

**2006 SHOREBIRD NESTING REPORT**  
**Dead Neck/Sampsons Island, Osterville, Massachusetts**

*Prepared by*  
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March 25, 2007

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## **Executive Summary**

Dead Neck Sampsons Island was monitored and managed by Mass Audubon's Coastal Waterbird Program for nesting Piping Plovers, Least Terns and Common Terns during 2006. This season, Piping Plover numbers reached their highest level since at least 1986, at 26 pairs of breeding plovers. However, productivity was low compared to previous years, with a total of 20 chicks fledged and an overall productivity of 0.77 chicks fledged/breeding pair. Hatching success was also very low at 29%; of the lost nests in which a cause was determined, Eastern Coyote predation was the main predator identified. A total of three Least Tern colonies established on Dead Neck Sampsons Island, including 252 pairs that nested on dredge material Sampsons Island entirely within electric fencing erected to protect the eggs and chicks from mammalian predators. Fledging success was fair to poor, primarily due to coyote predation that occurred due to a problem with the fencing after it was dismantled before a storm. A total of 24 Common Tern pairs nested on the Sampsons Island, outside of electric fencing, and productivity was estimated to be poor to zero. The first year of a long-term Least Tern foraging study took place on Sampsons Island; preliminary results indicated a high percentage of sandlance in both adult and chick feedings.

## **Introduction**

The Island of Dead Neck Sampsons Island (DNSI) is located between Cotuit Bay and West Bay in the villages of Cotuit and Osterville, MA, with its south shore located on Nantucket Sound. Natural movement of sand via offshore currents and wave action caused the two separate pieces of land, Dead Neck and Sampsons Island, to be joined in the early 1900s, hence the two part name. The island is approximately 1.5 miles long; Sampsons Island consists of the western third of the island, and Dead Neck the eastern 2/3 of the island (Figure 1). Mass Audubon (MAS) has owned and managed Sampsons Island for the past 4 decades. During that time, the Coastal Waterbird Program (CWP) has also monitored and managed breeding shorebirds and seabirds on Dead Neck, which is owned and managed by the Three Bays Preservation, Inc. (Three Bays). Today the channel on the eastern end of the island is maintained by dredging. The western channel has not been dredged since the around the 1950s, but will likely need dredging in the near future due to longshore transport of sand from recent (i.e. past 10 years) renourishment activity on the eastern end of the Island (Figure 1).

Dead Neck/Sampsons Island provides nesting habitat for several species of shorebirds and seabirds, and is also used as a stopover by migrating shorebirds. MAS and Three Bays work

together to ensure that humans and nesting shorebirds can both utilize the island. Dogs are not allowed anywhere on the island, and visitors must be a member of either Mass Audubon or Three Bays membership to visit DNSI.

## **Methods**

During the 2006 field season, two full-time seasonal field assistants, Lindsay Adrean and Pam Loring, and one part-time field assistant, Tyler Maikath, were assigned to monitor and manage Piping Plovers, Least Terns, Common Terns and other breeding birds at the site. In addition, staff provided educational programs and informal outreach to visitors at DNSI. Monitoring began in late April and continued through late August. DNSI was visited on all days, weather permitting, from April 21<sup>st</sup> to September 6. During this time, the CWP staff recorded breeding information for all coastal waterbirds observed on DNSI.

Symbolic fencing, constructed with orange baling twine strung between signs mounted on wooden stakes, was first erected on April 21<sup>st</sup> with assistance from Americorps and was continually monitored and moved in response to changing location of breeding birds. The fence ran the southern length of the DNSI beach on Nantucket Sound, and also encircled three dredge spoils located on both the eastern and western end of the island. The purpose of the fence is to prevent disturbance to the nesting habitat and/or on birds by human foot traffic. Signs were mostly yellow, with white and green “no dogs” signs in some areas. Nails were put into the tops of wooden stakes in order to prevent perching. Posts were numbered in order to allow staff to relocate and identify nesting pairs of plovers and terns.

### *Piping Plovers*

Daily monitoring of the Island for Piping Plovers began on April 12, when a total of 10 territorial pairs were identified. Pairs were identified and followed throughout the remainder of the season for any signs of breeding activity.

DNSI was checked daily unless weather prevented site access. Pair identification (last week in April), nest searching (last week in April to first week in July), brood monitoring (last week in May through August) was only conducted on days where weather was appropriate. Piping Plovers were not disturbed during poor weather conditions, including wet weather (any time water collected on glasses and/or clothing), light to heavy rain, temperatures < 55° Fahrenheit

(cold weather) or  $>85^{\circ}$  Fahrenheit (high heat), winds  $> 20$  mph winds (i.e. sand blowing across the beach near the adult, nest site, or brood), or recent extended disturbance.

Individual Piping Plovers were followed daily until observation of courtship activity (i.e. scraping, courtship tracks). Once a Piping Plover nest was located, a GPS location was taken and various data were collected regarding nest site characteristics. All Piping Plover nest attempts were monitored daily for hatching success. After hatching, broods were also observed until chicks reached a fledging age of 26 days, or until becoming capable of sustained flight  $\geq 50$ ft. The annual Piping Plover census was conducted on DNSI on June 6, in which a total of 21 pairs were documented. On July 8 an enclosure was erected around nest 10c. Enclosures are constructed using a 10' diameter metal 2"x4" mesh cage with a top made of bird netting. These enclosures have been designed to allow Piping Plovers and their chicks to move in and out freely while preventing mammalian and avian predators from entering. Nest 10c was the only nest on DNSI this season that met all the requirements necessary to erect an enclosure; the great majority of nests were located close to the tide line, a steep embankment, or within dense grassy areas and near tern nests.

#### *Least Terns and Common Terns*

For the third season since 2004, electric fence was erected around the Sampsons Island dredge deposits, encircling the Least Tern colony. The electric fence ran off of a battery that was charged with a solar panel. The charge was monitored daily with a voltage meter.

Least and Common Tern chicks are more difficult to monitor due to their mobility and use of vegetation for cover. Least Terns are also very sensitive to disturbance. For these reasons staff monitored tern species with adult high counts and dusk fledgling counts.

#### *Least Tern Foraging Study*

Brant (Robert) Jones, a graduate student at Antioch University, conducted a Least Tern Foraging Study in the Sampsons Island colony. Two plywood blinds were erected on the dredge spoil before the arrival of nesting terns to facilitate observation of the colony throughout the breeding season. Three hour observation stints (between 7-10am, 12-3 pm, or 5-8 pm) were completed by Brant with the help of Lindsay and Pam. During these stints the fish brought to the colony were identified and recorded. Feeding observations from blinds took place beginning with arrival of Least Terns at the colonies (courtship feedings) and continued throughout the season (chick

provisioning). Up to five pairs of courting or incubating adults were monitored at a time from a blind with use of binoculars, and nests observed were categorized as being within 10 m or outside 10 m to account for possible differences in detection of prey based on distance from the blind. Upon chick hatching, observations included prey deliveries to incubating adults and to any chicks present and visible. These observations were only possible during the first three or four days after hatching, at which point, chicks left the nest. Observations still occurred after this point; however, only one set of mobile chicks were monitored at a time. Observations continued with one chick or brood of chicks, until they are no longer visible, at which point another brood was watched. Observations continued with fledglings that were no longer hiding in vegetation. During each observation stint, prey species, size of prey in relation to adult bill length, result of fish provisioning (dropped, consumed by adult, consumed by chick, consumed by self), and time of provisioning were recorded. The colony was monitored for at least 12 hours weekly.

In addition to these stints, boat surveys were conducted to determine where the Least Terns are foraging. Foraging surveys were also conducted at each study site. Set observation points ranging in distance from the colony were visited within a six-hour time frame mid-day. The observation points, roughly 0.6 km from each other, were along the shoreline and all within 5 km of the colony. At each observation point, Least Terns observed during a one-minute stint were recorded as foraging, traveling or loafing. Surveys were conducted in the morning and time of observation was recorded to ensure tide data could be used during analysis. Observations were conducted on calm days, with seas no greater than 2 feet to ensure consistency in conditions and safety for observers. Observations were conducted roughly six times monthly at each of the two study sites (Osterville/Cotuit and Barnstable off Sandy Neck).

## **Results**

### *Piping Plovers*

During the past two years, Dead Neck/Sampsons Island has stood out as one of the most densely populated sites monitored by the Coastal Waterbird Program (and likely on the Atlantic Coast). The total number of nesting pairs of Piping Plovers on the island has increased from 1-3 pairs in 1986 to a high of 26 pairs in 2006. Plovers were first observed foraging and scraping on DNSI on April 12 this year. The first nest was found on April 27; however the first hatch did not occur until June 2. During the 2006 breeding season, CWP staff identified 26 pairs of Piping Plovers and located 43 nests on Dead Neck/Sampsons Island. The total number of eggs laid was 140, and 29% of those eggs hatched, yielding 41 chicks. Of those chicks, 20 survived at least 26 days

to fledge, when they are considered “recruited” into the Piping Plover population. Overall productivity was low at 0.77 chicks fledged per pair (Table 1, Figures 1 and 2). Productivity was largely influenced by high mammalian predation on nests.

Eastern coyote tracks were seen for the first time on April 25. Staff observed coyote tracks several times each week for the entire nesting season. A single set of these tracks was regularly seen down the entire front beach just below the vegetation line, as well as leading up to, and off of, the dredge spoil areas. The composition of dredge material makes tracking difficult, but there is no doubt that at a coyote was patrolling those areas. This is the predator that staff believed to have been the cause of at least 14 nest losses. Of those nests, 11 were located on the front beach, and 3 were located on a dredge spoil.

On the Sampsons Island dredge there were 3 Piping Plover nests located within the electric fence. All three nests were full 4 egg clutches and each nest hatched at least 2 eggs, for a total of 8 hatchlings. Two chicks from these nests survived to fledge. On the Dead Neck dredge, where there was no electric fence, 3 pairs of Piping Plovers laid 6 nests with a total of 21 eggs. One nest hatched 3 eggs before the brood and remaining egg disappeared. Three of the remaining 5 nests were lost to predation by Eastern coyote. Staff could not definitively determine the cause of egg loss for the other two nests.

Abandonment was observed twice during the breeding season. In both cases the nest was abandoned at one egg and the pairs re-nested within the same territory. Eastern coyote tracks were regularly seen near both of these abandoned nests, but the actual cause of abandonment is not known.

Only one enclosure was erected this season. This was placed around nest 10c which was located on the Sampsons end of the island, on the sound side beach. This was a 3-egg clutch. All three eggs hatched on July 16, 2006, and 2 chicks survived to fledge on August 13. Both adults attended to the nest, and subsequent brood, until August 20. After this date only one adult was observed with the chicks until they fledged.

The 2006 season was the first season that a banded Piping Plover was observed on Dead Neck/Sampsons Island. This bird had a red band on the left leg and an orange band on the right. Staff later discovered that researchers with Virginia Tech had banded the bird as part of a

wintering study at Oregon Inlet in North Carolina during 2005-2006. The bird was a male (named Sid by the original banders at Virginia Tech, and Hotlegs by our staff), was first observed at DNSI on April 27 and was identified as one adult of pair 01. This was also the day that the first nest attempt was located for pair 01. Nest 01a was laid on April 24 and was a 4-egg clutch. The nest was determined to be missing due to unknown causes on May 21. The banded bird then moved 1.15 miles west, down the beach to the Sampsons end, and re-nested. Nest 01b was laid on May 28, contained 4 eggs, and was lost on June 11 to unknown causes. Hotlegs then moved 1.15 miles east down the beach and laid a third nest less than 5 feet away from the site of the first nest. Nest 01c was laid on June 19, observed with 3 eggs on June 22, and was lost to a coyote on June 26. The pair was last observed on DNSI on July 7, 2006.

### *Least and Common Terns*

Electric fence was once again erected on the Sampsons Island dredge spoil in early may to protect and encourage nesting by Least and Common Terns. Three Least Terns were first observed courting on the dredge spoil on May 17. The number of nesting pairs of Least Terns has continued to increase from 218 pairs in 2005 to 252 pairs in 2006. The majority of these nests were located within the electric fence. Numbers of Common Terns have also been on the rise from 16 pairs in 2005 to 24 pairs in 2006 (Table 2, Figures 3 and 4). The first nest was found on May 28. The majority of these nests were not in the electric fence and many were lost to the coyote. The annual Least and Common Tern census was conducted on June 21; a total of 252 pairs of Least Terns were counted on Sampsons Island, as well as a total of 24 Common Tern nests. During the tern census, a total of 17 depredated eggs were found, a number of the eggs were identified as being predated by a canine. Overall productivity of Least Terns was fair to poor due to coyote predation inside the fencing after a malfunction. Overall productivity of Common Terns was estimated to be 0. On the Dead Neck end of the Island, a total of 8 Least Tern pairs were observed, and this increased to 12 pairs by July 20. Productivity of Least Terns was poor. 1 Common Tern pair and nest was observed on June 5, however this nest was lost and the pair did not fledge any chicks.

The overall productivity of the nests within the electric fence was also low due to failure of the electric fence mid-season. The fence was taken down by staff just before forecasted strong winds. Coyote tracks were found in the colony when staff returned to put the fence back in place, but the colony was still active. When the fence was re-erected one section lost electricity. The coyote found this section and jumped over the fence into the colony. The colony was

completely wiped out after this occurred and poor productivity was the result. The highest fledgling count recorded was 18 Least Tern fledglings loafing on the north side of the island at 5:30 pm on July 24<sup>th</sup>.

Dead Neck productivity was also low this year. Numbers of both Least Terns and Common Terns on Dead Neck have been in decline since 2002. There were 282 Least Terns in 2002. Least Terns hit a new low of 12 pairs in 2006. Common Terns hit a high of 203 pairs in 2002 and were at a low of 1 pair in 2006. Staff did not observe any chicks or fledglings of either species at this end of the island. Coyote tracks were regularly seen leading up to this dredge spoil and several Piping Plover nests were lost to coyote predation. After this occurred, staff solely monitored Least Tern nests by counting the number of incubating adults by using a spotting scope outside of the nesting area to avoid leaving a scent for the coyote to follow. On July 19 a high count of 12 incubating Least Terns was recorded on the Dead Neck dredge spoil. The high count of 45 adults was also recorded on that date.

Preliminary results of the Least Tern feeding study and boat-based foraging surveys are included in Appendix II.

### **Recommendations**

The monitoring of nesting shorebirds on Dead Neck/Sampsons Island requires that at least two full time Coastal Waterbird staff, and one part-time staff, are assigned to the island. During the 2006 season, two Cape Cod Academy seniors completed internships during the month of May, and one additional staff member, Tyler Maikath, assisted on the island about 3-4 days/week, in addition to help from Brant Jones, tern foraging researcher.

The Dead Neck dredge spoil is becoming less suitable for Least Terns and Piping Plovers due to encroaching vegetation. New dredging projects will likely enhance and restore this habitat. Should coyote(s) continue to patrol the island in the future, installation of electric fence on the Dead Neck dredge spoil would be advisable. With funding from MA Landowner's Incentive Program, electric fencing is planned for the Dead Neck end in 2008.

Only one Piping Plover nest was suitable for enclosure this year, but staff should continue to consider this method to help protect nests from predation in the future. Use of enclosures requires careful assessment of site characteristics and suitability for enclosure use as well as

daily monitoring for signs of predator attraction, adult mortality or abandonment after exclosures are installed. In future seasons, more exclosures should be used if possible to prevent coyote predation.

The electric fence was able to keep the coyote out of the tern colony when it was functioning correctly, however as predators become accustomed to management tools, it is important to try new methods. An electric fence training session is a requirement for every staff member at the beginning of the season and the entire perimeter of the fence must be checked daily for interference in the electricity current. A mammal biologist for the State of Massachusetts recommended that taller fence be utilized to prevent coyote from jumping over, although availability of taller fencing is not certain. The Common Terns may benefit from a section of electric fence pulled out from the dredge spoil to the vegetation line on the front beach. This was the area where most of the Common Tern nests were found this year, however they were outside of the electric fence and not well protected.

The staff of Three Bays Preservation were extremely helpful in educating the public about the birds and the rules of the island. The CWP staff should keep Three Bays updated on the progress of the birds with daily email reports to Judy Heller.

There were no Roseate Terns observed breeding on DNSI this year, however Roseates were observed on Sampsons early and late in the season (roosting on floating aquaculture bags nearby), and occasionally one would be observed in flight nearshore throughout the season. Staff should be prepared for their arrival and spot individually color-banded birds using a scope if possible.

### **Future Research**

Very little is known about Least Tern diet on the Atlantic Coast; the tern foraging study will be extended for at least three years, and expanded to include at least two other sites (Tern Island, Chatham, Grays Beach, Yarmouth, and Allens Pond, Dartmouth). Dead Neck Sampsons Island is an ideal place to conduct long-term research on habitat restoration and beach nesting bird management tools. The CWP will be working with a PhD student at Tufts University next summer who will be conducting additional tern foraging studies, and is very interested in habitat restoration studies as related to renourishment and tern population restoration. Use of electric fencing around both ends of the island is likely to enhance productivity of nesting terns;

increased monitoring of predators (especially nocturnal) would be facilitated with a remote camera system that is being tried this year on another site (Tern Island, Chatham).

### **Acknowledgements**

The Coastal Waterbird Program at Mass Audubon owes a number of people a debt of gratitude for the 2006 field season; without the help of all those involved, we could not manage Dead Neck Sampsons Island successfully for coastal waterbirds. We would like to thank Three Bays Preservation for providing funding for our important work on Dead Neck/Sampsons Island, particularly Lindsey Counsell and Judy Heller. The staff of Three Bays also deserves a thank you for all of their help with managing the island this summer, conducting tern surveys, and spreading the word about the interpretive programs. We would also like to thank the Landowner Incentive Program of Massachusetts for providing a second year of funding for Sampsons Island electric fencing and restoration efforts. In addition, we received important start-up funding through Charles Blake Fund of the Nuttall Ornithology Club to aide Brant Jones in the preliminary research and design of his study. Brant Jones and Dr. Jon Atwood of Antioch worked with the CWP to begin the first Least Tern foraging research program in Massachusetts and in the New England. Mrs. Kay Crawford provided an incredible service to Mass Audubon and the birds of Dead Neck Sampsons Island by housing Brant Jones for the duration of his field work, allowing CWP staff to moor the boat in the area in front of her property, store a dinghy on beach, and park cars at her property during field work hours. Harry Holloway provided boat maintenance and much needed advice and support regarding the Boston Whaler, as he has done for many years. AmeriCorps provided staff to help erect symbolic and electric fencing. Bill Babcock provided the fee needed for the mooring permit in the Town of Barnstable. Mark Renkawitz built blinds for the CWP that were put up on the Island. The Barnstable Waterways Commission allowed Mass Audubon to obtain a mooring in the Cotuit area, and Assistant Harbormaster Joe Gibbs was of great assistance in securing that mooring. Jeremy King and Vincent Manfredi of the Massachusetts Division of Marine Fisheries provided important information regarding juvenile fish identification and distribution in the Three Bays area for the Least Tern foraging study, and provided samples for the tern foraging program.

## Appendix I. Piping Plover and Tern nesting summaries.

**Table 1.** Piping Plover nesting summary for Dead Neck/Sampsons Island in 2006.

Pairs are numbered chronologically according to the date the nest was found.

*Nests designated with “a”, “b”, or “c” indicate first, second, and third nest attempts.*

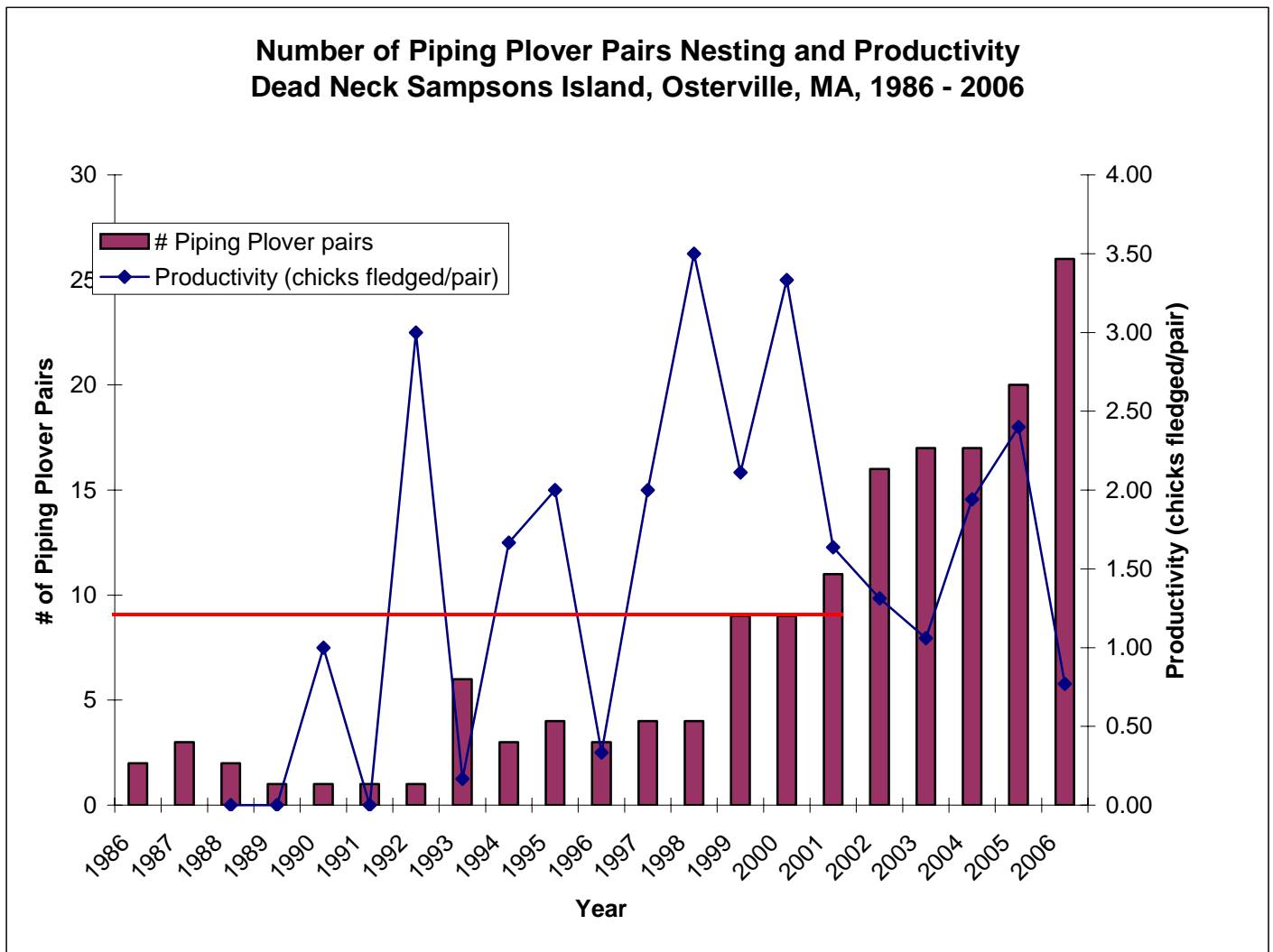
*DS indicates a nest located on top of a dredge spoil area.*

*EF indicates a nest located within electric fence.*

Site	Pair #	Nest ID	Cause of nest loss/failure	# eggs laid	# eggs hatched	# chicks fledged	GPS Location	
							Latitude	Longitude
DN	1	01a	Tidal overwash	4	0	-	N 41.60773	W 70.41010
SI	1	01b	Unknown	4	0	-	N 41.60708	W 70.43278
DN	1	01c	Predation	3	0	-	N 41.60773	W 70.41039
DN	2	02a		4	3	3	N 41.60635	W 70.42095
DN	3	03a		4	3	3	N 41.60634	W 70.42046
SI	4	04a DS/EF	Unknown	4	2	0	N 41.60641	W 70.43103
DN	5	05a DS	Unknown	4	3	0	N 41.60760	W 70.40414
DN	6	06a DS		4	4	4	N 41.60781	W 70.40849
SI	7	07a	Unknown	4	0	-	N 41.60704	W 70.43231
SI	7	07b	Unknown	4	0	-	N 41.60683	W 70.43227
SI	7	07c	Unknown	1	0	-	N 41.60695	W 70.43240
DN	8	08a		4	4	1	N 41.60768	W 70.41240
DN	9	09a	Tidal overwash	1	0	-	N 41.60738	W 70.41367
DN	9	09b	Unknown	4	0	-	N 41.60704	W 70.43236
DN	9	09c	Predation	4	0	-	N 41.60693	W 70.41570
SI	10	10a	Predation	4	0	-	N 41.60769	W 70.43330
SI	10	10b	Unknown	1	0	-	N 41.60769	W 70.43330
SI	10	10c		3	3	2	N 41.60804	W 70.43379
SI	11	11a	Abandoned	1	0	-	N 41.60663	W 70.43202
SI	11	11b	Unknown	4	0	-	N 41.60670	W 70.43204
SI	12	12a DS/EF		4	3	2	N 41.60660	W 70.43150
SI	13	13a		4	4	1	N 41.60558	W 70.42953
DN	14	14a	Unknown	4	0	-	N 41.60745	W 70.40516
DN	14	14b	Unknown	4	0	-	N	W
DN	15	15a	Abandoned	1	0	-	N 41.60661	W 70.41856
DN	15	15b	Predation	3	0	-	N 41.60655	W 70.41889
DN	16	16a DS	Unknown	4	0	-	N 41.60780	W 70.40381
DN	16	16b DS	Predation	4	0	-	N 41.60760	W 70.40414
SI	17	17a DS/EF		4	3	0	N 41.60727	W 70.43183
DN	18	18a		4	3	2	N 41.60558	W 70.42371
DN	19	19a	Predation	4	0	-	N 41.60766	W 70.41107
DN	19	19b	Predation	1	0	-	N 41.60771	W 70.41095
DN	20	20a DS		4	4	2	N 41.60794	W 70.40924
DN	21	22a DS	Unknown	4	0	-	N 41.60749	W 70.40292
DN	21	22b DS	Predation	2	0	-	N 41.60749	W 70.40292
DN	21	22c DS	Predation	3	0	-	N 41.60741	W 70.40250
SI	22	24a	Predation	4	0	-	N 41.60816	W 70.43375
SI	22	24b	Predation	3	0	-	N 41.60839	W 70.43388
DN	23	25a	Unknown	4	2	0	N 41.60699	W 70.41619
SI	24	26a	Predation	1	0	-	N 41.60618	W 70.43694
SI	24	26b	Unknown	4	0	-	N 41.60579	W 70.43013
SI	25	27a	Predation	3	0	-	N 41.60806	W 70.43379
DN	26	28a	Predation	4	0	-	N 41.60693	W 70.41641
<b>Total</b>	<b>26</b>	<b>43</b>	<b>33</b>	<b>140</b>	<b>41</b>	<b>20</b>		

**Figure 1. Map of Piping Plover nests on Dead Neck Sampsons Island, 2006.**

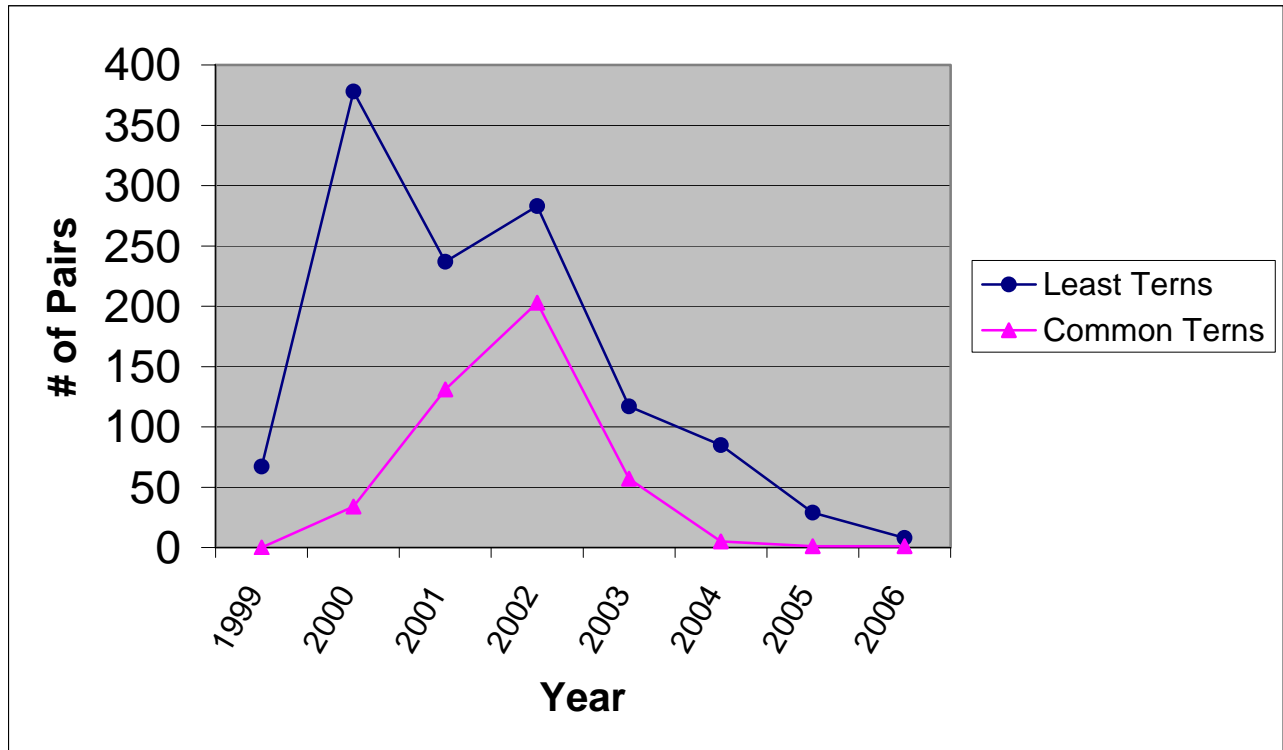
Figure 2. Long term population trends and productivity of Piping Plovers on Dead Neck Sampsons Island.



**Table 2.** Numbers of nesting Least Tern and Common Tern pairs and qualitative estimates of productivity (chicks fledged/pair) at Dead Neck/Sampsons Island, Osterville, MA, 1998-2006.  
*Productivity scale is excellent, good, average, poor, and very poor.*

Year	# Least Tern Pairs		# Common Tern Pairs		Total # Tern Pairs	Productivity Least Terns	Productivity Common Terns
	Dead Neck	Sampsons Island	Dead Neck	Sampsons Island			
1998		40		16	56	No data	No data
1999	67	20	0	0	87	Excellent	0
2000	378	5	34	15	432	Good	Good
2001	237	30	131	2	400	Good	Poor
2002	283	168	203	20	674	Average	Average
2003	117	126	57	2	302	Poor	Very Poor
2004	85	54	5	0	144	Very Poor	Very Poor
2005	29	218	1	16	264	Excellent	Poor
2006	8	252	1	24	285	Poor/Fair	Poor

**Figure 3.** Number of Nesting Pairs of Least and Common Terns nesting on Dead Neck end of Dead Neck/Sampsons Island, 1999-2006.



**Figure 4.** Number of nesting pairs of Least and Common Terns nesting on Sampsons end of Dead Neck/Sampsons Island, 1999-2006.

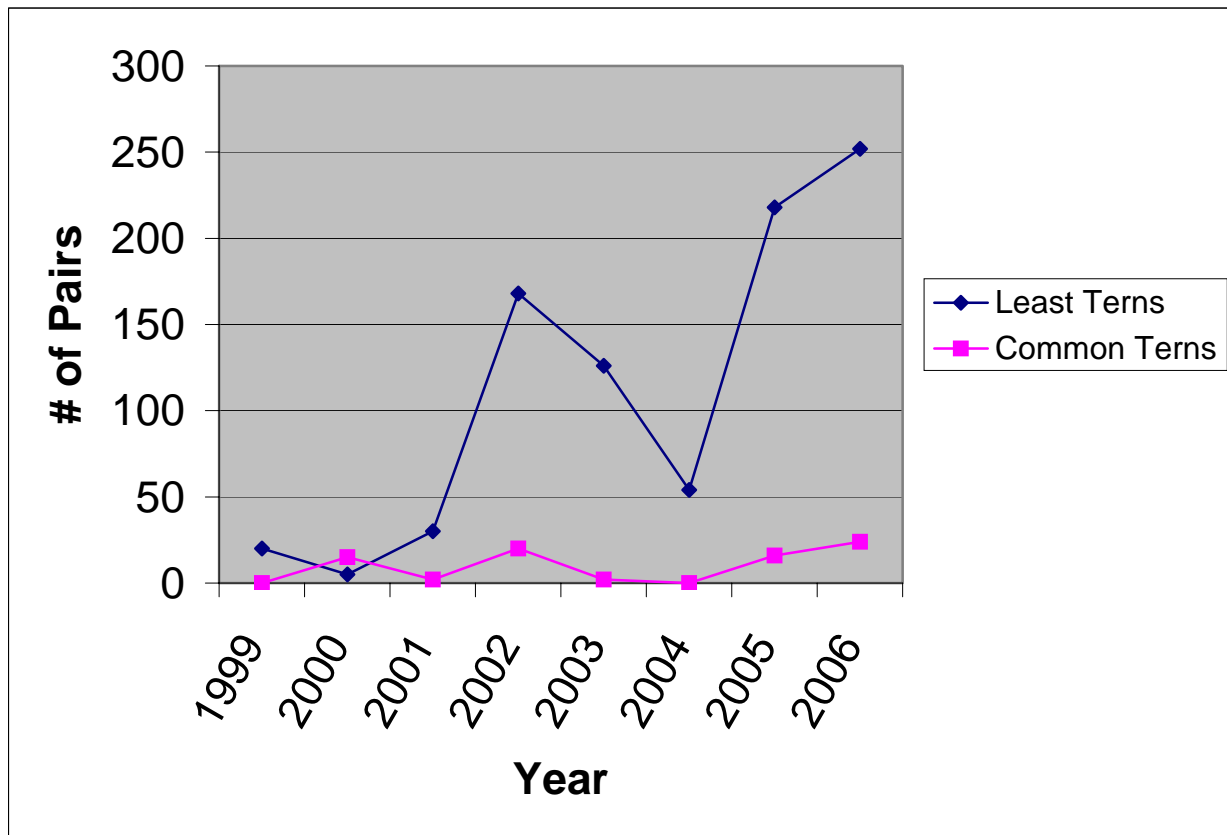
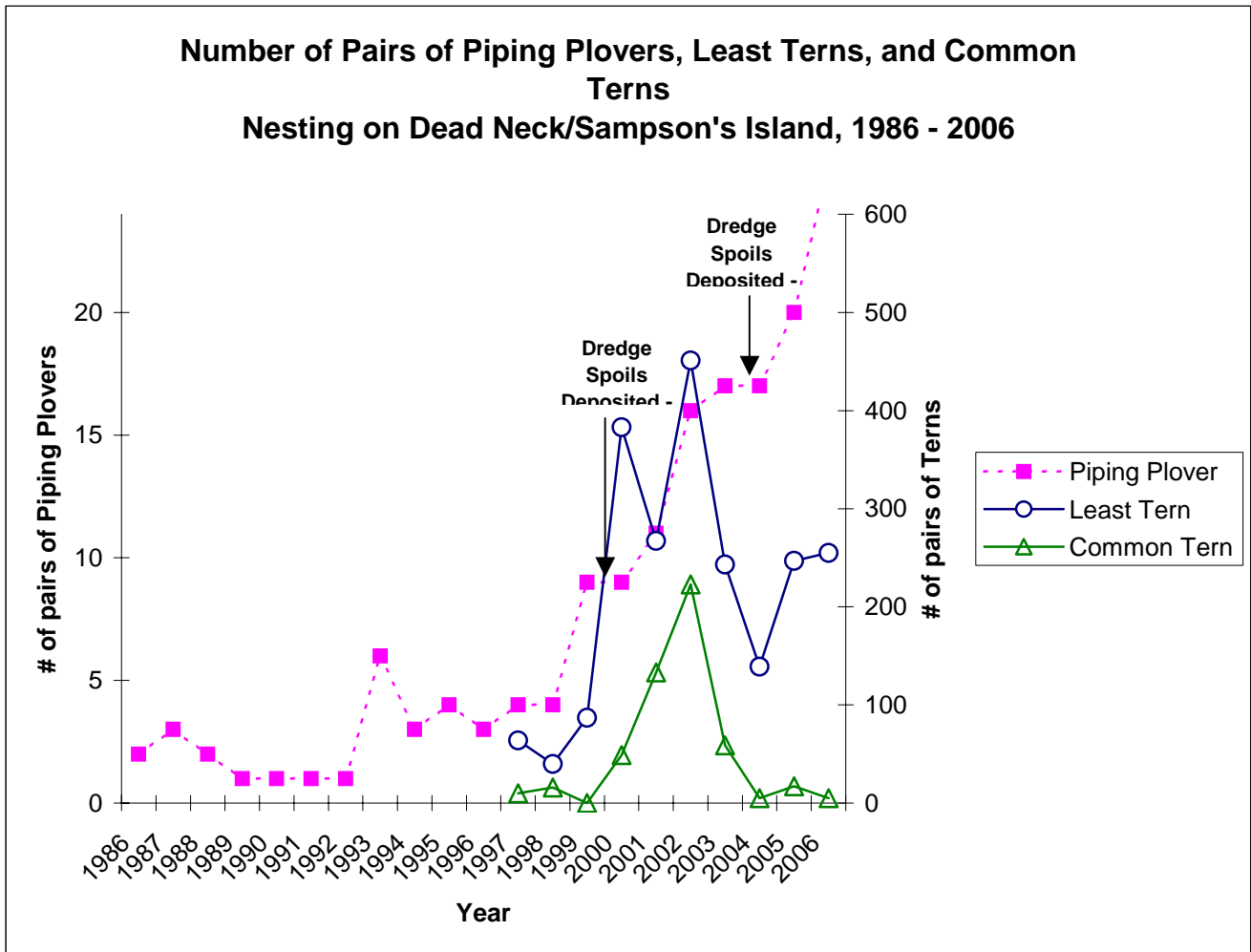


Figure 5. Long term trends in all beach nesting bird populations on Dead Neck Sampsons Island.



**Appendix II.** Preliminary results of Least Tern Foraging Study on Dead Neck Sampsons Island, 2006, Brant Jones.

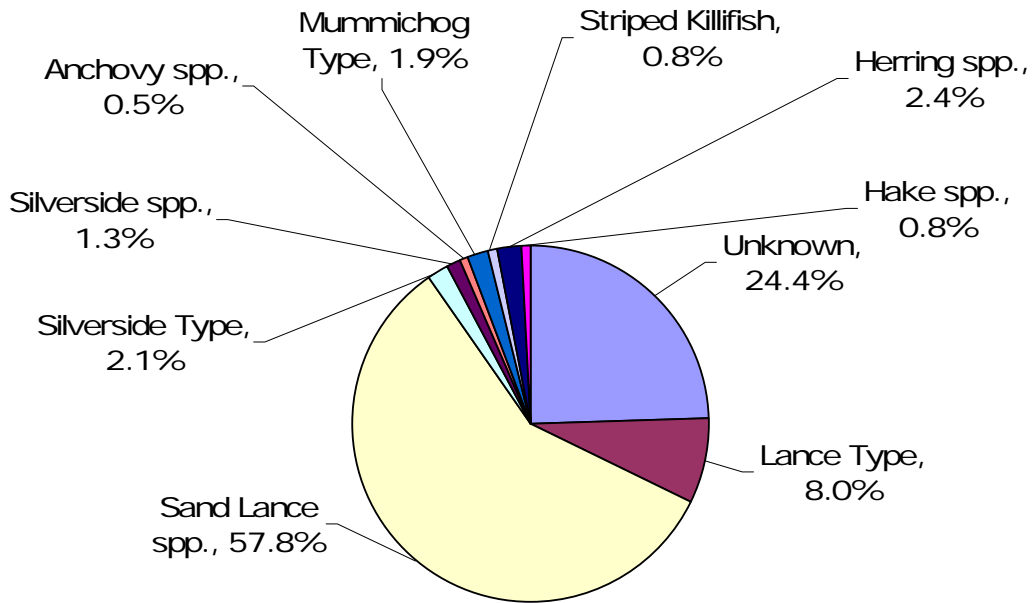
*Preliminary Results*

Feeding observations were conducted on 39 different nests at Sampsons Island. A total of 35 observation stints were conducted from June 4 through July 28. Chicks were watched during 13 of these stints. A total of 377 feedings were documented. Of these feedings, 298 were to incubating adults, and 79 were to chicks. Since Least Terns forage on small fish that are similar in appearance and not easily identified to species from afar, prey was identified to a pre-determined grouping or 'type'. Each type included several species. When possible, prey was identified to genus or species. Types observed were Lance, Herring, Hake, Mummichog, and Silverside. Lance type included: Northern Sand Lance (*Ammodytes dubius*), American Sand Lance (*Ammodytes hexapterus*), American Eel (*Anguilla rostrata*), and Northern Pipefish (*Sygnathus fuscus*). Herring Type included: Blueback Herring (*Alosa aestivalis*), Alewife (*Alosa pseudoharengus*), Atlantic Menhaden (*Brevoortia tyrannus*), and Atlantic Herring (*Clupea harengus*). Hake type included: Silver Hake (*Merluccius bilinearis*), Red Hake (*Urophycis chuss*), Spotted Hake (*Urophycis regia*), and White Hake (*Urophycis tenuis*). Mummichog type included: Sheepshead Minnow (*Cyprinidus variegatus*), Common Mummichog (*Fundulus heteroclitus*), Striped Killifish (*Fundulus majalis*), and Rainwater Killifish (*Lucania parva*). Silverside type included: Striped Anchovy (*Anchoa hepsetus*), Bay Anchovy (*Anchoa mitchilli*), Inland Silverside (*Menidia beryllina*), Atlantic Silverside (*Menidia menidia*), and Rainbow Smelt (*Osmerus mordax*). Other prey species are possible for this region, but these were the only prey observed at feedings during the observation stints.

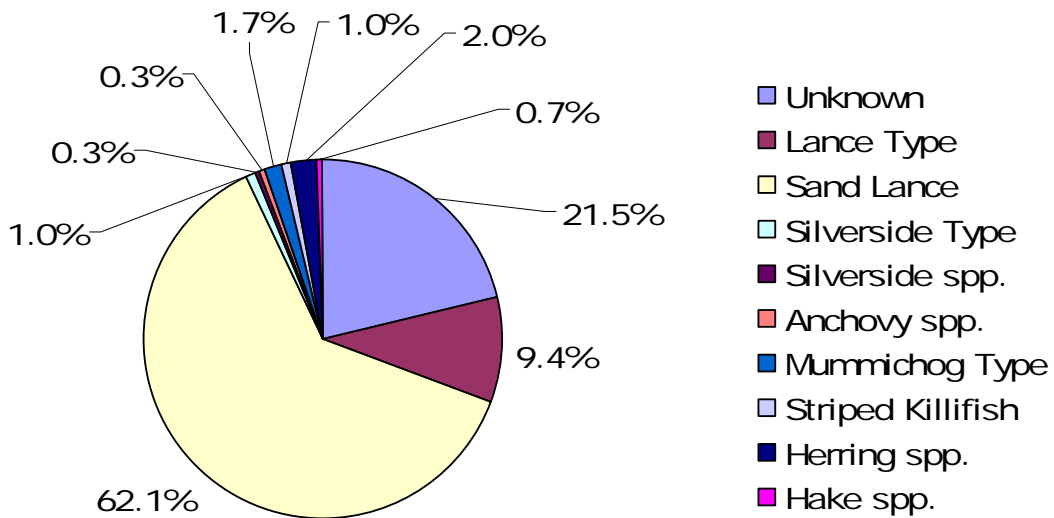
Sand Lance was the dominant prey throughout the study representing nearly 58% of the prey delivered to adults and chicks (Fig. 1). This number is likely even higher considering that prey identified to Lance Type was thought to be mostly Sand Lance. There was a notable difference in the percentage of Sand Lance delivered to chicks (41.8%, Fig. 3) as opposed to incubating adults (62.1%, Fig. 2). This may correlate to a temporal difference in prey delivered, but further analysis is necessary to make this claim. There also was an increase in percentage of Silverside type, Silverside species, and Herring species delivered to chicks (Figs. 2 and 3). An increase in herring deliveries to chicks may reflect high caloric and fat content of herring. Although Sand Lance continued to dominate the prey deliveries throughout the season, a few warm water fish species were observed delivered late in the season.

Other long-term tern foraging studies ongoing throughout the Gulf of Maine since the early 1990s indicate dramatic changes in fish species fed to chicks in recent years. On some sites, Common Terns are feeding their young up to 80% invertebrates; these results are indicative of declining and shifting fisheries stocks. Such studies point to the value of long-term tern foraging research. We hope to contribute to the understanding of tern diet, fisheries stocks, and potential influences of factors such as fishing practices and climate change on fisheries and tern productivity by expanding this research to Massachusetts Least Terns.

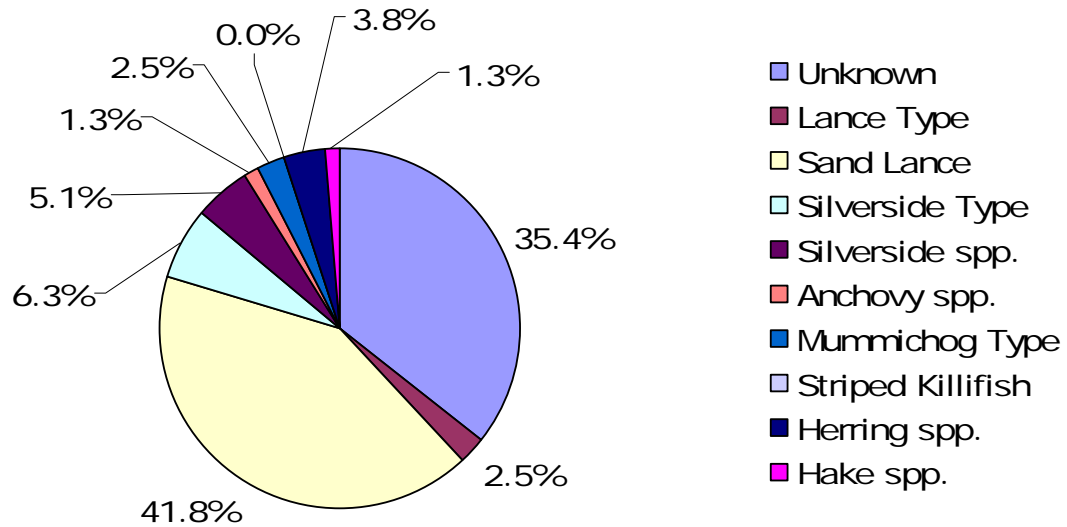
**Figure 1.** Prey observed during Least Tern incubating adult and chick feedings on Sampsons Island, n=377.



**Figure 2.** Prey observed during incubating adult Least Tern feedings at Sampsons Island, n=298.



**Figure 3.** Prey observed during Least Tern chick feedings at Sampsons Island, n=79.



Ten foraging surveys were conducted around each study site (Figs 4 and 5). No analysis has been conducted on these data at the time of this writing, but will be incorporated into a thesis (available by request upon completion). Surveys were conducted on the following days in Barnstable Harbor (Fig. 4): May 24, June 12, June 16, July 7, July 14, July 17, July 31, August 4, August 14, and August 18. Surveys were conducted on the following days for the waters surrounding Sampsons Island (Fig. 5): June 6, June 27, July 8, July 15, July 16, July 25, July 26, August 2, August 5, and August 9.

**Figure 4.** Survey route in waters surrounding Sandy Neck. Points in green were accessed by one observer in a kayak and points in blue via a separate observer in another kayak. The red line represents a circle of 10 km diameter.



**Figure 5.** Survey route in waters surrounding Sampsons Island. Points in green were accessed by an observer in a kayak and points in blue via another observer in a small motorboat. The red line represents a circle of 10 km in diameter.

