n	% of Total	n	% of Total	n	% of Total	n	% of Total	n	% of Total
<u>FISH</u>										
Unknown fish	16	88.9	10	90.9	8	80.0	15	75.0	6	40.0
Bocaccio (<i>Sebastes paucispinis</i>)	0	0.0	0	0.0	0	0.0	2	10.0	1	6.7
Unknown rockfish (<i>Sebastes</i> spp.)	0	0.0	0	0.0	1	10.0	0	0.0	3	20.0
Halfmoon (<i>Medialuna californiensis</i>)	0	0.0	0	0.0	0	0.0	0	0.0	1	6.7
California Sheephead (<i>Semicossyphus pulcher</i>)	0	0.0	0	0.0	0	0.0	0	0.0	1	6.7
Kelp bass (<i>Paralabrax clathratus</i>)	0	0.0	0	0.0	0	0.0	1	5.0	0	0.0
Garibaldi (<i>Hypsypops rubicundus</i>)	0	0.0	0	0.0	0	0.0	0	0.0	1	6.7
California barracuda (<i>Sphyaena argentea</i>)	1	5.6	0	0.0	0	0.0	0	0.0	0	0.0
California flying fish (<i>Cypselurus californicus</i>)	0	0.0	0	0.0	0	0.0	0	0.0	1	6.7
Opaleye (<i>Girella nigricans</i>)	0	0.0	0	0.0	1	10.0	1	5.0	1	6.7
Fish Subtotal	17	94.4	10	90.9	10	100.0	19	95.0	15	100.0
<u>BIRDS</u>										
Common Raven (<i>Corvus corax</i>)	0	0.0	1	9.1	0	0.0	1	5.0	0	0.0
Birds Subtotal	0	0.0	1	9.1	0	0.0	1	5.0	0	0.0
<u>UNKNOWN</u>										
	1	5.6	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL FOOD ITEMS	18		11		10		20		15	

K-35 (FWS Band # 629-47351), fostered into the West End nest in 2003, was reported at Seal Beach, California on 17 February. We received multiple reports of this bird in the Seal Beach and Huntington Beach area throughout much of February and March.

Collection of Tissue Samples

We collected blood samples for chemical analyses from five eaglets on Catalina Island this season. In addition, the ACC collected the egg shell and contents from eggs that were collected on Catalina Island, but failed to hatch or hatched and later died (Appendix II).

Linear regression analyses of eggs that have failed to hatch from each territory through 2004 show there have been significant decreases in egg DDE concentrations in only the Twin Rocks ($P = 0.0160$) and Seal Rocks ($P = 0.0028$) territories since 1989 (Fig. 8). When the contaminant values for the eggs laid by the Seal Rocks female in 1990 and 1992 are dropped (this bird died of apparent DDE poisoning in 1993; Garcelon and Thomas 1997), there is still a significant decrease in DDE contamination ($P = 0.0112$) and the slope of the regression line is similar to that for the Twin Rocks territory (Fig. 8). However, when eggs laid by each female (1-3 females/territory) were examined separately, there were no statistically significant declines in DDE contamination ($P > 0.05$), although the linear regression approaches statistical significance for the current Seal Rocks female (2001-2004: $P = 0.0562$) (Fig. 8). DDE contamination in unhatched eggs from the West End and Pinnacle Rock territories in 2004 were near or above the levels found in eggs in 1991 (Fig. 8). We only have data for the Two Harbors territory for 2003, at which time the mean DDE concentration was 21.42 ppm.

DISCUSSION

There were several milestones during the 25th year of bald eagle restoration on Catalina Island this season. We successfully fostered chicks into five active nests, all of which fledged. This is the most nests that have ever been successful in a single year on Catalina since the project's inception. The Pinnacle Rock pair had their first egg hatch since they began nesting in 1990. Unfortunately, the chick died at the ACC before it could be fostered. The Two Harbors pair also had their first egg hatch, although this was only their second breeding season.

All eggs laid through 2004 that failed to hatch have been analyzed for contaminants. DDE concentrations did not decline significantly in bald eagle eggs between 1989 and 2004 in some territories, and declined slowly in others.

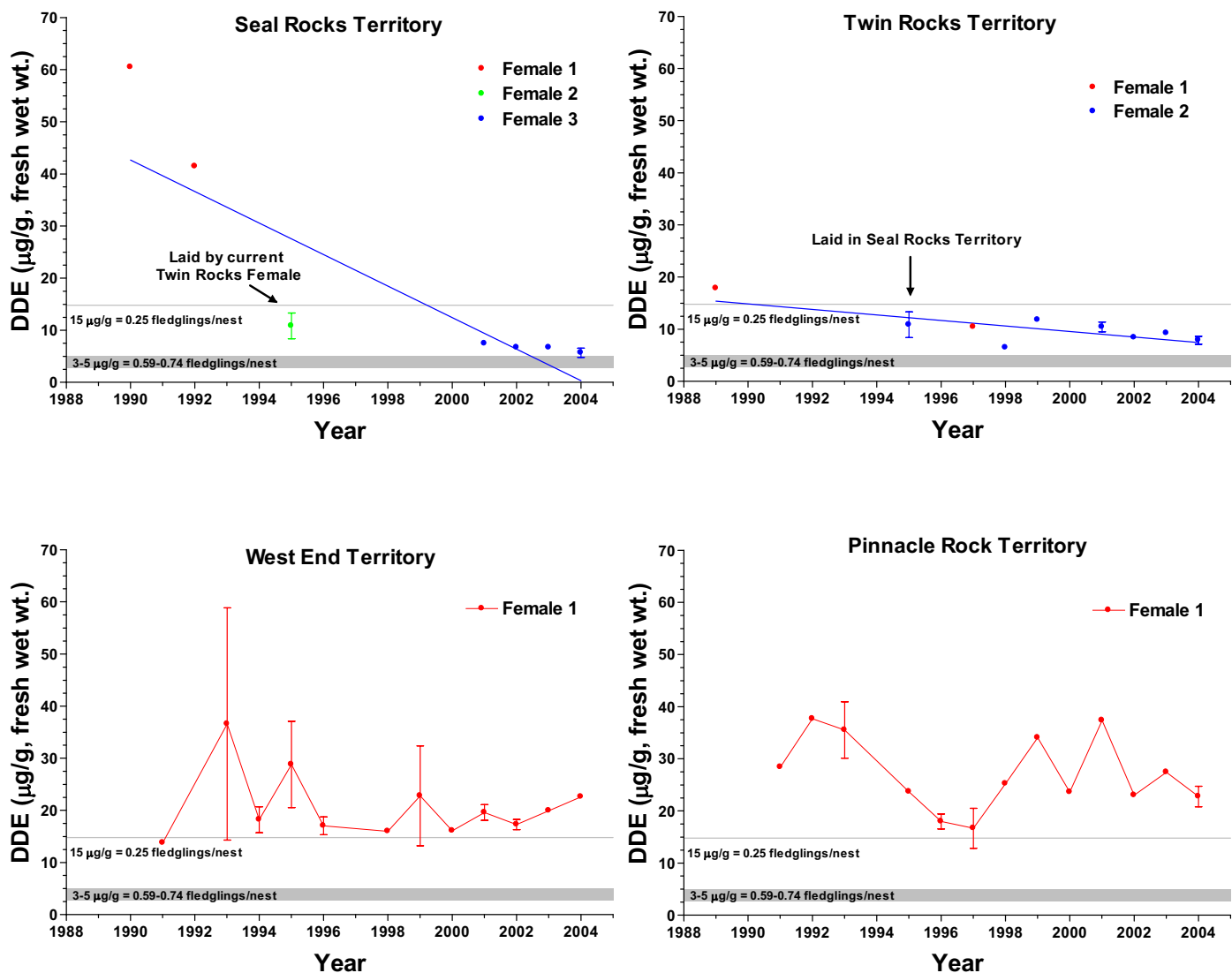


Figure 8. DDE concentrations (mean + 1 SD) in unhatched bald eagle eggs laid in four different territories on Santa Catalina Island, California. There have been significant declines in overall DDE content in eggs from the Seal Rocks and Twin Rocks territories (—) when females are grouped by territory. The current Twin Rocks female also laid two infertile eggs in the Seal Rocks territory in 1995. Those eggs are included in the Seal Rocks data for linear regression analyses by territory and in the Twin Rocks data for analyses of DDE in eggs laid by individual females. There are no statistically significant declines when females are examined individually ($P > 0.05$), although there is a trend towards a decrease in DDE levels in eggs laid by the current Seal Rocks female ($P = 0.0562$).

Only the Seal Rocks and Twin Rocks territories have had a significant decline in DDE contamination in the eggs analyzed. Although DDE concentrations in eggs did not decline significantly when individual females were examined separately, mean DDE concentration in eggs laid by the current Seal Rocks female have decreased each year since she began breeding (7.46, 6.70, 6.69, and 5.69 ppm in 2001-2004, respectively). Although this decrease was not statistically

significant ($P = 0.0562$), it could be considered “biologically” significant. If this trend continues we estimate (using the regression equation calculated for the current Seal Rocks female: $\text{DDE (ppm)} = -0.5595 \cdot \text{Year} + 1127$) that egg contamination could decrease to ≤ 3 ppm (fww), the level at which eggshell thinning is estimated to begin (Wiemeyer et al. 1984), around 2009.

The reason for the wide variation in DDE contamination in eggs from different territories is unclear. Although it is possible that prey contamination varies among territories, this is unlikely. In 2004, the lowest egg contamination was found in eggs from the Seal Rocks territory and the highest was found in eggs from the Pinnacle Rock territory (Fig. 8). These territories are located side by side on the southeastern portion of the island (Fig. 2) and we would not expect contaminant levels in prey to vary widely over such a short distance. A more likely explanation for contaminant differences is a difference in prey preference. For instance, the Seal Rocks female may have a higher proportion of fish (low DDE contamination) in her diet, whereas the Pinnacle Rock female may have a higher proportion of gulls or marine mammal carcasses (high DDE contamination) in her diet.

In 2005, we will begin incubating eggs on Catalina Island instead of at the ACC. Eliminating the travel to San Francisco may increase the hatching rate of the eggs by reducing the potential damage caused by the additional travel. We are creating an incubation facility in Avalon, California that will have a biologist present nearly 24 hours/day while eggs are incubating. Kathy Hobson (ACC) will assist in training our biologists in caring for the eggs to allow a smooth transition between incubation facilities.

We anticipate the addition of at least one new breeding pair on Catalina Island in 2005. There is a pair of eagles that established a territory near Avalon in 2003 and were seen copulating this season, but we found no evidence of nesting. These birds will be six and seven years old in 2005.

Bald eagles we released in previous years are continuing to return to Catalina Island and nearby areas on the mainland, making it likely that the breeding population on Catalina Island will continue to grow. Bald eagle reproduction on Catalina Island continues to suffer from reduced hatchability of eggs, as only three of 10 fertile eggs hatched this season and only two of the three hatchlings survived. Therefore, for the foreseeable future it likely will be necessary to continue manipulating nests on Catalina Island if we are to maintain a bald eagle population on the island.

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Appendix I

ADULT BEHAVIORS TO BE RECORDED DURING SCAN SAMPLING

POSTURES

Standing (ST)	Bird is upright on one or both of its feet on any substrate
Sitting (SI)	Bird is resting its weight on its tarsometatarsus (not its feet) and does not have its sternum touching the nest substrate
Lying (L)	Bird is prone on the nest with its sternum touching the nest substrate
Flying (F)	Feet of bird are not touching any substrate (flapping or hovering)

BEHAVIORS

Brooding (BR)	Bird is sheltering chick under body or wing, and may be pulling nest material around its body
Resting (R)	Bird is lying in nest with its head resting on the substrate
Eating (EA)	The act of pulling at or swallowing food
Feeding (FE)	The act of preparing or giving food to a chick
Preening (PR)	Bird has its beak buried in its feathers or is running its beak along the shaft of a feather
Nest Maintenance (NM)	Bird bringing nest material, or arranging nest material in the nest
Walking (WA)	Moving around the nest either in the standing or sitting postures
Vocalizing (V)	Head back, and appearing to vocalize
Out of view (O)	Bird is either facing away from camera and behavior is unknown, or bird is blocked from view by the nest or another bird
Alert (A)	Bird is attentively looking around or in a particular direction
Non-Descript (N):	Behavior belongs to no definite class (e.g., non-alert scanning, watching chick)

Appendix I (continued)

CHICK BEHAVIORS TO BE RECORDED DURING SCAN SAMPLING

POSTURES

Standing (ST)	Bird is upright on one or both of its feet on any substrate
Sitting (SI)	Bird is resting its weight on its tarsometatarsus (not its feet) and does not have its sternum touching the nest substrate
Lying (L)	Bird is prone on the nest with its sternum touching the nest substrate
Flying (F)	Feet of bird are not touching any substrate (flapping or hovering)

BEHAVIORS

Resting (R):	Bird is lying in nest with its head resting on the substrate.
Eating (EA)	The act of pulling at or swallowing food without help from an adult
Feeding (FE)	Act of taking food from the adult or swallowing food offered by the adult.
Preening (PR)	Bird has its beak buried in its feathers or is running its beak along the shaft of a feather
Playing (PL):	Toying with nest material, feathers, or food
Wing Exercising (WE):	Flapping both wings while the feet are in contact with the nest substrate
Walking (WA)	Moving around the nest either in the standing or sitting postures
Wing-flap/Jump (J):	Flapping wings and jumping from one part of the nest to another.
Wing Stretch (WS):	Extending one wing or a wing and a leg.
Wings Out (WO):	Extending both wings out, usually precedes a wing-flap/jump or flying.
Out of view (O)	Bird is either facing away from camera and behavior is unknown, or bird is blocked from view by the nest or another bird
Non-Descript (N):	Behavior belongs to no definite class (e.g., non-alert scanning, watching chick)

Appendix II

Specimens collected from bald eagles on Santa Catalina Island or the San Francisco Zoo, California for analyses in 2004.

Tissue Type	Collection Location	Description
Whole Blood	Twin Rocks Nest	10 cc from 8-week-old eaglet (K-42)
Whole Blood	Pinnacle Rock Nest	10 cc from 8-week-old eaglet (K-43)
Whole Blood	West End Nest	10 cc from 8-week-old eaglet (K-45)
Whole Blood	Two Harbors Nest	10 cc from 8-week-old eaglet (K-46)
Whole Blood	Seal Rocks Nest	10 cc from 8-week-old eaglet (K-47)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0005 (Twin Rocks egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0006 (Twin Rocks egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0009 (West End egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0010 (West End egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0013 (Seal Rocks egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0014 (Seal Rocks egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0015 (Pinnacle Rock egg)
Egg Shell and Contents ^a	San Francisco Zoo	Collected from egg 04-0016 (Pinnacle Rock egg)
Egg Shell ^a	San Francisco Zoo	Shell from hatched Pinnacle Rock egg (04-0017)
Yolk Sac and 5-day-old chick ^a	San Francisco Zoo	Successfully hatched, but died of complications

^aEgg shells were rinsed in water, air dried, and stored in aluminum foil. Shell contents were placed directly into a chemically clean jar, sealed with an evidence label, and frozen.