REPRODUCTION IN A CHESAPEAKE BAY OSPREY POPULATION

JAN G. REESE

THE Osprey, *Pandion haliaetus*, is becoming rare as a breeding bird in some parts of the United States particularly in the north. Unsuccessful reproduction and man's encroachment on its estuarine and seacoast nesting habitat are prime factors in the decline (Schmid, 1966; Ames, 1966; Peterson et al., 1969). Talbot County, Maryland, has the largest known—and reproductively the most successful—population of Ospreys on the east coast of the United States north of Florida. I have studied this large concentration of Ospreys since 1963 to determine the size and reproductive success of the breeding population. This paper reports data from the years 1963 through 1969 on numbers of young at different stages of development, discusses effects of various environmental factors on reproductive success, and compares success of Ospreys in Talbot County with that in other areas of the United States. Preliminary results of this study were presented in Reese (1965).

STUDY AREA

The study area comprises 213 square (statute) miles on Chesapeake Bay and includes most of the tidewater portion of Talbot County, Maryland (Figure 1). The thinly populated coast of this western part of rural Talbot County is deeply indented by estuaries. Harvesting and processing seafood and agricultural products are the major industries in the county. Boating is a popular recreation during the summer and the most intense activity coincides with the more critical stages of Osprey reproduction.

METHODS

Beginning in 1965, each Osprey nest in the study area was visited at least once every 12 days from March to September. In 1963 and 1964 nest sites were visited less frequently and more irregularly. The data obtained in the first 2 years consequently are not so reliable as those for 1965 through 1969.

All data on reproduction were collected at accessible active nests, i.e. those at which adult birds were present on at least four consecutive visits during a single season and the contents of which could be examined (Table 1). The application of less stringent criteria would not have added more than one or two active nests to the total each year until 1969, when five pairs were present near former nest sites on about half my visits and even added material to existing nests, but did not lay. Three other pairs apparently selected territories but did not nest. None of these sites was counted active in 1969. During the 7 years I located a total of 758 active nests in the area; most nests were active in more than one year and hence are counted more than once in the total. About one-third (231) of the active nests were in standing trees where I could

 The Auk, 87: 747–759. October 1970

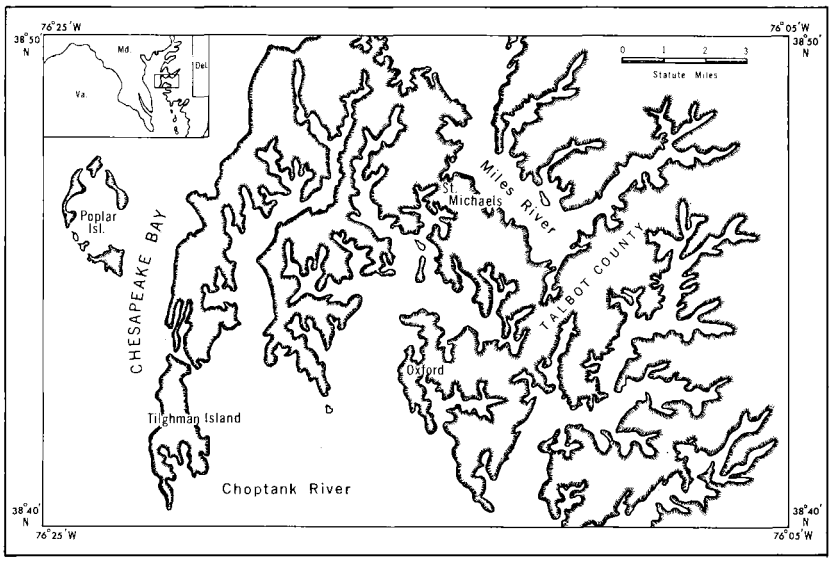

Figure 1. Map of study area in Talbot County, Maryland.

not see their contents; these are referred to as inaccessible active nests. The remaining 527 nests were on top of duck blinds, on channel markers, on roots of overturned trees (both on land and in water), and on platforms that I mounted on top of poles in shallow water. These accessible active nests I inspected from an outboard motorboat.

In early March I reinforced the supports of previously occupied nest sites when necessary and built new nesting platforms in suitable places. The platforms were approximately 4 ×4 feet and were mounted in standing dead trees on land or on the tops of existing poles and roots of fallen trees in shallow water (Figure 2). I erected a total of 133 platforms in the area between 1964 and 1969.

The program of nest surveillance included the following activities: All nesting sites were numbered with paint. During May and June nests were measured and construction materials were recorded. All eggs examined were measured and marked with a small ink dot; those that exceeded the normal incubation period were collected. Later, hatchlings were periodically checked for ectoparasites, weighed, and banded. Uneaten food items found in nests were gathered and identified. Weather conditions were recorded. Behavior of adults near the nests was recorded and various phases of the reproductive cycle were photographed. In 1966 through 1969 I also visited nest sites in Queen Anne's County, north of the study area, to obtain comparative data on reproduction from another portion of Chesapeake Bay (Reese, 1968).

RESULTS

Nests.—The yearly increase in total number of active nests recorded from 1963 to 1968 (Table 1) was due partly to improvements in survey methods and, to a lesser extent, to the construction of nest platforms. Each

TABLE 1
SUCCESS OF ACCESSIBLE ACTIVE OSPREY NESTS[1]

	1963	1964	1965	1966	1967	1968	1969
Total active nests found in study area	78	87	103	113	119	131	127
Accessible active nests[2]	44 (56)[3]	63 (72)	73 (71)	77 (68)	83 (70)	93 (71)	94 (74)
Nests producing eggs[4]	27 (61)	56 (89)	71 (97)	72 (94)	76 (92)	87 (93.5)	90 (96)
Nests producing hatchlings[4]	16 (36)	34 (54)	43 (59)	47 (61)	48 (58)	52 (56)	51 (54)
Nests producing fledglings[4]	14 (32)	32 (51)	42 (58)	40 (52)	42 (51)	51 (55)	45 (48)
Total eggs known	54	138	182	212	216	274	259
Eggs per nest with eggs	2.0	2.5–	2.6–	3.0–	2.8–	3.1–	2.9
Eggs producing hatchlings[5]	32 (59)	60 (43)	91 (50)	95 (45)	94 (44)	112 (41)	106 (41)
Eggs producing fledglings[5]	28 (52)	55 (40)	85 (47)	79 (37)	80 (37)	89 (32)	90 (35)
Per cent of hatchlings fledged	(88)	(92)	(93)	(83)	(85)	(79)	(85)
Average number fledged per nest producing fledglings	2.0	1.7	2.0	2.0	1.9	1.7	2.0
Average number fledged per accessible active nest	0.64	0.87	1.16	1.03	0.96	0.96	0.96

[1] Data from renestings are included, but renestings are not counted as additional nests.
[2] Per cent is ratio of accessible to total actve nests.
[3] Numbers in parentheses indicate per cent.
[4] Per cent is based on accessible active nests.
[5] Per cent is based on total eggs known.

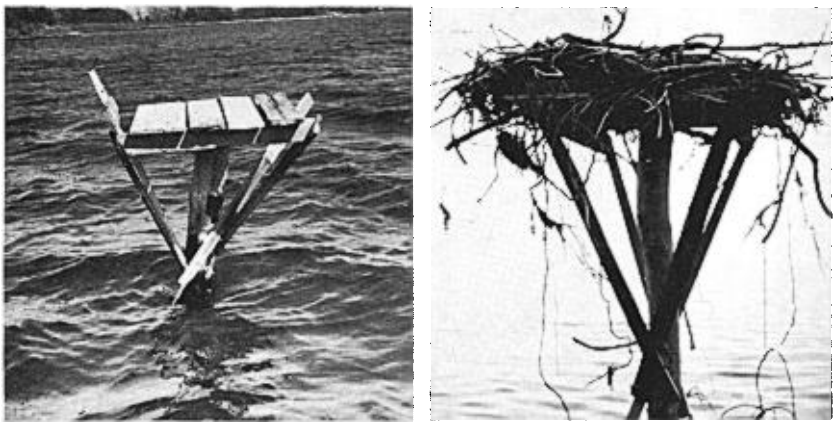

Figure 2. Osprey nesting platforms erected on top of existing poles in Talbot County.

year after 1964 more than two-thirds of the active nests were situated offshore and accessible for surveillance from a boat. The availability of preferred offshore nest sites varied with the severity of the preceding winter. In January 1966 a storm with high winds and drifting ice destroyed channel markers, poles with platforms, and offshore duck blinds, thereby forcing some birds that had previously nested at accessible sites to build elsewhere, generally at inaccessible heights in standing trees near the original nest site. This accounts for the slight drop in percentage of accessible active nests to below 70 per cent in 1966.

Building and repairing nest platforms in an effort to maintain a relatively stable number of accessible nest sites was a successful venture. Of the 133 platforms I put up between 1964 and 1969, 81 attracted breeding birds. Sixty of the platforms that attracted breeding birds were installed at previously occupied sites that had been damaged or destroyed during the winter. Such platforms had almost 100 per cent occupancy, as nest sites normally tend to be occupied year after year (Bent, 1937). Twenty-one platforms attracted pairs that appeared to be new to the area. Presumably these new birds moved in from elsewhere or were young birds breeding for the first time. The remaining 52 platforms were unoccupied.

During the 7-year study period, 82 accessible active nests were lost for various reasons. The major cause of nest loss was the U. S. Coast Guard, whose efforts to keep navigation aids unobstructed destroyed 43 nests. A Fifth Coast Guard District Operation Plan (applying to all of Chesapeake Bay) reads, "Bird nests shall be removed from aid to navigation structures. Nests containing eggs or young birds will be allowed to remain

until the nest is vacated by its occupants, unless the nest is obscuring the signal display in such a manner as to cause confusion to the mariner." Despite the clause prohibiting immediate destruction except when the signal is obscured, Coast Guard personnel destroy Osprey nests and their contents indiscriminately each year and occasionally several times in a single season. During the 7 years, about one-half of the nests the Coast Guard destroyed were on plaque-type (unlighted) channel markers. Starting in 1965 I made sure that all lighted channel markers in the study area were unobstructed; I moved each nest to a lower position on the marker beneath the light and opposite the battery box. Despite this effort and despite my efforts to establish an accord about nest removal with Coast Guard officials, the destruction of Osprey nests, eggs, and young from all types of channel markers continues. Other causes of nest loss included 14 flooded by high tides, 16 blown down by high winds, 4 raided by predators, 4 weak nest sites that collapsed, and 1 destroyed by fire.

The percentage of accessible active nests that produced eggs from 1965 through 1969 varied from 92 to 97 per cent and was highest in 1965 (Table 1). The percentage of nests producing hatchlings ranged between 54 and 61 per cent in this period. The drop in percentage of nests with hatchlings from a high of 61 per cent in 1966 to 58 per cent in 1967 resulted from the destruction of 7 nests containing 17 eggs by a wind funnel that struck the Choptank River area 8 May 1967. The 56 per cent in 1968 was due to a 27–28 May storm that damaged or destroyed 16 nests containing 21 eggs and 6 hatchlings. None of the pairs whose nests were destroyed by wind in 1967 laid again that year, but in 1968, 10 pairs built new nests and laid 26 eggs; 4 of these pairs fledged 7 young. Data from renesting are included in Table 1 but the renestings are not counted as additional nests.

In 1964, 1966, 1967, and 1969 nests producing fledglings ranged from 48 to 52 per cent; good weather in June and July and Coast Guard restraint may account for 58 per cent of the accessible active nests producing fledglings in 1965, while the 55 per cent in 1968 can be partly accounted for by the large number of nests with eggs and a particularly large average clutch size.

Eggs.—Through improved surveillance of accessible active nests, the numbers of eggs detected increased each year up to 1968 (Table 1). The total number of eggs that hatched remained about the same from 1965 to 1967, increased significantly in 1968, when the number of eggs found was substantially greater, and dropped somewhat in 1969. More significantly, the percentage of eggs hatching decreased each year from 1965–1968 and remained the same in 1969. This decrease contributed to the decreases in fledging success documented in Table 1.

Table 2 shows some of the reasons why one-half or more of the eggs

TABLE 2
CAUSES OF EGG AND HATCHLING LOSS

	1963		1964		1965		1966		1967		1968		1969		Totals	
	E	H	E	H	E	H	E	H	E	H	E	H	E	H	E	H
Disappeared from nest between visits	14	3	59	5	62	5	75	12	61	11	73	13	59	9	403	58
Collected after exceeding normal incubation period	1		5		21		21[1]		23		18		24		113	
Broken in nest	2		2		2		7		6		28		35		82	
Buried in nest									1		5		12		18	
Broken in handling									2						2	
U. S. Coast Guard	3		9		2			4	2		15		4	2	35	6
High tide					3		6		3	3	19	2			31	5
Wind			3						17				8		28	
Drowned		1				1						4		5		11
Raccoon					1		8		7		4		11		31	
Owl												4				4
Crow	1														1	
Rat	1														1	
TOTALS	22	4	78	5	91	6	117	16	122	14	162	23	153	16	745	84

[1] Includes six fresh eggs collected for pesticide analysis.

failed to hatch. Most losses occurred between visits and I can only suggest what happened. Since 1966 I have searched in and immediately under all nests from which eggs disappeared. I found shells of 82 broken eggs scattered among nest material and 18 intact eggs buried in the nest material or resting on thick branches beneath nests. I believe these eggs were accidentally broken or knocked from nests by adult birds as a result of disturbance. Predation cannot be ruled out entirely in this instance, but none of the nests was disrupted enough to suggest a struggle, only a portion of each clutch had disappeared, and 18 eggs were not even broken.

The 113 eggs that failed to hatch during the normal incubation period constitute the second largest portion of the total egg failures (Table 2). Of these 14 had cracks in the shell and were empty; they may have been broken by adults during incubation. The remaining 99 eggs were evidently addled, and when shaken their contents sounded dry or slushy wet. The possibility of pesticide poisoning resulting in low hatchability cannot be discounted, although no chemical analysis was made of any eggs collected (see Ames, 1966; Hickey and Anderson, 1968).

Other causes of hatching failure shown in Table 2 varied from year to year. Weather was not a serious factor until 1967 when 17 eggs were lost in a single windstorm. In 1968 high tides and wind-driven rains destroyed 21 eggs. The Coast Guard tended to take a larger toll of eggs than of young because they usually destroyed nests on channel markers early in the breeding season. Predation on eggs probably is greater than I observed. I actually saw a rat and a crow robbing nests. I did not see raccoons because of their nocturnal habits, but they were implicated in 20 instances on the basis of disrupted nests, eggshell fragments, and numerous raccoon tracks on nearby mud flats. I have flushed otters, water snakes, muskrats, and diamond-backed terrapins from duck blinds containing active Osprey nests, and I have seen such potential predators as Herring Gulls, Blue Jays, Great Blue Herons, red foxes, and other snakes near nests. As most nests in Talbot County are built at offshore sites they are inaccessible to most terrestrial predators, but Fernandez (pers. comm.) found terrestrial predation to be a major cause of egg loss in a largely tree-nesting Osprey population in Massachusetts.

Ames and Mersereau (1964) and Ames (1966) in Connecticut, Fernandez (pers. comm.) in Massachusetts, and Postupalsky (1968) in Michigan have cited egg failure as a major factor for low reproductive success in Ospreys. Despite the fact that less than 50 per cent of the eggs have hatched in recent years, this Chesapeake Bay colony still has a higher rate of hatching than the New England and Michigan populations (Table 3).

The percentage of eggs producing fledglings ranged between 32 and 40 per cent in 1964, 1966, 1967, 1968, and 1969 (Table 1). The high of 47

TABLE 3
HATCHING SUCCESS PERCENTAGES IN OSPREY POPULATIONS[1]

	1960		1961		1962		1963		1964		1965		1966		1967		1968		1969	
	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%	Eggs	%
Connecticut																				
Old Lyme[2]	66	6	32	25	48	6	39	10												
Massachusetts																				
Dartmouth[3]									29	52	40	22	52	17	30	23	48	63	52	21
Michigan																				
Fletcher Pond[4]											26	19	32	28	31	48	41	29		
Maryland																				
Talbot County							54	59	138	43	182	50	212	45	216	44	274	41	259	41
Queen Anne's County[5]													13	85	35	40	44	43	65	40
Potomac River[6]							26	54							47	60	31	22		

[1] Data for percentages other than those from Talbot County were gathered by only two or three visits and probably overlook some egg mortality. Unpublished percentages are subject to revision.

[2] Ames and Mersereau (1964); data for nonarborial nests only.

[3] Fernandez (MS).

[4] Postupalsky (MS).

[5] Reese (1968; MS).

[6] U. S. Fish Wildl. Serv. (1965); Krantz (MS).

per cent in 1965 may be attributed to good weather and Coast Guard restraint. The low of 32 percent in 1968 cannot be attributed to any one factor.

Young.—Mortality of hatchlings ranged between 7 and 21 per cent during the 7 years (Table 2). As I have seen adult birds remove egg shells and have found dead hatchlings outside nests, I may have failed to detect some lost young. Most young disappeared between my visits and most often during the first 2 weeks ofter hatching. In the accessible nests of the study area, weather was not an important factor in mortality of young until 1968 (Table 2). The high tide and driving rain that destroyed 21 eggs in late May that year also killed six nestlings and may have caused the death of five others. In an earlier study of Ospreys at Smith's Point, Virginia, Tyrrell (1936) found that several young died from heat exposure, and Valentine (1967) reported the loss of four young in two nests destroyed during a windstorm in Michigan.

Of the 58 hatchlings that disappeared between my visits, only two instances of killing by people (other than Coast Guard) were reported to me during the 7-year period; both hatchlings were killed by young boys. In Dartmouth, Massachusetts, a region more heavily populated than coastal Talbot County, Fernandez (pers. comm.) reports that persecution of Ospreys by people is more serious. In Lower California Kenyon (1947) found shooting and nest robbing by commercial fishermen to be an important factor in the decline of Ospreys nesting in coastal islands.

I cannot attribute any hatchling loss definitely to accidents. In Connecticut Ames and Mersereau (1964) found two dead hatchlings that had fallen from the nest. Although I had previously suspected predation on young I had no evidence until 1968 when I found four freshly killed and partly eaten hatchlings from two neighboring nests. The carcasses showed talon marks and I flushed a Great-horned Owl from a nearby thicket.

Discussion

The average number of young fledged per productive nest in Talbot County has remained near 2.0 throughout the 7 years (Table 1). This average is the only estimate of success that may be compared directly with some of the pre-1960 estimates of production in presumably stable populations (Table 4). The pre-1960 averages, which range between 2.0 and 2.3, are based on banding records and therefore overlook any losses of eggs or young that occurred prior to banding. Nestling Ospreys may be banded from 3 weeks of age (Tyrrell, 1936) to fledging at 6 to 8 weeks. The average number of fledglings (2) per nest in Talbot County is based on birds more than 6 weeks old and may thus be even closer to the pre-1960

TABLE 4

FLEDGLING SUCCESS IN U. S. OSPREY POPULATIONS[1]

		All nests		Nests producing fledglings			
	Year	No. of nests	Fledglings per nest	No. of nests	Fledglings per nest	Reference	No. of visits
Maine	1964	8	0.38			Kury (1966)	1
Massachusetts	1963		0.20		2.5	Fernandez (MS)	Infrequent
	1964	11	1.28	9	2.0		
	1965	15	0.60	4	2.25		
	1966	18	0.50	5	1.8		
	1967	14	0.36	4	1.25		
	1968	20	1.15	10	2.3		
	1969	16	0.69	8	1.4		
Connecticut	1957	35	0.37			Ames and Mesereau (1964)	Infrequent
	1958	39	0.33				
	1960	71	0.10				
	1961	31	0.39				
	1962	31	0.26				
	1963	24	0.38				
New York	1940				2.2	Ames and Mesereau (1964)	(Banding records)
New Jersey	1937	27			2.0	Schmid (1966)	1; (Banding records)
	1938	21			2.1		
	1939	25			2.2		
	1963	7			0.0		
Maryland							
Potomac River	1963	26	0.92	15	1.6	U. S. Fish Wildl. Serv. (1965); Krantz (MS)	2
	1967	47	0.98	26	1.7		
	1968	31	0.45		1.4		

[1] Data for most of these studies were gathered during less frequent nest visits than in the present study and consequently do not allow for nestling mortality between final visit and fledging. Unpublished averages are subject to revision. Averages from initial years of study in Massachusetts, Florida, New Jersey, and Talbot County, Maryland, are less reliable than in later years.

TABLE 4 (CONTINUED)

	Year	All nests: No. of nests	All nests: Fledglings per nest	Nests producing fledglings: No. of nests	Nests producing fledglings: Fledglings per nest	Reference	No. of visits
Queen Anne's County	1966	17	0.58	6	1.7	Reese (1968; MS)	2
	1967	23	0.61	9	1.5		
	1968	21	0.43	5	1.8		
	1969	27	0.81	14	1.6		
Talbot County	1963	44	0.64	14	2.0	This study	Every 12 days
	1964	63	0.87	32	1.7		
	1965	73	1.16	42	2.0		
	1966	77	1.03	40	2.0		
	1967	83	0.96	42	1.9		
	1968	93	0.96	51	1.7		
	1969	94	0.96	45	2.0		
Virginia	1934	46	1.60	25	2.3	Tyrrell (1936)	1
Florida	1968	44	1.27	30	1.9	Ogden (MS)	Infrequent
	1969	39	1.15	28	1.6		
Michigan	1965	50	0.36	11	1.6	Postupalsky (1968; MS)	2
	1966	50	0.30	9	1.7		
	1967	62	0.48	17	1.8		
	1968	69	0.58	25	1.6		
Wisconsin	1951–55	93	1.09	53	1.9	Peterson et al. (1969); Postupalsky (1968; MS)	2
	1956–59	51	1.16	31	1.9		
	1960–65	67	0.39	20	1.3		
	1966	67	0.48	19	1.7		
	1967	71	0.93	36	1.8		
	1968	64	0.69	28	1.6		
Minnesota	1967	60	0.98	36	1.6	Dunstan (1968)	2
	1968	79	1.03	50	1.6		
Montana	1967	18	0.94	12	1.2	MacCarter et al. (1969)	2
	1968	19	0.68	11	1.2		

averages than it appears to be. Certainly it is well above the averages of most other U. S. Osprey populations during the 1960s.

Even though the average production per accessible active nest in Talbot County has declined from a high of 1.16 in 1965 to 0.96 in the past 3 years the number of pairs found breeding in the study area has increased. This may reflect either (1) the combined result of improved coverage of the area over the years and construction of platforms, (2) immigration from elsewhere, or (3) actual increased recruitment from the Talbot County population. On the other hand decreases in Osprey populations over the past 90 years have been reported from other parts of the United States: in Massachusetts (Bent, 1937), Lower California (Kenyon, 1947), New Jersey (Schmid, 1966), Connecticut (Ames and Mersereau, 1964), Michigan (Postupalsky, 1968), and Wisconsin (Hickey and Anderson, 1968).

Henny and Wight's (1969) life table based on banding and recovery data for New York and New Jersey Ospreys from 1929 to 1947 shows that each adult female must produce between 0.95 and 1.30 immatures each year to insure population stability. The Talbot County production has has ranged between these figures since 1965 (Table 1). This may help account for the increase in the numbers of active nests found. Since the high in 1965 most phases of reproduction in Talbot County Ospreys have shown percentage decreases: 1 to 5 per cent fewer nests produced eggs, 5 to 9 per cent fewer eggs hatched, and 8 to 14 per cent fewer hatchlings fledged. On the other hand, total eggs and clutch size increased. Because these data are based on only 5 years of recording, whether the lower percentages of hatching and fledging represent an actual decline in productivity of Talbot County Ospreys is uncertain—possibly 1965 was an unusually favorable year and the small fluctuations of the past 4 years represent normal annual variability. At any rate this population is still producing at levels close to those prevailing before 1960 and well above those of most other well-documented United States populations. In view of the decline of Ospreys elsewhere on the northeast United States it is clearly desirable to continue studying the Talbot County population.

ACKNOWLEDGMENTS

I am grateful to Donald Meritt for his assistance throughout this study. Without his aid many of these data could not have been obtained. The Patuxent Wildlife Research Center, Bureau of Sport Fisheries and Wildlife, supplied an excellent boat, outboard motor, and trailer during the 1966–1969 seasons. In 1967 and 1969, funds and facilities in support of the project were made available by the Office of Ecology, Smithsonian Institution, and Chesapeake Bay Center for Environmental Studies. Special thanks should go to the many people who secured support for the study, participated occasionally in nest surveillances, loaned equipment, permitted property access, and reported additional nesting activities.

I would also like to thank Mr. and Mrs. Gilbert Fernandez, William C. Krantz, John Ogden, and Sergj Postupalsky for allowing me to cite their unpublished Osprey data. George E. Watson and William H. Stickel have provided many helpful suggestions and invaluable assistance in preparing this paper. Anne Keenan Poulson generously drew the map.

Literature Cited

Ames, P. L. 1966. DDT residues in the eggs of the Osprey in the northeastern United States and their relation to nesting success. J. Appl. Ecol., 3 (Suppl.): 87–97.

Ames, P. L., and G. S. Mersereau. 1964. Some factors in the decline of the Osprey in Connecticut. Auk, 81: 173–185.

Bent, A. C. 1937. Life histories of North American birds of prey. U. S. Natl. Mus., Bull. No. 167.

Dunstan, T. C. 1968. Breeding success of Osprey in Minnesota from 1963 to 1968. Loon, 4: 109–112.

Henny, C. J., and H. M. Wight. 1969. An endangered Osprey population: estimates of mortality and production. Auk, 86: 188–198.

Hickey, J. J., and D. W. Anderson. 1968. Chlorinated hydrocarbons and eggshell changes in raptorial and fish-eating birds. Science, 162: 271–273.

Kenyon, K. 1947. Breeding populations of the Osprey in Lower California. Auk, 49: 152–158.

Kury, C. R. 1966. Osprey nesting survey. Wilson Bull., 78: 470.

MacCarter, D. L., J. R. Koplin, and D. S. MacCarter. 1969. Pesticides and reproductive failure in the Osprey. 16th Ann. Meeting California-Nevada Section of Wildlife Soc., held February 28–March 1, 1969 at Berkeley, California.

Peterson, R. T., W. H. Stickel, S. Postupalsky, D. D. Berger, H. C. Mueller, and K. H. Moll. 1969. Brief reports: the status of the Osprey. Pp. 333–343 *in* Peregrine Falcon populations (J. J. Hickey, Ed.). Madison, Univ. Wisconsin Press.

Postupalsky, S. 1968. The status of the Osprey in the north-central United States, 1967. Detroit Audubon Soc., mimeogr. report, 3 February 1968.

Reese, J. G. 1965. Breeding status of the Osprey in central Chesapeake Bay. Maryland Birdlife, 21: 105–108.

Reese, J. G. 1968. Breeding Osprey survey of Queen Annes County, Maryland. Maryland Birdlife, 24: 91–93.

Schmid, F. C. 1966. The status of the Osprey in Cape May County, New Jersey between 1939 and 1963. Chesapeake Sci., 7: 220–223.

Tyrrell, W. B. 1936. The Ospreys of Smith's Point, Virginia. Auk, 53: 261–268.

United States Fish and Wildlife Service. 1965. Effects of pesticides on fish and wildlife, 1964. U. S. Fish. Wildl. Serv. Circ., No. 226.

Valentine, A. 1967. Man-made Osprey nesting sites—a success story. Michigan Audubon Newsletter, 14: 4–5.

Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D. C. 20560. Present address: St. Michael's, Maryland 21663.