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## **River Otter (*Lontra canadensis*) Monitoring Report 2021 Marin County, California**

**River Otter Ecology Project  
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### **Background**

While historical records on river otters in the San Francisco Bay Area are sparse, existing information indicates that river otters had been extirpated from much, if not all, of Marin County by the 1930's when both Grinnell (1937) and trapping records (Schempf and White, 1977; Kirk, 1975) indicate no coastal river otters in Marin and southward. Beginning in 1989, river otters were observed in coastal Marin County, particularly in Rodeo Lagoon, Walker Creek, and Lagunitas Creek.

As apex predators using variety of terrestrial and aquatic habitat types, river otters are sentinel indicators of watershed function and health (Larivière and Walton, 1998). They predate a wide variety of native and non-native species in freshwater and marine environments (Penland and Black, 2009; Garwood et al. 2013). They are susceptible to parasites such as *Cryptosporidium* and *Giardia* spp. (Gaydos et al., 2007), and *Vibrio* spp. (Bouley et al., 2015), and they may bioaccumulate environmental contaminants such as mercury, metals, organochlorines, and hydrocarbons (Francis et al., 1994; Halbrook et al., 1996; Bowyer et al., 2003). Furthermore, understanding river otter ecology and population status is a critical element of ecosystem management (Bowen, 1997; Kruuk, 2006; Ben-David and Golden, 2009). River otters transport aquatic nutrients to land (Ben-David et al., 2004); transmit trophic effects (Crait and Ben-David, 2007); and affect the composition and abundance of prey species via trophic subsidy (Garwood et al., 2013).

Beginning in 2012, River Otter Ecology Project launched the first study to document current recovery of river otters in the nine counties surrounding San Francisco Bay (Bouley et al., 2015) using camera traps and Otter Spotter, a community science initiative to collect river otter sightings. At the same time, we commenced a long-term monitoring project to study the status and ecology of river otters at 14 focal study sites in Marin County.

As Melquist et al. (2003) noted, long-term monitoring of river otter populations can help us understand and plan for water quality conditions and other factors that affect all species, and remain critical issues in the San Francisco Bay Area. River otters' ecological status and population trends can be significant indicators of progress in improving water quality and recovering habitat and ecosystem function. Restoration projects may also benefit from an understanding of river otter population changes. In our study area in Marin County, for example, the National Park service has in recent years undertaken three large restoration efforts: at Rodeo Lagoon; Muir Beach; and Giacomini Wetlands. Gauging the progress of those efforts can benefit from understanding the interactive effects of river otter populations and the restoration efforts, and their mutual success. Restoration projects in the wider SF Bay Area can similarly benefit.

Lastly, study of population trends in river otters as they reinhabit areas from which they were absent can help to elucidate the spatial, environmental, and anthropogenic factors that influence their habitat choices and ecological success (Barbosa et al., 2001, Weinberger et al., 2016). Although sensitive to habitat disturbance, river otters are also highly adaptable to human presence on the landscape (Weinberger et al., 2016).

This report includes new information and results our Otter Spotter community science program, and long-term monitoring and health studies. The report also summarizes other findings of interest, and other ongoing research.

## Otter Spotter Community Science Project

North American river otter (*Lontra canadensis*) were observed in Marin County with some frequency from the early 2000s; however, the distribution and abundance of river otters remained poorly documented at any agency level (Bouley et al., 2015). River Otter Ecology Project collected and documented river otter sightings during 2012 through the present, using a community science initiative called “Otter Spotter,” to solicit structured data from the public on river otter sightings from the San Francisco Bay Area and beyond. River Otter Ecology Project presented this dataset to the California Department of Fish and Wildlife (CDFW) in 2017, and CDFW updated their range map in 2019 (CDFW BIOS, 2019).

As of the end of 2021, we have received approximately 4,500 reports of river otter sightings from the SF Bay Area and beyond.

We formed a partnership with CDFW and California Academy of Sciences to collect and necropsy road-killed river otters reported through our Otter Spotter platform.

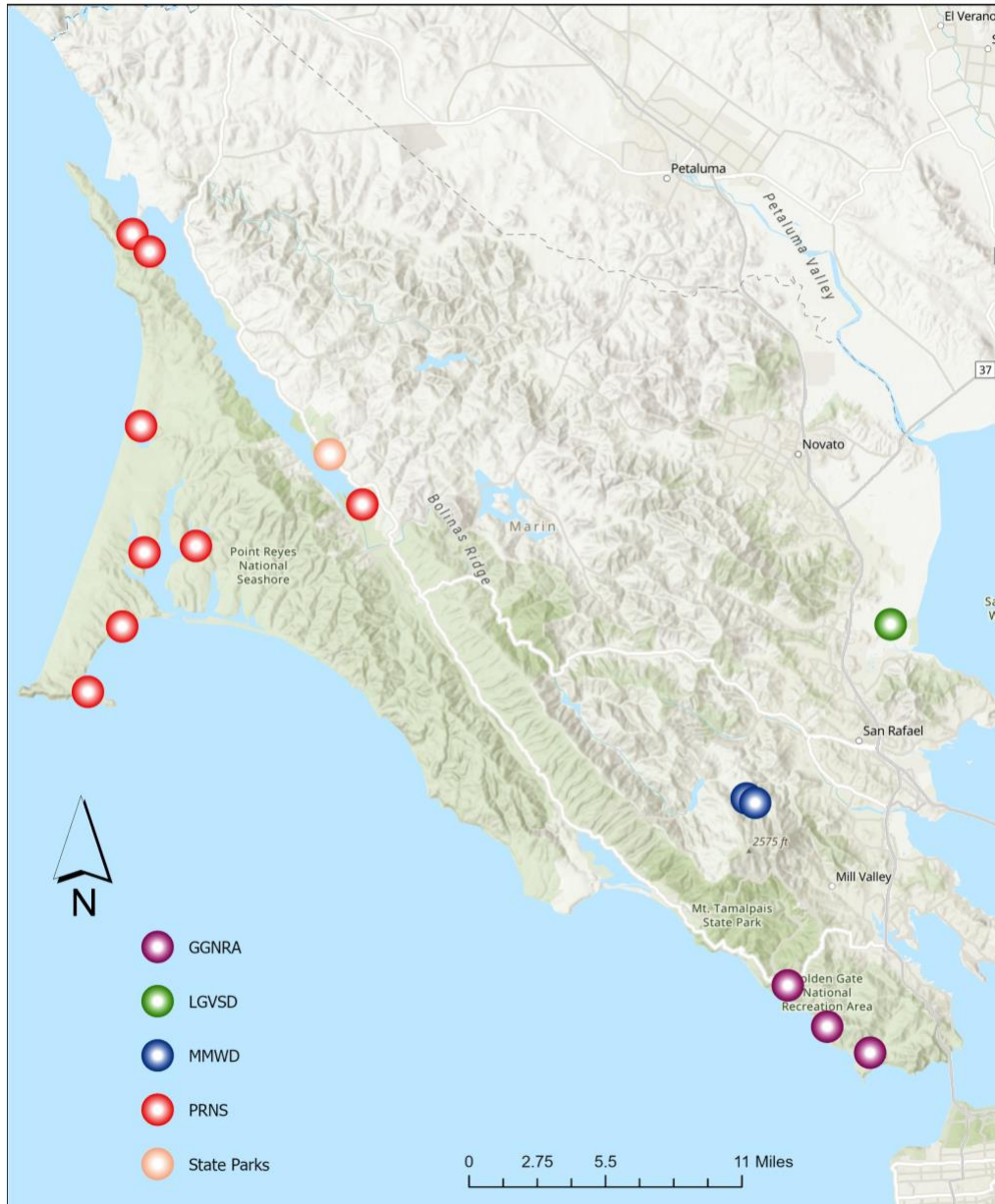
River Otter Ecology Project produced an ArcGIS Story Map, [Supporting Conservation, One Otter Sighting at a Time](#) to help the public understand why and how we collected the sightings and to whom they matter. The story map is being translated into Spanish.



## Long Term Monitoring, Focal Study Areas

Beginning in 2012, ROEP identified a study area consisting of approximately 225 linear km of coastline, stream, and reservoir spanning an area from the Golden Gate north, through Tomales Bay, including Lagunitas Creek and its tributaries and reservoirs, and parts of the shoreline of San Pablo Bay. We surveyed for active river otter latrines and movement corridors, which indicated ongoing presence of otters. The study area includes land within the Golden Gate National Recreation Area, Point Reyes National Seashore, California State Parks, Marin Municipal Water District and Las Gallinas Valley Sanitary District, and Marin County Parks. Please see Figure 1.

**Figure 1: Focal Study Areas, 2021**



## Change in Abundance

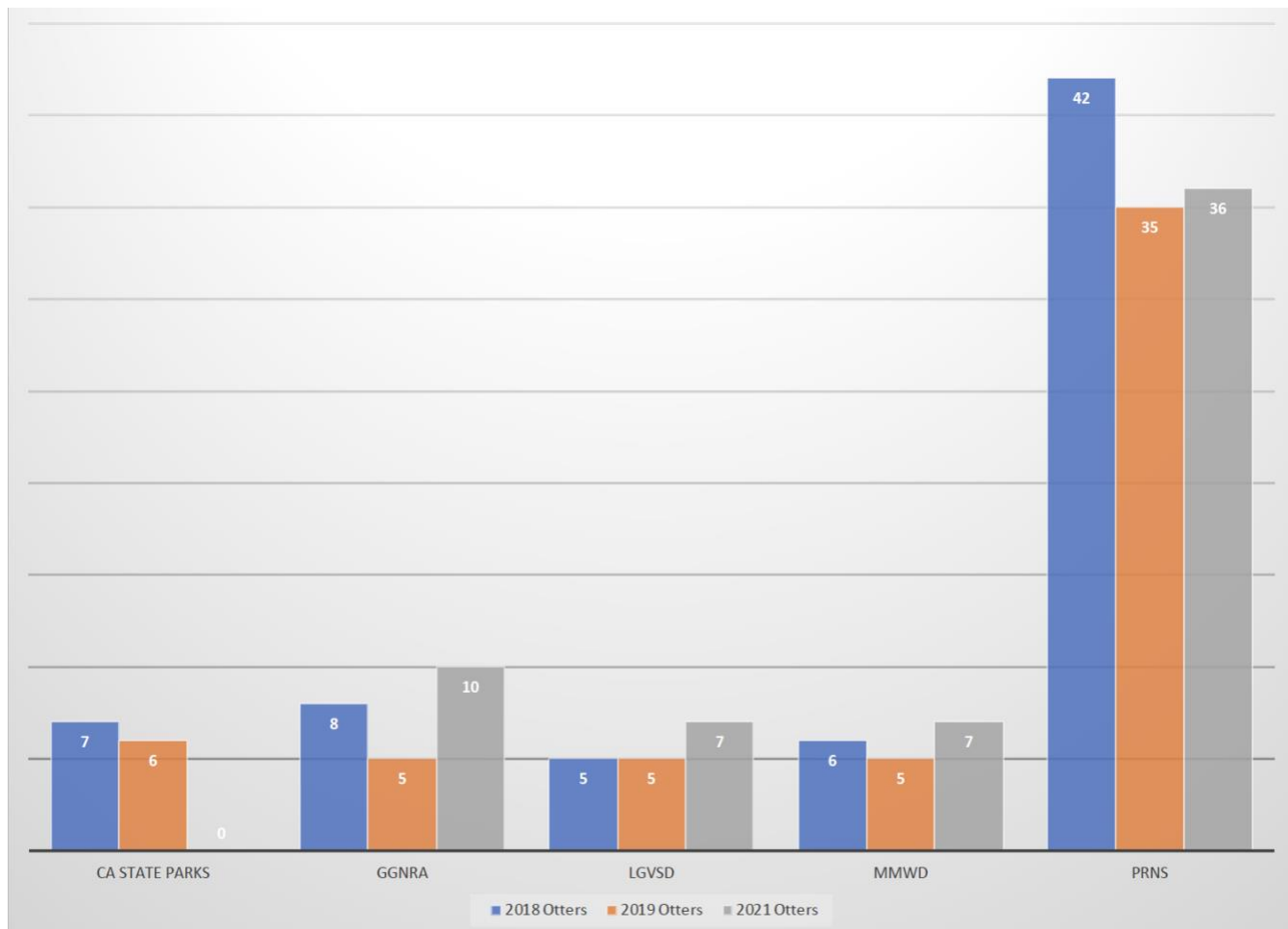
We determined the minimum abundance at each Focal Study Site (FSS) as the largest grouping of river otters observed together at any one time at that location over the course of a calendar year (Bouley and others 2015). From the camera data for each FSS, we extracted the maximum group size appearing on a single video. From ArcGIS Pro 2.9, we extracted all Otter Spotter reports in the vicinity of that location for the same year. If a mapped Otter Spotter submission reported a larger group size, we based the minimum abundance at that site on that report, otherwise we used the camera data. We did not collect data in 2020 due to Covid-19 restrictions.

**Table 1: Otter Abundance at Study Sites 2018 – 2021**

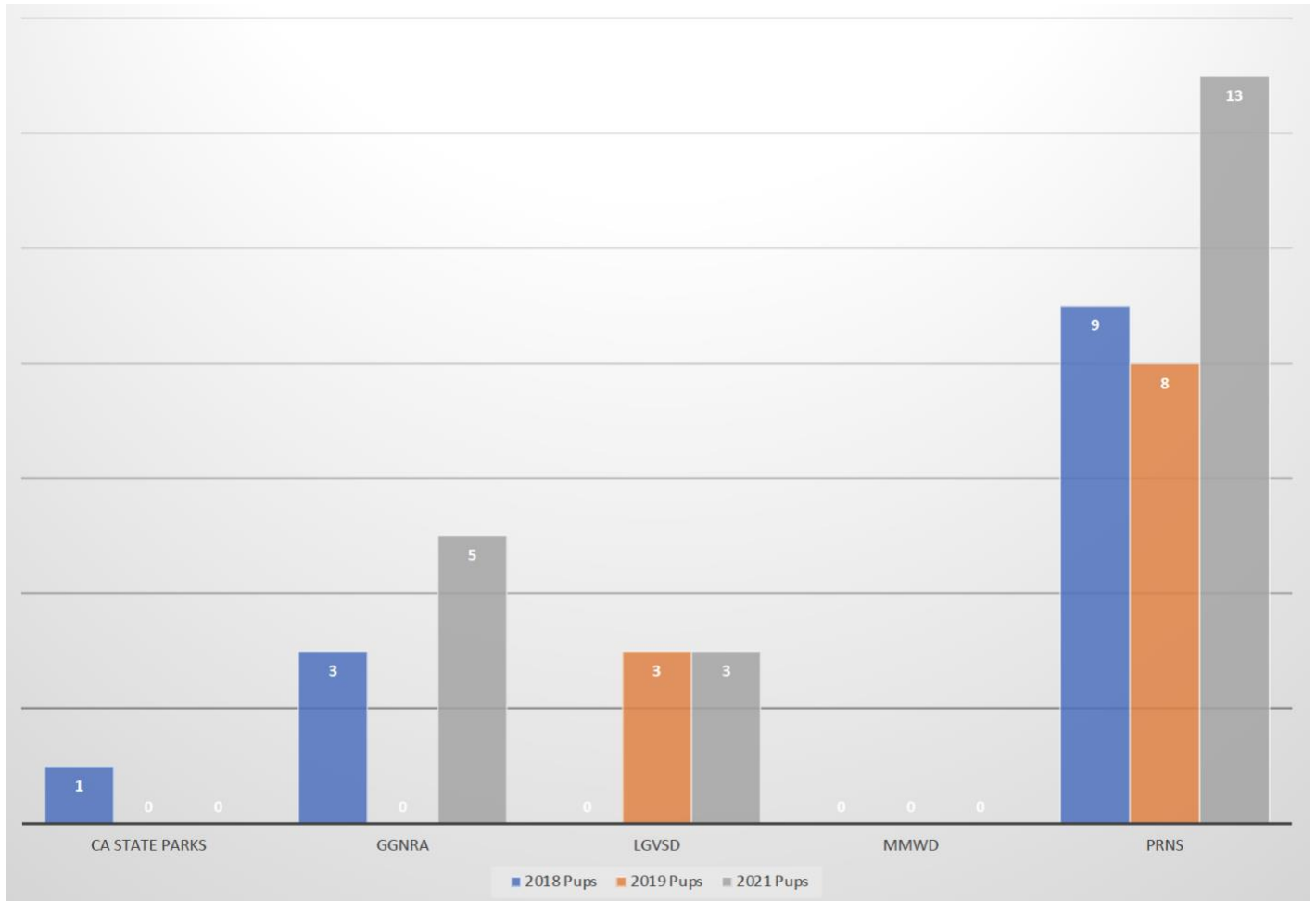
Study Site	Landowner	2018 Otters	2019 Otters	2021 Otters	2018 Pups	2019 Pups	2021 Pups
Abbotts Lagoon	PRNS	5	6	8	3	2	5
Northern Tomales Bay	PRNS	11	7	11	2	3	3
Southern Tomales Bay	PRNS	7	7	4	0	0	0
Rodeo Lagoon	GGNRA	5	3	6	3	0	3
Redwood Creek / Muir Bea	GGNRA	2	1	3	0	0	2
Tennessee Valley Lagoon	GGNRA	1	1	1	0	0	0
Drakes Bay	PRNS	7	6	7	3	0	3
Bass Lake	PRNS	5	2	NA	1	0	NA
MMWD Reservoirs	MMWD	6	5	7	0	0	0
Middle Lagunitas	CA State Parks	7	6	NA	1	0	NA
Las Gallinas	LGVSD	5	5	7	0	3	3
Drakes Estero	PRNS	7	7	6	0	3	2
<b>Totals</b>		<b>68</b>	<b>56</b>	<b>60</b>	<b>13</b>	<b>11</b>	<b>21</b>

In any given year river otter abundance varies considerably among the Focal Study Sites. At any given site, however, abundance generally does not vary considerably from year to year (Carroll et al., 2020). River otters do not breed in their first year, and males may not breed until their 4<sup>th</sup> or 5<sup>th</sup> year. (Reed-Smith, 2012). The numbers of otters counted are not precise due to camera trapping methods (Bouley et al., 2015). Otter numbers are meant to be indicative of trends rather than actual population counts (Carroll et al., 2020). Figure 2 below shows total otter abundance at Focal Study Areas for each landowner from 2018 to 2021. Figure 3 shows the same information for pups only.

**Figure 2: Otter Abundance by Focal Study Area Landowner, 2018 - 2021**



**Figure 3: Otter Pup Abundance by Focal Study Area Landowner, 2018 – 2021**



### **Disease Monitoring results**

Since 2013, in partnership with The Marine Mammal Center, ROEP has collected fecal samples to monitor for *Salmonella* and *Vibrio spp.* within our focal study areas.

No *Salmonella* has been detected during the course of the study.

Five species of *Vibrio* have been detected, including: *Vibrio alginolyticus*, *Vibrio parahaemolyticus*, *Vibrio cholera*, *Vibrio diazotrophicus*, *Vibrio metschnikovii* and possible *Vibrio fluvialis* (Table 2).

During 2019, *Vibrio diazotrophicus* was isolated from a single tested sample at Walker Creek.

Samples for 2021 have not yet been tested.

**Table 2: Cumulative Vibrio Detections at Study Sites, 2013 - 2019**

2019 Study Sites with Vibrio Detections (Cumulative)				
Key Location	Latitude	Longitude	Landowner	Description
Abbotts Lagoon	38.1192	-122.9511	PRNS	7/29/2015 <i>Vibrio alginolyticus</i> isolated
Northern Tomales Bay	38.198664	-122.946028	PRNS	8/23/2016 Possibility of <i>Vibrio fluvialis</i>
Northern Tomales Bay	38.198635	-122.946098	PRNS	4/1/2013 <i>Vibrio alginolyticus</i> isolated
Northern Tomales Bay	38.2228	-122.9202	PRNS	9/19/2019 <i>Vibrio diazotrophicus</i> isolated
Giacomini Wetlands	38.066144	-122.82051	PRNS	9/22/2014 Possibility of <i>Vibrio fluvialis</i>
Giacomini Wetlands	38.08298	-122.82192	PRNS	11/17/2016 Possibility of <i>Vibrio fluvialis</i>
Rodeo Lagoon	37.831972	-122.525914	GGNRA	9/10/2017 Possibility of <i>Vibrio fluvialis</i>
Rodeo Lagoon	37.831879	-122.526194	GGNRA	11/24/2013 <i>Vibrio metschnikovii</i> isolated
Redwood Creek / Muir Beach	37.866574	-122.579298	GGNRA	
Tennessee Valley Lagoon	37.843365	-122.550858	GGNRA	
Drakes Bay	38.028878	-122.96422	PRNS	8/3/2017 Possibility of <i>Vibrio fluvialis</i>
Bass Lake	37.951746	-122.765278	PRNS	10/16/2014 Possibility of <i>Vibrio fluvialis</i>
Marin Municipal Water District	37.94805555	-122.5981951	MMWD	
Middle Lagunitas	37.99878	-122.70682	CA State Parks	11/25/2017 Possibility of <i>Vibrio fluvialis</i>
Las Gallinas Valley Sanitary District	38.02801	-122.514	LGVSD	
Drakes Estero	38.06417	-122.919032	PRNS	

## Other Findings and Results

- In 2021, four instances of apparent river otter mortality occurred, three at Drakes Beach and one at Abbotts Lagoon. None of the carcasses were recovered, so the cause of death is unknown.
- We documented river otter predation of a Leopard shark (*Triakis semifasciata*) at Seadrift Lagoon on January 1, 2021. Video available [here](#).
- In 2021, we continued to receive regular reports of river otter predation of Brown pelicans (*Pelecanus occidentalis*) at Abbotts Lagoon. We have not attempted to quantify the extent of this predation, but we commonly observe pelican carcasses on the shoreline of the lagoon.

## Additional Research

- Current additional research includes Pixels v. Nucleotides, a comparative study of demographic results gained from camera trapping and DNA analysis from fecal samples.
- We have completed the first year of a two-year study of resident river otter response to the new wetland construction at Drakes Beach in Point Reyes National Seashore.



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