

RIVER OTTER MONITORING BY CITIZEN SCIENCE VOLUNTEERS IN NORTHERN CALIFORNIA: SOCIAL GROUPS AND LITTER SIZE

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ABSTRACT—Opportunistic observations of Nearctic River Otter (*Lontra canadensis*) were collected by volunteer observers in Humboldt and Del Norte counties to describe group and litter size patterns. In the first 5 y, 709 records were sent by email, mail, or an online form. River Otter pups were characterized relative to adult body size. Group sizes, ranging from 1 to 9 otters, were larger in summer and smaller in winter. Litter size ranged from 1 to 4 pups and declined from an average of 3.2 in spring to 1.6 in fall. Observers recorded 49 litters among 23 watercourses, with otters from some sites producing pups in multiple years. This Citizen Science approach to monitoring can provide valuable information to assess basic population parameters that might otherwise be unobtainable.

Key words: Del Norte County, demographics, Humboldt County, litters, *Lontra canadensis*, Nearctic River Otter, northern California, pups, social group

This paper reports on the establishment of a long-term demographic study of Nearctic River Otters (*Lontra canadensis*) in northern California. Data were generated by a ‘Citizen Science’ network of observers. Otter populations in North America and beyond have suffered dramatic declines due to human impacts (Foster-Turley and others 1990; Larivière and Walton 1998; Kruuk 2006). Legislation to protect otters and proactive re-introduction programs have been implemented in several states and provinces in North America; however, in most jurisdictions there is little information with which to assess population trends (reviewed in Melquist and others 2003).

In attempts to quantify the status of River Otters in northern California, Kirk (1975) and Gould (1984) reported 136 and 387 records, respectively, in historic databases from the National Forest Service/National Park Service and California Department of Fish and Game. So few records for such a large geographic region could indicate a population at risk or that monitoring efforts were minimal. Schempf and White (1977), as summarized in CDFG (2005), organized 136 records over time, and argued that otter numbers appeared to have increased through 1974 since trapping seasons were closed in 1961. When trapping was legal, annual reported take of River Otters ranged from 14 to 163 animals in California (Gould 1977). It is

assumed that the range and number of River Otters in California were “greatly reduced by trapping in the past, but increasing under protection” (Schempf and White 1977).

The objective of this study was to track demographic variables, including observations of social groups and litters, consistently over time within a limited geographic area. I report on the success of soliciting this information from citizen observers and describe initial findings in an attempt to contribute to a description of River Otter status in the study area. Citizen Science networks have provided useful information in a variety of systems, for example butterflies (Swengel 1990), woodland mammals (Newman and others 2003), waterbirds (Owen and others 1986), song birds (Butcher and others 1990), birds of prey (Bildstein 1998), and fish (Pattengill-Semmens and Semmens 2003).

Otters are said to be ideal species with which to track functionality of an ecosystem because they are a top predator making use of a variety of prey occupying a range of habitats throughout entire watersheds from coastal lagoons, bays, and estuaries to upland areas (*sensu* Lunnun and Reynolds 1991; Larivière and Walton 1998; Kruuk 1995, 2006; Melquist and others 2003). While northwestern California has had a relatively short period of habitat-altering activities in its 200-y post-European history, it has had its share of mining, forest clearing, and

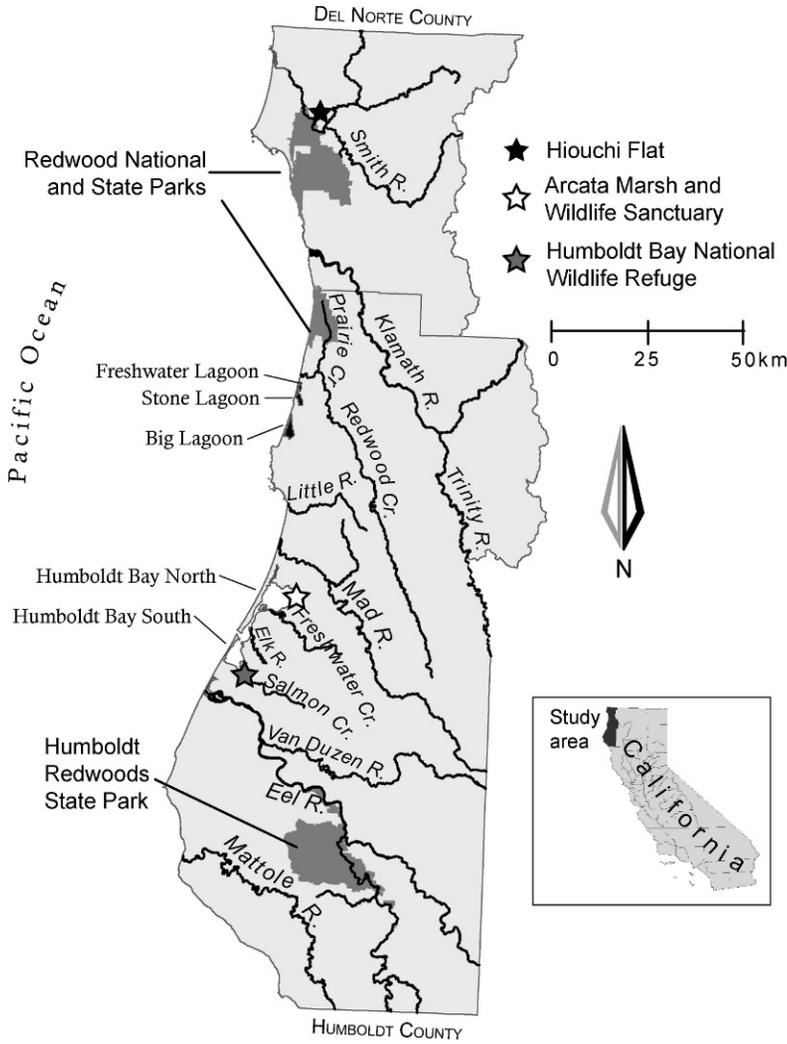


FIGURE 1. Primary study area where Citizen Science volunteers recorded River Otter observations from waterbodies in Humboldt and Del Norte counties, northern California, 2000–2005.

road construction, which negatively affects watercourses (Mount 1995). As use and alteration of natural areas continues there is need to monitor impacts on regional wildlife.

METHODS

I focused solicitation of River Otter observations in Humboldt and Del Norte counties (Fig. 1), but accepted and catalogued records from neighboring counties (Mendocino, Siskiyou, and Trinity). This region includes coastal bays, estuaries, lagoons, marshes, ponds, lakes, reservoirs, rivers, streams and associated upland

watersheds. Humboldt Bay is roughly the center of the study area (UTM: Zone 10, E 407634, N 4523226, NAD 27). Many records came from coastal rivers and estuaries, including the Mattole, Eel, Van Duzen, Salmon Creek, Elk, Freshwater, Mad, Little, Redwood, Prairie, Trinity, Klamath, and Smith River watersheds. The study area includes Humboldt Redwoods State Park (about 21,000 ha), Humboldt Bay National Wildlife Refuge Complex (about 1600 ha), Redwood National and State Parks and Lagoons (about 54,000 ha), and several national forests and wilderness areas. The study area extends from lush coastal habitats, including agricultural and

marshland flats, to rugged mountains dominated by extensive stands of conifers (for example, *Sequoia sempervirens*, *Pseudotsuga menziesii*) and deciduous woodlands (for example, *Alnus rubra*, *Lithocarpus densiflorus*). Elevation extends from sea level in the west to just under 2100 m along North Coast Mountain Ranges. Land uses include logging, mining, recreation, livestock grazing, and some croplands.

I solicited River Otter observations by publicizing a 'clearing house' for records (the database) and provided email and postal addresses and a website where information could be obtained and submitted (Black 2000, 2001). Regional wildlife and fisheries students and professionals in the area were invited to participate. Signs were placed at public access points to adjacent waterbodies and replaced as needed. Email reminders to network participants also were sent each year.

Observers were asked to record date, time, location, number of adults and pups. Pups were classified according to size relative to adults: 0.25, 0.50, 0.75, or same size as adult. I asked observers to document otter behavior, habitat features, tracks, slides, scat, dens, prey items, and social interactions. This information was used to support observer reports; 5 records were discarded as they were likely not otters and 'pup' records were assessed using information about their body size and date of observation (see below). To further help with scrutiny of records, observers were identified as scientist/naturalist, wildlife/fish/biology student, or layperson. I visited most locations to confirm habitat characteristics associated with River Otter activity (*sensu* Melquist and Hornocker 1983; Dubuc and others 1990; Bowyer and others 1995; Swimley and others 1998). Information was linked to UTM coordinates and data layers were created (ESRI ARCVIEW/ARCMAP) for subsequent spatial analyses. Data reported here are from Humboldt and Del Norte counties for the first 5 y after advertising the network in 2000 (Fig. 1). An additional 289 earlier records were catalogued, mostly from Redwood National Park archives beginning in 1970 (G Holme, Redwood National Park, Arcata, CA, pers. comm.).

Group size (or social unit) was the total number of animals reported in an observation, and litter size refers to number of pups. Citizen

observers sometimes incorrectly assumed that groups of 3 or more were comprised of a male and female parent attending a certain number of pups. Sex was not considered in analyses, and records of pups were included only when observers commented on their size, initially recording them as half adult size or smaller in spring and summer months. Thirty-eight observations (27%) reporting presence of pups did not meet these criteria. Because litters were attributed to distinct activity centers or clusters of re-sightings, records of larger pups (0.75 that of an adult) were used in areas where smaller pups had been recorded. I used the smallest size classes of pups (0.25–0.50 of adult size) to estimate month of emergence from dens.

I used the Kruskal-Wallis Test to examine variation in group size and litter size in relation to year (2000–2004), and group size in relation to month ($n = 12$). A one-tailed Spearman Rank Correlation was used to test for a decreasing trend in litter size with month (March–November), or time period, lumping data from March, April and May. Analyses were performed using SAS version 9.1, 2002.

RESULTS

After publicizing the Otter Records Network, 709 River Otter observations were catalogued, with an annual average of 140 records ($s_{\bar{x}} = 8$, $n = 5$ y); 86% included animal sightings, while 14% were observations of scat, tracks, slides, or dens.

Observed group sizes ranged from 1 to 9 individuals. The majority of observations were of single otters (40% of 607 records), then 2 (22%), 3 (17%), 4 (13%), and 5 or more otters (8%). Average group size was 2.3 ($s_{\bar{x}} = 1.1$, $n = 607$), which varied among months (Kruskal-Wallis $\chi^2 = 85.53$, $df = 11$, $P = 0.0001$), with larger groups occurring in July–October (Fig. 2). Group size did not vary significantly among years (Kruskal-Wallis $\chi^2 = 9.31$, $df = 4$, $P = 0.054$).

Some groups consisted of adults and smaller pups. Pups were typically seen with one or more adults (50 records with 1 adult; 37 with 2; 5 with 3; 1 with 4 adults), but on 10 occasions pups were recorded without an attending adult. Litter size ranged from 1 to 4 young and the overall average was 2.2 ($s_{\bar{x}} = 0.1$; $n = 103$ observations of 49 litters). Litter sizes were largest in spring (March–May) and declined through summer and autumn (Fig. 3) ($r_s = 0.75$,

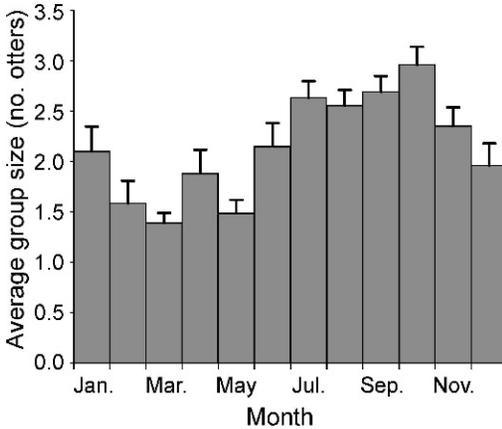


FIGURE 2. River Otter group size in relation to month (\bar{X} , $s_{\bar{X}}$) in Humboldt and Del Norte counties, northern California, 2000–2005. Sample range 25–87 observations (total $n = 603$).

$n = 7$ periods, $P = 0.026$). Pups reported initially as 0.25 the size of an adult were observed in March through August ($n = 9$). Those reported as 0.50 the size of an adult were observed in June through November ($n = 29$).

Observations that included pups occurred in 23 waterbodies within the study area (Fig. 1). Six to 16 litters were reported annually. Mean litter size did not vary among years (Kruskal-Wallis $\chi^2 = 0.428$, $df = 4$, $P = 0.367$). Litters were reported in each of 5 y at 1 site (Arcata Marsh), in 4 of 5 y at 3 sites (South Fork Eel River, Redwood Creek, and Eel River estuary), in 3 of 5 y at 4 sites (Salmon Creek Unit at Humboldt Bay National Wildlife Refuge, Elk River estuary, Mad River estuary, and Hiouchi Flat on Smith River), in 2 of 5 y at 5 sites, and once at 10 sites.

River Otter observations were made in all daylight hours. Individual citizen observers other than myself provided 1 to 41 records ($\bar{X} = 2.1$, $s_{\bar{X}} = 0.2$, $n = 443$ participants). I contributed 100 records (14%).

DISCUSSION

I agree with other program assessments that Citizen Science networks can provide useful information about wildlife populations (for example, Newman and others 2003). Sightings provided by volunteers for this study allowed an initial assessment of social group sizes and reproduction from a subset of this region’s River Otter population. Group sizes in the area

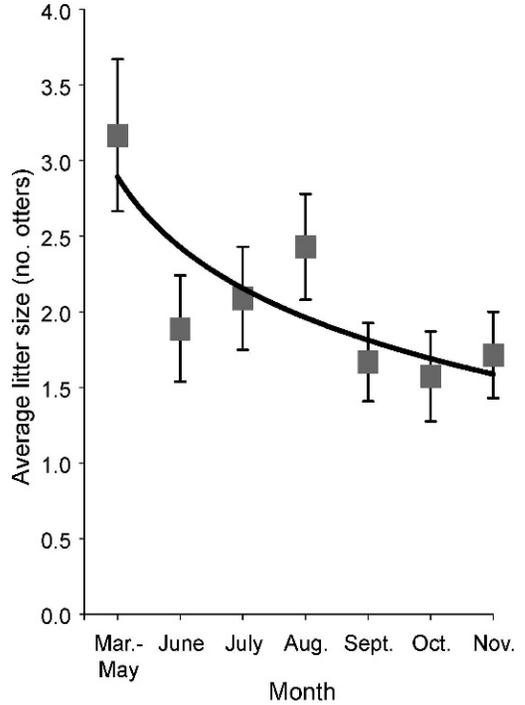


FIGURE 3. River Otter litter size in relation to month (\bar{X} , $s_{\bar{X}}$) in Humboldt and Del Norte counties, northern California, 2000–2005. Sample range 6–34 observations (total $n = 103$).

ranged from 1 to 9 otters; the group of 9 was on the Eel River in June and reported as “playing, rolling and swimming” as a group. River Otter group sizes varied among months, with larger groups occurring in summer and smaller groups in winter. A similar range of group sizes and seasonal pattern was described for River Otters in coastal Alaska, where, in addition to month, variation in group size was explained by age and sex of radio-marked animals (Blundell and others 2002). In that study males, more than females, formed groups, particularly when pelagic fishes were available in nearshore habitats (Blundell and others 2002). In our study area, otter diet was linked with seasonal patterns of rainfall and water levels in rivers and estuaries, as well as the arrival and departure of migratory birds at wetland sites (J. M. Black and T. Penland, unpubl. data, Department of Wildlife, Humboldt State University).

This study provides evidence that a minimum of 49 litters were produced in 23 watercourses during the 5-y study. Taking into account the decline in litter size to 1.6 pups in

autumn months, at least 78 pups may have survived to enter their 1st winter in the study area. Litters were observed in multiple years at some sites and in all 5 y at one. Annual and biannual reproduction has been demonstrated in several studies from a variety of US states (reviewed in Melquist and others 2003). The site that had records of young pups in all 5 y of the study (Arcata Marsh) had more extensive coverage than the others; it was a highly used recreational area with trails adjacent to ponds and the bay.

Litters were comprised of pups and 1 to 4 adults, suggesting pups were in some cases attended by multiple adults. Nearctic River Otter families have been reported as consisting of a reproductively active female, her young-of-the-year, and helpers who are older offspring or unrelated individuals (Melquist and Hornocker 1983; Rock and others 1994; Shannon 1989, 2008).

Due to otter's elusive nature, demographic studies are rare; although a 19-y project in Finland (Sulkava and others 2008) successfully used snow tracks to study the Eurasian Otter (*Lutra lutra*). Prior attempts to quantify California's River Otter population relied on relatively few sightings, making it difficult to assess status or trends (Kirk 1975; Gould 1977; Schempf and White 1977). In order to determine the conservation status of a River Otter population, we need measures of long-term recruitment, mortality, and movements to and from adjacent areas (*sensu* Melquist and others 2003). This study provides some indication that River Otters are reproducing in this region, though we have yet to make a contribution to quantifying mortality and movements to complete a population model.

Periodic assessments of the River Otter network database to detect trends will be valuable, particularly when tied to more detailed enquiries. I conclude that a continued effort to collect and collate River Otter sightings will provide a prolonged opportunity to assess status of a key carnivore within riparian watersheds and coastal habitats.

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