

MAHONE BAY ROSEATE TERN RECOVERY PROJECT'S
2009 FIELD SEASON REPORT:

DETERMINING ROSEATE TERN STEWARDSHIP OPPORTUNITIES IN
MAHONE BAY THROUGH BAY-WIDE SURVEYS



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Abstract

The Bluenose Coastal Action Foundation (BCAF), a non-profit charitable organization that addresses environmental concerns within Lunenburg County, initiated the Roseate Tern Recovery Project (RTRP) in April 2003. The primary goal of this project was to re-establish a secure nesting site for endangered Roseate terns on an island in Mahone Bay, NS. Historically, one-third of the Canadian Roseate tern population nested on Grassy Island. In the mid 1990's, this Roseate tern population sharply declined until there were no known nesting pairs in 2003. Currently, less than 100 pairs of Roseate terns nest in Canada on three established colonies.

During the first year of the RTRP, BCAF focused their efforts to determine the most appropriate stewardship site for Roseate terns in Mahone Bay; Quaker Island was chosen. From 2004 to 2007, BCAF facilitated research on this island to establish a Roseate tern colony by using tern decoys, sound systems, nesting boxes, predator deterrence, and predator control measures. In addition, daily observations of tern productivity, diet, and chick growth were recorded. Unfortunately, successful stewardship on Quaker Island was not accomplished due to mink predation, severe storm events, and potentially anthropogenic disturbances.

The lack of tern breeding success on Quaker Island led BCAF to refocus their efforts in 2008 and 2009. During these field seasons the Mahone Bay Roseate Tern Conservation Team (RTCT) conducted bay-wide surveys at a maximum of three times per week, to document tern distribution, abundance, productivity, and reproductive success. Based on observations from boat and land, terns attempted to nest on Crow, Gully, and Westhaver Islands in 2009. Only Common terns were confirmed in the bay; therefore, no Roseate terns nested in Mahone Bay. As terns abandoned Crow Island early in the season, nest and egg counts were conducted on Gully and Westhaver Islands. Gully Island had 119 nests, whereas Westhaver Island had 163 nests. Fledgling counts on Westhaver Island indicated a minimum of 50 juvenile terns survived to fledge the island. Therefore, the tern colony on Westhaver Island had reproductive success. A fledgling count was attempted on Gully Island; however, only 22 adult terns were present. Therefore, no chicks survived to fledge the island.

For the 2010 field season, it is recommended that a tern stewardship program be initiated on Grassy Island; the habitat is suitable for breeding tern colonies and, because of its history, it is hoped the island will easily attract terns. The island is also located offshore, which limits anthropogenic disturbances, but is close enough to be regularly monitored. Grassy Island is a Management Wildlife Area owned by NS DNR. Therefore, all gull deterrence and management efforts would have to be first approved by the department.

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List of Abbreviations

BCAF	Bluenose Coastal Action Foundation
ACAP	Atlantic Coastal Action Program
SARA	Species at Risk Act
RTRP	Roseate Tern Recovery Project
CWS	Canadian Wildlife Service
BSC	Biological Suitability Criteria
LPC	Logistic Practicality Criteria
RTCT	Roseate Tern Conservation Team
HSP	Habitat Stewardship Program for Species at Risk
NS DNR	Nova Scotia Department of Natural Resources

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- Atlantic Coastal Action Program, Habitat Stewardship Program, and Nova Scotia Economic and Rural Development for funding the project
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1.0 Introduction

1.1 Bluenose Coastal Action Foundation

The Bluenose Coastal Action Foundation (BCAF) is a non-profit charitable organization that addresses environmental concerns within the Lunenburg County watershed through research, education, and action. BCAF was incorporated in December 1993 and is a community-based member of the Atlantic Coastal Action Program (ACAP). ACAP was initiated by Environment Canada in 1991 to help Atlantic Canadians restore and sustain watersheds and adjacent coastal areas. The ACAP family is currently made up of 16 organizations in the four Atlantic Provinces.

BCAF manages ten projects which aim to promote restoration, enhancement, and conservation of Lunenburg County's watershed and ecosystems. These projects include, but are not limited to, the Atlantic Whitefish Recovery Project, Environmental Home Assessment Program, East River Elver Abundance Study, LaHave Water Rescue Project, and the Roseate Tern Recovery Project. This report discusses the objectives, outcomes, and results of the Roseate Tern Recovery Project for the 2009-2010 fiscal year.

1.2 Roseate Terns

The Roseate tern (*Sterna dougallii*) is a migratory seabird protected under the 1994 Migratory Birds Convention Act. This bird species migrates annually from its wintering grounds in South America to island breeding grounds off the Eastern coast of Canada and the United States. Terns arrive at breeding islands in Lunenburg County, Nova Scotia early May.

Roseate terns nest with Common (*Sterna hirundo*) and Arctic (*Sterna paradisaea*) terns on rocky coastal islands for added protection from predation and other disturbances. Terns are ground nesters, as their speckled eggs camouflage with the sand and rocks of the substrate. Roseate terns often seek further protection for their nests by concealing them in vegetation. Roseate tern chicks hatch late June, learn to fly late July, and leave their nesting grounds mid August to migrate to their winter feeding grounds. Roseate terns look similar to Common and Arctic terns, although they can be distinguished by the following features: bills are mostly black, occasionally have a rosie patch on its breast, tail streamers are much longer, lacks an outer black edge on its wings, and overall have paler bodies.

Roseate terns are listed as an endangered species by the Nova Scotia Endangered Species Act and the Federal Species at Risk Act (SARA). Currently less than 100 pairs of Roseate terns nest in Canada at three established colonies: Country Island (Guysborough County, Nova Scotia), North Brother Island (Yarmouth County, NS), and Sable Island (~ 290 km Southeast of Halifax, NS).

1.3 Project History (2003 – 2008)

Historically, one-third of the Canadian Roseate tern population nested on Grassy Island in Mahone Bay, NS. Since the mid 1990's, this Roseate tern population sharply declined until there were no known nesting pairs in 2003. BCAF then initiated the Mahone Bay Roseate Tern Recovery Project (RTRP) in April 2003. The primary goal of this project was to re-establish a secure nesting site for Roseate terns on an island in Mahone Bay. This goal would fulfill the third objective of the "Recovery Strategy for the Roseate Tern in Canada", which hopes to restore a

broader distribution of the Roseate tern by establishing at least one more managed colony. The abovementioned document, generated by Environment Canada's Canadian Wildlife Service (CWS), provides a guide to manage and aid in the recovery of this species; BCAF is committed to working in conjunction with CWS and supports their recovery efforts.

During the summer of 2003, the first year of the RTRP, BCAF focused their efforts to determine the most appropriate stewardship site for Roseate terns in Mahone Bay. Coastal islands in Mahone Bay were chosen as a possible stewardship site because of its historic population on Grassy Island and Mahone Bay lies midway between Atlantic Canada's two officially managed tern colonies (Country Island and North Brother Island). The United States Roseate Tern Recovery Team developed site selection criteria which consisted of two separate matrices: The Biological Suitability Criteria (BSC) and the Logistic Practicality Criteria (LPC). The BSC collected information on island size, vegetation, proximity to foraging area, predation pressures, and productivity of terns; whereas the LPC collected information on boat accessibility, ownership/management commitment, and disturbance potential. BCAF used this information to examine thirteen coastal islands. Quaker Island, located two kilometers south of Chester, was chosen as the most appropriate site to establish a stewardship program.

From 2004 to 2007, BCAF facilitated research on Quaker Island to establish a Roseate tern colony by using tern decoys, sound systems playing tern calls, nesting boxes, predator deterrence (human presence, pyrotechnics), and predator control measures (gull nest and egg destruction, mink trapping). In addition, daily observations of tern productivity, diet, and chick growth were recorded. Unfortunately, successful stewardship on Quaker Island was not accomplished due to mink predation, severe storm events, and potentially anthropogenic disturbances. While the stewardship program was being conducted on Quaker Island, BCAF also monitored tern and gull distribution, abundance, and productivity on other islands in Mahone Bay.

The lack of tern breeding success on Quaker Island led BCAF, in consultation with CWS, to refocus their efforts in 2008. During this field season the Mahone Bay Roseate Tern Conservation Team (RTCT) conducted bay-wide surveys at a maximum of three times per week, to document tern distribution, abundance, productivity, and reproductive success. In addition, tern foraging areas were documented throughout Lunenburg County. Primary gull colonies were also surveyed and predator watches were conducted. Tern colonies were established on six islands, with Westhaver and Gully Islands supporting the largest tern nesting colonies. No Roseate terns were observed in the bay; however, Common and Arctic terns successfully nested. Tern abandonment occurred on four islands due to predation from gulls and crows, flooding, and anthropogenic disturbances.

From the 2008 field season, it was concluded that Common and Arctic terns breeding in Mahone Bay were preferentially nesting on several islands in the bay as opposed to forming one large colony. As a result, the reproductive success of tern colonies was more susceptible to their primary threats: predation (from gulls, crows, and minks), habitat displacement (caused by human development, erosion, and severe weather events), and anthropogenic disturbances (increased boating activities in the bay). As Mahone Bay is a popular destination for boaters, recreationists, and naturalists, anthropogenic disturbances have increased and further threaten the recovery of Roseate terns; in addition to hindering the breeding success of Common and Arctic terns.

1.4 2009 Field Season

In consultation with CWS and the Habitat Stewardship Program for Species at Risk (HSP), the RTCT decided to continue bay-wide surveys during the 2009 field season to monitor tern breeding success and primary gull colonies. These results will be used in correlation with previously acquired data to determine the most suitable stewardship option for Roseate tern recovery efforts in Mahone Bay. The expectation is that bay-wide surveys will lead to a Roseate Tern Recovery Plan for 2010. Mahone Bay's RTCT also intently focused on public education and outreach (by presenting to local schools/yacht clubs and developing educational materials), community engagement (by attending various festivals), and boater surveys.

Funding for this project was generously provided by HSP, ACAP, and Nova Scotia Economic and Rural Development. Accordingly, efforts were made to ensure research goals and educational objectives satisfied those agreed upon in the funding proposals. The RTRP goals and objectives for 2009 included, but were not limited to, the following:

- 1) Monitoring tern distribution, abundance, productivity, and success throughout Mahone Bay to determine Roseate tern stewardship opportunities for 2010
- 2) Monitoring primary gull colonies to determine gull populations in Mahone Bay
- 3) Delivering the Tern Colony Signage Program
- 4) Delivering an Education and Outreach Program for recreational boaters and local residents in Lunenburg County

The Tern Colony Signage Program and the Education and Outreach Program will not be discussed in this report. The details of these programs can be found in the "Mahone Bay Roseate Tern Recovery Project's Tern Colony Signage Program: 2009 Summer End Narrative Report" and "Mahone Bay Roseate Tern Recovery Project's Education and Outreach Program: 2009 Summer End Narrative Report", respectively.

2.0 Methods & Materials

2.1 Bay-Wide Surveys

Mahone Bay's RTCT conducted bay-wide surveys a maximum of three times per week from May 20th to August 18th, 2009. These surveys were completed from the mainland and from a 20' Boston Whaler (generously donated by Rick and Barb Welsford) using binoculars and/or a spotting scope (generously loaned from Paul MacDonald). At the beginning of the field season, BCAF ensured all staff successfully completed the Small Craft Operators Course and Emergency First Aid CPR Level A. To ensure safe boating trips, the RTCT checked Environment Canada's weather forecast (wind, sea state, tides), all safety equipment, and reported to BCAF's office prior to departure. The RTCT also reported to the office at 12 noon and upon returning to shore.

Bay-wide surveys were implemented to first identify the location of tern colonies in Mahone Bay (tern distribution) and then to monitor tern abundance, productivity, and reproductive success. To monitor Pearl and Grassy Islands, BCAF required a scientific permit from Nova Scotia Department of Natural Resources (NS DNR) as these islands are provincially designated as Wildlife Management Areas. Therefore, activity within one nautical mile was prohibited. BCAF

has monitored these islands as terns historically nested on Pearl Island and one third of the Canadian Roseate tern population nested on Grassy Island. Grassy Island currently hosts a small gull colony. BCAF applied for and received this permit which authorized the RTCT to enter the protected waters surrounding Pearl and Grassy Islands a maximum of three times per week and to land on these islands three times during the breeding season (to assess tern productivity and reproductive success). The RTCT also monitored gull colonies and threats to terns (anthropogenic disturbances and predation). These surveys recorded bird observations, predation events, weather, and any other information which deemed useful when determining options for stewardship.

At the end of May, the RTCT surveyed the entire bay to determine tern distribution. Once completed, tern abundance per colony was estimated by eye or through photography. To do so, terns were flushed from the island and counted by the RTCT or a photo was taken of the birds in flight. Terns in these photos were later counted using a computer. Tern abundance per colony was monitored throughout the field season.

Tern productivity and reproductive success were monitored in June and July, respectively. Tern productivity was determined through nest and egg counts. To conduct these counts two or three technicians walked a path through the nesting colony, approximately one meter apart; the outside technician placed flags in the ground to mark the boundary where nests had been counted. When a nest was found it was recorded, along-with the number of eggs in the nest. Tongue depressors were laid by the nest to avoid counting nests twice. Nest and egg counts were completed prior to any significant number of hatchlings to minimize stress to chicks and to ensure accuracy of the counts as chicks tend to leave their nests shortly after hatching. These counts were also completed as quickly as possible as technicians caused adult terns to flush from their nests, leaving eggs and chicks susceptible to weather conditions. Tern colony success, determined through fledgling counts, estimated the minimum number of eggs which survived to juvenile terns. Fledglings aggregated near the base of the lighthouse on Westhaver Island and were counted from the Boston Whaler using binoculars. Juvenile terns are easily recognizable from adults by their white forehead (brownish-black hind crown and black nape), brownish plumage, and weak carpal bars.

2.2 Gull Colonies & Predator Watches

Most gull colonies in Mahone Bay were surveyed in the summer of 2009. Gull and tern distributions were determined simultaneously at the end of May. Gull nest and eggs counts were conducted for gull colonies in early June to indirectly estimate predation on tern colonies. The procedure used to complete gull nest and egg counts was the same for tern colonies (described previously). Gull abundance was also estimated while conducting these counts. Gull fledgling counts (reproductive success) were not completed in 2009.

To directly monitor predation on tern colonies in Mahone Bay, the RTCT conducted predator watches from land and the Boston Whaler using binoculars and/or a spotting scope. Observations such as proximity of the predator to the tern colony, behaviour of the predator (i.e., in flight over colony, landed on colony), and response from the tern colony (i.e., terns flushed, tern(s) “dive-bombed” predator) were recorded. Boat traffic near nesting colonies and response from terns were also documented.

3.0 Results

3.1 Tern Distribution & Abundance

Ten islands were visited in 2009 (Table 1) to determine tern distribution in Mahone Bay. Based on observations from boat and land, terns attempted to nest on Crow, Gully, and Westhaver Islands; being successful on Westhaver Island only. “Seabird Nesting Area – Do Not Disturb” signs were placed on the above three islands (2 signs per island), warning boaters to stay away from the islands as they were important seabird nesting areas. Tern presence was also observed on Meisners, Quaker, Mash, Mason, Spectacle, Saddle, and Pearl Islands (Figure 1). Only Common terns were confirmed in the bay; therefore, no Roseate terns were nesting on Gully and Westhaver Islands.

In 2008, terns attempted to breed on Westhaver, Gully, Crow, Mason, Pearl, and Quaker Islands. Terns abandoned Crow, Mason, Pearl, and Quaker due to flooding (Crow), predation (Pearl, Mason), and anthropogenic disturbances (Mason, Quaker). In 2009, terns attempted to breed on three islands only. This is beneficial as terns better defend and protect large colonies. However, terns abandoned Crow and Gully Islands due to anthropogenic disturbances. Tern abandonment is discussed in section 3.3. In 2008 and 2009, Westhaver and Gully Islands hosted the two largest tern colonies in Mahone Bay (Figure 2). In 2009, the observed abundance on Westhaver and Gully Islands was 105 and 80 terns, respectively.

Table 1: Islands monitored in Mahone Bay, Lunenburg County, from May to August 2009.

Island	No. of Visits	Length of Visits (Min.)
Spectacle	6	87
Crow	15	223
Gully	6	213
Quaker	3	46
Mash	3	51
Mason	3	65
Meisners	2	22
Pearl	1	40
Saddle	1	20
Westhaver	21	505
Total	61	1272



Figure 1: Map of islands monitored in Mahone Bay, Lunenburg County, excluding Pearl and Saddle Islands. Islands marked in red indicate the location of tern breeding colonies and posted “Seabird Nesting Area – Do Not Disturb” signs. Tern presence was observed on or near islands marked in green.

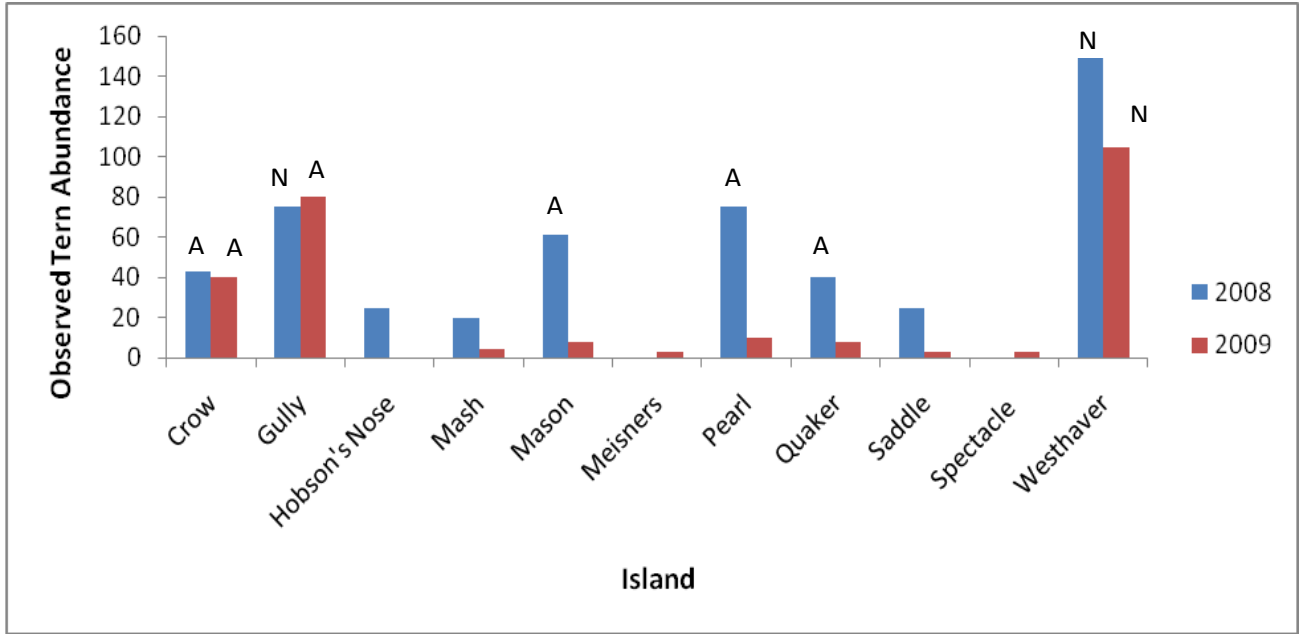


Figure 2: Observed tern abundance on each island in 2008 (blue) and 2009 (red). A = Terns attempted to nest on the island but abandoned. N = Terns successfully nested on the island. Islands not designated with a letter, indicate that terns were foraging near or roosting on the island.

3.2 Tern Productivity & Success

Tern nest and egg counts were conducted on Gully (June 17th) and Westhaver (June 25th) Islands (Table 2). Gully Island had 119 nests (average clutch size: 2.6), whereas Westhaver Island had 163 nests (average clutch size: 2.2). Compared to 2008, the number of nests on Westhaver Island increased by approximately sixty. Nest and egg counts on Gully Island were not available from 2008 (Table 3). Ideally, nest and egg counts should be conducted on the same day to minimize potential for error in estimation, as terns can quickly relocate and re-nest. This could not occur in 2009 on account of the boat prop being damaged on June 9th, while attempting gull nest and egg counts on Pearl Island. The RTCT used a row boat to access Gully Island on June 17th. A local resident was hired on June 25th, enabling the counts to be completed on Westhaver Island.

Table 2: Tern nest and egg counts conducted in Lunenburg County during the 2009 field season.

Island	Nest Count	Egg Count	Average Clutch Size	Fledgling Count
Gully	119	308	2.59	0
Westhaver	163	357	2.19	50
Total	282	665	-	50

Table 3: Tern nest and egg counts conducted in Lunenburg County during the 2008 field season. NA = Not Available

Island	Nest Count	Egg Count	Average Clutch Size	Fledgling Count
Gully	NA	NA	NA	16
Westhaver	104	265	2.55	50

To monitor reproductive success of tern colonies, the RTCT conducted fledgling counts late July. On Westhaver Island, a maximum of fifty juvenile terns were observed along the coastline (Table 2). At the beginning of August terns migrated from Westhaver Island. The RTCT counted unhatched (21) and predated (26) eggs on August 18th. On June 25th, 357 eggs were recorded. Therefore, the tern colony on Westhaver Island had reproductive success in 2009.

On July 27th, a fledgling count was attempted on Gully Island; however, only twenty-two adult terns were present. Gully Island was again monitored on August 4th. Upon arrival a Bayport local, who has been watching Gully Island, stated that terns left the island and seabird nesting signs were dismantled on August 3rd. The RTCT landed on Gully Island to count predated (23) and unhatched (45) eggs. On June 17th, 308 eggs were observed on this island. Unfortunately, Gully Island did not successfully fledge tern chicks this field season (Table 3). As the first eggs hatched on June 17th, the first chicks would not leave the island until late July at the earliest. Since the island was abandoned on July 27th, no chicks would have fledged from the island (Pers. Comm., Andrew Boyne, CWS). All fledgling counts were conducted from the Boston Whaler, using binoculars, to minimize disturbance.

3.3 Predator Watches

Predator watches were document for Crow, Gully, and Westhaver Islands throughout the breeding season to monitor predation attempts and anthropogenic disturbances (Table 4). Monitoring periods ranged from 31 to 43 minutes. In total, Crow Island was monitored for 220 minutes; with 32 minutes being one predator watch (July 6th). While monitoring Crow Island, no predation attempts were observed. Gully Island was monitored for a total of 240 minutes from May to August. Two predator watches were conducted on July 6th and 17th (70 minutes). Throughout the total observation period, one predation attempt was observed from a gull (species unknown). Terns responded by dive-bombing the gull. Throughout the field season, approximately five gull species (Herring Gulls and Great Black-Backed Gulls) were observed swimming and roosting near Gully Island. Lastly, Westhaver Island was monitored for 505 minutes; 180 of those being predator watches (July 2nd, 7th, 14th, and 27th). The RTCT observed three predation attempts from Great Black-Backed Gulls and one disturbance event from a Double Crested Cormorant. The response from terns was to dive-bomb and chase the Great Black-Backed Gulls and Double Crested Cormorant. All predation attempts and disturbance events were less than five minutes in duration.

Table 4: Predation attempts and avian disturbances observed while documenting predator watches and monitoring Crow, Gully, and Westhaver Islands.

Island	Monitoring Duration (Minutes)	Predator Watches (Minutes)	Predation Attempts & Disturbances
Crow	220	32	0
Gully	240	70	1
Westhaver	505	180	4

Human presence was observed (at least once) on six islands and anthropogenic disturbances to tern colonies was observed or reported on three islands: Crow, Gully, and Westhaver (Table 5). Throughout the breeding season, terns attempted to nest on Crow Island twice and abandoned both times due to anthropogenic disturbances. Terns attempted to nest on the island at the beginning of the season (15 terns were observed on May 27th); however, terns abandoned the island by June 15th, due to renovations being completed on a house adjacent to the island. These renovations continued until mid June. At the end of June, terns attempted to nest on the island for the second time. Before the RTCT could post “Seabird Nesting Area – Do Not Disturb” signs on Crow Island, two people on separate seadoos boated close to Crow Island and then landed on the island (early July). As reported by an Island Watcher, the people got off their seadoos and walked around the island. The Island Watcher yelled to them, stating they should leave the island immediately as an endangered bird species was attempting to breed. The seadoos left Crow Island and surrounding waters (length of disturbance unknown). After this disturbance event, terns only used the island to forage and roost.

Human disturbance was reported once on Gully Island and occurred on July 16th. This disturbance was caused by a man that owns the small engine shop on the mainland near Gully Island. The man is passionate about seabirds and landed on the island to check on the tern colony. It was explained to the man that he should not land on the island and must keep a distance of 200 meters, as he could cause a disturbance to the colony resulting in tern abandonment. It was further explained that he could monitor the colony from the mainland using binoculars or a spotting scope. The man stated he would stay off Gully Island in the future.

Three accounts of anthropogenic disturbance were observed or reported on Westhaver Island, which holds the largest tern colony in Mahone Bay. Two disturbances occurred on July 14th, when a power boat and later a fishing vessel passed in close proximity to the island. This resulted in approximately fifty terns flushing, indicating a disturbance had occurred. The third disturbance took place late July and was reported to BCAF by several Island Watchers and other concerned citizens. This disturbance occurred when the Canadian Coast Guard landed a helicopter on Westhaver Island to replace the navigational bulb in the lighthouse located on the island. The urgency and necessity of replacing the light bulb for navigational purposes was understood; however, the Canadian Coast Guard could have used a more unobtrusive form of transportation. The extent of this disturbance event to the tern colony is unknown.

Table 5: Islands monitored in Lunenburg County and the number/type of human disturbances observed or reported from May to August 2009. * indicates human presence on island.

Island	No. of Human Disturbances	Type of Human Disturbance
Spectacle *	0	-
Crow *	3	Construction in May & June, 2 Seadoos, 2 Humans landed on Island
Gully	1	1 Human landed on Island
Quaker*	0	-
Mash	0	-
Mason *	0	-
Meisners *	0	-
Pearl	0	-
Saddle *	0	-
Westhaver *	3	Power Boat, Fishing Vessel, Coast Guard landed for lighthouse maintenance
Total	7	-

3.4 Gull Colonies

Gull nest and egg counts were conducted on Chockle Cap, Grassy, Star, and Westhaver Islands (Table 6) with help from Andrew Boyne, CWS (Grassy and Star). Unfortunately, while attempting to conduct these counts on Pearl Island, the prop on the boat motor was damaged. Therefore, gull nest and egg counts were not completed for this island. In 2009, the largest gull colony was located on Star Island (210 nests), followed closely by Chockle Cap (192 nests). Westhaver Island has consistently hosted a Great Black-Backed Gull pair which threatens the survival of the tern colony located on the island. In 2009, this pair successfully fledged three gull chicks. It is suggested that BCAF obtain a permit from NS DNR, allowing the destruction of gull nests and eggs on Westhaver Island in April and May 2010.

Table 6: Gull nest and egg counts conducted in Lunenburg County during the 2009 field season.

Island	Observed Abundance	Nest Count	Egg Count	Average Clutch Size	Fledgling Count
Chockle Cap	218	192	457	2.38	NA
Grassy	98	57	142	2.49	NA
Star	107	210	506	2.41	NA
Westhaver	2	1	3	3.00	3

4.0 Discussion

4.1 Anthropogenic Disturbances

The total number of anthropogenic disturbances to tern colonies in 2009, (7) was substantially lower than the number of human disturbances in 2008 (71). This is partially due to the fact that terns inhabited three islands in Mahone Bay in 2009, compared to six in 2008. In 2009, human presence was recorded on Mason, Quaker, and Saddle Islands (Table 5); however, no disturbances occurred as terns were not breeding on these islands. From 2008 to 2009, the number of anthropogenic disturbances recorded on Crow, Gully, and Westhaver Islands decreased (Figure 3). Based on this data series, it is difficult to conclude that anthropogenic disturbance to tern colonies decreased solely due to increased knowledge of seabird nesting areas; although this is a co-factor. Other factors include high precipitation in July and loss of observational time in June.

The Weather Network recorded high precipitation levels during the month of July (rained for 17 nonconsecutive days) and August (Figure 4). In August, tropical storms occurred on the 23rd and 29th, resulting in extremely heavy rains. If these anomalies are removed from the data series (Figure 4, Red Column), the total accumulated precipitation is minimal (23.7 mm compared to 146.2 mm). The prolonged precipitation in July decreased the number of boats operating in the bay, resulting in decreased opportunities for humans to cause a disturbance to terns. The second factor which partially explains the decreased number of anthropogenic disturbances to tern colonies is observational time, which was lost from June 9th to 29th, when the boat prop was being repaired. Therefore, it is possible that human disturbances occurred but were not observed by the RTCT or reported to BCAF staff.

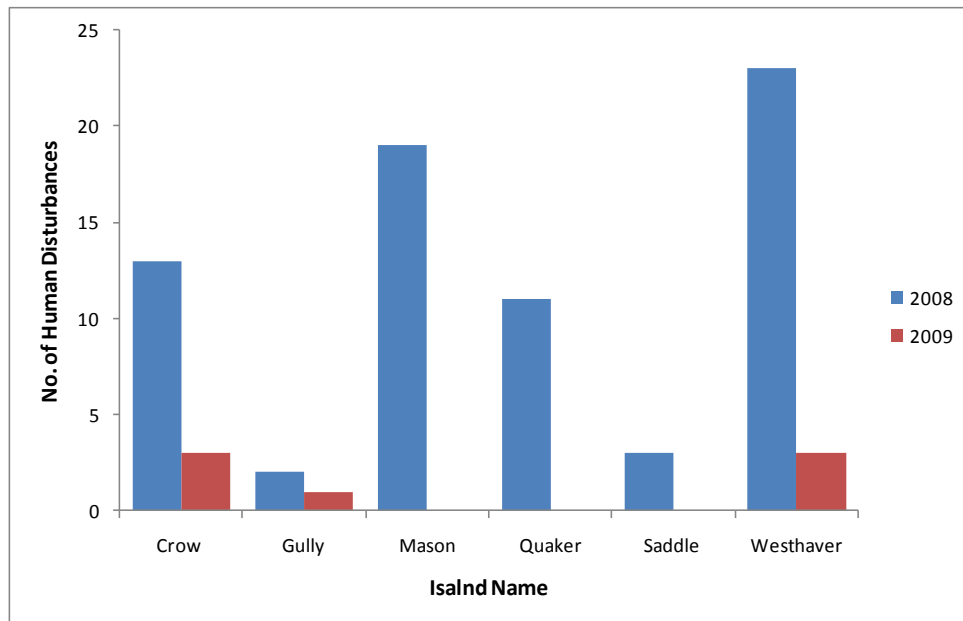


Figure 3: Comparison of the number of human disturbance events to tern colonies in Mahone Bay from 2008 (blue) to 2009 (red).

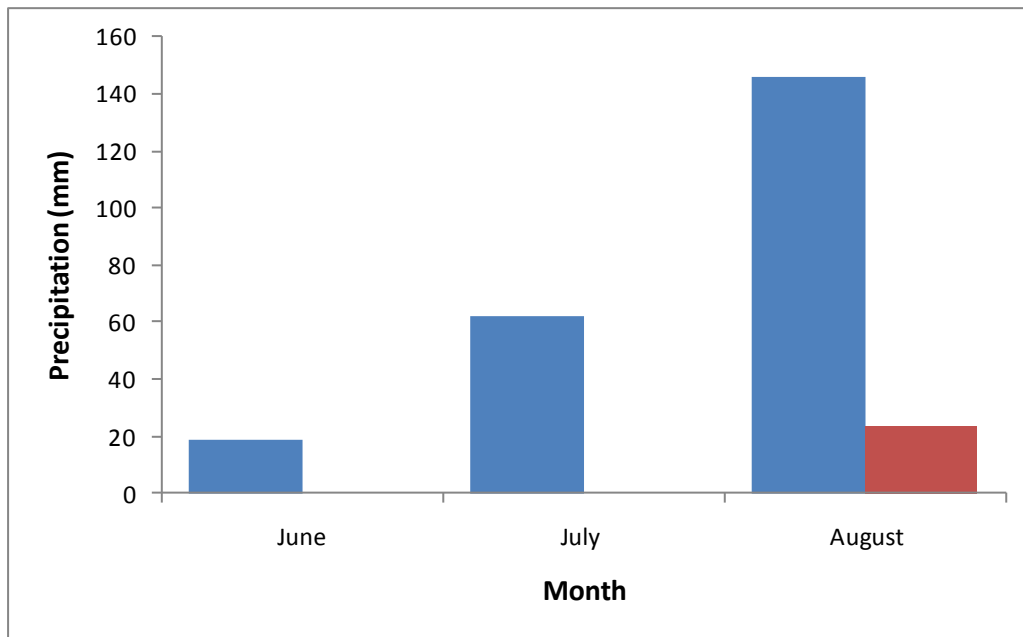


Figure 4: Accumulated precipitation, in millimetres, in June, July, and August 2009. In August, two tropical storms occurred at the end of the month. For comparison purposes, these anomalies were removed from the data series (shown in red). Accumulated precipitation was taken from The Weather Network’s historical data.

4.2 Predator Watches

The information gathered through predator watches does not provide an accurate account of all predation events, but rather provides a limited snapshot of predation events that are easily observed using binoculars and a spotting scope during the limited time when watches are conducted. In 2008, it was suggested that digital 24 hour infra-red cameras be used to monitor predation events in the future. As BCAF monitors predation events on three or more islands, using infra-red cameras to monitor predation would be extremely costly. In 2009, few predation attempts were observed on Crow, Gully, and Westhaver Islands (5 total); therefore, it is suggested that this activity be discontinued in 2010.

4.3 Stewardship Options for 2010

Terns attempted to nest on Crow, Gully, and Westhaver Islands during the 2009 field season. Provided below is a brief review of the suitability for future management on these islands, in addition to Pearl and Grassy Islands.

Crow Island

Crow Island, owned by NS DNR, would most likely not support a large number of breeding terns as the island is small, prone to flooding, and situated close to the mainland. As a result, nests would be consistently flooded and there would be an increased probability of anthropogenic disturbance, and predation from land (mink) and avian (gulls, crows) predators.

In the past, terns have attempted to nest on Crow Island unsuccessfully. In 2008 and 2009, terns abandoned Crow Island due to flooding and anthropogenic disturbances. Therefore, Crow Island is not a suitable option of tern stewardship.

Gully Island

The RTCT began monitoring Gully Island in 2008 when a Bayport local approached BCAF to inform staff of terns nesting on the island. Gully Island is located in Lower South Cove, a shallow, sheltered bay in Lunenburg County. Although the shallow bay restricts the use of motorized boats, Gully Island is not a feasible location for tern stewardship as Roseate terns prefer to nest on coastal islands rather than inland islands (Pers. Comm., Andrew Boyne, CWS). In addition, the island would be more susceptible to predation as it is located close to the mainland.

Westhaver Island

Although terns successfully nested on Westhaver Island (largest tern breeding colony) in 2008 and 2009, this island is not suitable for tern stewardship. Westhaver Island is a small island located in close proximity to the Town of Mahone Bay and its boating community. Specifically, the island is adjacent to a public beach used by local community members in the summer. As a result, the island is subject to offshore anthropogenic stresses. The island is also subject to onshore anthropogenic disturbances, as it hosts a lighthouse which requires regular maintenance from the Canadian Coast Guard. Other problems associated with Westhaver Island are erosion, predation, limited habitat suitable for nests, little vegetation for Roseate terns (to hide their nests), and it would be difficult to set up nesting boxes on the island.

Pearl Island

Pearl Island, a Wildlife Management Area owned by NS DNR, hosts a large gull colony (Herring and Great Black-Backed) along with significant populations of other seabirds including Atlantic Puffins, Razorbills, Black Guillemots, Common Eiders, and Double Crested Cormorants. For terns to successfully breed on Pearl Island, the large gull colony would have to be managed, if not fully removed. All gull deterrence and management efforts would first have to be approved by NS DNR and would be extremely difficult without disturbing the other breeding seabirds on the island. Pearl Island is also difficult to manage from a logistical perspective as the island is located offshore; transportation of staff and supplies would be extremely difficult. Frequent monitoring of Pearl Island would also be difficult for the RTCT. Boating to Pearl Island is very much dependent on an ideal sea state and weather conditions. If the weather forecast is remotely poor, boating to Pearl Island in the 20' Boston Whaler is unsafe. For all the above-mentioned reasons, Pearl Island is not a suitable location for tern stewardship.

Grassy Island

In 2009, a small gull colony (57 nests) and Common Eiders (5 nests) nested on Grassy Island. However, the island historically hosted one-third of the Canadian Roseate tern Population. For the 2010 field season, it is recommended that a tern stewardship program be initiated on Grassy Island; the habitat is suitable for breeding tern colonies and, because of its history, it is hoped the island will easily attract terns. The island is also located offshore, which limits anthropogenic

disturbances, but is close enough to be regularly monitored. Grassy Island is a Management Wildlife Area owned by NS DNR. Therefore, all gull deterrence and management efforts would have to be approved by the department and conducted in such a way to minimize disturbance to the nesting Common Eiders. Specifically, gull deterrence should begin at the end of April and tern decoys, nesting boxes, and a sound system (playing tern calls) should be placed on the island early to mid May. Grassy Island should be monitored a maximum of three times per week throughout the breeding season.

4.4 Stewardship Project Evaluation

The Mahone Bay Roseate Tern Recovery Project has been ongoing since April 2003. During this time, the RTCT has conducted bay-wide surveys (3 years) and a stewardship program was attempted on Quaker Island (4 years). Although a Roseate tern colony was not established in Mahone Bay during this time, information has been gathered on tern productivity and success, predation, and anthropogenic disturbances to tern colonies. This information is useful when considering future tern stewardship options in Mahone Bay, NS. Since 2008, the RTRP has also strongly emphasized public education and outreach because anthropogenic disturbances are a primary threat to terns nesting in the area. It is imperative to educate boaters and local residents in Mahone Bay about the plight of the Roseate tern and BCAF is committed to continuing and expanding its Educational Campaign. Therefore, the RTRP is aiding in the re-establishment of Roseate terns in Lunenburg County. Ultimately, BCAF is fully committed to working in conjunction with CWS and HSP to significantly increase the Canadian Roseate tern population and realizes this task takes a substantial amount of effort and time.

References

Bluenose Coastal Action Foundation. 2008. Roseate Tern Recovery Project: New Approaches and Review of Island Management. Mahone Bay, Nova Scotia.

Environment Canada. 2006. Recovery Strategy for the Roseate Tern (*Sterna dougallii*) in Canada.

Species at Risk Act Recovery Strategy Series. Environment Canada. Ottawa. vii + 37 pp.

Sibley, D.A. 2003. The Sibley Field Guide to Birds of Eastern North America. Alfred A. Knopf, Inc. New York. pp. 194 – 195.