

**SPRING RAPTOR MIGRATION IN  
OTTAWA NATIONAL WILDLIFE REFUGE AND SURROUNDING LAKE ERIE  
MARSHES, OHIO**

PROGRESS REPORT-2009  
BSBO-ONWR09-2

Mark Shieldcastle, Research Director  
Black Swamp Bird Observatory  
13551 W SR 2  
Oak Harbor, Ohio 43449  
markshieldcastle@bsbo.org

INTRODUCTION

Black Swamp Bird Observatory completed the 18<sup>th</sup> year of a comprehensive, long-term study to monitor the movement and dynamics of raptor migration along the southwest shore of Lake Erie. Little is known of spring raptor migration west of the Allegheny Mountains and east of the Rockies. Lake Erie represents a major physical barrier to migrating raptors resulting in measurable concentrations of birds. The combination of the expansive water and the thermals created by the land-water interface result in definable bands of migration activity; yet the importance of this habitat to raptors for hunting and migration is poorly understood, but expected to be of great importance. The marshes hold large populations of small mammals, from mice to muskrats, and extremely large numbers of neotropical migrant passerines and shorebirds can be found during spring migration (Shieldcastle 2009a, 2009b).

The wetland habitat along the shore of Lake Erie is under severe pressure from development and agriculture. Knowledge about the importance of these habitats to migrating raptors will help managers to make informed decisions about land use and habitat management. The large avian concentrations, whether passerines or raptors, attract many birders from March through May to the marshes. Improving our understanding of raptor migration will help managers and birders alike appreciate their presence.

In order to address these conservation and outreach priorities, we designed an annual spring raptor migration study which was first initiated in 1991. The objectives of this study are: to monitor long term trends in migrating raptors utilizing the region; to examine the importance of habitats within Lake Erie marsh region to migrating raptors, and to examine spatial and temporal differences in migration between species. The study also includes environmental education to improve the public's knowledge and perception of these avian predators.

METHODS AND MATERIALS

A prioritized list of observation points were developed to encompass the western basin of Lake

Erie (Table 1, Figure 1). Prioritization incorporated distance from the lake itself, effects of Sandusky Bay, and Toledo. The 2009 field season commenced 28 February and counts were conducted daily, depending on weather conditions, from 01 March to 09 May at the control site located on the Magee Marsh State Wildlife Area. Weather limitations included rain, heavy snow, and fog. Count data were gathered following the guidelines established by the Hawk Migration Association of North America (HMANA). These consisted of observations from fixed points, making visual counts of passing raptors, and identifying to species where possible. Flight direction, wind direction, wind speed, sky condition, time of observation, and length of observation were collected for each hour period. Data were collected by project personnel and volunteers assisting in the study. Two half-day workshops dealing with raptor identification and data collection were conducted for volunteers in February. Weather data were compiled at the watch sites and from hourly readings by Toledo Edison at the Davis Besse Nuclear Power Station (DBNPS). DBNPS weather data collected from 100 m above the land surface at 1000 hr was correlated with raptor movements. The 1000 hr weather data were chosen because thermals are usually formed around that time. Observation data were compiled and reported to HMANA.

## RESULTS AND DISCUSSION

### **COUNTS**

Raptor counts were conducted on 65 days between 28 February and 9 May in 2009 (Table 2). One hundred and eighty-three individual trips involving 660.10 observation hours and 1,082 volunteer hours counted 9,221 raptors. The Magee Marsh tower was monitored daily, weather permitting. Other sites were manned when personnel were available. The average number of hawks observed per hour for 2009 (13.47 birds/hr) was 3% below 2008's average (14.42 birds/hr).

Much remains to be learned about raptor flight paths and their variability along Lake Erie. Weather data were compiled from hourly readings by Toledo Edison at the Davis Besse Nuclear Power Station, and count data were analyzed for correlation with wind direction. In 2009, high count dates again appeared to be positively correlated with winds from the southwest quadrant (these counts are shown in bold type in Table 2). Southwest winds allow raptors to tack into the wind as they migrate along the western basin. Strong movements were also observed on southeast quadrant winds.

Magee Marsh Wildlife Area continues to function as a control site for the study. Table 3 shows observer hours, raptors observed, and raptors counted per hour for each site utilized. In 2009, Cullen Park, Pickerel Creek Wildlife Area, Turtle Creek, SR 590, Maumee Bay State Park, and South Bass Island provided highly productive counts when manned. Being operated daily, the tower site average is moderated by the number of days in which conditions are unfavorable for migration. Under these conditions alternate sites rarely have observers.

An observation point along the Magee Marsh beach is utilized to better assess falcon movement

which is theorized to be heaviest along the lake edge; however, this site had few observer hours in 2009. The Magee location was chosen over the Ottawa NWR beach because it is open to the public and there was an active eagle nest site on Ottawa NWR. The sledding hill at Maumee Bay State Park should be representative of the volume of birds crossing near the mouth of the Maumee river. The Cullen Park site may be useful in actual crossing determination of the birds on the western end of Lake Erie.

Pickrel Creek Wildlife Area was chosen to assess the movement along the south side of Sandusky Bay. It is thought that this is a different group of migrants than those recorded at the Ottawa NWR complex. South Bass Island identifies the potential of island hopping by various species. Ft. Meigs and S.R. 590 sites are the sole representatives for movements a considerable distance from the lake shore. A continued increase in monitoring will be important in addressing questions concerning these inland flight lines. The balance of the observation sites are designed to fill in and refine data on the flight paths.

The total raptors counted are shown in Tables 4 (accipiters), 5 (buteos), 6 (falcons), and 7 (miscellaneous species). To more accurately compare species and for year to year comparisons unknown accipiters and buteos were statistically assigned to species. This was done assuming that the unidentified birds were representative of the identified birds for that day or neighboring days. Table 8 shows bird/hour by species during the project history. The following species accounts document the individual species totals, peaks by number observed as well as average per hour, and a summary of that species during the season.

1) Turkey Vulture (6,480) Peak: 08 April (1,414 birds and 166.35 birds/hr). The first observation was 05 March and this species appeared consistently from mid-March into mid-May. It averaged 9.82 individuals per hour of observation in 2009, an increase of 8 percent from 2008 (9.07 birds/hr) (Table 8). Turkey Vultures were counted on 86% of the count days. Turkey Vultures are almost completely dependent on the thermals to migrate and are normally seen migrating in small kettles. An increase in observation points will better define the area used by this species.

2) Red-tailed Hawk (810) Peak: 17 March (77 birds and 2.35 birds/hr). The first observation was 01 March. Red-tails were encountered on 83% of the count days and averaged 1.23 individuals per hour of observation, 38% below 2008's 2.00. Breeding birds continue to cause some confusion for observers but will not effect on overall data as they should be present in similar numbers from year to year, regardless of migration trends.

3) Sharp-shinned Hawk (533) Peak: 25 April (126 birds) and 26 April (7.15 birds/hr). March 5 was the first observation date for this species and it was consistently seen mid-March into mid-May. The average number recorded per observation hour was 0.81 individuals. This was up from the 0.68 in 2008 (+19%). This species actively feeds throughout migration, consequently they are less dependent on thermals and have a more general movement. It was observed on 54% of the count days.

4) Broad-winged Hawk (476) Peak: 21 April (259 and 27.26 birds/hr). Broad-wings are late migrants and were first observed on 16 April. This species depends heavily on thermals and

migrates in large kettles. Broad-wings were counted on 18% of the count days. An average of 0.72 individuals per hour was down 12% from 2008 (0.82).

5) Red-shouldered Hawk (286) Peak: 17 March (58 birds and 1.77 birds/hr). March 4 was the first observation date. They were consistently recorded from mid-March to late-April. For 2009, Red-shoulders averaged 0.43 individuals per observer hour. This was 39% above the 0.31 average of 2008. Red-shoulders were observed on 42% of the count days.

6) Cooper's Hawk (260) Peak: 17 April (31 birds) and 26 April (2.04 birds/hr). The first observation of this species was 28 February. It was consistently seen mid March to early May. It averaged 0.39 individuals per observation hour compared to 0.42 in 2008 (-7%). It was observed on 60% of the count days.

7) Bald Eagle (180) Peak: 26 April (18 birds 1.23 birds/hr). The migration of the Bald Eagle is complicated by the resident population of breeding eagles and an increasing number of non-breeders. The first sighting was 1 March and was consistent into early May. It was reported on 60% of the count days. The average per observer hour for 2009 was 0.27, a decrease of 55% from 2008 (0.61).

8) Northern Harrier (70) Peak: 9 April (8 birds and 0.53 birds/hr). The harrier is another common wintering bird in the region. The first migrating bird was recorded 4 March. It was consistently recorded until late April and was observed on 58% of the count days. The harrier was seen at 0.11 individuals per observer hour compared to 0.27 in 2008.

9) Osprey (38) Peak: 25 April (12 birds and 0.56 birds/hr). The Osprey was first recorded on 9 April and was fairly consistent through early May. It was seen at 0.06 individuals per observer hour which was a 20% increase from 2008.

10) American Kestrel (38) Peak: 9 April (10 birds and 0.67 birds/hr). This species was first recorded 5 March and was fairly consistent in April. Kestrels were seen at a rate of 0.06 individuals per observation hour. Kestrel counts have fallen over the life of the project.

11) Rough-legged Hawk (12) Peak: 1 April (3 birds and 0.29 birds/hr). The species was first recorded on 4 March. The 0.02 birds per observer hour was 50% below that of the 2008 rate. Many Rough-legged Hawks may have passed through to the north before field work began this year. Warm fronts in January and February should have taken many birds north following snow melt.

Other species observed but in low numbers were the Merlin (9), Peregrine Falcon (7), and Golden Eagle (9).

## EDUCATION

Educational programming was supplied upon request. Two public workshops were given in 2009 to 110 persons. The workshops were designed to give prospective volunteers background knowledge in raptor movement and identification, and guidance in completing field work. A program was provided for the Audubon Society of Ohio in Cincinnati which had 50 attendees. A volunteer picnic was held at the Black Swamp Bird Observatory office to thank the volunteers for their hours of effort and to discuss future plans.

## CONCLUSIONS

The 2009 field season produced valuable data that will add to our understanding of the migrational timing, habitat use, and long-term population trends of migrating raptors. It also allowed us to continue making strides in improvement of count procedures and results. The workshops continue to be a very important and successful tool towards meeting the education objectives of this project.

The prioritized site list appears match monitoring needs and will be evaluated each year. The study along the south shore of Lake Erie has benefitted from having more than one count site in order to follow the shifts in thermals followed by the soaring raptors. The use of multiple marshes also allows an assessment of broad qualities of wetlands. Protection of this vanishing habitat type requires accumulation of data such as these. It is hoped that additional sites can be manned on more days next season, however it will be extremely important that the tower continues to be sampled daily. It will be the means of making daily, yearly and location comparisons.

Because these raptors are so dependent on weather conditions, the past 18 years have produced some information on movement and timing, but have not yet been able to address the population trends very well.

Study results to date have been utilized for informing the public on where and when to observe migrating hawks. These analyses will also provide guidance for land managers in the Lake Erie marsh region for implementing management schemes for this group of migrating birds.

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## LITERATURE CITED

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Shieldcastle, M.C. 2009b. Migrational Survey and Habitat Usage of Shorebirds in the Lake Erie Marsh Region. Progress Report BSBO-ONWR08-3. Black Swamp Bird Observatory, Oak Harbor, OH.

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Table 1. Priority list for observation sites, 2009.

RANK	WATCH SITE LOCATIONS	SITE #
1)	Magee Marsh Tower	1
2)	Turtle Ck. (Lick.-Har.)	3
3)	Magee Beach	5
4)	Pickeral Ck W/A	7
5)	County Line Rd.	14
6)	Maumee Bay St Park	9
7)	S. Bass Island	29
8)	Port Clinton (Fulton St/SR2)	10
9)	SR 590 at Portage River	21
10)	Ft Meigs - Wood Co.	22
11)	Oak Harbor Golf Course	11
12)	SR 579 Golf Course	24
13)	Barrett Rd (Bay Point)	8
14)	Cullen Pk (Toledo)	23
15)	Wildwood Metropark	28
16)	Kelley's Island	13
17)	Metzger Marsh (west)	19
18)	Anchor Pt. Public access	15
19)	Darby Unit (ONWR)	16
20)	Ottawa NWR parking lot	4
21)	Ottawa NWR (pool 2)	17
22)	Toussaint W/A	18
23)	Metzger Marsh (pier)	20

Table 2. Survey counts of raptors and predominant wind direction in the Lake Erie marsh region, 2009.

DATE	RAPTORS	NUM. OF HOURS	RAPTORS/HOUR* <small>*heavy movements in bold</small>	WIND DIRECTION
Feb. 28	1	0.33	3.03	NE
Mar. 1	6	7.25	0.83	N
2	RAIN			NNE
3	RAIN			NNW
4	17	9.25	1.84	SSW
5	15	14.33	1.05	S
6	30	14.50	2.07	SW
7	4	5.00	0.80	S
8	RAIN			E
9	188	14.67	<b>12.82</b>	NW
10	RAIN			E
11	33	12.50	2.64	WSW
12	1	5.83	<b>17.00</b>	NNW
13	40	9.75	4.10	ESE
14	148	14.92	9.92	SSE
15	30	8.00	3.75	ENE
16	47	10.33	4.55	ENE
17	240	32.77	7.32	SSW
18	147	6.42	<b>22.90</b>	WSW
19	56	7.33	7.64	NE
20	20	8.83	2.27	NNE
21	141	10.25	<b>13.76</b>	SSW
22	148	12.33	<b>12.00</b>	WSW
23	123	8.50	<b>14.47</b>	E
24	19	8.00	2.38	ESE
25	339	10.00	<b>33.90</b>	S
26	66	9.83	6.71	NNE
27	180	11.50	<b>15.65</b>	SSW
28	220	6.42	<b>34.27</b>	ENE
29	413	13.25	<b>31.17</b>	SW
30	81	11.50	7.04	WNW
31	71	11.00	6.45	ESE
Apr. 1	428	10.42	<b>41.07</b>	SSW
2	423	11.50	<b>36.78</b>	SSE
3	1	6.25	0.16	WNW
4	232	14.42	<b>16.09</b>	WNW
5	72	13.75	5.24	E
6	RAIN			NNW



Table 2. Survey counts of raptors and predominant wind direction in the Lake Erie marsh region, 2009.

DATE	RAPTORS	NUM. OF HOURS	RAPTORS/HOUR* <small>*heavy movements in bold</small>	WIND DIRECTION
Apr. 7	15	5.92	2.53	WNW
8	1449	8.50	<b>170.47</b>	WSW
9	360	15.00	<b>24.00</b>	SW
10	6	8.00	0.75	ENE
11	94	10.67	8.81	N
12	44	9.00	4.89	ENE
13	3	5.83	0.51	E
14	RAIN			ENE
15	3	6.17	0.49	NE
16	87	8.25	<b>10.55</b>	NE
17	315	25.33	<b>12.44</b>	SW
18	216	14.58	<b>14.81</b>	SW
19	8	6.58	1.22	ENE
20	6	11.00	0.55	SE
21	393	9.50	<b>41.37</b>	SSW
22	86	9.75	8.82	W
23	131	13.28	9.86	NW
24	432	21.58	<b>20.02</b>	SSW
25	442	21.58	<b>20.48</b>	SW
26	427	14.67	<b>29.11</b>	WSW
27	305	15.17	<b>20.11</b>	SSW
28	0	0.50	0	NNE
29	2	7.00	0.29	E
30	11	4.00	2.75	SSE
May 1	42	6.00	7.00	W
2	57	8.00	7.13	SW
3	119	8.00	<b>14.88</b>	SW
4	70	9.25	7.57	ENE
5	37	9.00	4.11	ENE
6	16	6.00	2.67	ESE
7	12	4.05	2.96	S
8	48	6.00	8.00	S
9	5	1.00	5.00	WSW
<b>TOTAL</b>	9,221	660.10	13.97	

Table 3. Observer hours and count totals for count sites, 2009.

<b>SITE</b>	<b>HOURS OBSERVED</b>	<b>RAPTORS COUNTED</b>	<b>AVERAGE RAPTORS/HR</b>
Tower	298.00	3,149	10.57
Turtle Creek	96.85	2,300	23.75
Magee Beach	1.67	2	1.20
Pickeral Creek	30.25	355	11.74
Maumee Bay SP	90.67	1,220	13.46
County Line	22.08	195	8.83
S.R. 590	66.83	798	11.94
Cullen Park	41.00	443	10.80
Wildwood	2.25	3	1.33
Wildwood MP	1.00	4	4.00
South Bass Is	9.50	752	79.16
<b>TOTAL</b>	<b>660.10</b>	<b>9,221</b>	<b>13.97</b>

Table 4. Total accipiter hawks counted in the Lake Erie marsh region, 2009.

DATE	SHARP-SHIN HAWK*	COOPER'S HAWK*	NORTHERN GOSHAWK	UNIDENT. ACCIPITER	TOTAL
Feb. 28		(1)		1	1
Mar. 1		2			2
2					RAIN
3					RAIN
4		1			1
5	1				1
6	2	2			4
7					0
8					RAIN
9		12			12
10					RAIN
11	1	1			2
12					0
13	1	1			2
14	2	4			6
15		4			4
16		3			3
17	4	11 (12)		1	16
18	1	3			4
19		1			1
20					0
21	1				1
22	3	2			5
23					0
24		3			3
25	5	3			8
26		1			1
27		1			1
28					0
29	3	17			20
30	1	3			4
31					0
Apr. 1	7 (10)	4 (5)		4	15
2	4	9			13
3					0
4	2	10			12
5					0
6					RAIN

Table 4. Total accipiter hawks counted in the Lake Erie marsh region, 2009.

DATE	SHARP-SHIN HAWK*	COOPER'S HAWK*	NORTHERN GOSHAWK	UNIDENT. ACCIPTER	TOTAL
Apr 7	1				1
8	6	6			12
9	31 (33)	10		2	43
10		1			1
11	1 (2)			1	2
12		1			1
13					0
14					RAIN
15					0
16					0
17	8	31			39
18	17 (19)	6 (7)		3	26
19					0
20					0
21	52	7			59
22	19	4			23
23	2	3 (4)		1	6
24	54	12			66
25	121 (126)	16 (17)		6	143
26	104 (105)	30		1	135
27	14 (16)	17 (19)		4	35
28					0
29					0
30	1				1
May 1	12				12
2	19 (22)	2		3	24
3	4	2			6
4		1			1
5	1	4			5
6	2				2
7		1			1
8	4 (5)			1	5
9	2				2
TOTAL	513 (533)	252 (260)		28	793

\* Numbers in () include statistically assigned unknowns.

Table 5. Total buteo hawks counted in the Lake Erie marsh region, 2009.

DATE	RED-SHOUL. HAWK	BROAD- WING HAWK	RED-TAIL HAWK	ROUGH-LEG HAWK	UNIDENT. BUTEO	TOTAL
Feb. 28						0
Mar. 1			2			2
2						RAIN
3						RAIN
4	2		9	1		12
5			8 (9)	1	1	10
6	5		11	1		17
7	3					3
8						RAIN
9	95		58			153
10						RAIN
11	3		16			19
12						0
13	5 (6)		9 (11)	1 (2)	4	19
14	18 (25)		24 (33)		16	58
15			11			11
16			6 (7)		1	7
17	52 (58)		69 (77)		14	135
18	10(12)		8 (10)		4	22
19	11 (15)		9 (12)		7	27
20			7			7
21	1		5			6
22			16			16
23	6		7 (8)	1	1	15
24			2			2
25	1		4 (5)	1	1	7
26			37	1		38
27	18 (19)		22 (23)		2	42
28			1			1
29	1		21 (25)		4	26
30			18			18
31			5 (6)		1	6
1			22 (28)	2 (3)	7	31

Table 5. Total buteo hawks counted in the Lake Erie marsh region, 2009.

DATE	RED-SHOUL. HAWK	BROAD- WING HAWK	RED-TAIL HAWK	ROUGH-LEG HAWK	UNIDENT. BUTEO	TOTAL
Apr. 2	14 (16)		26 (29)		5	45
3						0
4			6 (7)		1	7
5	1		9 (10)	1	1	12
6						RAIN
Apr. 7			1			1
8	1		11(16)		5	17
9	1		39 (47)		8	48
10						0
11	3		6 (7)		1	10
12	1		6 (7)		1	8
13						0
14						RAIN
15			1			1
16	1	14 (15)	7		1	23
17			49 (55)		6	55
18	2	18 (21)	14 (16)		5	39
19		1	1			2
20						0
21	1	259	14			274
22		18	7			25
23		2	15 (17)		2	17
24	3	29 (31)	12 (13)		3	47
25		50 (59)	14 (16)		11	75
26	1	24 (26)	30 (33)		5	60
27	2 (3)	24 (27)	16 (18)		6	48
28						0
29						0
30			2			2
May 1			1			1
2			8 (13)		5	13
3		1 (2)	4 (8)		5	10
4			8			8
5			4 (7)		3	7
6			1			1
7			1			1
8		7 (15)			8	15
9						0
<b>TOTAL</b>	<b>262 (286)</b>	<b>447 (476)</b>	<b>720 (810)</b>	<b>10 (12)</b>	<b>145</b>	<b>1,584</b>

\* Numbers in ( ) include statistically assigned unknowns.

Table 6. Total falcons counted in the Lake Erie marsh region, 2009.

DATE	AMER. KESTREL*	MERLIN	PEREGRINE FALCON	UNIDENT. FALCON	TOTAL
Feb. 28					0
Mar. 1					0
2					RAIN
3					RAIN
4					0
5	1				1
6					0
7					0
8					RAIN
9					0
10					RAIN
11	1				1
12					0
13	1				1
14		1			1
15					0
16					0
17	4				4
18					0
19					0
20					0
21					0
22					0
23					0
24	1				1
25		1			1
26					0
27					0
28					0
29					0
30	1		1		2
31	1				1
Apr. 1	1				1
2					0
3					0
4					0
5					0
6					RAIN
7					0
8	2				2

Table 6. Total falcons counted in the Lake Erie marsh region, 2009.

DATE	AMER. KESTREL*	MERLIN	PEREGRINE FALCON	UNIDENT. FALCON	TOTAL
Apr. 9	10	1			11
10					0
11					0
12					0
13	1				1
14					RAIN
15					0
16					0
17	2				2
18	1				1
19					0
20					0
21			1		1
22					0
23		1			1
24		1			1
25	1	2			3
26	4				4
27	4	2	2		8
28					0
29	1				1
30					0
May 1					0
2					0
3					0
4					0
5	1				1
6			1		1
7					0
8			1		1
9			1		1
TOTAL	38	9	7	0	54



Table 7. Total vultures, ospreys, eagles, harriers and unidentified raptors counted in the Lake Erie marsh region, 2009.

DATE	TURKEY VULTURE	OSPREY	BALD EAGLE	GOLDEN EAGLE	NO. HARRIER	UNIDENT. RAPTOR
Feb. 28						
Mar. 1			2			
2						
3						
4			2		2	
5	1				1	1
6	3				6	
7					1	
8						
9			21		2	
10						
11	5		3		3	
12						1
13	17		1			
14	80				3	
15	10		5			
16	32		3		2	
17	75		5		5	
18	117		3		1	
19	28					
20	8		4		1	
21	133				1	
22	126				1	
23	100		7		1	
24	13					
25	319		2	1	1	
26	24				1	2
27	136		1			
28	219					
29	358		8		1	
30	43		11	1	2	
31	59		3			2
Apr. 1	374		6		1	1
2	359		6			
3			1			
4	208		4		1	
5	58		2			
6						
7	12				1	
8	1,414		2		2	

Table 7. Total vultures, ospreys, eagles, harriers and unidentified raptors counted in the Lake Erie marsh region, 2009.

DATE	TURKEY VULTURE	OSPREY	BALD EAGLE	GOLDEN EAGLE	NO. HARRIER	UNIDENT. RAPTOR
Apr. 9	235	2	6	3	8	4
10	4		1			
11	79		2		1	
12	33		2			
13	1				1	
14						
15			1		1	
16	64					
17	209	1	6		3	
18	144		5		1	
19	2		2			2
20	5				1	
21	56	1		2		
22	37					1
23	90		12	1	2	
24	313	3	2			
25	204	12	4		1	
26	203	6	18		1	
27	199	7	4		4	
28						
29					1	
30	8					
May 1	27	1			1	
2	17	1	1		1	
3	95	2	6			
4	60		1			
5	22				2	
6	11			1		
7	5		5			
8	24	2			1	
9	2					
TOTAL	6,480	38	180	9	70	14

Table 8. Birds per hour of observation of major species and total raptors, 1991 - 2009.

SPEC	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991
TUVU	9.82	9.07	9.74	3.99	6.57	7.97	9.48	6.33	3.91	3.64	5.73	10.06	6.46	4.17	3.38	5.36	4.11	3.55	2.76
OSPR	0.06	0.05	0.02	0.02	0.04	0.09	0.05	0.07	0.08	0.03	0.03	0.04	0.03	0.16	0.03	0.04	0.11	0.09	0.05
BAEA	0.27	0.61	0.31	0.41	0.22	0.39	0.21	0.19	0.15	0.16	0.16	0.22	0.16	0.12	0.09	0.10	0.11	0.12	0.02
NOHA	0.11	0.27	0.21	0.15	0.13	0.33	0.19	0.15	0.19	0.13	0.19	0.13	0.14	0.33	0.16	0.23	0.24	0.28	0.54
SSHA	0.81	0.68	0.89	0.40	0.69	2.20	1.06	1.32	1.22	0.55	0.54	0.93	1.03	1.66	0.52	0.97	1.07	1.12	1.81
COHA	0.39	0.42	0.42	0.20	0.24	0.61	0.38	0.26	0.21	0.16	0.30	0.23	0.24	0.26	0.17	0.43	0.32	0.52	0.91
RSHA	0.43	0.31	0.97	0.25	0.38	1.17	0.77	0.71	0.38	0.51	0.76	0.57	0.16	0.44	0.41	0.50	1.07	0.79	0.32
BWHA	0.72	0.82	0.40	0.29	1.61	5.78	1.43	3.45	2.30	1.04	0.17	1.39	0.51	1.17	0.75	1.10	2.71	1.92	1.47
RTHA	1.23	2.00	1.53	0.99	1.16	2.52	2.25	1.62	1.01	1.09	1.85	2.11	1.90	1.89	1.24	2.41	2.01	2.07	1.63
RLHA	0.02	0.04	0.04	0.05	0.05	0.07	0.05	0.03	0.05	0.07	0.16	0.03	0.05	0.27	0.06	0.08	0.10	0.35	0.06
AMKE	0.06	0.05	0.07	0.05	0.05	0.18	0.13	0.09	0.11	0.09	0.11	0.12	0.10	0.14	0.11	0.10	0.11	0.17	0.30
Total hrs	660.1	607.6	589.5	644.9	647.3	608.1	781.1	886.9	980.2	938.0	876.1	924.48	987.30	1029.7	1064.2	1209.3	611.25	575.92	392.25
Total raptors	9221	8760	8622	4418	7224	13003	12519	12580	9493	7096	8875	14720	10789	11051	7517	14067	7642	6362	3931
Total raptors/Hr	13.97	14.42	14.63	6.85	11.16	21.38	16.03	14.18	9.68	7.56	10.13	15.92	10.93	10.73	7.06	11.63	12.5	11.05	10.02

Figure 1. Raptor count locations by site #.

