



## United States Department of the Interior

### FISH AND WILDLIFE SERVICE

Raleigh Field Office

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September 20, 2002

Commander, Atlantic Division  
Attn: Ms. Kelly Knight (BD33)  
1510 Gilbert Street  
Norfolk, Virginia 23511-2699

Dear Ms. Knight:

The U.S. Fish and Wildlife Service (Service) has reviewed the Department of the Navy, U.S. Marine Corps' Environmental Assessment (EA) for Proposed Military Operations Areas in Eastern North Carolina, dated June 2002. Our comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.)

The U.S. Marine Corps (USMC) proposes to create two independent Military Operations Areas (MOAs) in eastern North Carolina. One MOA would allow for the high-speed ingress and egress of aircraft along the coastline, and the other would meet the need for additional aerial training space. The EA addresses the potential environmental effects of five alternatives, in addition to the No Action Alternative. These alternatives include the Core MOA, Cherry MOA, and Mattamuskeet MOA, and combinations of the Core and Cherry MOAs and Core and Mattamuskeet MOAs.

The proposed Core MOA is the only MOA identified that would satisfy the requirement for tactical jet traffic to transit across the coastline and enter the existing Pamlico B MOA or either of the proposed Mattamuskeet or Cherry MOAs. The selection of either the Mattamuskeet MOA or Cherry MOA would create additional special use airspace desired to meet the training needs of USMC aviators. The proposed Core MOA is located in Carteret County over a significant portion of the Cape Lookout National Seashore. The proposed Cherry MOA is located over portions of Beaufort, Craven, Hyde, Pamlico and Washington counties. The proposed Mattamuskeet MOA overlies portions of Beaufort, Hyde, Pamlico, Tyrrell, and Washington counties. The USMC has selected the Core and Mattamuskeet MOAs as their preferred alternative.

There is a long history and controversy surrounding airspace use in eastern North Carolina; elements of the proposed action date back to the 1980s. The preferred Core and Mattamuskeet MOAs alternative overlies some of eastern North Carolina's most pristine and sensitive natural resource areas, including the Cape Hatteras National Seashore, the Swanquarter National Wilderness Area, and portions of Alligator River National Wildlife Refuge (NWR),

Mattamuskeet NWR, Swanquarter NWR and Pocosin Lakes NWR. Each of these holdings is federally-mandated with a mission to conserve and protect natural resources for the continuing benefit of future generations. In past consultations, the Service has attempted to provide the Navy with comments and recommendations that confirm the mission of the Service and the Department of the Interior. However, our recommendations have been and will continue to be adjusted to reflect the complexity of the area and changes that have occurred over the years in eastern North Carolina. For these reasons, it is pertinent that the potential impacts of the proposed actions are completely and thoroughly evaluated.

The Service was dismayed by the USMC's issuance of an EA for the proposed activities and the inclusion of the Mattamuskeet MOA as the preferred alternative. During the scoping meeting in Manteo, North Carolina, on October 30, 2000, the USMC did not reveal, nor did any of the Service representatives present get the impression, that the Mattamuskeet MOA was being seriously considered as a preferred alternative. We also were confused by the manner in which the USMC has handled the preparation of the environmental review documentation for the proposed activities. Specifically, the Department of the Navy (Navy) issued a Notice of Intent to prepare an Environmental Impact Statement (EIS) for the proposed action on October 6, 2000 (65 *Federal Register* 59829). On February 21, 2001, a briefing to the National Park Service (NPS), with representatives present from the Service, USMC, Navy, and TAMS Consultants, Inc., was held in Beaufort, North Carolina, to discuss the proposed actions. However, the preparation of an EA was not presented, nor discussed. In fact, you stated in that briefing "that agencies/public would be afforded a greater opportunity to understand and review the proposal if an EIS was prepared." We could not have agreed more with this statement.

In general, the EA is effective in describing the alternatives and explaining the technical information needed to understand the effects of training activities on the environment. However, the EA is deficient in evaluating the potential impacts of the proposed action on federally-protected species, such as threatened and endangered species and migratory birds, and the natural soundscape of eastern North Carolina. The following comments reflect our evaluation of the EA.

**Front Cover of EA** – The map on the front cover of the EA shows only the Pungo Unit of Pocosin Lakes NWR. The refuge's entire acreage, however, is addressed in the text on page 3.6-10.

**Section 3.1.1 Airspace** – In describing the primary users of airspace overlying eastern North Carolina, use by other federal agencies is not mentioned in the first paragraph. The Service uses airspace in eastern North Carolina to monitor endangered species and waterfowl numbers on several NWRs, to conduct annual mid-winter waterfowl surveys throughout the project area, to monitor and suppress wildland fires, and to conduct law enforcement activities. The National Park Service also uses airspace in eastern North Carolina. Corrections should be made to this section to reflect this airspace use.

**Section 3.1.1.6 Civilian Airports and Military Air Fields** – Two small landing strips located in Hyde County are not included in the text discussion, Table 3.1-2, or Figure 3.1-2 of this section. First, the North Carolina Forest Service maintains a landing strip and a plane north of Lake Mattamuskeet, near the Town of Fairfield, for fire detection and suppression. Second, a local crop duster, Tim Whitfield, has a landing strip just north of the Town of Fairfield.

**Section 3.1.2 Aircraft Operations in Eastern North Carolina** – Referencing Figure 3.1-4, the map does not reflect current flights for endangered species surveys (e.g., red-cockaded woodpecker (*Picoides borealis*)), southern pine beetle (*Dendroctonus frontalis*) monitoring, and wildland fire detection and management. In addition, on page 3.1-11 in the third paragraph, Figure 3.3-1 should read Figure 3.1-3.

**Section 3.2.1 Noise Descriptors** – We acknowledge that the EA does an outstanding job of describing the various metrics used to define noise levels. However, the EA insufficiently provides information on the perception of noise levels of the proposed action for eastern North Carolina. While the  $L_{dnmr}$  metric is useful for measuring low and fast subsonic aircraft noise, the metric is inadequate when considered solely in measuring the “startle effect” on communities and wildlife. A noise analysis might be more meaningful in understanding the impacts on the effected environment and community if additional metrics (e.g., SEL - Sound Exposure Level,  $L_{max}$  - Maximum Level) are included and considered collectively. Furthermore, the  $L_{dnmr}$  metric may be wholly unqualified for measuring the impacts of noise on wildlife. Unfortunately, the references you cited on page 3.2-4 in the first paragraph were not included in the References. Therefore, we could not determine whether or not these studies evaluated or were applicable for analyzing noise effects on wildlife. In general, the EA is deficient in evaluating the effects of noise on wildlife.

**Section 3.2.2.1 Ambient Noise Levels in Areas Outside Existing SUA** – The references cited in Table 3.2-2 are not included in the References. Therefore, we could not verify data cited. All references, especially those used to cite data, should be included in the References so that readers can evaluate and verify the data being used in assessing the proposed action.

**Section 3.2.2.2 Ambient Noise Levels in Areas Underlying Existing SUA** – In the noise modeling depicted in Figure 3.2-2 using DNL, about 10 percent of individuals living in the vicinity of the targets could be expected to be highly annoyed by existing aircraft operations, and between 1 and 7 percent of the individuals residing beneath R-5306A outside the target areas would be highly annoyed. However, the USMC has stated in the EA that DNL is not the appropriate metric for the proposed action to evaluate the impacts of noise on communities. While we realize analyzing noise impacts is a cumbersome task, we suspect that greater than 10 percent of the residents of eastern North Carolina will be annoyed by the proposed action if a more appropriate metric was used. In fact, during a scoping meeting in September 2000 for a Comprehensive Conservation Plan for Cedar Island National Wildlife Refuge, complaints of military aircraft activity over Cedar Island was the first issue raised by the public.

**Section 3.3.1 Aircraft Safety** – The EA reports that only two near midair collisions were filed for operations in North Carolina in 2000. We believe this section downplays the potential for near midair collisions or mishaps (i.e., actual collisions) by providing data from a single year. Furthermore, the EA does not address the plausibility of near midair collisions that go unreported.

**Section 3.3.2 Bird/Aircraft Strike Hazards** – The EA recognizes that eastern North Carolina represents a location with the greatest hazard for bird/aircraft strikes. However, details are not provided on the procedures implemented to minimize the potential for bird/aircraft strike hazards (i.e., 2d MAW's BASH plan). Furthermore, the document fails to acknowledge the biases in pilot reported bird/aircraft strikes (e.g., see Linnell et al., 1999).

**Section 3.3.3 Hazardous Materials Management** – We do not believe that a one hour response time to a mishap is realistic. Greater detail is needed on the spill response procedures, including plans and procedures for addressing wildlife impacts associated with hazardous materials.

**Section 3.4.1 Water Resources** – In describing the water resources of the study area, the size and depth for Lake Mattamuskeet is given as 42,000 acres and 2.5 feet. We have no specific bathymetric or other data on Lake Mattamuskeet, but we estimate its size at about 40,000 acres and its average depth at approximately 2 feet.

**Section 3.4.2.4 Birds** – The text discussion on ducks and geese and Table 3.4.3 oversimplifies and understates the importance of eastern North Carolina to migratory waterfowl. For example, North Carolina plays a vital role in the yearly cycle of the Eastern Population of tundra swans, wintering more swans, by far, than any other state on the East Coast. Approximately 60,000 to 80,000 tundra swan (*Cygnus columbianus*) – about 70 to 80 percent of this species occurring in the Atlantic Flyway – winter in eastern North Carolina to take advantage of the abundant food sources found in our lakes, sounds and farms. Most of these swans use the refuges and agricultural lands within the proposed Mattamuskeet MOA. Mid-winter waterfowl survey data maintained by the Service's Division of Migratory Birds demonstrates that 30,000 to 40,000 northern pintails (*Anas acuta*), about 50 to 60 percent of the Atlantic Flyway census total, routinely overwinter in North Carolina. Lake Mattamuskeet, impoundments on Mattamuskeet NWR, and nearby farmlands support approximately 50 percent (15,000 to 20,000 birds) of the State's wintering pintail population. The migratory Canada goose (*Branta canadensis*) also is a species of management interest in the study area, with numbers of wintering birds approaching 20,000 per year.

**Section 3.4.2.5 Terrestrial Mammals** – Dare and Beaufort counties should be added to the list of counties in which the red wolf (*Canis rufus*) occurs.

**Section 3.4.2.6 Reptiles and Amphibians** – The southern hognose snake (*Heterodon simus*) is not a listed species; however, it is considered a federal and state species of concern.

**Section 3.6.3 Tourism and Recreation** – In the paragraph discussing the value of tourism and recreation of each county it is important to acknowledge the counties in the study area, and that their natural resources (e.g., waterfowl, black bear, deer, and fish) are the primary attractions for the tourist and recreation dollar. Moreover, the EA does not address the Partnership for the Sounds, a partially state-funded, non-profit organization promoting an economic strategy in northeast North Carolina predicated in nature-based tourism. This partnership is an important component of recreation and tourism that must be addressed.

**Section 3.6.3.2 Open Space and Recreation (Hyde County) –**

**Pocosin Lakes National Wildlife Refuge** – The description of this refuge is not completely correct. The Pungo NWR was established in 1963, but the area became the Pungo Unit of Pocosin Lakes NWR when the new refuge was established in 1990. Also, Lake Phelps is not part of Pocosin Lakes NWR.

**Section 3.7.1.4 Hyde County** – A significant portion of Pocosin Lakes NWR lies within Hyde County and should be added to the list of refuges occurring in the county.

**Section 3.7.1.6 Tyrrell County** – The EA incorrectly states that Alligator River NWR is located in Tyrrell County. In addition, our records show 56,303 acres of Pocosin Lakes NWR occurs in Tyrrell County.

**Section 3.8 Air Quality** – The Swanquarter National Wilderness Area is a Class I air quality area which imposes stricter requirements on discharges within a 100 mile radius of the Class I area. This designation should be recognized in the EA.

**Section 4.1.2.2 Effects on Nonparticipating Civil Aircraft Operations** – The EA does not adequately address the impacts associated with increased air traffic above the voluntary minimum altitude of 2,000 ft. MSL and below the 3,000 ft. MSL ceiling created by the proposed action. This increased air traffic poses additional problems and concerns for aircraft and pilot safety, interference and disruption of non-military flights (e.g., wildlife surveys, wildland fire monitoring), and increased bird/aircraft strike hazards below the 3,000 ft MSL floor. The direct and indirect effects of the proposed action must be considered in the USMC's assessment of the proposed action. In addition, more detail is needed on how the MCAS Cherry Point RATCF would ensure that military aircraft engaged in training exercises would cause no "spillouts" from the MOA.

**Section 4.3.2.1 Aircraft Safety** – The EA uses national averages when discussing the potential for bird/aircraft strike hazards, and fails to recognize that local data more pertinent to the potential for bird/aircraft strikes to the Mattamuskeet MOA is available. Specifically, the U.S. Air Force contracted with Geo-Marine, Inc. ([www.Geo-Marine.com](http://www.Geo-Marine.com)) to monitor bird concentrations and movements on the Albemarle-Pamlico Peninsula and develop a Bird Avoidance Model for their pilots to use for activities related to the Dare County Bombing

Range. Geo-Marine completed the field work in 1994-96, the results of which documented bird flights as high as 3600 ft MSL. Potential for bird strikes above 3000 ft MSL was identified for the months of February, March, April, and November. The model recommends all altitudes below 4000 MSL be considered "bird plagued" during the peak of migration. In our recent telephone conversations with Geo-Marine, however, they indicated the potential for bird/aircraft strikes has probably increased since 1996 because tundra swans and snow geese have changed their feeding locations due to changes in agricultural practices in the study area since the monitoring study was conducted. Cotton has become a more prevalent crop in the study area and winter wheat less prevalent, which has forced swans and snow geese to range farther for food sources and consequently fly at higher altitudes. We suggest contacting Geo-Marine's principal investigator, Adam Kelly, at (850) 871-5657 for further clarification on the potential for bird/aircraft strikes in the Mattamuskeet MOA.

#### Section 4.4.1.2 Core and Mattamuskeet MOA's Alternative -

**Fisheries** - The EA does not address the impacts on fisheries resources associated with oil, gas, and hydraulic spills resulting from aircraft mishaps.

**Wading Birds and Colonial Waterbirds** - The EA provides little information on the effects of military overflights on wading birds and waterbirds. We recognize that there are many studies that report contradictory results on the effects of these activities on birds. However, it appears that the EA only provides information in support of a "no effect" or "little effect" position. In fact, studies such as Conomy et al. (1998a and 1998b) show that while some species habituate or show little startle response to aircraft overflights, other species never habituate during the course of the study. These researchers caution that inferences made from their results or similar research should not be extended to all species or all locations. Additional site-specific assessments of the effects of aircraft overflights on avian behavior and physiology must be conducted as part of a complete analysis.

**Snow Geese and Tundra Swans** - The EA's analysis of impacts on waterfowl is inadequate and inaccurate. While the EA references studies that indicate varying degrees of disturbance by aircraft to snow geese (*Chen caerulescens*), there is a little acknowledgment that the proposed action could result in more frequent flushing which would result in decreased feeding time and increased stress. By stating that Pocosin Lakes NWR continues to support a wide variety of wintering birds despite low-level military flights in airspace (R-5314) over Alligator River NWR and Pocosin Lakes NWR is misleading. The vast majority of the existing military flights over these refuges occur over pocosin, forest, and saltmarsh habitats, not directly over the primary waterfowl areas. Furthermore, to use the Service's aerial surveys (8 to 10 flights over a five month period) as evidence that the waterfowl are habituated to overflights is inappropriate. We contend that two low-level, slow speed flights a month or once weekly is not sufficient exposure for wild migrant birds to habituate. Regardless, it is inappropriate to consider the impacts from these few flights as representative of the impacts that would be associated with the

number of military flights that would occur in the Core and Mattamuskeet MOAs (i.e., 1,460 and 2,423 sorties, respectively).

The EA also fails to analyze the impacts on migrant Canada geese and the many other species of waterfowl, particularly those gregarious species like canvasbacks (*Aythya valisineria*), ring-necked ducks (*Aythya collaris*), greater scaup (*Aythya marila*), lesser scaup (*A. affinis*), and redheads (*Aythya americana*), that flock together on large bodies of water like Lake Mattamuskeet and Pamlico Sound for security and food. The behavior mechanisms of these species do not allow them to habituate to disturbance factors, unlike dabbling ducks such as the mallard (*Anas platyrhynchos*) or black duck (*Anas rubripes*) that are more independent and solitary in their behavior. A classic example of the effects of these impacts can be seen in the Core Sound region (Cedar Island NWR area) of North Carolina where up to 40,000 redheads wintered in the 1950s. However, with increased development along the coastline and the associated impacts to water quality, increased boat traffic, modern commercial fishing impacts to vegetation, and frequent low level military aircraft activity, the Core Sound area now supports only 10 to 20 percent of the birds it once did.

Professional waterfowl managers have recognized for decades the value of sanctuary areas for wintering waterfowl. In fact, most of the national wildlife refuges established in the 1930's-40's were established as inviolate sanctuaries for these birds. Swanquarter NWR and Mattamuskeet NWR, as well as the Pungo Unit of Pocosin Lakes NWR, are examples of these sanctuaries. The EA fails to address the increased disturbance attributable to general aviation being confined to lower altitude flights between 2,000 ft and 3,000 ft MSL over these areas and the increased potential for violations from general aviation to violate the FAA recommended 2,000 MSL floor over national wildlife refuges.

**Section 4.4.1.3 Core and Cherry MOAs Alternative** – The Pamlico Sound, the bays around Swanquarter NWR, and the Pungo River traditionally support significant numbers of diving ducks (scaup, canvasback, redhead, etc.) which are gregarious species that are easily disturbed. The EA does not adequately address impacts on these species in this alternative. (See comments above.)

**Section 4.4.1.6 Cherry MOA Alternative** – See comments above.

**Section 4.5.2.1 Effects of Subsonic Noise-Induced Vibrations on Structures** – If high decibel levels (above 130 dB) can cause damage to structures (e.g., break windows, plaster walls or ceilings, etc.), then it seems logical that the analysis of noise impacts should be done with  $L_{Amax}$  values rather than  $L_{dmin}$  values. It only takes one noise-related vibration from a loud noise to cause damage. Average noise values have no meaning in this analysis.

**Section 4.6.2.1 Direct Impacts on Socioeconomic Resources** – The EA fails to consider waterfowl and other wildlife resources are an important economic commodity in the study area. If military overflights cause increased flushing of certain waterfowl species and the reproductive

capability of that species is reduced resulting in a decreased wintering population of snow geese, Canada geese, canvasbacks, etc., then there is a direct impact on the economic resources of the study area. Real estate adjacent to Mattamuskeet NWR with a viable waterfowl impoundment is some of the most valuable real estate on mainland Hyde County. If the Corps' MOA impacts waterfowl in the area, then the economy will be impacted.

**Section 4.6.2.2 Indirect Impacts on Socioeconomic Resources** – The EA acknowledges that noise could make the study area less desirable for tourists and there could be an indirect impact on local economics. However, in the discussion of judging impacts of noise on individuals, the analogy is overly simplistic. Most visitors to national wildlife refuges (and national seashores) are there not to view overflights of jets, but rather to enjoy the refreshing sounds and sights of the natural world where human impacts are minimal. That same visitor can be equally inspired by a military overflight at a military air show or similar event. However, we believe that it is safe to assume most visitors to national wildlife refuges would prefer to enjoy the natural resources and soundscape that those environs provide, namely, one without military overflights. Using the excuse that judging impacts of noise on individuals is subjective in the context of assessing impacts of military flights over sensitive areas is ill-conceived and argumentative.

**Indirect Impacts on Tourism and Recreation** – The EA references a study of recreation users (i.e., backpackers, sightseers, etc) in National Forest System wilderness areas and National Parks to imply most tourists would not be annoyed by military overflights in the study area. While the results of the referenced study might be applicable to Cape Lookout National Seashore and perhaps hunters on a forested portion of a refuge, it is not applicable to recreation users (e.g., birdwatchers, waterfowl hunters, etc.) on the shores of Lake Mattamuskeet or in the marshes of Swanquarter NWR. Type of user group and habitat type will influence the visitor's level of annoyance to the noise or presence of aircraft in the area.

The statement in the third paragraph on page 4.6-7 that “[a]ircraft operations occur routinely along MTRs that cross the Core Banks and the Lake Mattamuskeet area...” is not completely correct. While occasional, military and private aircraft may fly over Lake Mattamuskeet, the refuge manager of Mattamuskeet NWR contends this use is not frequent enough to refer to it as routine. Also, the Pamlico B MOA has a floor altitude of 8,000 ft MSL which provides the refuge adequate buffer from military aircraft use of the Pamlico MOA.

**Table 4.7-1 Future Land Use Trends in the Study Area Counties** – The majority of the land included in Pocosin Lakes NWR in Tyrrell County is wetlands, not prior converted agriculture land as is suggested in the table.

**Section 4.7.2.2 Coastal Zone Management and Land Use Zoning and Policy** – The EA fails to mention whether the USMC will adhere to the North Carolina Coastal Resources Commission's Aircraft Operations Standard. Furthermore, the Mattamuskeet MOA does not overlie any portion of Craven County; therefore, County policy on supporting growth and development of MCAS Cherry Point appears to be irrelevant. Rather, policies on economic

development of coastal zone management and land use zoning and planning relevant to those coastal counties affected should be evaluated in this section (e.g., Partnership for the Sounds). Lastly, in reference to emergency airspace use and unrestricted access below the 3,000 ft MSL altitude floor, what is "sufficient opportunity" and how does it provide "support for and facilitation of aircraft use by local, state, and federal government agencies for resource management, law enforcement, and public health, safety, and welfare?"

**Section 4.9.2.3 Development of a New Department of the Navy Outlying Landing Field (OLF)** – The EA provides very little detail on an analysis of the cumulative impacts associated with the proposed action and the proposed introduction of the F/A-18 E/F (Super Hornet) Aircraft to the East Coast of North Carolina and the development of a new OLF. We contend that details on potential impacts associated with these projects are available, as evidenced by the Navy's release of a draft EIS, dated July 2002, on the subject.

**Section 6 Relationship of the Proposed Action to Federal, State, and Local Plans, Policies and Controls – Executive Order 13186 "Responsibilities of Federal Agencies to Protect Migratory Birds"** is omitted from this section and not considered anywhere in the EA.

**Section 10 References** – Many articles, manuscripts, reports, and documents cited in the EA are not listed in the References section.

**Appendix B** – In reference to Table B-6, this project is not supported by an EIS; therefore, it cannot be determined whether or not the proposed project is consistent with the resource protection policies. We strongly recommend the USMC prepare an EIS to fully evaluate the potential impacts the proposed activities will have on federally-protected wildlife, the natural communities, and the soundscape. In addition, we recommend the USMC consider an MOA configuration that avoids the Lake Mattamuskeet and Pungo Lake areas, but would provide connectivity between airspaces R-5306A and R-5314. The Cherry MOA seems more acceptable to the Service in that there is less potential for impacts on waterfowl and bird/aircraft strikes than the Mattamuskeet MOA. Furthermore, while the proposed floor altitude of 3,000 ft MSL is much improved over the 500 ft MSL proposed for MOAs in the 1980s (and recommended by the Service at that time), we now have information from the study conducted by Geo-Marine, Inc. that bird flights do occur during the migration and wintering period above 3,000 ft MSL. For this reason, we strongly recommend that any MOA placed over or near the refuges in eastern North Carolina have a minimum altitude floor of 5,000 ft MSL during the period of November 1 to March 1 to avoid bird/aircraft strikes and minimize the potential disturbance to waterfowl and refuge visitors from military and private aircraft operations. Lake Mattamuskeet and the Pungo Unit of Pocosin Lakes NWR routinely support between 200,000 to 300,000 waterfowl each year, including 50,000 to 60,000 snow geese, 50,000 to 70,000 tundra swans, 5,000 to 10,000 Canada geese and over 100,000 individuals of greater than 20 species of ducks. Attempting to mix aircraft operations with these numbers of large birds, without an adequate buffer between the two, is going to cause significant physical, socioeconomic, and environmental conflicts.

We look forward to working with you on this issue and appreciate your cooperation with our agency in protecting federally-listed species. We are confident that our agencies can work cooperatively to find a solution that satisfies both of our missions. If you have any questions or comments, please contact Messrs. John Hammond or David Rabon of this office at (919) 856-4520 extension 28 and 16, respectively.

Sincerely,



Garland B. Pardue, Ph.D.  
Ecological Services Supervisor

#### Literature Cited

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Linnell, M. A., M. R. Conover, and T. J. Ohasi. 1999. Biases in bird strike statistics based on pilot reports. *Journal of Wildlife Management* 63:997-1003.

cc: Mattamuskeet NWR, Swan Quarter, NC (Don Temple)  
Alligator River NWR, Manteo, NC (Mike Bryant)  
Pocosin Lakes NWR, Columbia, NC (Howard Phillips)  
North Carolina Wildlife Resources Commission,  
Cape Lookout National Seashore,