

Point Reyes National Seashore
Summer 2011 Raven Disturbance Monitoring
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Summary:

Weekly observations of common raven (*Corvus corax*) predation and disturbance events were conducted at two common murre (*Uria aalge*) colonies within Point Reyes National Seashore (PRNS). The observations were conducted at six established viewing points with predefined sub-colonies surveyed once a week from May through August, 2011. Twenty disturbance events were observed in 119 hours of surveying. All the disturbances recorded were located in the Point Reyes Headland colony. Results indicate the proximity to ranch lands may play a role in the amount of corvid predation on common murre colonies. Continued monitoring of corvid predation is recommended to determine the degree of impact occurring.

Methods:

The two monitored common murre colonies at PRNS, Point Reyes Headlands (PRH) and Arch Rocks, were divided into 10 sub-colonies (Table 1, Figures 1-8) through consultation with USFWS Biologist G. McChesney. Observations took place for 2 to 4 hours between 0600 and 1800 hours, from the middle of May until there were no longer common murres roosting on the sub-colony (middle of August). The objective was to have each site monitored weekly for a minimum of 2 hours and on a rotating schedule so that all hours of the day were covered in a six week period.

Table 1: List of observation points and the respective sub-colonies observed from each

Observation Point	Sub-colonies Observed
Point Reyes Headlands Colony	
PRH Lighthouse Building	Lighthouse Rock
Boulder Rock	Boulder Rock
East Seal Cove	Middle Rock, East Rock, Flattop Rock, Beach Rock, Pointy Rock
Arch Rock Colony	
Millers Point	Millers Point South Rock
Arch Rock	Sea Stack
Point Resistance	Point Resistance Rock

For each day that a sub-colony was monitored, the following was recorded: start and end time of monitoring, location, visibility, approximate number of common murres on the rock, type of survey, and maximum count of common ravens seen at one time (Appendix A). Survey type was either a full survey or a colony check. A full survey was classified as any survey conducted for disturbance monitoring. A colony check survey was classified as any survey conducted for checking the status of the colony either for presence of eggs or for presence of common murres on the rocks.

During a full survey, the monitor would continuously scan the rocks using a combination of binoculars and a spotting scope until a disturbance was observed. A disturbance event is when any common murre flushes from the sub-colony or an egg or chick is lost resulting from the actions of common ravens. Once an event was observed, the monitor recorded the following information on the aforementioned datasheet: the start and end time of the event, number of ravens involved, the technique used by the raven (Table 2), characteristics of sites attacked, outcome of the event, and other anecdotal observations. Site characteristics include classifying edge site or interior site, number of vertical rock faces around the site, and number of neighboring sites. An edge site is located within 5m of the edge of the occupied area, and an interior site is located more than 5m from the edge of an occupied area. The number of vertical rock faces is between zero and three, and located within one common murre width of disturbance location. The number of neighboring sites is any site located within one common murre width of disturbance location. The outcome of the disturbance includes number of common murres flushed, number of eggs taken and number of chicks taken. If an egg or chick was taken, it was considered a predation event. Examples of anecdotal observations include permanent marking on ravens and ravens roosting or nesting in the area.

Table 2: Techniques used by common ravens to take common murre eggs or chicks

Technique	Explanation
Lunge	Lunging at common murre with beak to force common murre from its site
Pull	Pulling the common murre off site by a wing, foot or beak
Snatch	Snatching an unattended or poorly guarded egg or chick without driving the parent off the site
Easy Picking	Taking unattended eggs or chicks following a flushing event
Air Attack	Taking an adult common murre from the air
Incidental Loss	Egg rolled away from sited during flushing and broke

Common ravens typically lay clutches in March or early April, consisting of 1 to 5 eggs (Boarman and Heinrich 1999). Their chicks can be expected to fledge around 5 weeks, so early detection of nest locations is beneficial to controlling raven population numbers. Adult common ravens that appear aggressive towards intruders on their territory can be good indicators of nesting locations and pair boundaries, especially during the breeding season (Webb et al. 2003). When a common raven nest was observed near the study area, the location was recorded using a Global Positioning System (GPS) and plotted on a map of the study site so that the nesting pair could be easily located in the future.

Results:

For the 2011 monitoring season, 20 disturbance events were recorded, 54 observations were conducted resulting in 119 hours of observation (Table 3). All of the disturbances observed were at the PRH colony. Out of the ten sub-colonies, five (50%) had recorded disturbance events (Table 3). The overall disturbance rate per hour for PRNS was 0.17, and for PRH colony was 0.29 (Table 3). Nine of the 20 (45%) disturbances were predation events (Table 4). Six of these occurred on Lighthouse Rock and three on Boulder Rock (Table 5). The other 11 of the 20 (55%) disturbances were flush events. Two of these occurred on Lighthouse Rock, three on Boulder Rock, one on Middle Rock, three on Flattop Rock and one on Pointy Rock (Table 5).

Of the 20 disturbance events, 16 occurred when visibility was clear and four when visibility was hazy. Most of the disturbance events occurred in the afternoon hours between 1200 and 1600. Although, all survey times between 0600 and 1800 had a disturbance occur. Of the 20 disturbance events, 12 occurred during the months of May, June and July, six occurred during the first week of August. Common ravens were observed flying by all monitored sub-colonies at least once. Group sized ranged from one to four. The data for maximum common raven counts during a survey was only collected for the second half of the season. The majority of the disturbance events involved one or two common ravens, a group of three common ravens was observed once. Most events took place at an edge site. Only one progressed into the interior as the common raven walked through the colony. Most events occurred in less than ten minutes and the technique most frequently used was the lunge.

In the 2011 monitoring season, Millers Point South Rock had no nesting common murres thought the season. Surveys were conducted on a routine schedule during the first six weeks of observation. During the second six week round of observations, checks for common murres were done while surveying Sea Stack. At the end of the season, once a sub-colony was observed with no common murres, one more check was conducted to verify the common murres had left for the season.

Two common raven nests were located during the 2011 monitoring season. Both nests were around the Chimney Rock area and the locations were recorded with GPS points. The first nest's location was UTM: E 501264 N 4205157. The second nest's location was UTM: E 502778 N 4204809. Neither of the nests was located close enough to a monitored sub-colony to obtain frequent observation of the pair.

In comparison with the 2010 monitoring season which had 8 predation events, the 2011 monitoring season had 9 predation events (Table 5). Flush events were not recorded in the 2010 monitoring season but were recorded in the 2011 monitoring season. In the 2010 monitoring season, half of the predation events occurred at Point Resistance Rock with four eggs predated. No disturbance events were observed at Point Resistance Rock during the 2011 monitoring season. In the 2010 monitoring season, two eggs and one chick were predated at Boulder Rock, and one egg was predated from Flattop Rock. In the 2011 monitoring season, four eggs and two chicks were predated from Lighthouse Rock and two eggs and one chick were predated from Boulder Rock (Table 5).

Discussion

The increase in common raven population numbers at PRNS over the past 2 decades is assumed to cause more disturbances on common murre colonies and other avian species throughout PRNS. This observed rise in common raven numbers highlights the need for an established management plan for the coming years (Engle and Young 1989, Stiehl and Trautwein 1991, Marzluff et al. 1994). Nine predation and 20 disturbance events were recorded during 119 hours of monitoring, only one more predation event than the previous year. There is a possibility that more events occurred outside of the monitoring window. The total predation rate for all 10 sub-colonies was 0.08 per survey hour, resulting in approximately one predation event every day (a

day equaling a 12 hours time period). The total disturbance rate for all 10 sub-colonies was 0.17 per survey hour, resulting in approximately one disturbance for every six hours. The 12 hour survey time frame is designed to capture the peak activity of common ravens, feeding mostly in the morning and afternoon (Boarman and Heinrich 1999).

Common ravens and other types of non-anthropogenic disturbances may be a factor affecting where common murres breed (Roth et al. 1999). The distance a common murre colony is from a territorial pair seems to impact the amount of disturbances on the colony. In the 2010 monitoring season half the documented disturbances occurred at Point Resistance Rock. A territorial pair was observed taking eggs and the pair's nest was located 0.09 kilometers south of the sub-colony. The pair was subsequently removed from that location along with the nest. In the 2011 monitoring season there were no documented disturbances at Point Resistance Rock (Table 5). Additionally, with half the disturbances in the 2010 monitoring season occurring at Point Resistance Rock there was no correlation between number disturbances and distance the common murre sub-colony is from the ranch land. In the 2011 season, every disturbance was within 3km of the closest ranch. Every sub-colony more than 5km away had zero disturbances in the 2011 monitoring season (Table 6). Both the factors of distance from a territorial common raven pair and proximity to ranch lands seem to have influence in the amount of disturbances at each sub-colony.

High common raven numbers have been documented in the Western U.S. and have been attributed to the species' ability to adapt and exploit a variety of food resources and thrive in human-structured environments (Engle and Young 1989, Stiehl and Trautwein 1991, Marzluff et al. 1994). Breeding common ravens construct nests throughout the landscape, and may feed their young at least partially with forage obtained at anthropogenic resources (Kristan 2001). Findings by Webb et al. (2003) on a study of common raven nest distance from anthropogenic resources in the western Mojave Desert suggest that common ravens are reluctant to contract their territories simply in order to nest near anthropogenic resources, even though the natural resources within their territories may be scarce. Juvenile non breeding common ravens are reported to have survived better if nests had been closer to anthropogenic resources and were routinely observed foraging at these locations during the study by Webb et al. (2003). At PRNS, dairy and cattle ranches provide a year round anthropogenic food source. Common ravens have been observed feeding at livestock feed bins, water troughs, and calving pens, where they can obtain nutrients more easily from scavenging instead of hunting. Consistent access to these food and water sources may permit larger common raven clutch sizes or recruitment with the result being higher number of non-breeding common ravens moving around in flocks. Roth et al. (1999) describe the differences between breeding versus non-breeding home ranges, suggesting that breeding birds have smaller home ranges with more localized movement patterns.

Preliminary observations at the monitored sub-colonies, in both the 2010 and 2011 monitoring seasons, have revealed that most disturbances were caused by lone birds or a breeding pair, not large flocks, thus supporting the hypothesis presented in previous publications that territorial individuals have learned to capitalize on the common murre colonies (Roth et al. 1999). It would be difficult to investigate this hypothesis further at PRNS without placement of permanent identifying markers (i.e. leg bands, radio-tagged) on individual common ravens. However, maximum count data often showed groups sizes of three and once a group of four. The large

group sizes may be a product of the proximity of the ranch lands. There was only one instance in the 2011 monitoring season of a group of three common ravens disturbing a common murre sub-colony.

Recommendations

Conclusively determining the effects that common raven predation has on egg and chick loss will remain a challenge without collection of data on the total number of eggs laid at the colonies and the total number of eggs and chicks lost to predation, abandonment, non-viable eggs, etc. (Roth et al. 1999). Collaboration with common murre researchers from USFWS could help in providing an estimate of the total number of eggs and chicks in one season on each monitored location. However, it will remain difficult to obtain precise numbers due to the logistic infeasibility of monitoring the entire colony from land-based vantage points.

A study from 1999, conducted by PRBO, Audubon Canyon Ranch, USFWS, and PRNS on the ecosystem-level management of common ravens, recommended alteration of land-use practices (i.e. ranching) and the possible use of controlled taste aversion (CTA) to help control the common raven population and reduce depredation, respectively. Immediate changes by ranches could include covering food troughs, setting up exclusion fencing to keep cows away from sensitive areas, and immediate removal of common raven food sources such as afterbirths and calf carcasses. CTA could be effective if administered to territorial common ravens near common murre colonies, but accessibility and disturbance issues make the task of placing treated eggs in common murre colonies at PRNS difficult (Roth et al. 1999).

Lethal control of territorial or paired common ravens in the vicinity of these and other sub-colonies is another management option. However, removal of territorial pairs may also allow larger numbers of non-territorial common ravens to depredate the previously defended colonies (Nicolaus 1987). In addition, there are logistical and public relations factors with lethal control of common ravens at PRNS. The close proximity of monitored locations to high-use visitor areas, such as the Lighthouse and Arch Rock, presents challenges. However, lethal control has shown success at PRNS with the Point Resistance Rock sub-colony, reducing the disturbances observed. Additionally, the predation of a large group entering a previously defended area was not observed. Common ravens were rarely ever seen at Point Resistance following removal during the 2011 monitoring season. Further monitoring of the Point Resistance Rock should continue to determine if a new territorial raven pair appears.

The two common raven nests documented in the 2011 monitoring season were discovered by USFWS and USDA staff members late in the season. Neither was located near a monitored common murre sub-colony, resulting in irregular observations. One of the common raven pairs was observed predating a common murre colony in the vicinity of its nest. The pair was subsequently removed. The other pair consisted of one common raven missing a middle tail feather. Three of the disturbances that occurred on Boulder Rock were conducted by a common raven missing a middle tail feather. However, once these predation events occurred, the pairs chicks had fledged and there was no longer an opportunity for removal. For lethal control to be a continual method for decreasing disturbances, locating the common raven nests early in the season would be advantageous. Common murres begin to lay their first eggs between the middle

of April to late May. Common ravens can start building nests between the end of January to middle of April (Boarman and Heinrich 1999). In future years, the monitor could spend the time in April before common murres lay their eggs searching the area for common raven nests. If common raven nests are located early, additional monitoring of the pair can be conducted to observe if they are disturbing the common murres. Additionally, if they are disturbing the common murres, early removal could reduce the amount of predation and disturbance during the season.

In order to further determine the effects that ravens are having on common murre populations at PRNS, an ongoing raven monitoring and management program is warranted. Part of this program should involve monitoring the effects of implementing the National Park Service's Best Management Practices on ranches (i.e. covered food bins, exclusion fencing, and debris removal) adjacent to the Headlands (A, B, and C Ranches). The impacts of lethal removal should also be monitored under this program in order to determine the most effective methods of decreasing raven predation pressure on common murre colonies.

Acknowledgments

Natalie Gates and Gerry McChesney provided help in determining important monitoring locations, as well as project goals. Corey Shake and the USFWS common murre team who provided information on the Common Murre Restoration Project and background on Common Murre breeding behavior. Dave Press for all the problem solving assistance throughout the season and editing the end year report.

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Figure 1: Point Reyes Headlands Colony

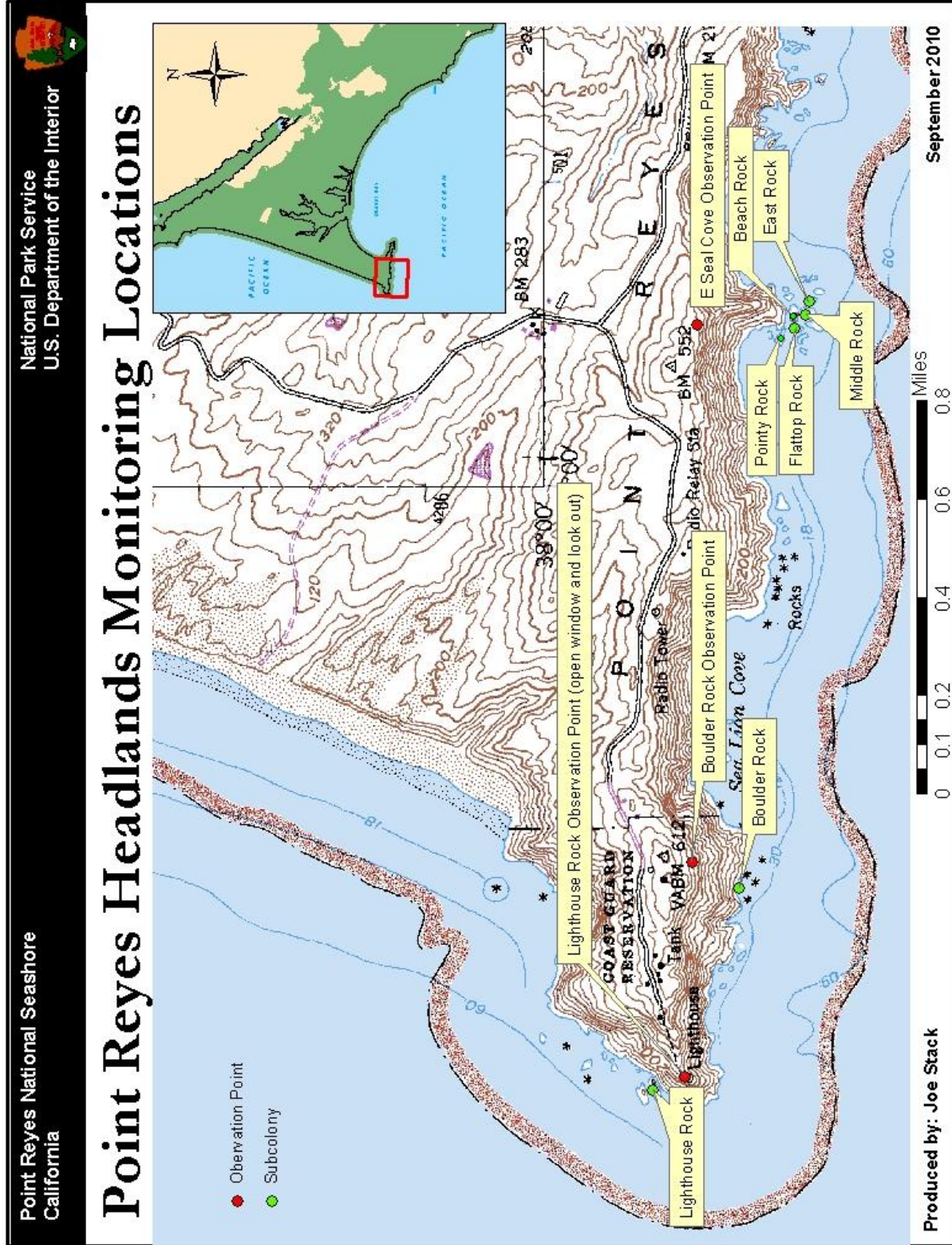


Figure 2: Lighthouse Rock Sub-colony

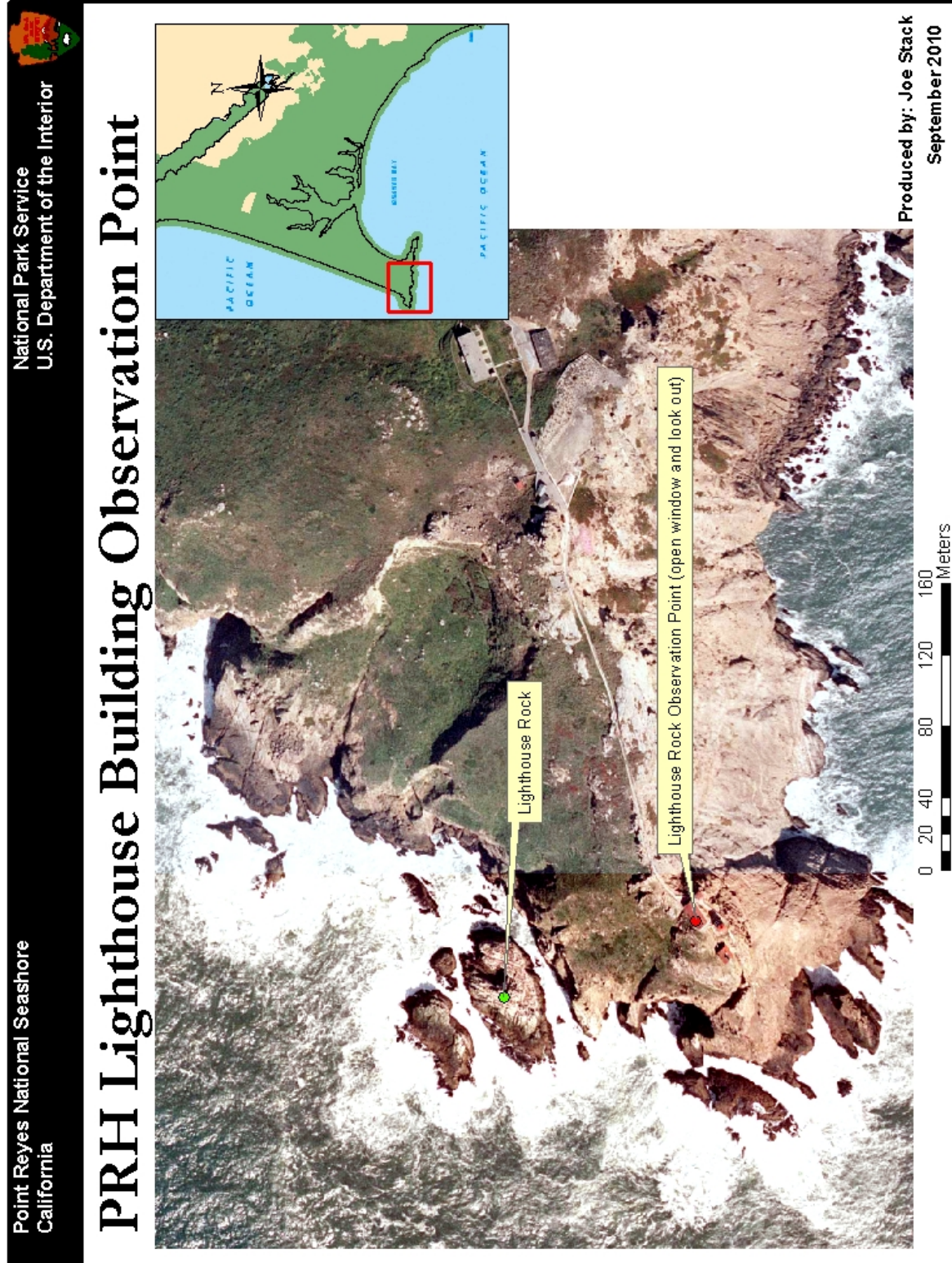


Figure 3: Boulder Rock Sub-colony

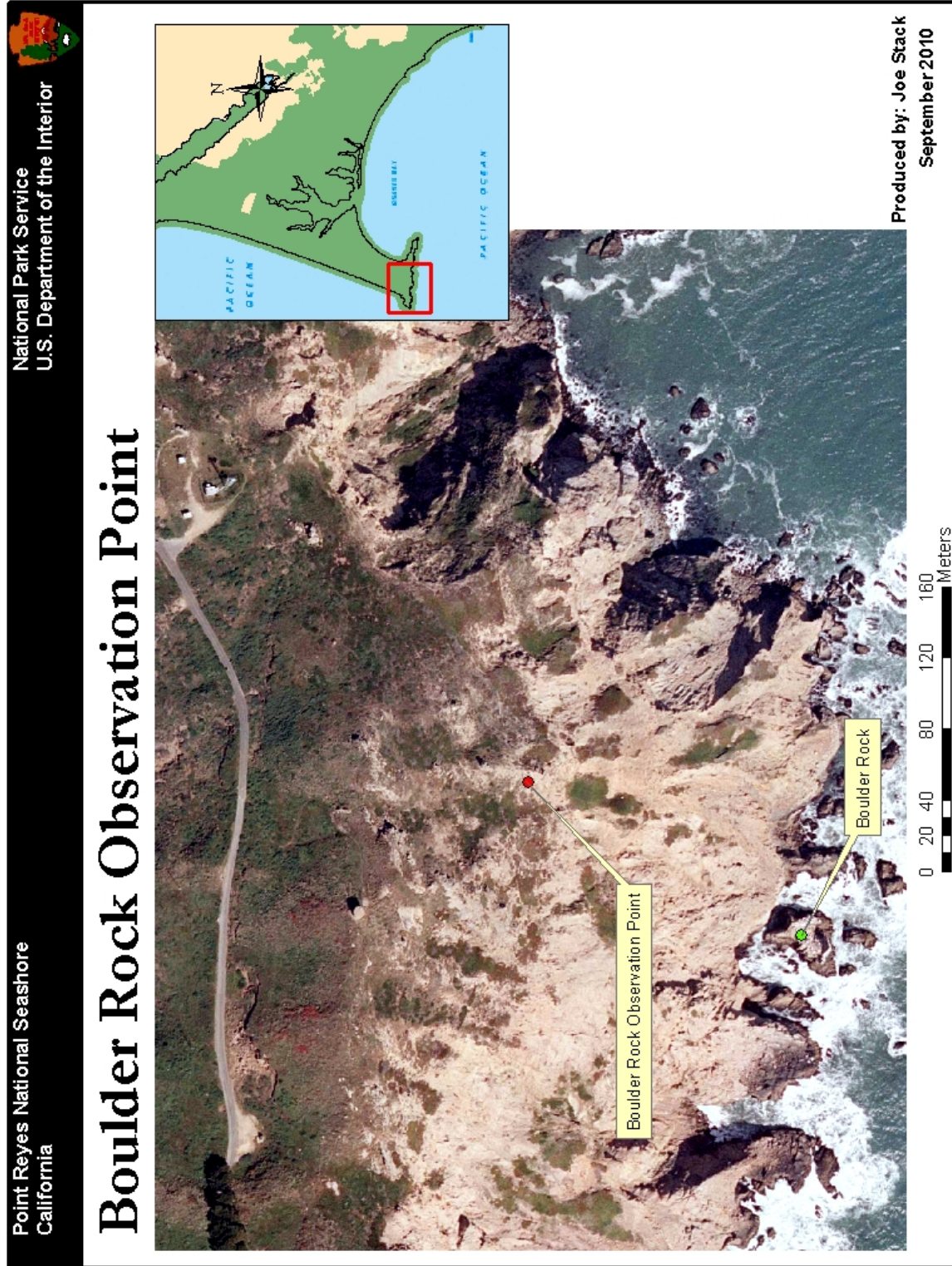


Figure 4: East Seal Cove Sub-colonies

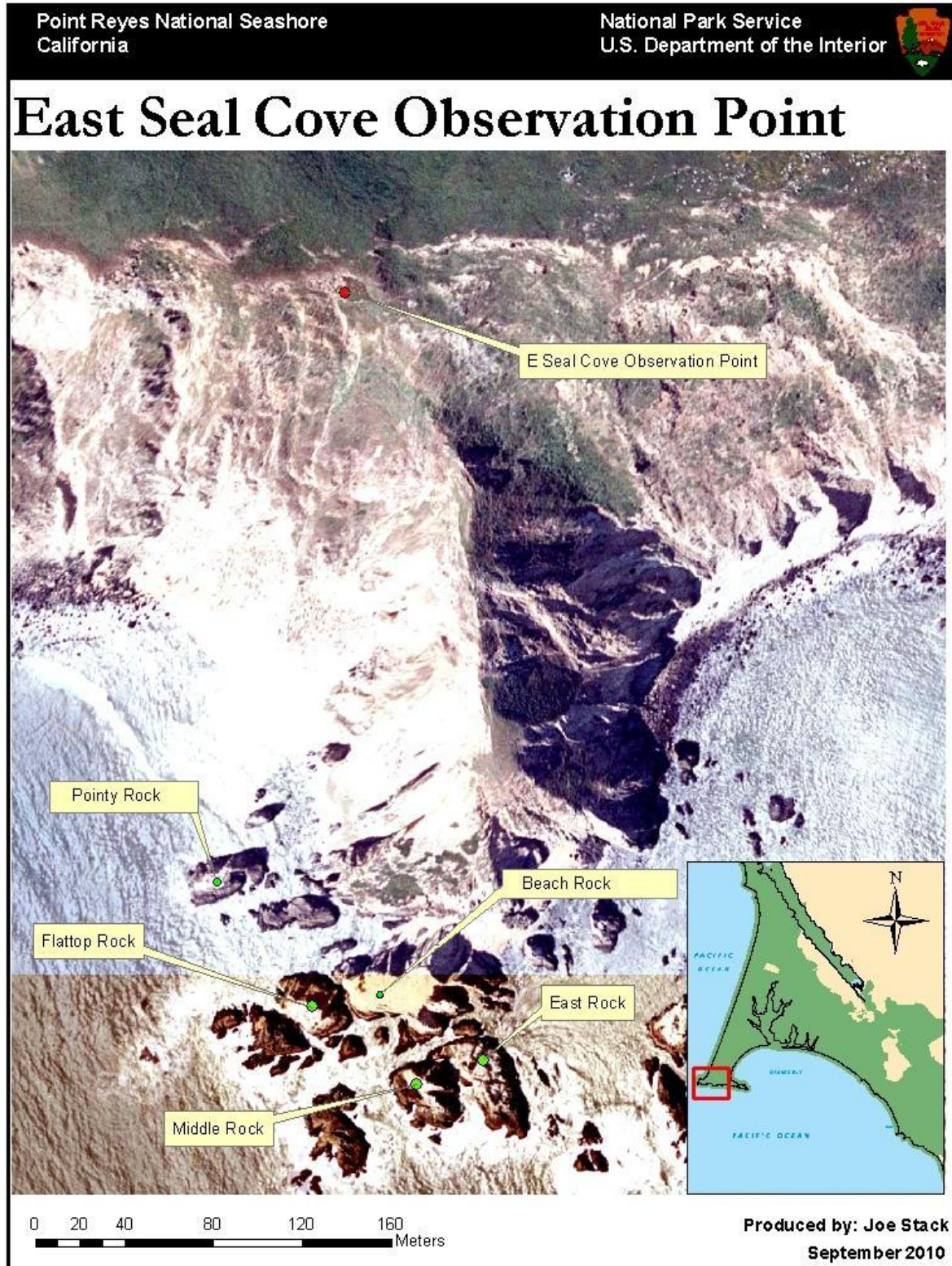


Figure 5: Arch Rock Colony

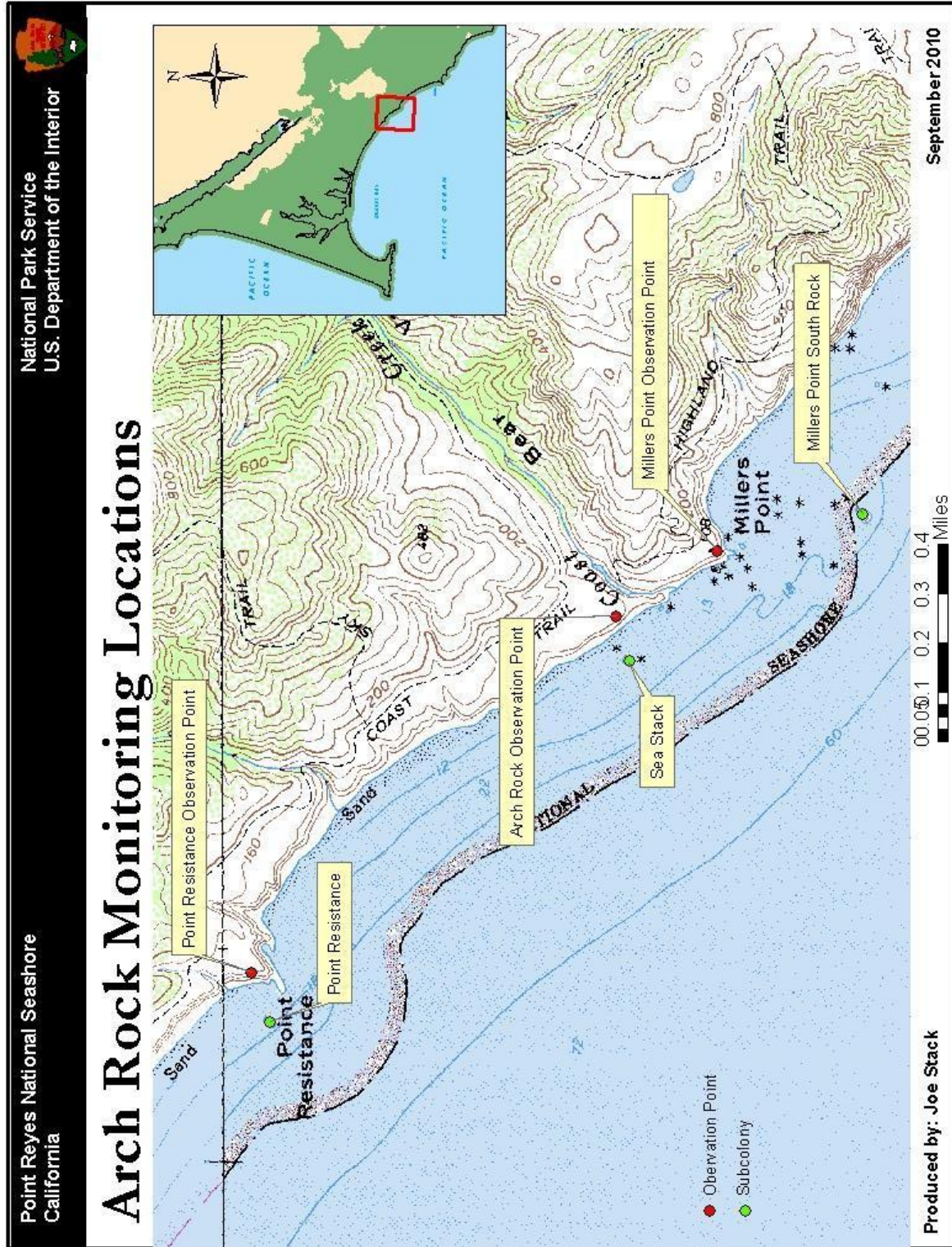


Figure 6: Millers Point South Rock Sub-colony

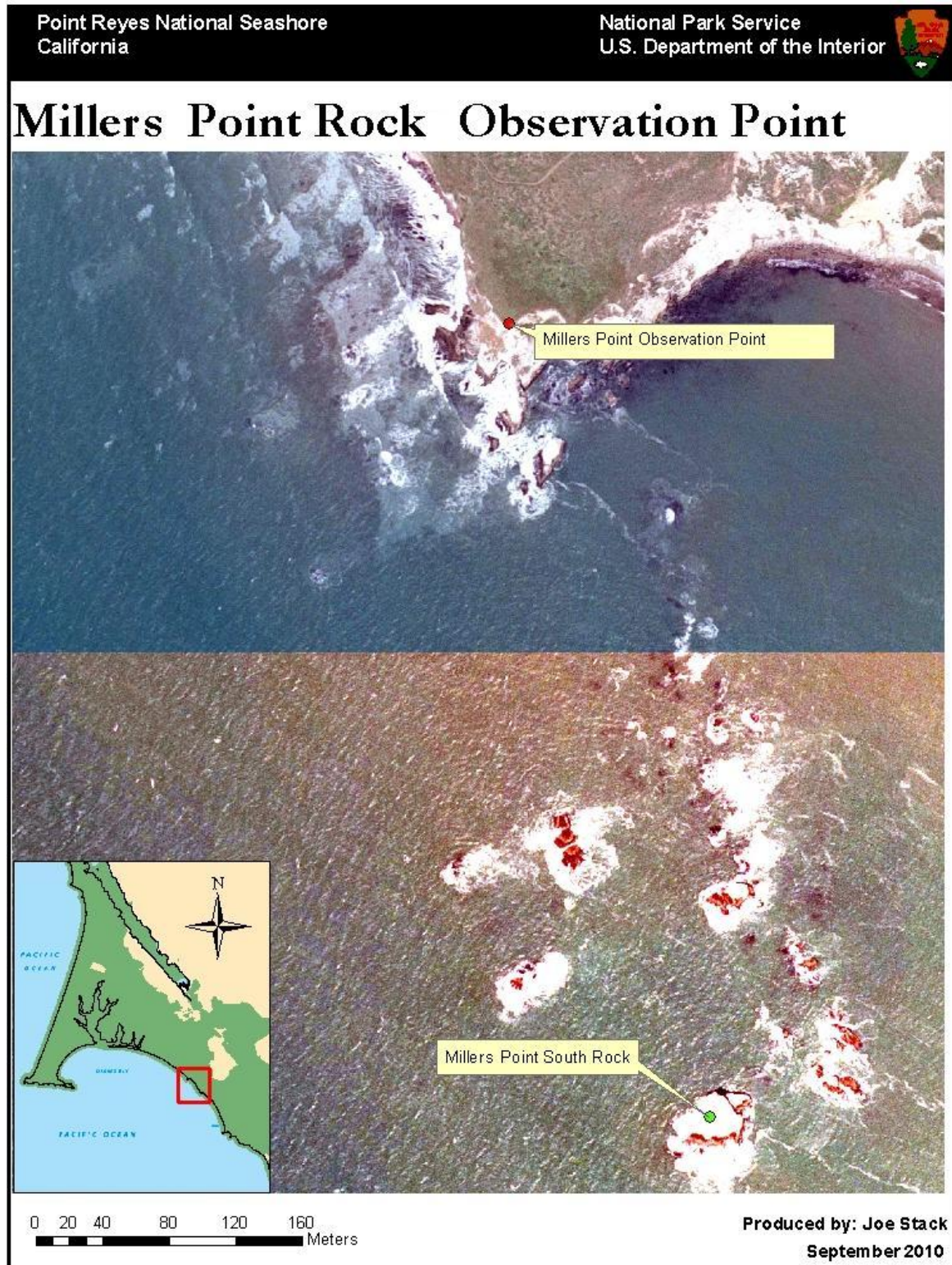


Figure 7: Sea Stack Sub-colony

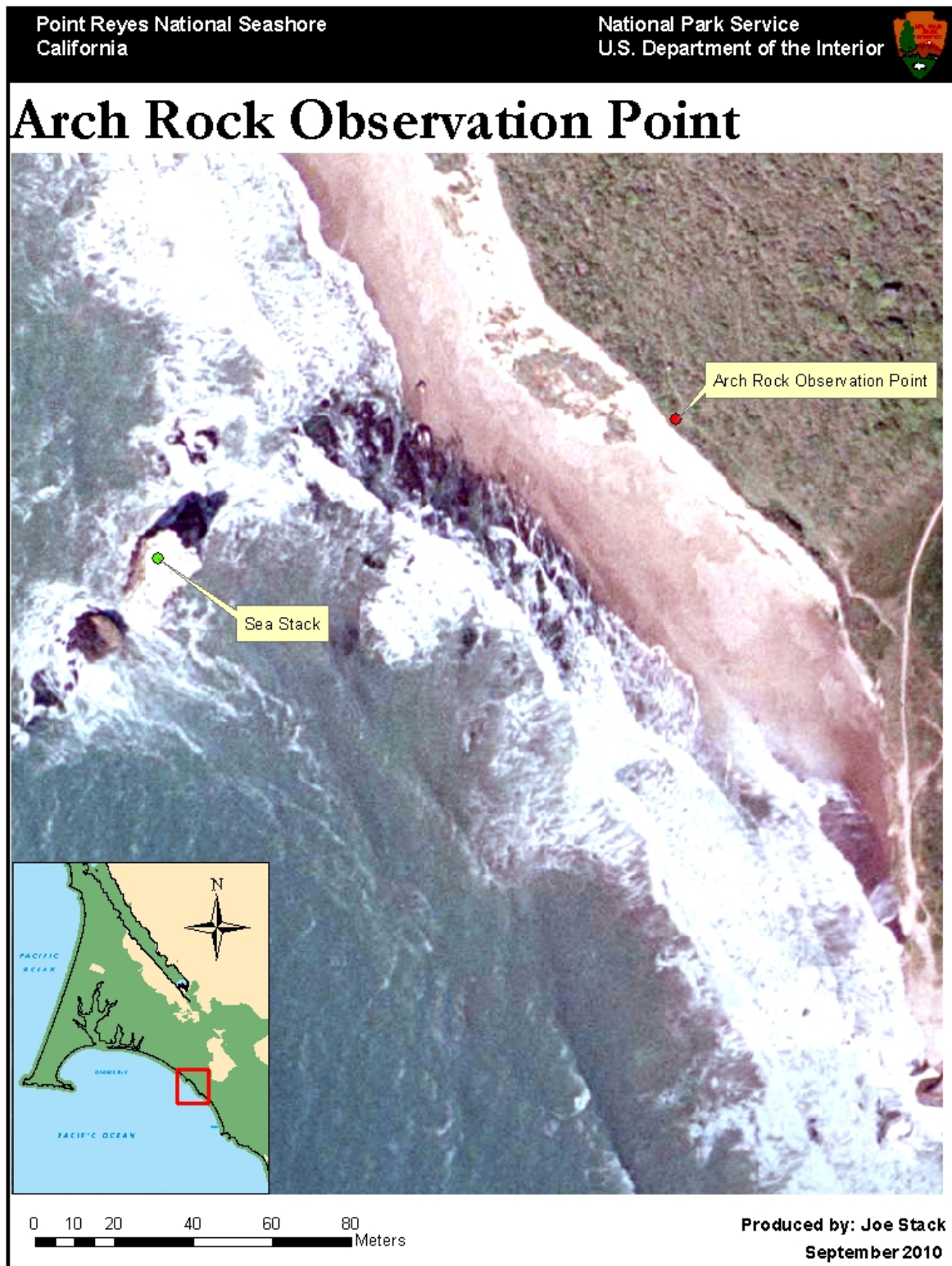


Figure 8: Point Resistance Rock Sub-colony



Appendix A: Example of Raven Disturbance Monitoring PRNS data sheet

Raven Disturbance Monitoring PRNS

Date: _____ Observer: _____ Time: _____ to _____

Observation Point: ☐ PRH Lighthouse Building ☐ E Seal Cove Obs. Point ☐ Boulder Rock Obs. Point

☐ Arch Rock Obs. Point ☐ Miller's Point Rocks Obs. Point ☐ Point Resistance Obs. Point

Visibility (circle): Clear Hazy Foggy Rainy Survey type Full Check

Murres on Rock: 0 1-100 100+ Max Raven Count _____

Notes:

Time: _____ to _____ No. of Ravens Involved: _____ Event ID: _____

Subcolony: ☐ Lighthouse Rock ☐ Boulder Rock ☐ Flattop Rock ☐ Middle Rock ☐ East Rock

☐ Sea Stack ☐ Point South ☐ Point Resistance

Techniques: Lunge Pull Snatch Easy Picking Air Attack Incidental Loss Unknown

Site Characteristics: Edge Site Interior Site No. of Vertical Rock Faces: _____

No. Neighboring Sites:	Notes:
No. Birds Flushed:	
No. Eggs Taken:	
No. Chicks Taken:	

Table 3. Total number of disturbances, surveys conducted, hours surveyed and percent disturbance events per hour for all of PRNS, both colony areas and each sub-colony

Survey Area	Number of Disturbance Events	Number of Surveys Conducted	Number of Hours Surveyed	Rate Disturbance Events per Hour
All PRNS	20	54	119	0.17
PRH Colonies	20	33	69	0.29
Lighthouse Rock	8	10	25	0.32
Boulder Rock	7	12	22	0.32
Middle Rock ¹	1	11	22	0.05
East Rock ¹	0	11	22	0.0
Flattop Rock ¹	3	11	22	0.14
Beach Rock ¹	0	11	22	0.0
Pointy Rock ¹	1	11	22	0.05
Arch Rock Colonies	0	21	50	0.0
Miller's Point South	0	5	10	0.0
Sea Stack	0	8	21	0.0
Point Resistance	0	8	19	0.0

1. Middle Rock, East Rock, Flattop Rock, Beach Rock and Pointy Rock are all surveyed from the same observation spot during the same monitoring time.

Table 4. Total number predation events, disturbance events, percent predation per disturbance event, and rate of predation events per hour for all of PRNS, both colony areas and each sub-colony

Survey Area	Number of Predation Events	Number of Disturbance Events	Percent Predation Per Disturbance	Rate Predation Events Per Hour
All PRNS	9	20	45	0.08
PRH Colonies	9	20	45	0.13
Lighthouse Rock	6	8	75	0.24
Boulder Rock	3	7	42.9	0.14
Middle Rock ¹	0	1	0	0.0
East Rock ¹	0	0	0	0.0
Flattop Rock ¹	0	3	0	0.0
Beach Rock ¹	0	0	0	0.0
Pointy Rock ¹	0	1	0	0.0
Arch Rock Colonies	0	0	0	0.0
Miller's Point South	0	0	0	0.0
Sea Stack	0	0	0	0.0
Point Resistance	0	0	0	0.0

1. Middle Rock, East Rock, Flattop Rock, Beach Rock and Pointy Rock are all surveyed from the same observation spot during the same monitoring time.

Table 5. Total number of flushes, eggs and chicks predated in the 2010 and 2011 monitoring seasons for all of PRNS, both colony areas and each sub-colony

Survey Area	Number of Flushes		Number of Eggs		Number of Chicks	
	2010 ²	2011	2010	2011	2010	2011
All PRNS	N/A	11	7	6	1	3
PRH Colonies	N/A	11	3	6	1	3
Lighthouse	N/A	2	0	4	0	2
Boulder Rock	N/A	4	2	2	1	1
Middle Rock ¹	N/A	1	0	0	0	0
East Rock ¹	N/A	0	0	0	0	0
Flattop Rock ¹	N/A	3	1	0	0	0
Beach Rock ¹	N/A	0	N/A ³	0	N/A ³	0
Pointy Rock ¹	N/A	1	N/A ³	0	N/A ³	0
Arch Rock Colonies	N/A	0	4	0	0	0
Miller's Point South	N/A	0	0	0	0	0
Sea Stack	N/A	0	0	0	0	0
Point Resistance	N/A	0	4	0	0	0

1. Middle Rock, East Rock, Flattop Rock, Beach Rock and Pointy Rock are all surveyed from the same observation spot during the same monitoring time.
2. Flushes were not recorded during the 2010 season.
3. Beach Rock and Pointy Rock did not have common murre colonies on them during the 2010 season.

Table 6. Number of disturbances, distance to nearest ranch and area of each sub-colony

Survey Area	Number of Disturbances	Distance from Nearest Ranch (km)	Area of Colony (m ²)
PRH Colonies			
Lighthouse	8	2.562	1684.387
Boulder Rock	7	1.960	381.781
Middle Rock	1	0.803	237.128
East Rock	0	0.794	465.452
Flattop Rock	3	0.769	176.205
Beach Rock	0	0.805	1054.819
Pointy Rock	1	0.730	104.911
Arch Rock Colonies			
Miller's Point South	0	5.073	1014.039
Sea Stack	0	5.022	306.211
Point Resistance	0	5.771	585.726