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Autumn Migration of Northern Saw-whet Owls on the Lower Delmarva Peninsula 1994-1998
Project Report 1998

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The Center for Conservation Biology is a not-for-profit organization dedicated to finding practical solutions to current environmental problems by integrating research, education and management. Only through the exchange of information and ideas may we hope to maintain the rich diversity of the mid-Atlantic region.

INTRODUCTION

In eastern North America, Northern Saw-whet Owls (*Aegolius acadicus*) breed primarily in the forests of Canada and the northern United States (Cannings 1993). Some scattered breeding locations occur in the mountains of Maryland, Virginia, West Virginia, Tennessee and North Carolina (Am. Ornithol. Union 1983, Smith et al. 1988). Although Saw-whet Owls are resident year-round throughout much of the breeding range, some populations migrate to wintering areas at lower latitudes (Mueller and Berger 1967a, Holroyd and Woods 1975, Weir et al. 1980). The winter range of most northeastern populations is believed to be in the east-central United States, but the limits of this range are uncertain (Cannings 1993). Sporadic winter records of this species exist for all southeastern states including Florida (Holroyd and Woods 1975, Miller and Loftin 1984, Smith et al. 1988).

The Atlantic Coastal Plain may serve as a Saw-whet Owl migration route extending from Nova Scotia to the southeast (Holroyd and Woods 1975). Duffy and Kerlinger (1992) demonstrated that substantial numbers of Saw-whet Owls migrate at least as far south as Cape May, New Jersey every year. Beginning in 1991, Saw-whet Owls have also been banded each fall at several locations in Maryland including Assateague Island National Seashore (Brinker et al. 1997). Despite evidence that Saw-whet Owls use the Atlantic Coast as a flyway to wintering areas, there are very few fall or winter records of this species in Virginia. The species is described as a rare winter visitor on Virginia's Coastal Plain (Kain 1987).

Each autumn huge numbers of migrating passerines, shorebirds and diurnal raptors are concentrated on the lower Delmarva Peninsula. It seems likely that the peninsula should also function as a migration bottleneck for Saw-whet Owls reluctant to cross the Chesapeake Bay. Since the nocturnal habits and secretive nature of this species make detection very difficult, an annual banding study was needed to document the occurrence of Saw-whet Owls on the lower Delmarva Peninsula.

The objectives of this onging study are to: 1) determine the magnitude of the autumn migration of Saw-whet Owls on the lower Delmarva Peninsula, 2) analyze the spatial dynamics of migration on the lower Delmarva Peninsula, 3) determine the seasonal timing of migration, and 4) investigate differences in the timing of migration between age classes.

METHODS

A banding study of fall migrating Northern Saw-whet Owls was conducted on the Eastern Shore of Virginia during the late fall of 1998. Owls were trapped at 3 stations located within a 10 km^2 area at the southern tip of the Delmarva Peninsula. Stations were located on the Eastern Shore of Virginia National Wildlife Refuge, Gatr Tract/Mockhorn Island Wildlife Management Area, and Kiptopeke State Park. Each station was wooded with a mixture of loblolly pine (*Pinus taeda*) and/or hardwoods (*Quercus* sp.) and contained moderate to dense understory vegetation.

A continuous line of 6 mist nets was erected along an east/west axis at each station. Mist nets were 12 m long by 2 m tall and were made of 61 mm, black nylon mesh. An electronic audio-lure was situated at the center of each net lane to attract

migrating owls. Audio-lures consisted of a cassette tape-player, amplifier and loud-speaker. A continuous broadcast of a Saw-whet "advertising call" was played (Cannings 1993). The effectiveness of audio-lures has been demonstrated by increased capture rates over passive trapping (i.e. trapping without an audio-lure) at other owl banding stations in the United States. Capture rates are increased 5 to 10 fold when an audio-lure is used (Erdman, *personal communication*).

The focus of owl banding during the 1998 migration season was the first 3 weeks of November. This period has been determined in previous years to be the peak migration window on the lower Delmarva Peninsula (Whalen et al. 1997). Banding operations began 1 November, 1998 and continued through 27 November, 1998. On each night, nets were opened and audio-lures were started at sunset. Nets were usually checked for owls in rounds occurring at 21:00, 24:00, 3:00, and dawn. An individual round involved driving to all 3 stations in the order in which they were opened and inspecting nets for captured owls. The order in which stations were opened was varied night to night. Captured owls were stored in holding boxes and taken to the College of William and Mary field station (located on the Eastern Shore of Virginia National Wildlife Refuge) for processing. All owls were later released at their original site of capture.

Owls were banded with U.S. Fish and Wildlife Service aluminum tarsal bands. Wing chord measurements were recorded to the nearest mm and mass was recorded to the nearest gm. Wings were inspected for evidence of molt to determine age according to criteria established by the U.S. Fish and Wildlife Service (Anonymous 1977). Saw-whet

Owls were aged as hatching year (HY) if all primary and secondary remiges and coverts appeared uniform in color or as after hatching year (AHY) if primary and secondary remiges were not uniform in color, indicating the presence of more than one generation of feathers.

RESULTS

Banding operations were conducted on 22 nights during the month of November, 1998. Total effort was 4,499 net-h (3 stations * 6 nets/station * hours of operation). Only 22 Northern Saw-whet Owls were captured resulting in a capture rate of 1.0 birds/trap-night or 0.5 birds/100 net-hours. Both the number of birds captured and the capture rate were the lowest recorded throughout the 5-year study (Table 1). Capture rate varied between the three trap sites. Kiptopeke accounted for 50.0% of new captures followed by the Gatr Tract (36.4%) and the Eastern Shore of Virginia National Wildlife Refuge (13.6%). This pattern of capture is consistent with that observed since 1994 (Table 2).

The temporal distribution of captures during 1998 appears to be bimodal (Figure 1). However, a much shorter time window was covered during 1998 compared to previous years. With additional years data, it is becoming increasingly evident that migration is bimodal with hatching-year birds moving through the lower Delmarva in early to mid November and after hatching-year birds moving through in late November and early December. Further data is needed to adequately evaluate this pattern. The proportion of captures represented by hatching-year birds and after hatching-year birds was equal in 1998. The ratio of young to adults may have been influenced by the early

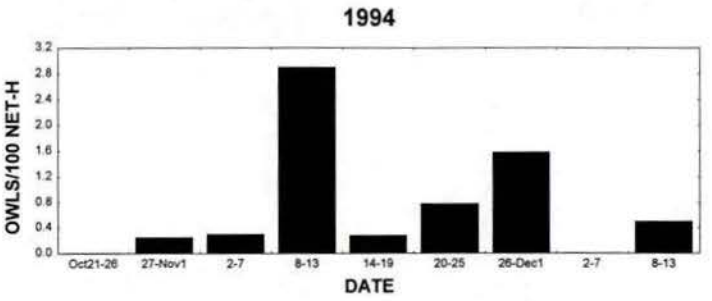
Table 1: Effort, capture totals, and capture rates for Saw-whet Owl trapping on the lower Delmarva Peninsula, 1994-1998

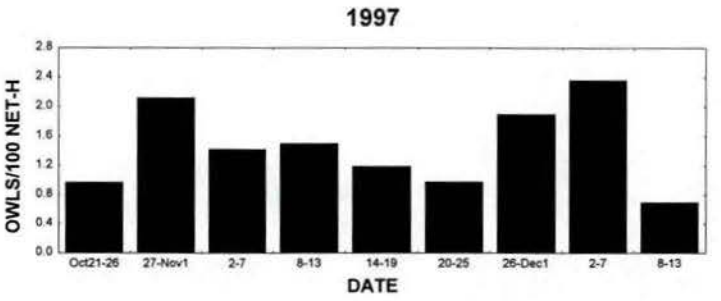
	1994	1995	1996	1997	1998
Trap-Nights	32	44	42	40	22
Net-Hours	6,903	9,481	8,817	8,212	4,499
Owl Captures	52	1,007	106	101	22
Owls/Trap-Night	1.6	22.9	2.5	2.5	1.0
Owls/100 Net-Hours	0.8	10.6	1.2	1.2	0.5

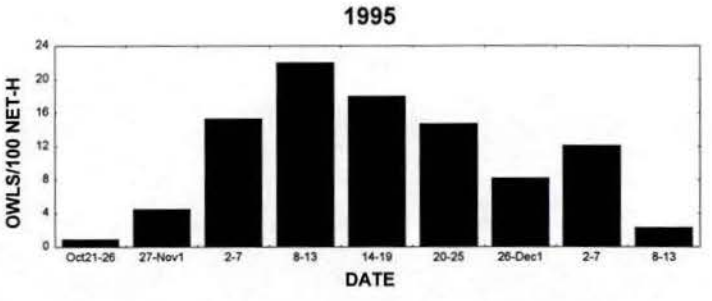
Table 2: Summary of capture locations for Saw-whet Owls on the lower Delmarva Peninsula, 1994-1998.

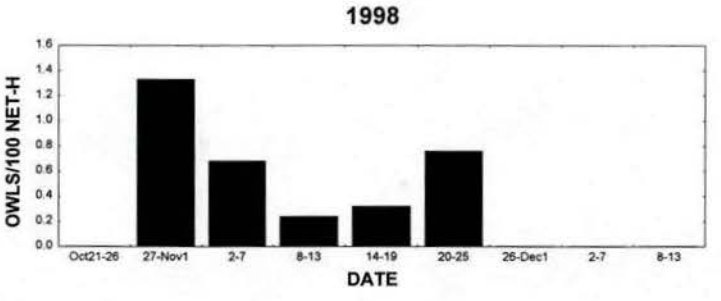
	Station 1 Refuge		Station 2 Gatr Tract		Station 3 Kiptopeke		
Year	**#**	**%**	**#**	**%**	**#**	**%**	**Total**
1994	17	32.7	21	40.4	14	26.9	52
1995	237	23.5	323	32.1	446	44.4	1007
1996	29	27.4	40	37.7	37	34.9	106
1997	19	18.8	35	34.7	47	46.5	101
1998	3	13.6	8	36.4	11	50.0	22

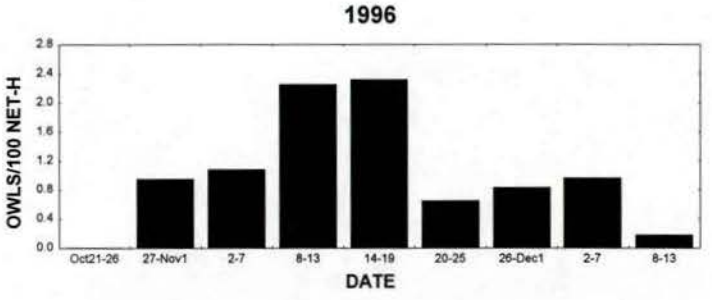
Figure 1: Seasonal capture rates of Northern Saw-whet Owls on the lower Delmarva Peninsula, 1994-1998. Each season was divided into nine different six-night time intervals. Note that the scale of the Y-axis changes in different years. Only 5 time periods were covered in 1998.


1994
OWLS/100 NET-H
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
Oct21-26
27-Nov1
2-7
8-13
14-19
20-25
26-Dec1
2-7
8-13
DATE


1997
OWLS/100 NET-H
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
Oct21-26
27-Nov1
2-7
8-13
14-19
20-25
26-Dec1
2-7
8-13
DATE


1995
OWLS/100 NET-H
24
20
16
12
8
4
0
Oct21-26
27-Nov1
2-7
8-13
14-19
20-25
26-Dec1
2-7
8-13
DATE


1998
OWLS/100 NET-H
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Oct21-26
27-Nov1
2-7
8-13
14-19
20-25
26-Dec1
2-7
8-13
DATE


1996
OWLS/100 NET-H
2.8
2.4
2.0
1.6
1.2
0.8
0.4
0.0
Oct21-26
27-Nov1
2-7
8-13
14-19
20-25
26-Dec1
2-7
8-13
DATE

termination of trapping. However, young to adult ratios have varied widely since 1995 (Table 3).

DISCUSSION

Although Northern Saw-whet Owls occur regularly on the Atlantic Coast each autumn, the magnitude of the migration is irruptive in nature. The number of Saw-whet Owls trapped at Cape May, NJ during 1980-1988 ranged from a low of 8 owls in 1984 to a high of 115 owls in 1980 (Duffy and Kerlinger 1992). Our data demonstrate that considerable year to year variation exists in the number of owls migrating through the lower Delmarva Peninsula. In 1995 the owl capture rate on the Delmarva was almost 10 times higher than in 1996 , 14 times higher than in 1994, and 21 times higher than in 1998. It has been suggested that annual variations in the number of Saw-whet Owls migrating are almost entirely due to variations in breeding success (Weir et al. 1980). However, huge variation in the magnitude of migration is likely to be caused by a number of additional factors. Newton (1979) suggests that the most important cause of annual fluctuations in the number of migrating raptors is variation in the amount of available prey. In years with particularly harsh weather, such as unusually cold temperatures and early snow cover, prey availability may decrease drastically. Predators may be forced to migrate to lower latitudes in search of a sufficient prey base. As a result, the magnitude of the raptor migration may be larger than normal.

Age ratios of captured owls were found to vary between years. During the invasion year of 1995, 83% of the Saw-whets trapped on the lower Delmarva were immature birds while that trend was reversed in 1996 when 86% of owls caught were

Table 3: Patterns in age ratios between years.

	Hatching-year Birds		After Hatching-year Birds	
Year	**Number**	**%**	**Number**	**%**
1995	836	83	171	17
1996	15	14	91	86
1997	59	58	42	42
1998	11	50	11	50

adults. This suggests that exceptional levels of productivity are a contributing factor in causing a major irruption year for this species. However, the difference in the number of immature Saw-whet Owls trapped in 1995 and 1996 is probably too extreme to be accounted for by variation in productivity alone. In 1995 more than 800 immature Saw-whet Owls were trapped on the lower Delmarva while in 1996 only 15 immature owls were captured. Fluctuations in the abundance of prey may be an important factor contributing to this difference. Lack (1954) proposed that prey cycles may intensify the effect of food shortages because low prey years may often be preceded by years of abundant prey in which predator populations experience low mortality and high productivity. The combination of high population levels and sudden prey shortages may cause a major migration year for a species that is capable of migrating in irruptive fashion. Such factors may have been responsible for the Saw-whet Owl invasion seen on the Atlantic Coast in 1995.

The seasonal timing of the Saw-whet Owl migration on the lower Delmarva lags about 1.5 to 2 weeks behind the passage of this species on the Cape May Peninsula. Duffy and Kerlinger (1992) found a mid-migration of 7 November for Saw-whets trapped at Cape May. This is 9 days before the mid-migration date on the lower Delmarva. During 1980-1988, 90% of Saw-whet captures at Cape May occurred during a 5 week period between 16 October and 19 November. On the lower Delmarva 90% of Saw-whets were caught during a 5-week period occurring between 1 November and 5 December. However, it is increasingly clear that age classes move during slightly different time periods.

Although Saw-whet Owls breed almost exclusively in the northern forests of the United States and Canada, substantial numbers penetrate the Southeast each fall and winter. Prior to the start of owl banding efforts in 1994, there was only a scattering of fall and winter records of Saw-whet Owls on Virginia's coastal plain. However, in both 1995 and 1996, more Saw-whets were captured on the Eastern Shore of Virginia than at any other owl banding site in the eastern United States. Clearly this species occurs on Virginia's coastal plain as a regular transient each fall. Descriptions of Saw-whet Owls as rare on the coastal plain should be attributed to the secretive nature of the species rather than to its relative abundance.

ACKNOWLEDGEMENTS

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Appendix I: Information on returns and recoveries of Saw-whet Owls on the lower Delmarva Peninsula, 1994-1998.

Banding Location	Banding Date	Recovery Loction	Recovery Date
Cape May, NJ	11/10/94	Gatr Tract	11/2/94
Assateague Is., MD	11/11/94	Eastern Shore NWR	11/12/94
Cape May, NJ	11/07/94	Kiptopeke	11/26/94
Cape May, NJ	11/04/94	Gatr Tract	12/01/94
Cape May, NJ	11/07/94	Kiptopeke	12/08/94
Eastern Shore NWR	10/27/94	Assateague Is., MD	01/30/95
Cape May, NJ	10/26/95	Gatr Tract	10/30/95
Cape May, NJ	10/26/95	Gatr Tract	11/05/95
		Cape May, NJ	11/09/95
Assateague Is., MD	10/30/95	Kiptopeke	11/13/95
Cape May, NJ	11/01/95	Gatr Tract	11/13/95
Cape May, NJ	11/09/95	Gatr Tract	11/13/95
Cape May, NJ	11/08/95	Kiptopeke	11/17/95
Turkey Pt., MD	11/05/95	Kiptopeke	11/18/95
Assateague Is., MD	11/09/95	Kiptopeke	11/18/95
Assateague Is., MD	11/09/95	Kiptopeke	11/18/95
Assateague Is., MD	11/12/95	Eastern Shore NWR	11/18/95
Assateague Is., MD	11/15/95	Gatr Tract	11/18/95
Cape May, NJ	11/08/93	Eastern Shore NWR	11/20/95
Cape May, NJ	11/11/95	Eastern Shore NWR	11/20/95
Cape May, NJ	11/13/95	Kiptopeke	11/20/95
Assateague Is., MD	11/12/95	Eastern Shore NWR	11/23/95
Assateague Is., MD	11/17/95	Kiptopeke	11/25/95
Cape May, NJ	10/30/95	Gatr Tract	11/26/95
Cape May, NJ	11/12/95	Kiptopeke	11/26/95
Assateague Is., MD	11/19/95	Kiptopeke	11/26/95
Assateague Is., MD	11/19/95	Kiptopeke	11/26/95
Assateague Is., MD	11/16/95	Eastern Shore NWR	11/30/95
Cape May, NJ	11/17/95	Eastern Shore NWR	12/03/95
Cape May, NJ	11/20/95	Eastern Shore NWR	12/03/95
Cape May, NJ	11/10/95	Gatr Tract	12/10/95
Assateague Is., MD	10/30/95	Kiptopeke	12/12//95
Cape May, NJ	10/31/95	Gatr Tract	12/12/95
Assateague Is., MD	11/08/94	Eastern Shore NWR	12/06/95
		Eastern Shore NWR	12/06/95
Cape May, NJ	11/13/95	Kiptopeke	12/13/95
Cape May, NJ	11/06/95	Eastern Shore NWR	12/29/95
Cape May, NJ	11/16/95	Kiptopeke	01/20/96
Kiptopeke	10/22/95	Cape May, NJ	11/03/96
Eastern Shore NWR	11/12/95	Assateague Is., MD	11/04/96

Appendix I: - continued -

Banding Location	Banding Date	Recovery Loction	Recovery Date
Kiptopeke	11/17/95	Cape May, NJ	11/05/96
		Assateague Is., MD	11/12/96
Summit, NC	11/17/95	Gatr Tract	11/13/96
Cape May, NJ	11/07/93	Gatr Tract	11/15/96
Cape May, NJ	10/29/96	Gatr Tract	11/15/96
Cape May, NJ	11/10/95	Gatr Tract	11/16/96
Summit, NC	11/17/95	Kiptopeke	11/20/96
Gatr Tract	11/01/96	Kiptopeke	11/04/97
		Kiptopeke	11/05/97
		Kiptopeke	11/28/97
Kiptopeke	12/02/97	Kiptopeke	11/18/98

Appendix II: Publications and manuscripts from the Northern Saw-whet Owl migration project on the lower Delmarva Peninsula. Included are as follows:

Whalen, D. M., B. D. Watts, M. D. Wilson, and D. S. Bradshaw. 1997. Magnitude and timing of the fall migration of Northern Saw-whet Owls through the Eastern Shore of Virginia, 1994-1996. The Raven 68:97-104.

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