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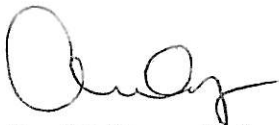
Ries Collier
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Dear Ries,

Enclosed please find the final report for the aquatic macro-invertebrate study funded by the Eastern National Park and Monument Association. As we discussed (last month ?) over the phone, I will be writing a short journal article, probably to **Wetlands**. Once that is complete, I will send you a copy, and that will be the final final report. As my time here grows somewhat short, I anticipate that manuscript will be done sometime in the next 1-2 months.

I appreciate the opportunity to have been able to work on this project, and I hope the results prove to be of some use to the Seashore.

Sincerely,

A handwritten signature in dark ink, appearing to read 'C. Andrew Cole', written in a cursive style.

C. Andrew Cole, Ph.D.

INTRODUCTION

Cape Hatteras National Seashore (CAHA) is located on the Outer Banks of North Carolina, extending over 75 miles from Bodie Island on the north through Ocracoke Island on the south. Eight villages are located within or adjacent to the Seashore.

Recent development adjacent to the Seashore has led to concerns over possible deterioration of surface and groundwater supplies within CAHA. Almost all local dwellings rely upon septic systems for wastewater treatment. Additionally, the Seashore is receiving urban storm runoff from streets, parking lots, driveways, etc. Several drainage ditches originate outside but course through Seashore boundaries on their ways to Roanoke and Pamlico sounds. The Seashore is further concerned, particularly in the Buxton Woods area, that increased pumping from local aquifers may impact significant freshwater wetlands.

Septic systems and associated drain fields possibly affect CAHA in two ways. Due to an extensive drainage system throughout Nags Head and CAHA, waters from Nags Head drain through CAHA, especially during storm events. These waters either drain through to Roanoke Sound or dissipate into the interior freshwater wetlands. Secondly, due to a high water table on Bodie Island and a very widespread recharge zone (essentially the entire island), the surface aquifer may accept and drain sewage waters from Nags Head through CAHA, thus directly affecting wetland resources on Bodie Island.

Buxton Woods lies partially within the boundaries of CAHA on Hatteras Island and is the largest remaining tract of maritime forest in North Carolina. Unique to Buxton Woods are several small wetlands, locally known as sedges. The largest of these areas is known as Jeannette Sedge. Buxton Woods is currently the object of some controversy due to actual and planned development on or near the site. CAHA owns approximately one-third of nearly 2000 acres, leaving a large proportion of Buxton Woods in private or state ownership. Although the State of North Carolina is currently engaged in purchasing certain areas of the Woods, most is still privately owned and under developmental pressure. Recent development along the CAHA boundary of Buxton Woods has led to concern for current and future water levels and water quality within that section of the Seashore. This is especially true in light of the expected surge in housing development and attendant septic systems and drainfields.

Although the National Seashore is currently conducting preliminary water quality research in order to ascertain possible impacts from adjacent development, additional, biological information was also deemed necessary. Thus a survey of the aquatic and semi-aquatic invertebrates within the Seashore was begun.

Invertebrates are well known as general indicators of water quality (Wilhm 1970; Armitage 1983). Waters within CAHA are currently threatened by development of resort areas within, and adjacent to, the Seashore itself (Aquatic Advisory Team 1986). Potential pollution problems range from septic pollution from overloaded soil capacities, to saltwater intrusion into the freshwater lens on the barrier islands. Preliminary data (Cole 1990) show that CAHA surface waters are at least mildly degraded, in some instances several kilometers from any obvious source of pollution. This survey was designed to provide an initial analysis of the composition of the invertebrate community and provide some sense as to biological impacts from development.

Objectives:

1. Provide baseline data on aquatic and semi-aquatic organisms in water bodies and marshes within CAHA.
2. Quantify invertebrate species diversity as a possible indicator of water quality within the Seashore.

METHODS

Invertebrate sampling occurred quarterly (June, October, and December) during 1990. Sampling was undertaken at 3 marsh sites on Bodie Island already established as long-term water quality monitoring locations (Cole 1990). Four such sites were also located within Buxton Woods, in the southern reaches of the park. At each site, surface and water column macro-invertebrates were sampled with a sweep net, passed 2 to 3 times through the water column and any vegetation at the edge of the water. Samples were preserved in 70% ETOH. Invertebrates were identified to the lowest taxon possible; however, at times this was no better than order. Identification was limited by the resolving power of the stereoscope. Keys to orders, genera and species included Merritt and Cummins (1984) and Pennak (1989).

RESULTS

The general distribution of invertebrate taxa is shown in Table 1. This survey found 4 Classes (Mollusca, Annelida, Crustacea, and Insecta) with the predominance of taxa located within Insecta. Snails were found at all locations, and at each date, except for the Water Plant wetland. This was the most ubiquitous group. Fingernail clams were found only within the Buxton Woods wetlands, while freshwater shrimp were only found around blinds 9 and 3 on Bodie Island. The most diverse group were the beetles (Coleoptera) as seven families and nine genera were identified. Interestingly, beetles were fairly common on Bodie

Island in June, but less so in December. Just the opposite pattern was seen in the Buxton Woods wetlands.

Species diversity was low in all wetland sites (Table 2) primarily due to low numbers of taxa in October and December on Bodie Island, and missing data for October in Buxton woods. The only site within Buxton Woods which declined significantly in number of taxa between June and December was the Water Plant wetland. Overall species richness for Bodie Island and Buxton Woods was similar, with 27 taxa found on Bodie Island and 26 in Buxton Woods.

DISCUSSION

There appears to be no real cause for concern for the invertebrate populations of the marshes and wetlands within the Cape Hatteras National Seashore. However, as no samples were collected within the drainage ditches coming from Nags Head, no close assessment of that impact can be made. Also, no attempt was made to determine numbers of each taxa, nor productivity. Thus instances of single individuals of one species show up as important as large quantities of other species.

The Seashore should be satisfied that large number of snails and somewhat smaller numbers of freshwater clams are widespread. These two taxa provide an important source of food for breeding waterfowl. I do note, however, that no clams were seen in sites 1-3, those areas on Bodie Island. This may have something to do with the water quality, as salinities are typically higher on Bodie Island than in Buxton Woods (Cole 1990). Bodie Island is a more important waterfowl area than Buxton Woods, such that lack of clams may in some way impair production. However, enough other invertebrate taxa were present to make this problem unlikely at best.

Very little diversity was seen on Bodie Island in October and December. This pattern was also seen in Buxton Woods, to some extent, although beetles comprised a significant number of taxa in the fall. This may simply reflect a normal seasonality in invertebrate production and natural history. However, it does reflect a diminution of the food resource at the very time wintering waterfowl are on site.

As an indicator of water quality, the macro-invertebrate population of CAHA appears healthy and reasonably diverse. At this point in time, there appears to be no deleterious impact upon invertebrates from the moderate septic impact from the town of Nags Head on Bodie island, or from development adjacent to Buxton Woods. Such impacts are only likely to be visible through time and could even be underway. This study only provides a "snapshot" in time, with no way to compare with what invertebrate populations may have been some years in the past.

LITERATURE CITED

- Aquatic Advisory Team. 1986. Final report. Cape Hatteras National Seashore, North Carolina. 2-3 March 1986. CPSU Tech. Rep. 24, Coop. Park Studies Unit, Inst. Ecol., Univ. Georgia, Athens. 13 pp.
- Armitage, P.D., D. Moss, J.F. Wright, and M.T. Furse. 1983. The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. Water Res. 17:333-347.
- Cole, C.A. 1990. Surface water quality, Cape Hatteras National Seashore, North Carolina: Annual report. National Park Service, Manteo, NC. 22 pp.
- Merritt, R.W., and K.W. Cummins. 1984. An introduction to the aquatic insects of North America. Kendall/Hunt Publ. Co., Dubuque, IA. 722 pp.
- Pennak, R.W. 1989. Fresh-water invertebrates of the United States. Protozoa to Mollusca. John Wiley and sons, Inc., New York, NY. 628 pp.
- Smith, R.L. 1980. Ecology and field biology. Harper and Row, New York, NY. 835 pp.
- Wilhm, J.L. 1970. Range of diversity index in benthic macroinvertebrate populations. J. Water Poll. Control Fed. 42:221-224.

Table 1. Aquatic and semi-aquatic macro-invertebrates from the freshwater and brackish wetlands of the Cape Hatteras National Seashore. Site numbers 1-3 are all on Bodie Island and refer to Bodie Island Lighthouse (1), Blind 9 (2), and Blind 3 (3). Sites located within Buxton Woods include the Nature Trail (4), Open Pond (5), Round Pond (6), and the Water Plant (7). Under each site number, June sightings are indicated by a 1, October sightings by a 2, and December by a 3. Due to a complete lack of water within Buxton Woods, no data were collected there in October.

Taxa	Site						
	1	2	3	4	5	6	7
Mollusca							
Gastropoda	1, 2, 3	1, 2	1, 2, 3	1, 3	1, 3	1, 3	
Pelecypoda							
Pisidiidae				1, 3	1, 3	1, 3	1
Annelida							
Hirudinea							
Glossiphoniidae							
<u>Helobdella</u>				1			
Crustacea							
Amphipoda							
Gammaridae							
<u>Gammarus</u>	1						
Talitridae							
<u>Hyaletella azteca</u>					1	1	1
Decapoda							
Palaemonidae							
<u>Palaemonetes paludosus</u>		1, 2, 3	2, 3				

Table 1. Continued.

Taxa	Site						
	1	2	3	4	5	6	7
Diptera	3	3			3		1
Ceratopogonidae					1		1
Chironomidae	1	1,3		1		1	1
Culicidae	3		1	1		1	
<u>Anopheles</u>							
Dolichopodidae						3	
Sciomyzidae				3			
Stratiomyidae							
<u>Odontomyia</u>	1						
<u>Stratiomys</u>			1				
Megaloptera							
Corydalidae		1					
<u>Nigronia</u>							
Ephemeroptera					1		
Baetidae							
Trichoptera							
Polycentropodidae			1				
Leptoceridae							
<u>Leptocercis</u>						1	1
<u>Oecetis</u>	1		1				

Table 1. Continued.

Taxa	Site						
	1	2	3	4	5	6	7
Odonata							
Anisoptera							
Libellulidae	2		1				
<u>Sympetrum</u>							
<u>Erythrodiplax</u>		1					
Zygoptera							
Coenagrionidae	1		1				
Lestidae							
<u>Lestes</u>	3				1	1	
Hemiptera							
Belastomatidae				1			
<u>Belastoma</u>					1		
Corixidae							
<u>Hesperocorixa</u>	2, 3	3	1, 2				
<u>Sigara</u>	1						
Gelastocoridae							
<u>Gelastocoris</u>	1		1				
<u>Nerthra</u>		1		3	1, 3		
Gerridae							
<u>Limnoporus</u>		1	1				
Naucoridae							
<u>Pelocoris</u>	1						

Table 1. Continued.

Taxa	site						
	1	2	3	4	5	6	7
Coleoptera							
Carabidae							
Elmidae							
<u>Dubiraphia</u>				3		3	1
Halipilidae							
<u>Halipilus</u>	1						
<u>Peltodytes</u>		1		1,3	1	3	
Heteroceridae					1,3	3	
Hydrophilidae							
<u>Berosus</u>				3			
<u>Enochrus</u>							1
<u>Laccobius</u>	1		1,3	1,3		3	1
<u>Tropisternus</u>	1				1,3	1,3	3,1
Noteridae							
<u>Hydrocanthus</u>		1	1				
Staphylinidae							
<u>Stenus</u>						3	

Table 2. Macro-invertebrate species diversity patterns for the sample sites on Bodie island and in Buxton Woods.

Taxonomic Richness: Bodie Island n=27
 Buxton Woods n=26

Site	Month		
	June	October	December
1	12 ^a	3	5
2	9	2	3
3	12	3	3
4	8	b	8
5	11		8
6	8		10
7	9		2

^a Values are number of taxa located within a site. The lowest possible taxon was used, thus forcing a conservative estimate for taxonomic richness. This meant that Order was given the same weight as species.

^b No data were collected for the four Buxton Woods sites in October due to a lack of water.