

**A Study of a River Otter Family on an Island Heritage Trust Property on
Deer Isle, Maine**

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March, 2023

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Table of Contents

List of Figures and Tables.....	3
Acknowledgements.....	3
Introduction.....	6
Methods	10
Results.....	13
Discussion.....	19
References.....	22

List of Figures and Tables

Page 6	Figure 1: Land currently under management by the IHT
Page 9	Figure 2: The location of the study site
Page 11	Table 1: GPS coordinates for camera traps and sites of reported and observed otter activity
Page 12	Table 2: Animal visits per camera
Page 13	Figure 3: Graph of visits by 16 animal species recorded by camera traps
Page 14	Figure 4: Four graphs showing patterns of activity over 24 hours
Page 15	Figure 5: Otter visits at the bridge location by month
Page 16	Figure 6: Graph of monthly
Page 17	Figure 7: Graph of otter visits corresponding to nocturnal high tide.

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Title: A Study of a River Otter Family on an Island Heritage Trust Property on Deer Isle, Maine

North American river otters (*Lontra canadensis*) have been expanding their range into habitats where they are previously extirpated. This study is designed to observe a romp of North American river otters residing on a strip of private land in Deer Isle, Maine that is recently transferred to the ownership of the Island Heritage Trust (IHT) during 2022. It is in the mutual interests of the Trust and the original land owner to have this strip of land turned into a nature preserve without disrupting or driving away the established otter romp, since they have the potential to be a tourist draw for the preserve. The primary objective of the study is to observe a half-rotation of the otters' annual behavioral cycle (June 6 – November 25, 2022) using eight Cuddeback trail cameras for 723.93 trap days. During the study period, there are a total of 655 unique visits, of which 45 are of humans and 20 are river otter detections. The otter visits occurred in June and September through November. The results of this study can be used to propose possible approaches by which IHT could best preserve and protect the resident wildlife while also making the area suitable for the use of locals and other visitors as a future nature preserve.

Introduction

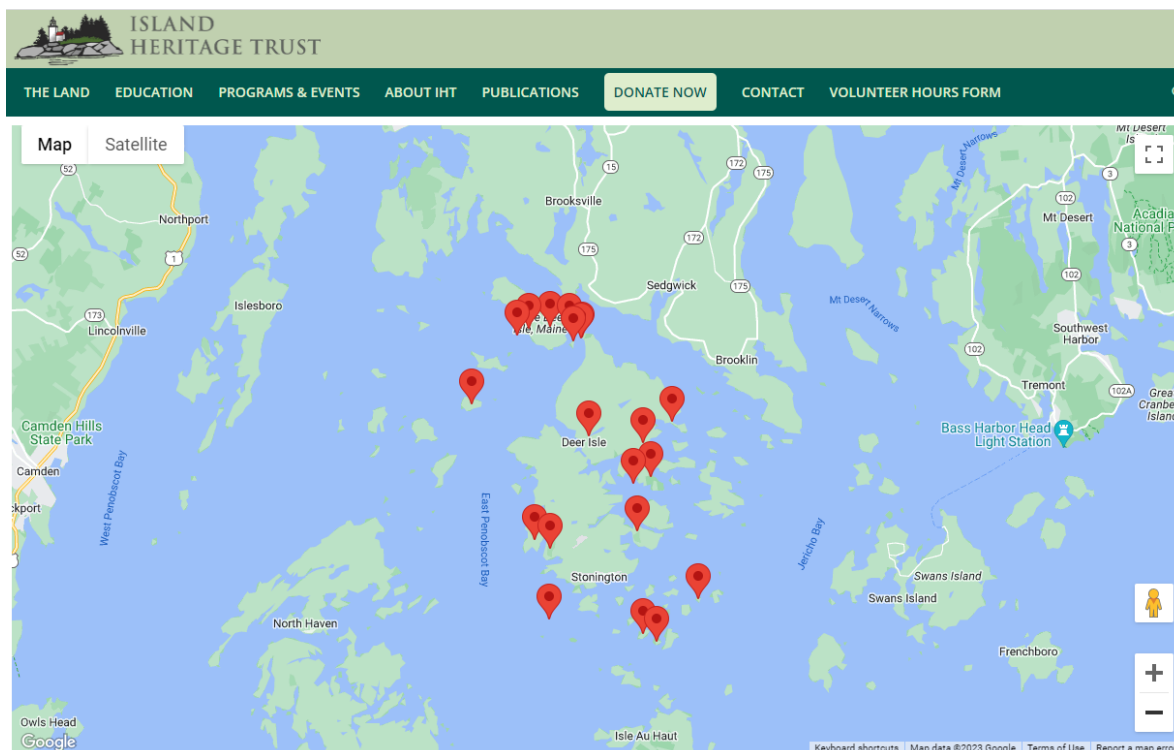
North American river otters (*Lontra canadensis*) are a subspecies of otter with a wide habitat distribution covering most of the eastern North American continent. River otters are typically found in environments with fresh or brackish water, and even in marine environments (Kaufman, 2012). River otters are semi-aquatic predators that spend much of their time hunting for food. The otters diet is varied and includes fish, crustaceans, shellfish and other land and marine organisms. Water pollution can cause declines in the aquatic life otters eat, and they are not found in heavily polluted waterways. Despite being classified as diurnal, meaning they are most active at dusk and dawn, otters are famously active and may be observed during both daylight and nighttime hours. River otters usually reach maturity at two years of age, and litter sizes typically range from one to six pups, although most litters comprise two to four (Hunt, 1986).

River otters have been reported to range around their habitat with males traveling up to 5.2 km and females 1.8 km (Helon, 2006; Larson, 1983). The river otter is listed as vulnerable in the Midwest (Boyle, 2006), but the conservation status of the North American river otter in the entire United States is currently listed as a species of least concern (IUCN Red List). According to research by The Friends of Rachel Carson National Wildlife Refuge, the population of river otters in Maine is increasing. It is illegal to shoot otters in Maine, but it is legal to trap (Natural Resources Service Center 2022).

River otters have been trapped for their pelts throughout the years and even into the present making them important to the fur trade (Hunt, 1986). Otters are a popular species for sight-seeing tourists and wildlife enthusiasts due to their often playful and social behavior (River Otter Species Profile, 2022). Due to their size, predatory nature and behavioral impacts in the habitats where they live, river otters often serve as an excellent indicator species for researchers studying the relative health, stability and functionality of local and regional ecosystems (River Otter Ecology Project, 2022). Most importantly, otter behavior in a habitat can provide crucial insight for researchers on possible environmental threats to an ecosystem (Black, 2009). For these reasons, various business and research groups such as trappers, fishery managers, conservationists, and naturalists have an interest in protecting the river otter and preserving the diverse habitats where they live (Smithsonian's National Zoo, 2022).

Figure 1:

Land currently under management by the IHT as shown on the Island Heritage Trust website (updated January, 2023)



With Acadia National Park, the northern terminus of the Appalachian Trail at Mount Katahdin, its rugged coastline, and the woodlands and lakes in between, Maine is known for its wilderness and tourism is recognized as one of the state's primary industries (Maine.gov, 2022). People travel from all over for outdoor experiences in these diverse settings. According to the Maine Department of Inland Fisheries and Wildlife, most property in Maine is privately owned with only 6% held by the government for public use, somewhat limiting access to trails, beaches, and other traditional resources. Since the 1980s private land trusts have started to protect more land in the state for public use (Island Heritage Trust, 2022). Currently over 2.34 million acres of publicly accessible land (12%) is managed by over eighty land trusts throughout the state. These lands provide visitors and local residents with protected habitat, managed forests, working waterfronts, farms, and more than 1000 miles of recreational trails (U.S. National Park Service, 2022).

Since so much land is privately controlled (Farmer, 2015), conservation of private land is critical to the success of many global initiatives to protect forested land to slow warming and reduce runoff, to curb development, allow for protection or restoration of waterways, to maintain historic uses of the land, to protect biodiversity (O’Connell, 1992) and achieve the goals of the Convention on Biological Diversity (<https://www.cbd.int/sp/targets/>), and other global and local initiatives. Understanding what motivates, or can motivate, people to protect their land for future generations is important for conserving land now and into the future. Studies have shown that many factors motivate landowners to enter into agreements to conserve their property (Drescher, 2018). In order to be successful in fulfilling their goals, it behooves land trusts to understand the psychology and motives that bring individuals to seek to conserve their land.

The Island Heritage Trust (IHT) is a land trust on Deer Isle, Maine in the Penobscot Bay. Founded in 1987 to address concerns about development pressures that threatened to block access to the shore and other areas essential for traditional use of the land. IHT’s mission is to conserve local natural landscapes and resources, shores and islands, and to provide public access trails to allow people to appreciate these environments. To date, IHT has taken in, through voluntary donation, conservation easements on over 771 acres of shore land, wildlife habitat, islands, and forests, protecting over 13 miles of shore. The IHT presently manages approximately 20 preserves on Deer Isle and the neighboring islands (Figure 1) (<https://www.islandheritagetrust.org/>).

Since the use of protected land can allow for access and traditional use it is possible that there will be increased interaction between resident wildlife and the people using the conserved properties. Different animal species respond differently to having human activity in their environments with some having apparent positive responses while others respond negatively. Some of the potentially negative responses to human activity include shifting activity schedules to being more nocturnal, being more vigilant, and circumspect with quieter calls and displays among others (Montgomery, 2021)

A 31-acre parcel of land on Deer Isle that is privately owned at the start of the study and is to be transferred to the IHT during 2022. The property owners have maintained two trails on the property, and they have hiked them and the shore and recreated on the water for decades. Throughout that time, the owners have enjoyed observing a family of river otters. They have reported primarily seeing the otters on the beach on the northwestern edge of the property.

Aside from the observations of local residents, little is known about the full extent of the otters' range and activities on the property (personal communication, A. Hooke).

Otter exposure to humans has not been found to substantially affect their behavior, likely resulting from relatively low levels of predation in areas where they live. This lack of fear around human areas, such as docks and fisheries, have resulted in them becoming 'pests' in human industries such as fishing and aquatic farms where they will steal catch or fish for themselves. In more rural environments where human contact is minimal, otters will usually avoid contact with humans, but will not remain away from locations where humans have been (Pardini, 1999; Naderi, 2017).

To most effectively preserve and utilize the land, it is essential that the Island Heritage Trust have a clear understanding of the otter activity on the property in order to minimize the impact of new trails and human traffic on the habitats of the otters and other resident wildlife. Since these waters are frequented by recreational kayakers so it is important to study both the island and the beach to determine whether trails could be made accessible for kayak landings, or if it is better to limit shore access from the water. The existing trails along with the current owner's knowledge of the otters informed where the study began and how the area would be accessed, as well as what additional information would be needed.

Because the IHT would likely view the otters as an asset, they could benefit from being able to assess how new human access could be incorporated with as little impact on the otters as possible. This study's objective is to perform a comprehensive series of observations over a four-and-a-half-month period from June through November, 2022 to develop a better understanding of how the otters used the areas around the current trails and locations they have been known to frequent. The goal is that the information gathered about the activity of the otters would be useful in determining what measures are wanted or needed to best maintain the existing equilibrium of the habitat the otters and other animals called home.

The objectives of this study are to assess otter activity on the property and how they could be impacted by increased human activity in a newly created IHT nature preserve. By looking at where the otters are on the property and the resources being used, can better inform IHT on how to create trails that respect the activity of the residing otters and other wildlife. Additionally, information on the other species using the site will be gathered and shared with IHT.

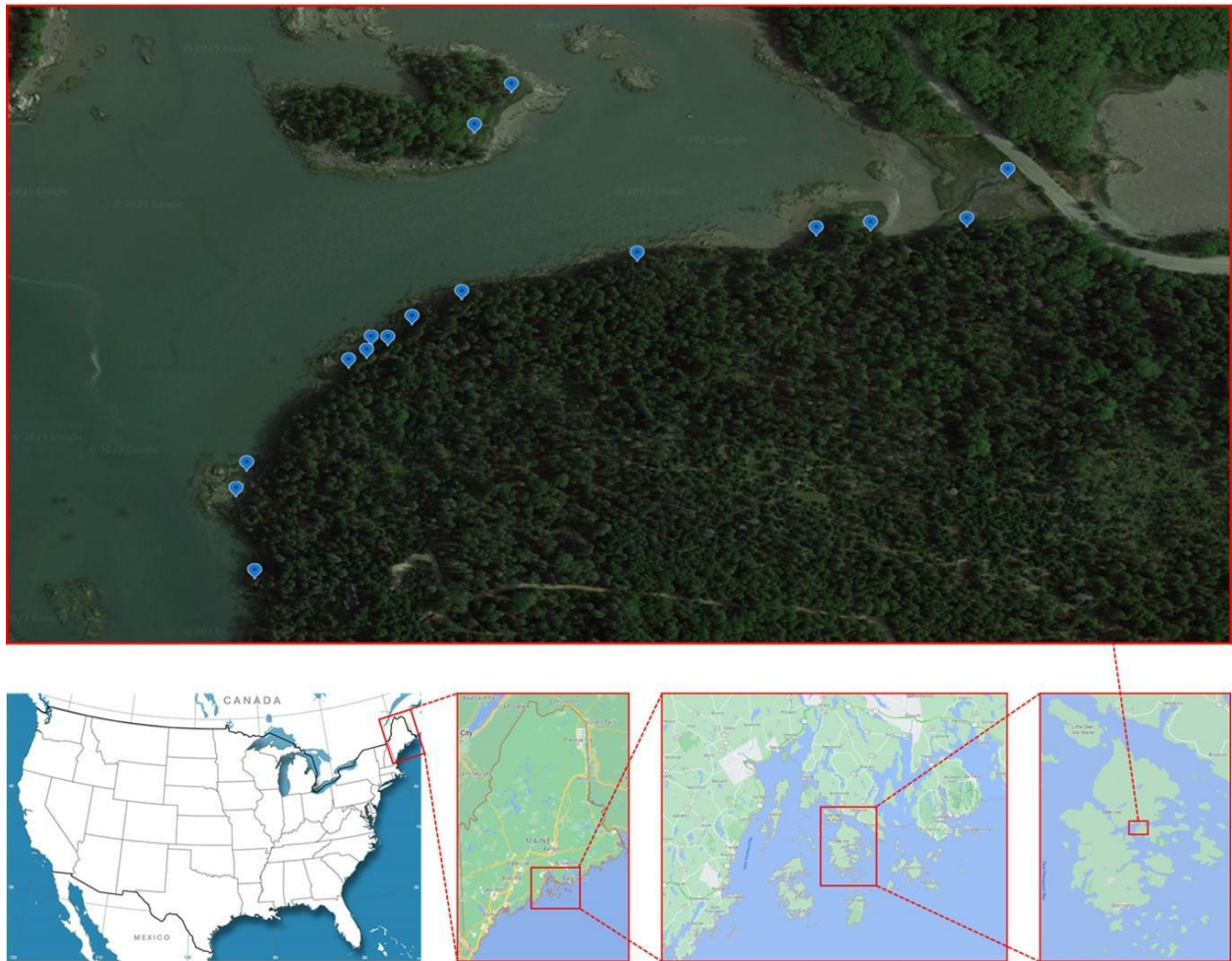
Methods

The study took place from June 1, 2022 to November 25, 2022 as part of a senior research project by an Environmental Sciences student at Allegheny College in Meadville, PA. It is anticipated that the research will be performed with minimal disruption to the habitat or romp.

Figure 2:

The location of the study site is on Deer Isle, Maine in the United States. Deer Isle is an island in the Penobscot Bay and the study site is on the shore of Long Cove that is a tidal inlet of the Bay. The otters are reported to frequent Whig Island across from the study site below it on the image.

Study Site Location



The property on which the study is conducted is located on Deer Isle, Maine in the Penobscot Bay. The study site is 31 acres of woodland on a hillside leading to nearly 2000 feet of rugged shoreline on Long Cove. Long Cove is a tidal body of water off the Penobscot Bay that experiences 10-foot tides draining the water adjacent to the shore to a mudflat twice a day. (Figure 2). Long Cove area has been designated, “Resource Protection Zone” in the Deer Isle Shoreland Ordinance to protect the richness of the marine habitat and the wildlife that depends on that richness for food. The land and sea have offered the romp an abundance of fish and shellfish, that can be observed from scat at latrines along paths and trails at the edge of the woods, not far from the shore. With the exception of the two trails used by the landowner, and people who know of them, the land has been left mostly unaltered from its natural state presumably due to the steeply sloped terrain. According to the property owner, the romp has been spotted in the area for generations (personal communication, A. Hooke).

In preparation for the study, informal conversations took place with the property owner to learn more about the land, the otters, and the motivation to donate the property to IHT. During the course of the study, other wildlife and environmental enthusiasts offered their insight on otter activity at other sites around Long Cove.

The study utilized the techniques employed in two previous studies conducted on North American river otters. The placement and use of several Cuddeback camera traps closely followed the techniques demonstrated in other studies (Serfass, 2008; Wagnon, 2016).

Table 1:

GPS coordinates for camera traps and sites of reported and observed otter activity as well as kayak access points for reaching Whig Island. iSailGPS app used to collect GPS data.

Locations of Camera Traps, Otter Activity, Access points	Longitude (N)	Latitude (W)
Kayak Launch Point 1	44° 12.9332'	-68° 38.8333'
Spring (Camera 7)	44° 12.9333'	-68° 38.85'
Barrel (Camera 8)	44° 12.9247'	-68° 38.9294'
Latrine 2 (Camera 7)	44° 12.9281'	-68° 38.9462'
Game Trail (Camera 8)	44° 12.9088'	-68° 39.0396'
Whig Island 1 (Camera 8)	44° 12.9752'	-68° 39.1085'
Whig Island 2 (Camera 5)	44° 12.9664'	-68° 39.1130'
Den Woods (Camera 1)	44° 12.8943'	-68° 39.1206'
Latrine 1 (Camera 4)	44° 12.8787'	-68° 39.1566'
Den Beach (Camera 4)	44° 12.8797'	-68° 39.1573'
Game Trail Camera 6	44° 12.8801'	-68° 39.1576'
Bridge (Camera 3)	44° 12.8675'	-68° 39.1656'
Woods (Camera 6)	44° 12.8724'	-68° 39.1669'
Point (Camera 2)	44° 12.8676'	-68° 39.1691'
Game Trail (Camera 2)	44° 12.8662'	-68° 39.1721'
Kayak Launch Point 2	44° 12.7920'	-68° 39.2000'
Game Trail (Camera 2)	44° 12.8131'	-68° 39.2202'
Latrine 3 (Camera 1)	44° 12.8298'	-68° 39.2219'

The study utilizes the techniques employed in two previously reported studies conducted on North American river otters. The placement and use of eight Cuddeback camera traps closely followed the techniques demonstrated in other studies (Serfass, 2008; Wagon, 2016).

Cuddeback camera traps are motion-activating, with a 30-second delay to record the otters' movements over the course of the research window. Selected camera trap locations include latrines, a 'digging site' the property owner pointed out during the initial land survey (personal communication, A. Hooke), the three most trafficked and defined 'slides,' the den, and Whig Island (Table 1), which would be reached by kayak. Based on the number of detections at all sites and times of detection within the range of a 24-hour day, patterns of behavior and activity

are determined based on charts and data projections. The study requires 8 camera traps, 24 SD cards. Periodic check-ins to be spread out over the research window in alignment with breaks in the academic schedule at Allegheny College, Meadville, PA to see that all cameras are still functioning properly and possibly to replace any dead or defective batteries.

After receiving permission from the owner to conduct the study on the property, a project proposal was submitted to IHT on December 20, 2021. The project was approved February 9, 2022. The first camera trap is deployed on June 5, 2022. Table 1 shows areas of interest and the locations where camera traps are deployed. A small game trail can be observed running in the woods near the boundary between the woods and the shoreline. Otter activity is observed and reported along the trail including scat. The game trail and the signs of otter activity observed during surveys of the property are used to select locations for the camera traps.

At least 2 camera traps are targeting a latrine and the plank bridge along an existing trail used by the family that currently owns the property and other people. Additional cameras are placed over the following weeks. Table 1 shows the GPS coordinates for camera trap locations and the sites targeted by them. Trail and camera locations are plotted using the iSailGPS app including the locations on Whig Island.

The site is visited on multiple occasions to check the set up and data collection procedures over the first two weeks. Based on low capture rates and environmental indicators of otter activity in other locations, camera traps are relocated in the hope of finding more heavily trafficked areas. Camera traps are inspected at intervals throughout the study and the data cataloged after it is acquired.

Five of the Cuddeback camera traps, borrowed from Allegheny College, are removed from the field on October 9, 2022, and the remaining three camera traps are kept in the field until November 25, 2022.

Results

Data is collected using 8 camera traps over a 172-day period from June 6 to November 25, 2022, for a total of 723.93 camera-trap days (TD). The data shows 655 unique visits by a variety of animal and human activity occurring at the proposed preserve over the course of the study.

Table 2:

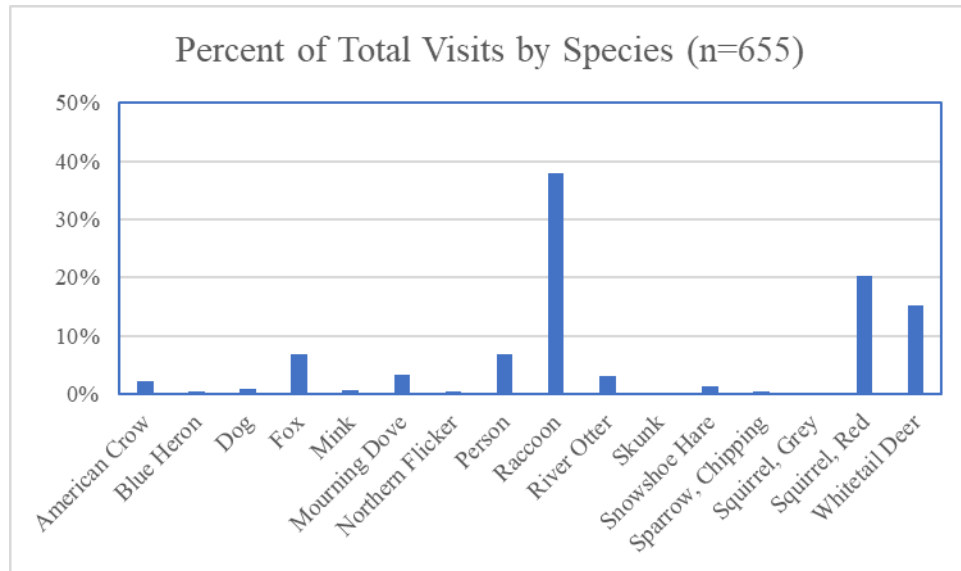
Animal visits per camera during the 723.4 camera trap days (TD) of the study.

Animal	Scientific Name	Camera 1	Camera 2	Camera 3	Camera 4	Camera 5	Camera 6	Camera 7	Camera 8	Totals
American Crow	<i>Corvus brachyrhynchos</i>	1	.	9	1	0	2	0	1	14
Blue Heron	<i>Ardea herodias</i>	0	.	0	0	0	3	0	0	3
Dog	<i>Canis lupus familiaris</i>	0	.	3	1	0	0	1	0	5
Fox	<i>Vulpes vulpes</i>	3	.	32	8	0	1	0	0	44
Mink	<i>Neovison vison</i>	1	.	2	0	0	0	0	0	3
Mourning Dove	<i>Zenaidura macroura</i>	0	.	21	1	0	0	0	0	22
Northern Flicker	<i>Colaptes auratus</i>	0	.	3	0	0	0	0	0	3
Person	<i>Homo sapiens</i>	1	.	27	11	1	3	2	0	45
Raccoon	<i>Procyon lotor</i>	44	.	151	18	25	4	5	2	249
River Otter	<i>Lontra canadensis</i>	1	.	20	0	0	0	0	0	21
Skunk	<i>Mephitis mephitis</i>	0	.	1	0	0	0	0	0	1
Snowshoe Hare	<i>Lepus americanus</i>	4	.	3	1	0	0	0	0	8
Sparrow, Chipping	<i>Spizella passerina</i>	0	.	1	0	0	2	0	0	3
Squirrel, Grey	<i>Sciurus carolinensis</i>	0	.	1	0	0	0	0	0	1
Squirrel, Red	<i>Sciurus vulgaris</i>	0	.	116	2	9	6	0	0	133
Whitetail Deer	<i>Odocoileus virginianus</i>	4	.	37	21	2	7	29	0	100
Total Visits		59	.	427	64	37	28	37	3	655
Camera-trap days		69.08	0	171.08	100.23	92.92	96.58	96.96	97.08	723.93

Table 2 lists the number of each species identified as visiting each camera trap site. The number and variety of animals captured by camera trap 3 is much higher than at any of the other camera trap location. During the study, cameras detecting minimal activity are redeployed at sites with apparent otter scat and if they again fail to yield any images of otters, are relocated to different locations to identify otter activity. Camera 2 misfired repeatedly throughout the study and generated no useable data.

Figure 3:

Graph of visits by 16 animal species recorded by camera traps over the 724 camera trap days of the study. The numbers shown are a percentage of the 655 total visits by each of the recorded species.



Raccoons (38.02% of all visits), red squirrels (20.31%), whitetail deer (15.27%) and foxes (6.72%) are animals that are seen to commonly visit the camera locations. Their visits occur in the daytime as well as overnight (Figure 3).

Figure 4:

Four graphs: Graph A showing patterns of activity over 24 hours including all visits by humans, pets, and wildlife; Graph B shows all visits by wildlife (excluding humans and dogs); Graph C shows activity of humans with their pets and Graph D shows the visits of otters.

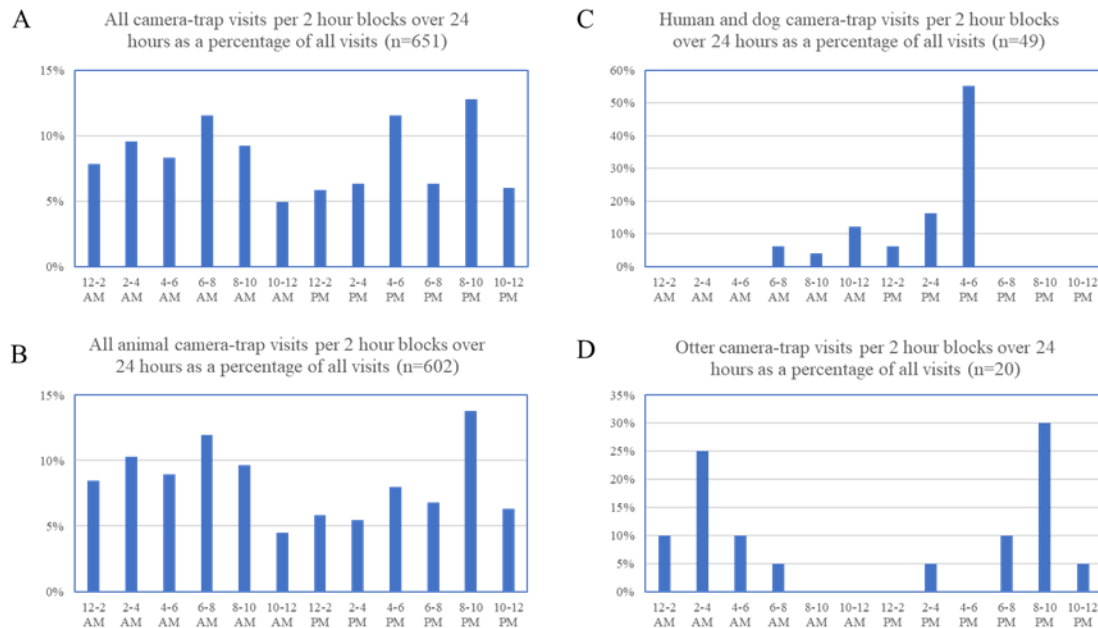
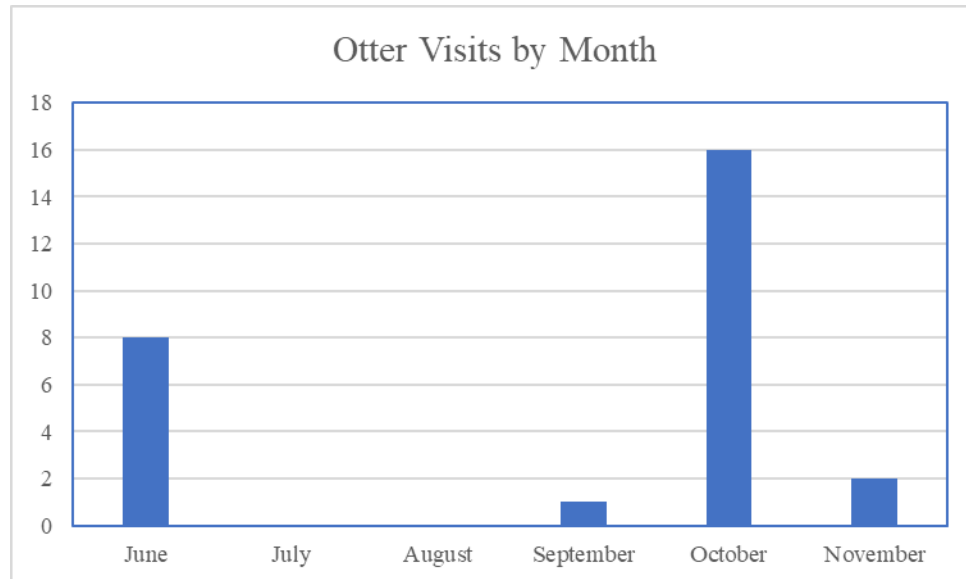


Figure 4 shows the pattern for all visits to the site distributed over a 24 hour period with the lowest activity occurring in the middle of the day. The same distribution of activity is evident when looking at just the visits by wildlife. Human activity is restricted to daylight hours, with a peak in the late afternoon and evening. The pattern of otter activity is significantly different from that of the humans at the site.

Figure 5:

Otter visits at the bridge location by month during the course of the study.

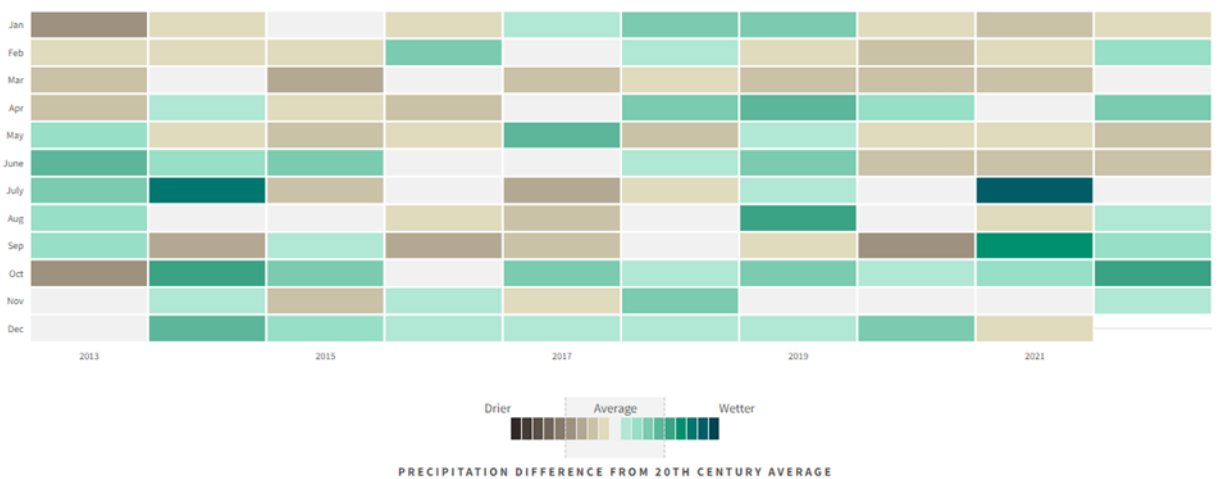


Monthly otter activity at two locations is shown in Figure 5 with 8 otter visits in June, 1 in September, 16 in October, and 2 in November. Figure 5 shows no otter activity at the site for the months of July and August.

Figure 6:

Graph of monthly rainfalls above or below average for the decade 2013-2022.

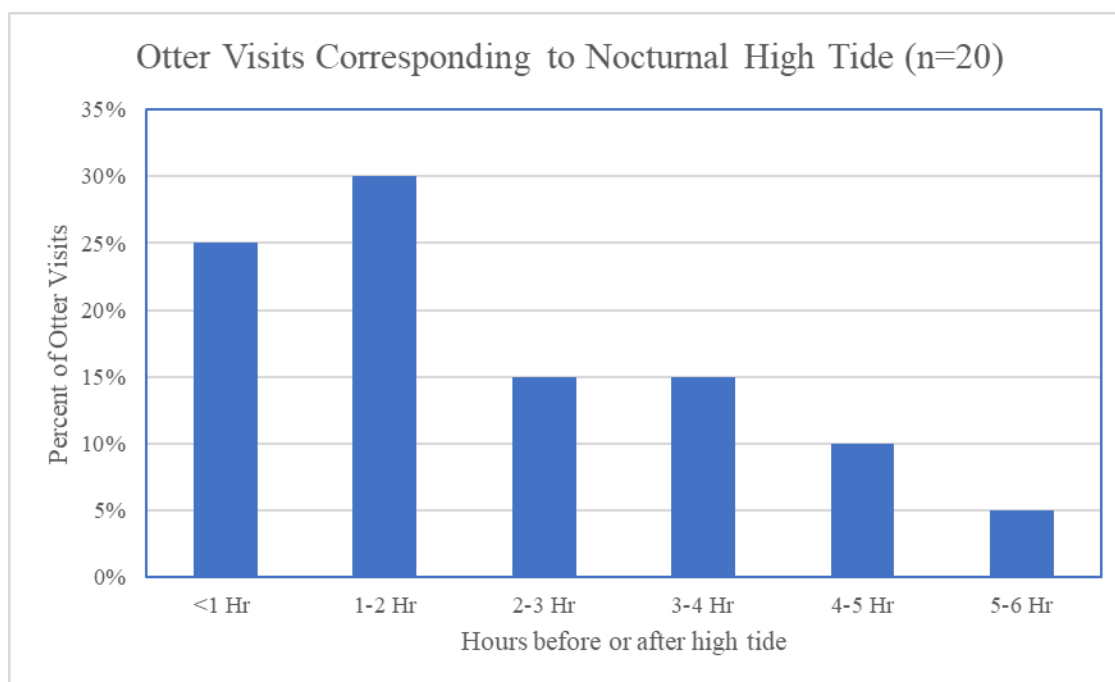
Source <https://www.ncei.noaa.gov/pub/data/cirs/climdiv/>



During the study, it was observed that the flow and level of water at the bridge site noticeably decreased throughout the summer, until the water was all but gone. The months of May, June, and August were notably dry. The observation is supported by the National Centers for Environmental Information (NCEI) graph in Figure 6, showing precipitation for Hancock County over the last decade.

Figure 7:

Graph of otter visits corresponding to nocturnal high tide.



The tides in Long Cove can range from 8–12-foot differences between high and low tides approximately twice a day. Due to the tide the water level recedes away from the rocky shoreline at the edge of the woods, leaving dozens of meters of mud and sand between the water and the shore. Figure 7 is a graph of otter activity at locations 3-5 meters into the woods from the shoreline. The activity is predominantly within 2 hours before or after a high tide (55%). Using the observations recorded in Figure 4 is apparent that the activity of the otters is occurring around the high tides that occur overnight.

Discussion

The results of this study show that a variety of species currently reside on the property located on Deer Isle Maine. The animals roam the woods and the shore, and the stream at the bridge appears to be a focal point of activity. On average, over three animal or human visits are captured by the camera trap at the bridge each day for the 172-day study. The water source at the bridge is regularly visited by adult animals with juveniles, and these groups often stay at the site for a longer duration compared to other visitors. Animals also remained longer at the bridge site

than any other location in the study. The consistently high rate of activity appears to suggest that this is an important resource to the residing wildlife.

Another interesting finding of the study is that the activity on the property is relatively consistent both day and night, with the lowest activity at the middle of the day. While the property is not officially an IHT preserve at the time of the study, some human activity is recorded along with the animal activity. The human activity is only recorded during daylight hours and did not appear to disrupt wildlife activity at the camera sites. The observations in Figure 4 shows that there is little overlap between otter and human activity on this property. Furthermore, otter activity at the site appears to be associated with high tides as well as the overnight hours. This would suggest that the use of the property as a nature preserve may not have a strong impact on the otters and other species residing on the property (Montgomery, 2021; Lewis, 2021).

No otter activity is recorded for the months of July and August, 2022. The summer of 2022 is notably dry and the water source at the bridge dried out. According to the National Oceanic and Atmospheric Administration (NOAA), June 2022 was the 6th driest on record in Bangor. The start of the summer “was abnormally dry along the Downeast coast including most of Hancock County. By the end of August conditions improved to the point no drought was observed (<https://www.weather.gov/car/Summer2022ClimateReview>). The coincidence of drought and lack of observed otter activity at the site may be correlated as the otters returned soon after the flow in the stream returned. Long Cove is approximately 25 hectares which is in line with some reported otter ranges. As this study is only for one season, it is unknown if the otters regularly move to other parts of their territory in Long Cove throughout the summer or if their absence from the study site is attributable to the drought.

Other researchers have noted that otters can be elusive and difficult to study (Black, 2009; Stevens, 2008; Wagnon, 2016). Latrine behavior of otters is more prevalent in the fall and spring and is reportedly more erratic during the summer months (Just, 2012; Stevens, 2008). Some otter romps have been observed following semi-migration patterns, and otter behavior has been reported to be impacted by tides (Larson, 1983; Woolington, 1984), temperatures, food and water levels, and, occasionally, by the presence of potential predators. It is possible that some sites will only be temporarily or intermittently used by otter romps, which has frustrated some

research and reporting efforts. Otter behavior has also been documented changing in response to drought, particularly the Pacific sea otter, which has been observed to change their movement patterns in response to California droughts. Factors such as these may have played a role in the difficulty locating areas of otter activity on the property during the summer of the study.

It is also difficult to know if human activity is impacting the otters. There are reports of animals shifting their wake/rest activity cycles in response to human activity with the activity shifting to hours later at night (Montgomery, 2021). The activity observed in this study is occurring late at night and close to high tides when the otters are less exposed on the mudflats around the site. The study was not designed to be able to distinguish if the potential vigilance this may represent is related to avoiding human activity or avoiding being exposed to potential predators such as seals, fox, bobcat, coyote, lynx or even cougars.

In keeping with the owner's wishes and the IHT's mission, it can be expected that human activity is likely to increase on the property as it transitions to becoming a recreational nature preserve. With even an insignificant looking puddle being a focal point of activity on the property, understanding where and how the wildlife on the site and the human visitors are most likely to encounter one another can allow the IHT to focus on managing the property to best suit all parties.

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