

Redwood

National and State Parks

National Park Service
US Department of the Interior

Department of Parks and Recreation
State of California

2013 HERD UNIT CLASSIFICATION and MANAGEMENT OF ROOSEVELT ELK



Photo: Redwood National and State Parks

April 15, 2014

INTRODUCTION

The Roosevelt elk (*Cervus elaphus roosevelti*), the largest of the six recognized subspecies of elk, once occurred from southern British Columbia south to Sonoma County, California. The tribes living in and around what is now Redwood National and State Parks (RNSP or “parks”), the Tolowa, Yurok, Hupa, and Chilula, burned the prairies of the Bald Hills and other forest openings regularly in part to promote the growth of new grass attractive to wildlife (i.e., elk and deer); their use of elk for subsistence presumably had minimal impact on elk populations. With the arrival of European and other foreign settlers intense hunting began in the mid-1800s and the Roosevelt elk’s range was highly reduced. In 1848 through 1855 market hunting for elk hide and meat supplied gold miners during the northern California gold rush. When the gold rush was over a large amount of elk habitat was converted to cattle and sheep ranching and croplands, and elk were killed to protect against crop depredation. Elk populations and distribution in the Marble and Siskiyou Mountains and the Salmon-Trinity Alps were significantly reduced (USDI 1983). The only Roosevelt elk populations that persisted through this period were those occupying coastal lowlands in the northern part of California, where dense forests and brush fields provided protective cover. Today Roosevelt elk in California persist only in Humboldt and Del Norte Counties, and extreme western Siskiyou County.

The Redwood National Park 1986 *Elk Management Report* (Hofstra et al. 1986) stated the long term goal for elk within what is Redwood National and State Parks is “...an elk population in equilibrium with the environment, regulated by vegetation dynamics, predation, competition with other species, and other natural forces.” It goes on to acknowledge that achieving this goal may be “problematic at Redwood, given its configuration, relatively small size, land use history, adjacent activities, and habitat needs of elk.”

Work in RNSP

Annual classification of elk herds within RNSP began in 1996 to document relative abundance and simple population characteristics, such as cow numbers, recruitment, and calf survival within known herds (Wallen 1997). These herd count/classifications have been conducted annually each fall since that time by parks staff and others. Also in 1996, a monitoring program of the elk population in the Prairie Creek drainage was established independent of the RNSP program (Weckerly 1996, Weckerly et al. 2004). The 2 independent monitoring programs in the same area provide a unique opportunity to compare data gathered unsystematically with data gathered using a science-based approach using a standard protocol.

Beginning in 2004, elk in the Bald Hills were counted by Dr. Floyd Weckerly using a method he developed (Weckerly and Francis 2004). Unlike the Prairie Creek herd counts which tend to be similar between the parks’ and Weckerly’s survey methods, the Bald Hills herd counts were quite dissimilar between the 2 methods, with staff counts consistently undercounting the number of animals. Due to the inaccuracy of the park staff counts, those counts in the Bald Hills were discontinued in 2008.

METHODS

Seven separate herds were counted/classified within RNSP. Six of the herds were counted by RNSP staff between late August and mid-December in 2013. The Bald Hills herd was counted 10 times in January 2013 by Dr. Weckerly. Surveys by Dr. Weckerly associated with Prairie Creek herd monitoring also were conducted in January. Results from these latter two surveys are considered part of the 2013 elk count “season” and are included in this report with the fall 2013 information. This is compatible with how survey results have been reported in previous reports. The seven fall count herd units are:

- (1) **Old South Operations Center (OSOC)** herd
- (2) **Lower Redwood Creek (LRCR)** herd; (sometimes referred to as the “Levee” herd in previous reports)
- (3) **Davison Ranch/Berry Glen (DARA)** herd
- (4) **Elk Prairie/Hwy 101 Bypass** herd (EPBY)
- (5) **Gold Bluffs Beach (GOBB)** herd; (several co-mingling groups)
- (6) **Crescent Beach Education Center (CBEC)** herd
- (7) **Bald Hills (BAHI)** herd

Classification counts were conducted by RNSP staff driving or hiking to the identified herd units. Using binoculars and spotting scopes, staff recorded the total number of elk observed, and the total number of elk within each classification group. The groups are mature bulls, spikes (first year males identified by a lack of brow tine off the main beam), cows, and calves. The observers also assigned ranking criteria to the classification counts that specified the accuracy of the count, using a scale of 1 to 4. A rating of 1 indicated good visibility and the animals were close enough to accurately count and classify the herd. A rating of 4 indicated that the observation was unacceptable for determining herd composition because of poor visibility due to low light level, fog, vegetation, or topography. In calculating the ratio of calves to adult cows, ratings of 3 and 4 were dismissed due to poor quality of observations. As in previous years, the highest cow counts with a favorable ranking were used as the herd size estimates for 2013. The counts from the fall period were used, even though more animals may have been observed during earlier months.

Fall Count Herd Classification Groups

- **Cows** = all females >1 year old.
- **Calves** = young of the year (<1 year old; recognized by spotted coat and small size; later the spots disappear, but they retain a short, rounded snout).
- **Spikes** = year old males exhibiting only a main beam, brow tine absent.
- **Mature bulls** = males ≥ 2 years, with brow tine evident off the main beam.

Fall Count Herd Observation Ranking Criteria

- 1 = Good**, visibility good and animals close enough to observe with high confidence of an accurate count and classification.
- 2 = Fair**, animals are either distant or not fully cooperative for good confidence in classification (e.g. some vegetation blocking full view or movement into cover while counting).
- 3 = Poor**, animals too far away (e.g. difficult to track individuals or animals are in adjacent hiding cover).
- 4 = Unacceptable**, bad visibility due to low light levels, fog, uncooperative animals.

Elk in the Bald Hills during January surveys were counted from vantage points or approached on foot. A set route was driven/walked once a day 10 times. When groups were approached on foot it was to obtain an unobstructed view or to conduct a coordinated stalk. A coordinated stalk consisted of an attempt to alert elk groups to the presence of one surveyor in such a manner that the group moved to an area with an unobstructed view where they could be counted by another surveyor. All elk seen were counted and classified as mature bulls or “cows” using binoculars and field telescopes. Generally, juveniles and spikes were combined with female counts due to the large size of the herd, however, this year cow, calf, and spike counts were obtained. All animals within 50 m of one another displaying coordinated activity or movement were considered a group (Weckerly et al. 2004). As with the other herd counts, the highest reliable cow count was used as the year’s herd size estimate for this season.

RESULTS AND DISCUSSION

Fall classification counts (and January 2013 for Bald Hills) for the different age classes are presented in Table 1. It should be noted that the parks’ DARA and EPBY herds are combined in Weckerly’s “Prairie Creek” herd. Table 1 numbers for DARA/EPBY reflect fall staff counts.

Table 1. Highest number of elk reported within each herd unit and for each classification grouping in 2013. MB = mature bull, SP = spike, CW = cow, CV = calf, n = total fall counts when animals were observed.

Location	MB	SP	CW	CV	Total	n
OSOC	4	0	11	5	20	5
LRCR	2	4	19	11	36	7
Bald Hills	5	17	193	25	240	10
DARA	2	3	26	11	42	8
EPBY	2*	0	4	2	8	6
GOBB	0	4	25	5	30	4
CBEC	1*	4	40	8	53	4

* High bull counts during the year for EPBY and CBEC were 9 and 6, respectively.

Weckerly's January 2013 estimate for the Davison herd (including Boyes Prairie or "EPBY") was 46 elk (F. Weckerly pers. comm.). The staff count for the Davison/EPBY herd was 50, indicating that count numbers between RNSP staff and Weckerly are comparable.

Cow counts by year, the best indicator of herd persistence (McCullough et al. 1994, Weckerly and Francis 2004), are displayed in Fig. 1. Numbers for all herds for all years are provided in Appendix A. Four herds showed increases in cow numbers over last year's numbers, and 3 herds had slightly fewer cows counted. There were 4 cows observed in the EPBY herd, the highest number since 2007; 2 of the cows had calves still present during the fall count period. No cows were recorded in the January counts (F. Weckerly pers. comm.). The GOBB herd normally ranges widely over a large area and is difficult to count, however, this year's count may have been more representative of an actual number; the cow count was the highest it's been since 2002.

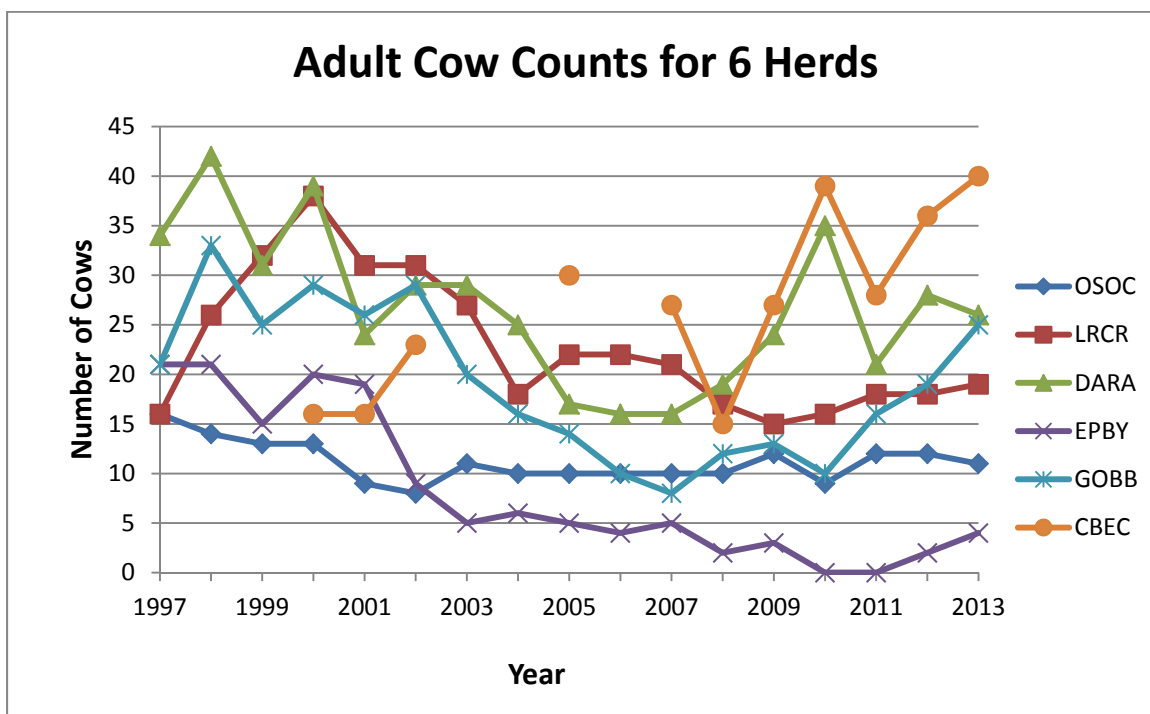


Figure 1. RNSP fall elk herd cow numbers from 1997 to 2013 indicating herd persistence through time. The CBEC herd counts did not begin with regularity until 2007.

The highest fall cow count in each herd was used to determine calf:cow and bull:cow ratios. The ratio of calves to cows is an indication of herd productivity; ratios were up from last year's counts in 2 herds, down in 3 herds, and equal in 1 herd (Table 2). The high calf:cow ratios in 2004, 2007, 2008, and to a lesser extent in 2009 and 2012 for the EPBY herd were artifacts of an extremely small population size. Weckerly (unpub. data) calculated a calf:cow ratio of 0.31 for his "Prairie Creek" herd. The staff fall counts indicated a calf:cow ratio of 0.42 (not including

the 2 cows with calves in the EPBY herd). Thus, herd counts in the Prairie Creek drainage were similar between staff counts and Weckerly's, but herd composition ratios were not. Weckerly and Francis (2004) suggested differences in composition ratios may be due to observer bias in classifying calves. In 2013, staff counted 11 calves in the DARA herd as late as the end of November, however, by January mortality could have reduced the number of calves in that herd to 8, which was the number consistently counted by Weckerly (F. Weckerly pers. comm.).

Table 2. Calves per 100 cows for fall elk herd counts, 2003 to 2013 (N/A = data not available).

Herd	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
OSOC	27	10	40	30	40	40	25	55	16	8	45
LRCR	11	22	18	45	33	23	20	56	44	61	58
DARA	21	24	12	18	56	37	33	22	38	18	42
EPBY	20	50	0	25	60	100	33	0	0	50	50
GOBB	15	6	17	30	50	50	54	60	44	53	20
CBEC	N/A	N/A	N/A	N/A	30	40	30	5	14	28	20

One reason for monitoring bull:cow ratios is that these ratios may indicate the quantity of available forage. That is, when food is less abundant males may use habitats where they are more difficult to observe, in part due to social demands unique to males of polygynous species (Weckerly et al. 2004, Weckerly 2007). Figure 2 displays the bull:cow ratios for the 6 herds monitored in the fall by park staff. Weckerly reported a bull:cow ratio of 0.15 for the "Prairie Creek" herd. This was comparable to the staff count ratio of 0.13 for the EPBY and DARA herds. Bull:cow ratios increased slightly for all herds this year, except for the GOBB herd, which was zero due to no bulls present during the fall high cow count; in fact only one bull was seen in this herd during any of the fall counts.

Overall, the numbers of bulls counted among all herds were low for the second consecutive year when compared to previous years, with 9 bulls being the maximum counted at one time, earlier in the year in Boyes Prairie.

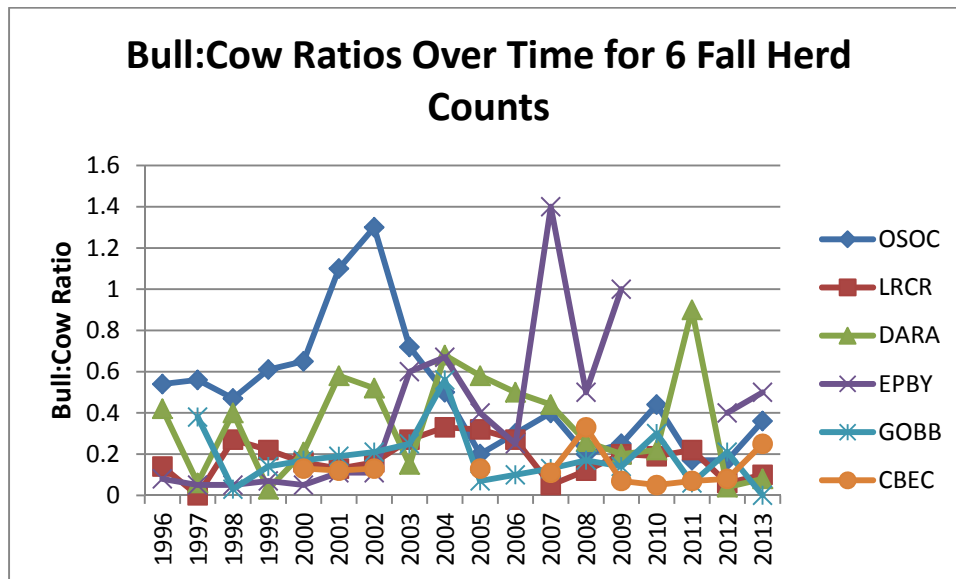


Figure 2. Bull:cow ratios from 1996 to 2013 indicating herd reproductive capability through time. The CBEC herd was not counted consistently every year.

Herd Summaries

Old South Operations Center (OSOC) Herd

The cow count for the OSOC herd was again at a “typical” number for this herd in recent years, but still below the higher numbers from 1997 to 2000. Calf production was good, with 5 this year as compared to just one calf present by fall last year. The number of bulls observed doubled over last year from 2 to 4.

Lower Redwood Creek (LRCR) Herd

This elk herd uses a long corridor of habitat along lower Redwood Creek extending from the beaches and private land pastures near the Redwood Creek estuary, upstream to the Tall Trees Grove. During the fall of 2013, this herd was located primarily around the Redwood Creek estuary, behind the “new” South Operations Center in Orick, and upstream of the Elam Creek tributary in Redwood Creek. The cow count was similar to what it’s been in the previous 2 years and was as high as it’s been since 2007 when 21 animals were counted. It has yet to regain the high numbers observed in the late 1990s and early 2000s (Fig. 1 and Appendix A). The calf:cow ratio was again high, with 11 calves surviving until fall. The bull:cow ratio was low due to only 2 bulls observed. The Northwestern Elk Hunt removed animals from this herd on private ranchlands in and around the Orick Valley (see *Annual Elk Hunts* below).

Davison Ranch (Elk Meadow) / Berry Glen (DARA) Herd

This herd consists of a group of mature bulls that often occupies the northern portion of Elk Meadow north to the Lost Man Creek Fish Hatchery, and a group of cows, spikes, and calves that occupy the southern portion of Elk Meadow south to Skunk Cabbage Creek. These animals also frequent the Redwood Adventures cabins and the lawn of the Valley Green Office (Green Diamond Resource Co.) on the east side of the highway. The number of cows counted (26) was slightly down from last year's 10-year high of 28 and far lower than highs of 42 and 39 in 1998 and 2000, respectively. The calf:cow ratio rose to the second highest since counting began, at 0.42 after hitting a 7-year low last year at 0.18. The bull:cow ratio was low, at 0.08.

Elk Prairie / Hwy 101 Bypass (EPBY) Herd

In May and June, 9 bulls were observed in this herd. Up to 4 cows were present, the highest number since 2007 when there were 5. Two cows produced calves which were still present by fall, resulting in a calf:cow ratio of 0.50.

Gold Bluff Beach (GOBB) Herd

The GOBB herd is comprised of several sub-herds that come together on occasion. They use a large area that extends from Mussel Point at the south end of Gold Bluffs Beach to Carruther's Cove near the northern limit of this beach, a distance of 12 miles. This year 8 fall counts were attempted, and animals were observed during 5 of them. This herd is difficult to count because of the large area the animals use and the brushy nature of the coastal bluffs which can obscure some individuals. Due to these factors it is possible the counts under-represent the total herd number to some degree. This year 25 cows were counted, the highest number since 2002 when 29 cows were counted. The calf:cow ratio was 0.20, down by less than half of the previous year's 0.53. The bull:cow ratio also was zero due to no bulls observed in the fall. Just one bull was observed during the entire year. It is possible that some animals in this herd are impacted by the Klamath Elk Hunt (see *Annual Elk Hunts* below).

Crescent Beach Education Center (CBEC) Herd

Interpretation staff stationed at CBEC recorded elk in the meadows near CBEC throughout much of the year. The high fall count in 2013, on December 13, was 53 animals (down by just one individual from last year), including 40 cows and 8 calves. The cow count was the highest on record for this herd, which appears to be increasing in size. The 8 calves recorded resulted in a calf:cow ratio of 0.20, down from last year's 0.28. There was only 1 bull recorded in the fall, however, up to 6 were seen at this location earlier in the year. The Northwestern Elk Hunt may remove animals from this herd (see *Annual Elk Hunts* below).

Bald Hills Herd

There were 10 counts in the Bald Hills in 2014, from January 4 to January 13. This year the high count for the Bald Hills herd was 240, two fewer than last year's 242. Five bulls were counted in a group east of the park boundary on the Stover Ranch, and 4 others were observed in the park.

This year herd classification was possible. The high count included 193 cows, 25 calves, 17 spikes, and 5 bulls. The calf:cow ratio was 0.13, down from last year's 0.21. It is possible that some animals in this herd are impacted by the Klamath Elk Hunt (see *Annual Elk Hunts* below).

Winter survey routes in the Bald Hills were displayed in previous Annual Elk Reports (through 2008).

A Note Regarding the Five Declining Herds

The National Park's 1986 *Elk Management Report*, in the section titled "Past and Future Habitat Changes", discussed different phases of elk habitat in what are now park lands. Specifically, the report suggested that elk habitat within the park was "greatly" increased by clearcut logging that took place prior to the national park expansion in 1978. Elk expanded into these harvested areas and populations increased. The report predicted continued expansion of the elk populations in lower Redwood Creek, May Creek and northward to the Klamath River until the time when the habitat began to decline in logged areas (stated as 10-20 years from the time of the report). As second growth forests mature to the point where canopy shades out available browse, the habitat becomes no longer suitable, forcing the elk into prairies and adjacent forest. Specifically the report states: "Numbers of animals will decline and reproduction will be reduced with elk age distributions skewed toward fewer, older animals with constricted ranges. Habitat will be degraded by concentrated use and the general vigor and appearance of the various elk groups will decline" (p.10).

With the exception of the CBEC and BAHI herds, the elk herd numbers discussed above began to decline after 2000, 15 years after the 1986 report's prediction, and within the 10-20 year range described in the report. None of the 5 herds described above have approached the numbers reported in the late 1990s or early 2000s.

Other Observations

There were only 5 opportunistic staff or visitor observations of elk entered in the Wildlife Observation database in 2013, all of live animals.

Incidents

Calving Season

On May 31, a 911 caller reported encountering an aggressive female elk on the Coastal Trail along Gold Bluffs Beach close to Butler Creek; the cow had just given birth. The visitor was charged by the elk, forcing him to walk back to Fern Canyon on the beach. That same afternoon a couple hiking on the same section of trail also were a target of the elk's aggression at close range, and they reported that other people also may have been trapped on the trail. Law enforcement rangers investigated and observed the elk, then set up barricades and closure tape and posted "trail closed" or "warning" signs where West Ridge Trail intersects the Coastal Trail.

Other warning signs were posted at the Fern Canyon Trailhead, the Gold Bluffs Beach entrance kiosk, at the beginning of Davison Road (past Elk Meadow), near the Elk Prairie Campground Visitor Center, and at the Zig Zag 2 and Ossagon Trailheads on the Newton B. Drury Parkway.

On June 5, a man running on Enderts Beach Road was bluff-charged by a cow elk, about 100 ft east of the entrance to CBEC. The animal approached from roadside vegetation and wasn't seen until quite close to the man.

On June 10, two NPS biological technicians hiked the Coastal Trail between the Fern Canyon Parking Lot and the junction with West Ridge Trail to follow up on the May 31 incident. Six cow elk were seen along the trail. One cow had a calf and moved away from the technicians and 3 other cows in a group moved off trail away from them; keeping a very close eye on the pair, they started to follow, but then went back to eating. Later that same day there was a report of an elk behaving aggressively in the Gold Bluffs Beach Campground. It was learned that a single cow encountered by three female hikers on Gold Bluffs Beach Road "barked" and stomped her foot at them. The women flagged down a maintenance worker who helped them get around the cow and they continued to Fern Canyon. The maintenance worker said the cow "barked" at him, too.

The area in and around Gold Bluffs Beach campground, Fern Canyon, and to the north on the Coastal Trail continues to be a popular calving area for the elk, and is likely to pose problems for visitors on an annual basis.

Rut

On September 6, Redwood Parks Association staff at the Elk Prairie Visitor Center informed an NPS biologist that an elk herd was in the forest on the West Ridge Trail, and had been there for at least the previous 3 days according to visitor and volunteer reports. The animals were first seen near Friendship Ridge Trail and over the days moved south until they were south of Zig Zag 1 Trail about the time of the phone call to the biologist. There was a report of 2 sparring bulls, about 12 cows and half as many calves. Visitors could not pass the herd and needed to turn back. In one case this may have resulted in 2 visitors becoming lost, causing law enforcement rangers to respond. Based on their direction of travel and their behavior, most likely this group was associated with the Gold Bluffs Beach herd. Two days later the group moved into Boyes Prairie and then proceeded into the forest behind the campground. Signs were posted at the Elk Prairie visitor center and Prairie Creek Trailhead, and on Newton B. Drury Parkway at a trail connector closest to Zig Zag 1.

In the weeks that followed, by September 26, there were numerous reports of the elk on trails in the forest in Prairie Creek Redwoods State Park, in Boyes Prairie, at the Wolf Creek housing and education center, Gold Bluffs Beach road and Fern Canyon parking lot, Highway 101 south of Newton B. Drury Parkway, and the Parkway near Boyes Prairie. Bull elk charged and chased people on trails, blocked trail access, and charged vehicles at Wolf Creek housing, on the Gold Bluffs Beach road, and on Newton B. Drury Parkway. Signs were updated and posted at the Elk

Prairie visitor center and nearby trailheads; on the Parkway opposite the South Fork Trail; at Miner's Ridge Trailhead on Gold Bluffs Beach road; and at Fern Canyon Trailhead.

Entanglements

Unlike 2012, when there were at least 4 cases of entangled antlers in RNSP, there was just one case of entanglement reported in 2013. A bull from the CBEC herd acquired something that looked like a thin cord dragging on the ground from its antlers; however, it is possible cord could have been a vine. Whatever it was dropped off on its own.

Another animal, at Stone Lagoon outside of RNSP, got into a lot of rope with PVC pipe attached to it. This animal was observed on numerous occasions, however, since this area is not within RNSP jurisdiction, nothing was done about it by parks staff.

Mortality

There were 9 known elk deaths (from other than hunting) in RNSP in 2013 that included 2 bulls, 1 spike, 5 cows, and 1 of unknown sex.

In late January, a large 6x6 point bull that had been wandering in Boyes Prairie for the previous month with an injured hind leg laid down just off the shoulder of Newton B. Drury Parkway. The animal was very thin, could not move, and was being approached closely by on-lookers. This animal was dispatched by a law enforcement ranger on January 31.

On March 26, a 2x2 point bull was found dead at the base of a slide on the east side of Gold Bluffs Beach Road. There was no indication of cause of death.

In April and May, staff discovered the remains of 2 poached elk in the Bald Hills. One of these was a cow in Childs Hill Prairie. Tire tracks were visible off of Bald Hills Road; the animal was butchered on site. A second poached elk was located on the back side of Williams Ridge. Tire tracks were again visible; in this case only the rumen and hair remained.

On May 31, in the same area north of Fern Canyon where a cow with a calf charged visitors that same day (see *Calving Season* above), a cow was found dead by law enforcement rangers, apparently of "natural causes".

On July 7, a pair of hikers heading down Carruther's Cove Trail, off of Coastal Drive, came upon a cow elk on the trail. She was "behaving oddly", did not seem bothered by the hikers, and eventually lay down on the trail and would not move. She made odd facial expressions and seemed sluggish and possibly ill, but upon further inspection it was determined she was in the midst of giving birth. A "football-sized pink fleshy amniotic sack" was seen coming out of the birth canal. At this point the hikers turned back. By July 11 the cow had died where it lay on the trail. The calf was not born.

On July 8, a cow elk was hit by a vehicle on Freshwater Spit, and the California Highway Patrol responded. They left the animal there and did not notify the park. Soon after, a local resident took the elk from the road and moved it to Hiltons Road where it was butchered.

On August 27, a park employee came upon a mountain lion standing over a dead spike buck lying in the middle of Bald Hills Road east of Lyons Ranch. The lion ran off when the employee drove up, and he noticed the herd just down slope from the dead spike. Later inspection revealed that this animal did not have puncture wounds indicative of a lion attack. Nor did it appear to have been hit by a vehicle. Thus, remained a mystery.

On September 11, a sick cow elk that had been observed wandering around the Orick Valley for the previous month died in the yard of a burl shop in downtown Orick.

Annual Elk Hunts

Two local elk hunts may impact RNSP elk herds. The Klamath Hunt takes place on Green Diamond Resource Company lands adjacent to the parks, and may take animals from the Bald Hills herd and possibly the GOBB herd. In 2013, California Department of Fish and Wildlife (CDFW) issued 5 antlerless and 6 bull elk tags for this hunt. According to CDFW 2013 hunt statistics, 6 animals (all males) were taken, including 1 spike male from Williams Ridge, just outside the national park in the Bald Hills.

The Northwestern Hunt is on all lands in Del Norte and Humboldt Counties that are not Green Diamond Resource Company or park lands. The Northwestern Hunt may cause hunting pressure in the Orick Valley (OSOC, LRCR herds) and in the north (e.g., CBEC herd). There were 20 animals, either sex, tags issued in 2013. According to CDFW 2013 hunt statistics, 19 animals were taken that included 2 bulls from the LRCR herd in the Orick Valley; a 6x6 point bull taken from a local ranch near the Orick Rodeo grounds, and another taken from private land near the Redwood Creek estuary.

Report Prepared by Kristin Schmidt, RNSP Wildlife Biologist

LITERATURE CITED

- McCullough, D.R., F.W. Weckerly, P.I. Garcia, and R.R. Evett. 1994. Sources of inaccuracy in black-tailed deer herd composition counts. *Journal of Wildlife Management* 58:319-329.
- Hofstra, T., J. Sacklin, S. Veirs, A. Zakis, S. Hurd, J. Grenier, and T. Margquette. 1986. Elk management report, Redwood National Park, Arcata, CA 95521.
- USDI [U.S. Department of the Interior]. 1983. Elk live trapping and relocation environmental assessment. Redwood National Park, Arcata, California. 11pp.
- Wallen, R. L. 1997. Monitoring abundance and distribution of Roosevelt elk in 1996 in Redwood National and State Parks. Annual project report, Resource Management and Science Division files, Orick, CA. 6pp.
- Weckerly, F.W. 1996. Roosevelt elk along the Prairie Creek drainage: an evaluation of estimating abundance and herd composition. *California Fish and Game* 82:175-181.
- Weckerly, F.W. 2007. Constant proportionality in the female segment of a Roosevelt elk population. *J. Wildl. Mgmt.* 71(3): 773-777.
- Weckerly, F.W. and D.R. Francis. 2004. Elk in north coastal California: habitat suitability, sign survey utility and population monitoring. Dept. of Biology, Texas State University, San Marcos, Texas. Unpub. Rept. on file at South Operations Center, Redwood National and State Parks, Orick, CA. 61pp.
- Weckerly, F. W., McFarland, K. A., Ricca, M. A., and Meyer, K. P. 2004. Cropping rates, social affinity and sexual segregation in Roosevelt elk when population density changes. *American Midland Naturalist* 152.

PERSONAL COMMUNICATION

Dr. Floyd "Butch" Weckerly, Professor, Texas State University, San Marcos, TX

Appendix A

Highest reliable (ranking <3) cow counts for identified elk herds, 1997 to 2013 (data displayed, in part, in Figure 1 in the report). ND = no data available for that year.

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
OSOC	16	14	13	13	9	8	11	10	10	10	10	10	12	9	12	12	11
LRCR	16	26	32	38	31	31	27	18	22	22	21	17	15	16	18	18	19
BAHI	45	98	62	104	54	35	26	241*	251*	278*	270*	244*	261*	225*	241*	242*	240*
DARA	34	42	31	39	24	29	29	25	17	16	16	19	15	23	21	28	26
EPBY	21	21	15	20	19	9	5	6	5	4	5	2	3	0	0	2	4
GOBB	21	33	25	29	26	29	20	16	14	10	8	12	13	10	16	19	25
CBEC	ND	ND	ND	16	ND	23	ND	ND	30	ND	27	15	27	39	28	36	40

* Counts conducted by Weckerly account for differences in herd counts beginning in 2004. Note that these “cow” counts represent cow, calf and spike groups.