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Virginia Peregrine Falcon monitoring and management program: Year 2003 report

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**VIRGINIA PEREGRINE FALCON
MONITORING AND MANAGEMENT PROGRAM:
YEAR 2003 REPORT**



**CENTER FOR CONSERVATION BIOLOGY
COLLEGE OF WILLIAM AND MARY**

VIRGINIA PEREGRINE FALCON MONITORING AND MANAGEMENT PROGRAM: YEAR 2003 REPORT

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The Virginia Department of Game and Inland Fisheries
(Wildlife Diversity Program)
National Aeronautics and Space Administration
National Park Service
United States Fish and Wildlife Service
Virginia Department of Transportation
The Nature Conservancy
Dominion
Center for Conservation Biology

Front Cover: *Peregrine with chicks in Richmond Virginia. Photo by Shawn Padgett.*



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EXECUTIVE SUMMARY

The Peregrine Falcon (*Falco peregrinus*) was believed to be extinct as a breeding species in Virginia by the mid-1960's. Intensive management efforts since the late 1970's have resulted in a known breeding population that is now approaching 20 pairs. However, all known breeding pairs currently nest on artificial structures and reproductive performance continues to be erratic. The primary objective of this program is to continue monitoring efforts to document population trends and to learn more about factors that may limit breeding success and survivorship. The ultimate goal is to develop management actions that will result in a population that is self-sustaining.

Fifty-three nesting structures were surveyed for falcons during the 2003 breeding season. Surveys resulted in the documentation of 18 occupied territories. Seventeen breeding attempts produced 29 chicks that were documented to survive beyond fledging (reproductive rate 1.6 chicks/occupied territory). As in previous years, hatching rate continued to be relatively low. Of 14 clutches that were followed completely, only 33 of 54 (61.1%) eggs hatched. Of these 33 chicks, 29 (87.9%) fledged. Three of these chicks died of the West Nile Virus. This is the first documented case of brood mortality related to this disease and raises concerns for the future of this population.

The improvement in reproductive rates compared to recent years could, at least partially, be accounted for by direct management activities. High parasite loads involving a wingless *Hippoboscid* fly were documented to cause pre-fledging mortality during the previous 2 breeding seasons. Sterilization of nesting material within sites with a history of infestation was 100% effective in reducing this mortality factor and should become a standard management practice. Translocation of chicks from bridge sites known to have a history of poor fledging success to mountain hawk sites has improved chick survivorship and increased the potential for birds to re-colonize the historic mountain breeding range. This management practice should continue for the foreseeable future.

BACKGROUND

Context

The original population of peregrine falcons in the eastern United States was estimated to contain approximately 350 breeding pairs (Hickey 1942). From published records and accounts, there have been 24 historical Peregrine eyries documented in the Appalachians of Virginia (Gabler 1983). Two additional nesting sites were documented on old osprey nests along the Virginia portion of the Delmarva Peninsula (Jones 1946). Throughout the 1950's, and into the 1960's Peregrine Falcon populations throughout parts of Europe and North America experienced a precipitous decline (Hickey 1969). A survey of 133 historic eyries east of the Mississippi River in 1964 failed to find any active sites (Berger et al. 1969). The Peregrine Falcon was believed to be extinct in Virginia as a breeding species by the early 1960's.

As part of a national effort to restore the eastern Peregrine population, the Virginia Department of Game and Inland Fisheries, Cornell University, and the College of William and Mary initiated a hacking program for Virginia in 1978. The program involved the release of captive-reared Peregrines with the hope that these birds would re-colonize the historic breeding range. Between 1978 and 1993, approximately 250 young falcons were released in Virginia. Since the close of this program, captive-reared Peregrines have been released on a limited basis within the state. Such releases have involved more targeted projects. Beginning in 2000, wild-reared falcons have been translocated from coastal breeding sites to mountain release sites. Such movements have taken advantage of young produced from sites where fledging success is known to be poor.

The first successful nesting of Peregrines Falcons in Virginia after the DDT era occurred in 1982 on Assateague Island. Since that time, the breeding population has continued a slow but steady increase. The size of the known breeding population within the coastal plain has now exceeded 15 pairs. However, both hatching rate and chick survival remain somewhat erratic. An analysis by the U.S. Fish and Wildlife Service in the early 1990's of addled eggs collected in Virginia, showed levels of DDE, Dieldrin, and egg-shell thinning that have been shown previously to have an adverse impact on reproduction. An additional problem that has been suspected but not fully quantified is that the turnover rate of breeding adults appears to be high. At present, the long-term viability of the Virginia population in the absence of continued immigration from surrounding populations remains questionable. Continued monitoring and management of this population is needed to ensure that the population will continue to recover.

Objectives

The objectives of this project were 1) to track the recovery of the breeding population of Peregrine Falcons in Virginia (both in terms of the size and distribution of the breeding population and the number of young produced), 2) to evaluate the success of past and present management techniques used with the breeding population, 3) to improve

productivity of nesting pairs through active management, and 4) to increase our understanding of Peregrine Falcon natural history in the mid-Atlantic region.

METHODS

Geographic Focus

The geographic scope of this project was limited to the coastal plain of Virginia. Given the known number of breeding pairs of Peregrine Falcons in the mountains of surrounding states, it is highly likely that breeding pairs do exist on natural cliff sites within Virginia. However, none are currently known. No attempts to systematically survey these areas have been made since 1992.

Nest Site Surveys

Between 1977 and 2003 approximately 60 structures have been established specifically for breeding Peregrine Falcons within the coastal plain of Virginia (Table 1, Figure 1). Nearly all of the structures that survived to the 2002 breeding season were checked for evidence of resident falcons. An initial survey of breeding structures was conducted between 15 February and 30 March. All surveys of towers and boxes along the Delmarva Peninsula and fringe of the western shore were surveyed from the air using a Cessna 172, high-wing aircraft. Flybys were conducted at low altitude to flush attending adults and to view the inside of nest boxes for activity. The number of adults attending sites and/or activity within the nest box was recorded. Remaining sites on bridges or within urban areas were surveyed on the ground for occupation and activity. Sites that were confirmed to have Peregrine activity were monitored with 2-5 additional ground visits to document breeding activity and to band young. A breeding territory was considered to be “occupied” if a pair of adult Peregrines was resident during the breeding season. Nests were considered to be “active” if eggs or young were detected (Postupalsky 1974). Complete breeding information (i.e. clutch size, hatching rate) could not be obtained for a small portion of active sites due to poor access.



Bryan Watts and Shawn Padgett band chicks on Metompkin Island Tower (Lft). Shawn Padgett, Bryan Watts and Mitchell Byrd attach a satellite transmitter to falcon chick (Rt). Photos by Bart Paxton.

Table 1. Catalog of nesting structures established for Peregrine Falcons in Virginia (1977-2003). Table gives year of establishment and whether or not the site was checked for Peregrine Falcon activity during the 2003 breeding season. Dashed lines indicate that the structure is no longer present.

Site Code	Location Description	Structure Type	Year Est.	Checked 2003
VA-PEFA-01	Fisherman's Island Tower	Peregrine Tower	1980	Y
VA-PEFA-02	Cobb Island Tower	Peregrine Tower	1978	Y
VA-PEFA-03	Hog Island Tower	Peregrine Tower	1977	Y
VA-PEFA-04	Paramore Island Tower	Peregrine Tower	1982	-----
VA-PEFA-05	Metomkin Island Tower	Peregrine Tower	1982	Y
VA-PEFA-06	Wallops Island Tower	Peregrine Tower	1981	Y
VA-PEFA-07	Chincoteague Tower	Peregrine Tower	1979	Y
VA-PEFA-08	Great Fox Island Tower	Peregrine Tower	1981	Y
VA-PEFA-09	Watts Island Tower	Peregrine Tower	1997	Y
VA-PEFA-10	Finney's Island Tower	Peregrine Tower	1997	Y
VA-PEFA-11	Tangier Island Water Tower	Nest Box	1999	-----
VA-PEFA-12	Hyslop Marsh Tower2T	Peregrine Tower	1995	Y
VA-PEFA-13	Saxis Marsh N. Tower	Peregrine Tower	1996	Y
VA-PEFA-14	Saxis Marsh S. Tower	Peregrine Tower	1998	Y
VA-PEFA-15	Parker Marsh Tower	Peregrine Tower	1997	Y
VA-PEFA-16	Elkins Marsh Chimney	Nest Box	1995	Y
VA-PEFA-17	Elkins Marsh Shack	Nest Box	1997	Y
VA-PEFA-18	Wachapreague Shack	Peregrine Tower	1994/2000	Y
VA-PEFA-19	James River Ghost Ship	Moth Ball Fleet	1987	Y
VA-PEFA-20	Coleman Bridge Box	Nest Box	1989	Y
VA-PEFA-21	Norfolk Southern RR Bridge	Bridge	1992	N
VA-PEFA-22	James River Bridge	Nest Box	1991	Y
VA-PEFA-23	Berkley Bridge	Nest Box	1996	Y
VA-PEFA-24	Benjamin Harrison Bridge	Nest Box	1996	Y
VA-PEFA-25	Mills Godwin Bridge	Nest Box	1996	Y
VA-PEFA-26	West Norfolk Bridge	Nest Box	1996	Y
VA-PEFA-27	Norris Bridge	Nest Box	1989	Y
VA-PEFA-28	Stoney Man, SNP	Natural Cliff Face	-----	Y
VA-PEFA-29	Old Rag, SNP	Natural Cliff Face	-----	Y
VA-PEFA-30	Back Bay tower	Peregrine Tower	1982	-----
VA-PEFA-31	Plum Tree Island tower	Peregrine Tower	1998	Y
VA-PEFA-32	Plum Tree Island box	Nest Box	1990	Y
VA-PEFA-33	Saxis Marsh W. tower	Peregrine Tower	1998	Y
VA-PEFA-34	Mockhorn Island tower	Peregrine Tower	1997	Y
VA-PEFA-35	Tangier Island tower	Peregrine Tower	2000	-----
VA-PEFA-36	Upsher Bay tower	Peregrine Tower	2000	Y

Table 1. Continued.

Site Code	Location Description	Structure Type	Year Est.	Checked 2003
VA-PEFA-37	Silver Beach Range Tower	Nest Box	1997	Y
VA-PEFA-38	Hawksbill Mountain	Natural Cliff Face	-----	Y
VA-PEFA-39	Concrete Ships	Nest Box	1995	Y
VA-PEFA-40	Chesapeake Substation	Nest Box	1998	Y
VA-PEFA-41	Holiday Inn VA Beach	Nest Box	1997	Y
VA-PEFA-42	Possum Point Substation	Nest Box	1998	Y
VA-PEFA-43	Newport News City Hall	Nest Box	1993	Y
VA-PEFA-44	Elizabeth River Substation	Nest Box	1998	Y
VA-PEFA-45	Cargill Grain Elevator	Nest Box	1993	Y
VA-PEFA-46	Lafayette Bridge	Nest Box	1998	Y
VA-PEFA-47	North Elkins Shack	Nest Box	1994	Y
VA-PEFA-48	Churchland Bridge	Nest Box	1999	Y
VA-PEFA-49	Yorktown Substation	Nest Box	1998	Y
VA-PEFA-50	Jordan Bridge	Nest Box	1995	Y
VA-PEFA-51	Campostella Bridge	Nest Box	1998	Y
VA-PEFA-52	I-64 Bridge	Nest Box	1999	Y
VA-PEFA-53	ALCOA Bridge	Nest Box	1999	Y
VA-PEFA-54	I-295 Bridge	Nest Box	2001	Y
VA-PEFA-55	Dominion Building	Nest Box	2000	Y
VA-PEFA-56	River Front Plaza	Nest Box	2002	Y
VA-PEFA-57	Bank of America Building	Nest Box	1984	Y
VA-PEFA-58	Russell Island	Peregrine Tower	1982	-----
VA-PEFA-59	Bermuda Hundred	Nest Box	1998	Y



Chick fitted with solar-powered, satellite transmitter. Photo by Bart Paxton.

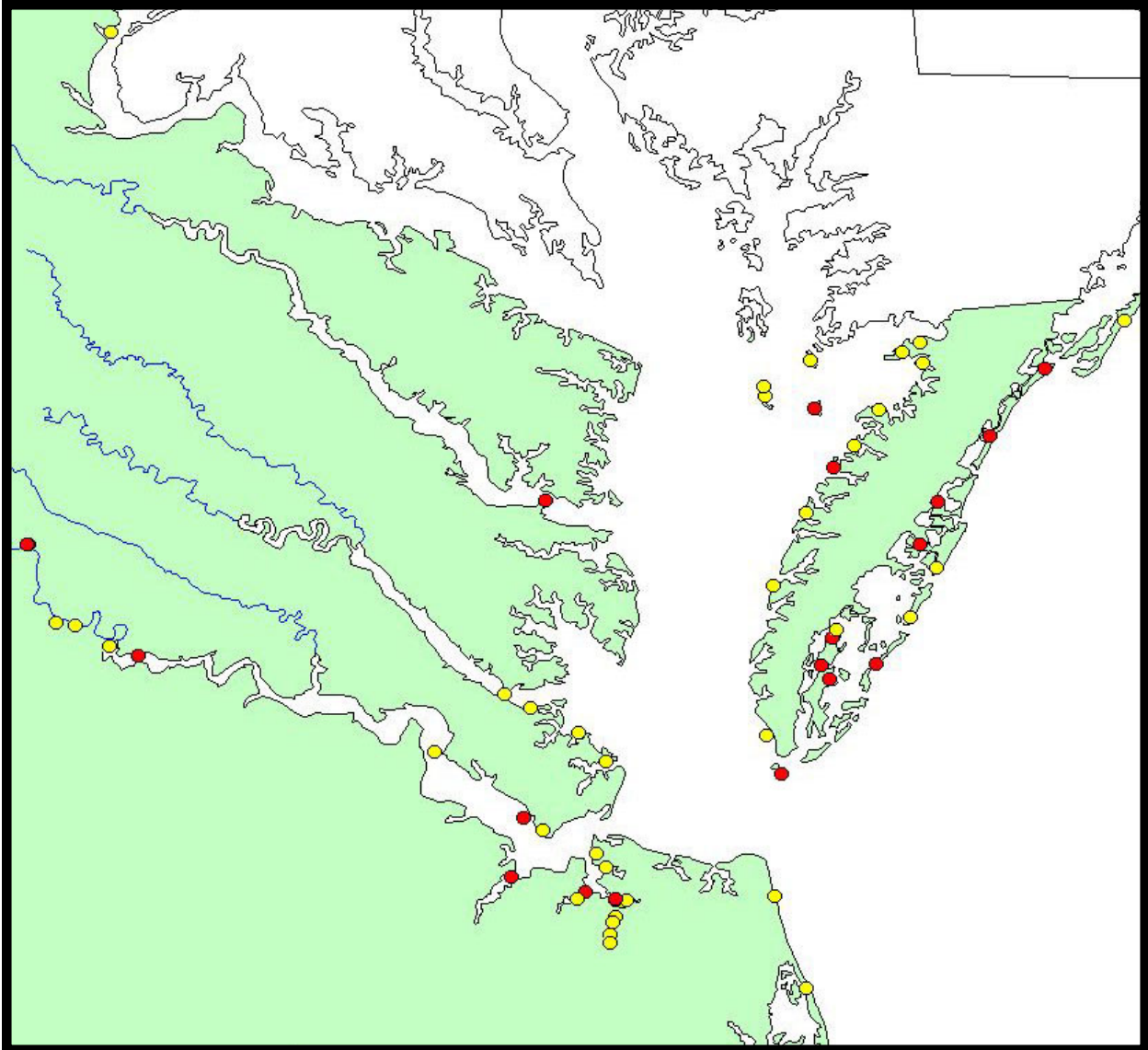


Figure 1. Map of coastal Virginia indicating the location of nesting structures established for Peregrine Falcons. Red circles indicate the location of structures occupied by resident pairs during the 2003 breeding season.

Banding

An attempt was made to band all chicks surviving to banding age (21-32 d). Chicks were banded with a U.S. Fish and Wildlife Service lock-on, aluminum tarsal band on the right leg and a bi-colored, green and black, alpha-numeric auxiliary band on the left leg. FWS bands used in Virginia during the 2003 breeding season were anodized green.



Chicks after banding on the Benjamin Harrison Bridge showing green anodized FWS band on right leg and black/green alpha-numeric band on left leg. Photo by Catherine Markham.

Translocations

Over the past several years, some breeding sites on bridges have been known to experience low fledging rates. Observations indicate that losses occur during initial flight attempts or when chicks are near fledging age. Numerous chicks have been lost in the water during early flights when they are unable to fly back up to nest structures. Other chicks have flown down to the roadbed and been killed by automobiles. In order to improve survivorship for high-risk sites, a program was initiated to translocate bridge chicks to mountain release sites. Chicks are typically removed from nest sites, transported to mountain sites, and released using standard hacking techniques (Sherrod et al. 1981).

RESULTS

Site Surveys

Fifty-three nesting structures were surveyed for Peregrine Falcon activity during the breeding season (Table 1). Only one structure that is still standing was not surveyed and it is within the territory of a pair nesting on a nearby structure. Of the sites with known occupation, 18 supported resident pairs. These included 8 peregrine towers, 6 bridges, 3 shack remnants on the seaside of the Delmarva, and 1 high-rise building (Table 2).

Table 2. Summary of productivity results for Peregrine Falcon pairs in Virginia during the 2003 breeding season.

Location Description	Site Code	Occ Terr	Active Nest	Eggs	Chicks Hatched	Band Age	Fledg
Fisherman's Isl Tower	PEFA-01	Y	Y	3	0	-----	-----
Cobb Island Tower	PEFA-02	Y	Y	4	3	3	3
Metomkin Island Tower	PEFA-05	Y	Y	5	5	5	5
Wallops Island Tower	PEFA-06	Y	Y	4	3	3	3
Watts Island Tower	PEFA-09	Y	Y	4	2	2	2
Finney's Island Tower	PEFA-10	Y	Y	4	4	1	1
Elkins Marsh Chim Box	PEFA-16	Y	N	-----	-----	-----	
Elkins Marsh Shack Box	PEFA-17	Y	Y	4	2	2	2
Wachapreague Shack	PEFA-18	Y	Y	2	0	-----	-----
James River Bridge Box	PEFA-22	Y	Y	≥2	≥2	0	-----
Berkley Bridge Box	PEFA-23	Y	Y	5	1	1	1
Ben Harrison Bridge Box	PEFA-24	Y	Y	4	3	3	3
Mills Godwin Bridge Box	PEFA-25	Y	Y	4	3	3	3
West Norfolk Bridge Box	PEFA-26	Y	Y	?	?	0	-----
Norris Bridge	PEFA-27	Y	Y	4	4	4	4
Mockhorn Tower	PEFA-34	Y	Y	≥2	2	2	0
Upsher Bay Tower	PEFA-36	Y	Y	3	0	-----	-----
Richmond City	PEFA-56	Y	Y	4	3	3	2
Total	-----	18	17	≥58	≥37	32	29

Breeding Results

Coastal Virginia supported 18 known breeding pairs of Peregrine Falcons during the 2003 breeding season (Figure 1). One of these pairs was not documented to produce eggs such that there were only 17 active territories (Table 2). Pairs produced at least 58 eggs and at least 37 chicks hatched. Thirty-two chicks survived to banding age and 29 were documented to fledge. Fledging success was 1.6 chicks/occ terr and 1.7/act terr. Post-fledging mortality has been documented within broods that have been monitored with satellite transmitters.

As in recent years, hatching rate within the Virginia population continued to be relatively low. Of 14 clutches that were followed completely from laying to fledging, only 33 of 54 (61.1%) eggs hatched. Of these 33 chicks, 30 (90.9%) survived to banding age and

29 (87.9%) fledged. At least 7 chicks were documented to be lost in the pre-fledging period. Three of these chicks were discovered dead within the Finney's Island tower and tested positive for West Nile disease. The fourth chick of this brood was rehabilitated and released. The adult male from this pair was on the ground below the tower and was taken to the Wildlife Center of Virginia for treatment. This bird recovered and was released on site. The two-chick brood on the Mockhorn Island tower disappeared shortly after banding. No obvious reason for the disappearance was detected. The breeding pair on the James River Bridge attempted to nest within a hollow support beam. At least 2 young chicks were heard food begging from this location. One week later when the site was investigated the chicks were gone and presumably had fallen through a hole on the under side of the beam.

Pre-fledging survivorship was better in 2003 compared to recent years. Unlike in the 2001 and 2002 breeding seasons, no chicks died from parasites. Prior to the breeding season, nest trays that had shown problems in previous years were sterilized with alcohol to kill the over-wintering larvae of the wingless *Hippoboscidae* fly. This treatment was nearly 100% effective in reducing parasite loads on developing chicks and is recommended as a standard management procedure for future years. Also unlike the 2002 breeding season, only a single chick was lost around the time of fledging. This bird was a male that flew prematurely from the high rise building in downtown Richmond. Although the bird was carrying a satellite transmitter, it was never heard from or seen again. In past years, many chicks have been lost at fledging from bridge sites. In 2003, most chicks produced on bridges were translocated to the Hawksbill hawk site. However, single chicks were left in place on the Norris, Benjamin Harrison, and Berkley bridges. All of these chicks were documented to fledge successfully.

Banding

All of the falcon chicks (N = 33) that survived to banding age were fitted with both FWS and alpha-numeric bands. This included 16 females and 17 males (Table 3). Twelve of these birds (7 females and 5 males) were also fitted with solar-powered satellite transmitters.

Translocations

Nine young falcons were moved during the course of the 2003 breeding season (Table 4). This included 5 females and 4 males. All but one of these chicks originated on bridges that have a history of poor fledging success. The remaining bird was collected from the Finney's Island tower where all siblings were found dead of West Nile. This bird also tested positive for West Nile but was taken to the Wildlife Center of Virginia for treatment. Upon recovery this bird was released at Hawksbill. The bird was later found in poor condition, was rehabilitated at the Wildlife Center and then re-released at Hawksbill. The bird was fitted with a satellite transmitter and at this time appears to be doing well.

Table 3. List of band codes for peregrine falcon chicks banded in Virginia during 2003 breeding season.

FWS Band	A-N Band	Trans	Location	Date
Females				
987-51265	*C/*B	-----	Mills Godwin Bridge	5/27/03
987-51266	*C/*C	24090	Richmond	5/28/03
987-51267	*C/*D	27412	Watts Island	5/28/03
987-51268	*C/*E	-----	Berkley Bridge	5/30/03
987-51269	*C/*H	-----	Wallops Island	5/30/03
987-51270	*C/*K	27407	Norris Bridge	6/12/03
987-51271	*C/*M	-----	Norris Bridge	6/12/03
987-51272	*C/*P	-----	Norris Bridge	6/12/03
987-51273	*C/*R	27404	Ben Harrison Bridge	6/20/03
987-51274	*C/*S	-----	Mockhorn	6/21/03
987-51275	*C/*U	-----	Mockhorn	6/21/03
987-51276	*C/*V	27396	Cobb Island	6/21/03
987-51277	*C/*W	36491	Cobb Island	6/21/03
987-51278	*C/*X	-----	Metomkin Island	7/03/03
987-51279	*C/*Y	-----	Metomkin Island	7/03/03
987-51280	8/A	36486	Metomkin Island	7/03/03
Males				
2206-43461	*7/*R	-----	Mills Godwin Bridge	5/27/03
2206-43462	*7/*S	-----	Mills Godwin Bridge	5/27/03
2206-43463	*7/*U	-----	Richmond	5/28/03
2206-43464	*7/*V	27403	Richmond	5/28/03
2206-43465	*7/*W	41301	Watts Island	5/28/03
2206-43466	*7/*X	-----	Elkins Marsh	5/28/03
2206-43467	*7/*Y	-----	Elkins Marsh	5/28/03
2206-43468	*2/*A	-----	Wallops Island	5/30/03
2206-43469	*2/*B	41299	Wallops Island	5/30/03
2206-43470	*2/*C	-----	Norris Bridge	6/12/03
2206-43471	*2/*D	-----	Ben Harrison Bridge	6/20/03
2206-43472	*2/*E	-----	Ben Harrison Bridge	6/20/03
2206-43473	*2/*H	-----	Cobb Island	6/21/03
2206-43474	*2/*K	-----	Metomkin Island	7/03/03
2206-43475	*2/*M	36492	Metomkin Island	7/03/03
2206-43476	*2/*P	41300	Finney's Marsh	7/22/03

Table 4. Summary of translocation activities for Peregrine Falcons in Virginia during the 2003 breeding season.

FWS Band#	Hatch Site	Date Moved	Release Site	Date Released
987-51265	Mills Godwin Bridge	5/27/03	Shenandoah National Park	6/5/03
987-51270	Norris Bridge	6/12/03	Shenandoah National Park	6/23
987-51271	Norris Bridge	6/12/03	Shenandoah National Park	6/23
987-51272	Norris Bridge	6/12/03	Shenandoah National Park	6/23
987-51273	Ben Harrison Bridge	6/20/03	Shenandoah National Park	7/2
2206-43461	Mills Godwin Bridge	5/27/03	Shenandoah National Park	6/5
2206-43462	Mills Godwin Bridge	5/27/03	Shenandoah National Park	6/5
2206-43472	Ben Harrison Bridge	6/20/03	Shenandoah National Park	7/2
2206-43476	Finney's Island	7/22/03	Shenandoah National Park	7/25&8/19

Adult Problems/Mortality

Three adult falcons were believed or known to have problems during the 2003 breeding season. An effort was launched in 2003 to identify banded adults to begin the process of quantifying age distribution and turnover rates within the Virginia breeding population.

Berkley Bridge Female – This female was 17 years old and had been resident within the Norfolk territory for many years. She was found by a citizen at the ship yard in Portsmouth and was transferred to a local rehabilitator. She was later taken to the Wildlife Center of Virginia. The examination indicated that she would not be releasable. Rather than attempting to place this bird in a captive program, she was euthanized.

Wallops Island Male – After the fledging period, satellite transmitter signals indicated that chicks at this location had gone down in the local area. A ground visit resulted in the discovery of chicks that had been killed by an aerial predator. The condition of the chicks was not indicative of a Great-horned Owl kill. Injuries appeared to be more consistent with those inflicted by another Peregrine Falcon. Researchers at the site who were familiar with the resident male's behavior believe that the male present at that time was a different individual. It seems possible that the resident male was replaced just after the breeding period and the new male killed the brood. This behavior has been reported elsewhere. An attempt will be made in 2004 to identify the resident male to confirm this turnover.

Finney's Island Male – During a nest visit to band chicks, this male was found under the tower and was incapacitated. The bird could not maintain sustained flight and appeared to be neurologically impaired. Symptoms were consistent with West Nile infection. The bird was transported to the Wildlife Center of Virginia. A diagnosis of West Nile has still not been confirmed. The bird recovered and was released within the breeding territory with a satellite transmitter. The bird is still active.

DISCUSSION

The breeding population of Peregrine Falcons in coastal Virginia increased to 18 pairs during the 2003 breeding season. Prior to this year the population had remained stable for the previous 5 years with 17 pairs. A targeted effort was mounted in 2003 to collect definitive information on fledging success. Fledging rate was 1.61 chicks/pair which is believed to be higher than in recent years and is above the 1.25 young/pair suggested to be required to sustain a stable population. Some of the gains in productivity appear to have resulted from direct management actions.

During both the 2001 and 2002 breeding seasons several chicks have been in poor condition or have died due to infestations with a small species of wingless *Hippoboscid* fly. This species is capable of over-wintering as pupae within the nesting material and prey remains within the aeries. This appears to allow the population to build up within a site through the years. Soon after the chicks hatch they can very quickly become overwhelmed by the parasites. The flies become concentrated under the wings of the chicks and feed on blood. Very high infestations were observed in selected sites during 2001 and 2002. In 2001 chicks died even after they had been treated. Prior to the breeding season in 2003, aeries with a history of problems were sterilized with alcohol. Chicks within these sites did not develop parasite loads. This treatment represents an inexpensive solution to the problem and successfully increased reproductive rates.

In recent years, pairs nesting on bridges represent approximately 30% of the breeding population. Historically, fledging success from some of these bridges have been relatively poor. Chicks apparently have a difficult time negotiating the wind currents around these structures and frequently do not make it back to the aeries during early flight attempts. These birds often end up in the water or on the road bed below. Translocation of chicks from these locations to mountain hack sites has increased fledging success and potentially could result in some re-colonization of their historic mountain range.

Although better than in recent years, hatching rate continued to be relatively poor in 2003. The underlying causes of these low rates remain unclear. Addled eggs collected from the population in 1992 (Morse 1993) revealed DDE concentrations within ranges that have been shown to have adverse impacts on reproduction in previous studies (Wiemeyer et al. 1986). Egg-shell thinning ranged up to 26.9%, a level above the reported 14% to 17% range that has been documented to result in egg failure (Peakall and Kiff 1988). Sixteen addled eggs were collected during the 2001 and 2002 breeding seasons and transferred to Rob Hale's lab at the Virginia Institute of Marine Science. Preliminary contaminants analysis revealed unexpected levels of highly brominated diphenyl ether flame retardants (BFR), as well as, the more traditional organochlorine compounds (Hale and Potter, preliminary results). The effect of these compounds on hatching rate are not clear. However, further monitoring of contaminants within this breeding population and an evaluation of potential routes of exposure would appear warranted.

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