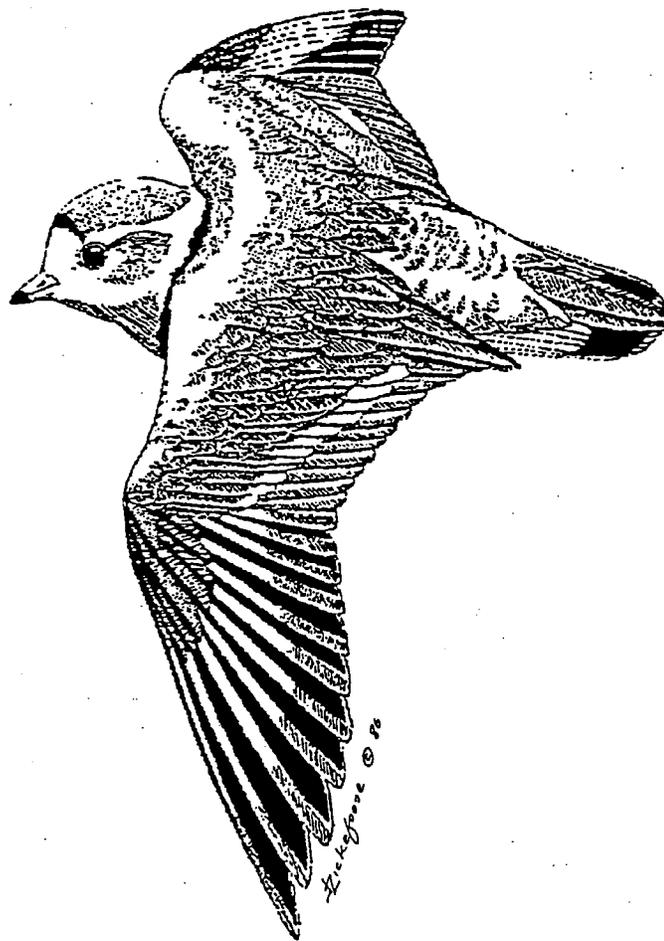


AN ECONOMIC ANALYSIS OF  
PIPING PLOVER RECOVERY ACTIVITIES  
ON THE ATLANTIC COAST



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## **EXECUTIVE SUMMARY**

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Piping plovers are small, migratory shorebirds that nest on beaches. The Atlantic population nests on barrier beaches from North Carolina to Newfoundland and is currently listed as threatened under the Endangered Species Act (ESA). Management plans to protect plovers during breeding periods in spring and summer include closure of beaches or sections of beach to offroad vehicles (ORVs) and in some cases to pedestrians. Closure of beaches has generated controversy and protests from beach users in some locales. The purpose of this study is to determine the extent to which beach closures have impacted the economies of these locales.

Beach closures or restrictions may cause swimmers, sunbathers, anglers and others to reduce the number of trips they take to an area. Understanding the relationship between closures or restrictions and resulting changes in recreational behavior is fundamental to this study. Where adequate data are available, this analysis employs various modeling techniques to quantify these relationships. Where data are unavailable, the analysis relies on interviews and other qualitative data. Quantification of economic impacts then links changes in visitation to changes in direct spending on food, lodging, transportation and other sectors. It then uses IMPLAN to model the structure and linkages in the local economy at the county level to quantify how changes in these sectors affect the overall production of goods and services. IMPLAN quantifies the impact of changes in direct spending on overall economic activity, employment and tax collections. In addition, where the data support a quantitative link between beach closures or restrictions and beach access, the analysis quantifies changes in welfare by drawing upon the existing body of economic literature to value these losses.

This report consists of five case studies of local areas where beach managers have initiated closures and other management actions to protect piping plovers. The criterion for selecting areas for the case studies included availability of data, geographical diversity of management, and geography. The beaches areas studied range from Assateague Island in

Maryland/Virginia to Parker River NWR in Massachusetts and include areas in four states. The case studies include management by the U.S. Fish and Wildlife Service (FWS), the U.S. National Park Service (NPS), local governments, and private entities.

## **SUMMARY OF CASE STUDY SITE ANALYSES**

### **Parker River NWR**

Parker River National Wildlife Refuge in Massachusetts, which is owned and managed by the FWS, includes roughly six miles of barrier beach on Plum Island. It is located in Essex County adjacent to the towns of Newbury and Newburyport. The refuge manager initiated partial closure of the beach to both ORVs and pedestrians in 1986 and full closure in 1991. In most years the closure has lasted from early April into August.

Regression analysis of visitor data from 1973 to 1996 indicates that closures resulted in a loss of about 600 visitor trips per day of total beach closure. Since 1991, when the refuge began implementing full closures, the effect of the closure has amounted to about 80,000 visitor days lost per year. Typical daily expenditures by beach users amounted to about nine dollars per person.

Estimates of total economic impacts on the local economy have ranged from \$230,000 in 1987, a partial closure year, to \$790,000 in 1995, when the beach was fully closed for nearly five months. The latter total represents approximately 0.02 percent of baseline economic output in the study area. Additional economic impacts result from the loss of revenues to the refuge from sales of surf fishing permits, both ORV and pedestrian, which have ranged from \$6,000 to \$16,000 per year. Finally, estimates of consumer surplus losses associated with forgone beach access and fishing opportunities range from \$170,000 to \$660,000 per year.

### **Martha's Vineyard**

Martha's Vineyard is an island that lies about 10 miles south of Cape Cod. Its permanent population is about 15,000, but its beaches and other amenities attract large numbers of seasonal residents and vacationers. There are many beaches on the island, but the barrier beaches on Chappaquiddick Island provide the best nesting habitat for piping plovers. Dukes County, which manages Norton Point Beach, and The Trustees of Reservations, which manages Leland and Cape Poge beaches, began implementing plover management restrictions in 1993. The primary impact of these restrictions has been to close sections of these beaches to ORVs (but not to pedestrians) from late May through July, extending into August in some years.

Analysis of the tourism data for the island do not indicate that beach closures have resulted in any discernible negative impacts on visits, visitor spending, or overall economic activity. Rather, these beach closures primarily affected ORV users, especially surf fishing anglers, and resulted in lost revenues from the sale of ORV permits. Dukes County suffered an increase in management costs and a decrease in permit sales associated with the closure, which amounted to a net loss of about \$40,000 per year. The Trustees of Reservations (TTOR) suffered a significant revenue decline in ORV permit sales from 1993 to 1995. However, revenues from increased pedestrian usage and increased membership sales compensated for the revenue losses from ORV permit sales. TTOR costs attributable to managing the beaches to protect plovers amount to an overall net loss of about \$18,000 per year.

Closures of Norton Point Beach has also affected access to shellfish beds, and the Town of Edgartown also appears to have suffered a recurring loss of about \$5,000 per year in revenues from the sale of recreational shellfish permits. Anecdotal evidence suggests that restrictions on ORV access to beaches greatly affected surf fishing anglers, and owners of local bait and tackle shops reported significant declines in revenues in the first few years of beach closures; however, several of these businesses have expanded into charter boat fishing and guided fishing tours and revenues now exceed pre-closure levels.

### **Assateague Island**

Assateague Island is a barrier island that extends 37 miles from Maryland into Virginia. The NPS manages the National Seashore in both Maryland and Virginia, and the FWS manages the Chincoteague NWR at the Virginia end of the island.

The NPS is responsible for plover management on the Maryland portion of Assateague Island. Beginning in 1993 the NPS began restricting all access to dune areas to protect plovers, but has been able to maintain pedestrian and ORV access to all beaches. The main effect of these restrictions has been to restrict boater access to Atlantic beaches at the north end of the island. Analysis of data on total visits and ORV visits found no negative impacts on pedestrian or ORV users as a result of these plover restrictions. The resulting conclusion is that plover restrictions at the Maryland Unit have resulted in negligible economic impacts.

The FWS imposed plover restrictions at Chincoteague NWR beginning in 1988. Since that time the refuge manager has closed the lower 2.7 miles of Toms Cove Hook to all visitors, both pedestrians and ORVs, from March 15 through August 31. The main impact has been on ORVs, since miles of beaches remained open to pedestrian users. The maximum number of ORVs allowed in the ORV zone on the Hook declined from 42 to 18 vehicles during the closure period (but increased from 42 to 48 in the off-season). Analysis of data on ORV trips found that these restrictions resulted in a loss of about 4,400 ORV trips per year, and anecdotal evidence suggested that the main impact was on surf fishing

anglers who relied on ORVs to access fishing sites on the Hook. Further analysis of room tax and refuge visitation data provide conflicting results. Analysis of real room tax revenues showed increases in collections after implementation of the closure, indicating continued growth in numbers of overnight visitors. But regression analysis of refuge visitation data provided evidence of declines of about 16,000 visitor-days per year, primarily in the months of June and August. The mixed evidence increases the level of uncertainty as to whether plover restrictions did actually result in negative economic impacts. Relying on the visitation data results in an estimate of about \$6 million in lost output to the Accomack County (Virginia) economy. However, given evidence of increasing room tax revenues since the initiation of closures, one can not dismiss the possibility that there is no negative effect attributable to plover restrictions; such a conclusion implies that non-ORV visitors made up for the loss in ORV visitors.

### **Holgate Unit, Edwin B. Forsythe NWR**

Long Beach Island is an 18 mile barrier island in Ocean County, New Jersey. The Holgate Unit, part of Edwin B. Forsythe NWR, comprises the southernmost 2.75 miles of the island. To protect plovers, the FWS closed the refuge to both pedestrians and ORVs beginning in 1988. There are no data available to assess visitation to the refuge before and after the implementation of closures. Interviews with local officials and business people indicated that the closures had negligible impact on the overall economy of the island, which amounts to about \$500 million in output per year. However, the closures appear to have affected the beach usage patterns of some residents and visitors with consequent welfare losses and effects on the revenues of some businesses, especially at the south end of the island.

The closures especially affected surf fishing anglers, and many apparently sought alternate sites off-island with consequent effects on businesses that catered to surf fishing anglers. Bait and tackle shops throughout the island appear to have lost some revenues, and one shop nearest to the refuge reported losing 30 percent or more of revenues in the first few years after the closure. In addition, several other motels and restaurants that catered to anglers also reported a loss in revenues. However, all these businesses survived the closure and remain viable.

### **Sandy Neck**

Sandy Neck is a six mile barrier beach in the town of Barnstable on Cape Cod Bay. Beach closures to protect nesting plovers began in 1990. Since that time, ORV usage of the beach has declined dramatically, and the Department of Recreation and Human Services of the Town of Barnstable (responsible for management of the beach) has experienced a corresponding loss in revenues due to depressed permit sales. This decline has rendered the Sandy Neck division unable to meet the Town of Barnstable's cost recovery mandate over

the last several years and forced reductions in staffing. These staffing cuts have a number of consequences, including potentially reduced efficiency in plover protection and management.

Qualitative evidence suggests that local and regional economic effects associated with these closures have been minimal. The number of ORV trips has declined since the implementation of beach closures, and these lost trips probably represent some loss in local spending. However, there are few local businesses in the area, which is primarily residential. In addition, there are a number of substitute beaches on the Cape (within the county) that allow ORVs, and anecdotal evidence suggests that most of the displaced ORV users are likely to relocate to other Cape beaches. As a result, economic impacts appear limited to some redistribution of consumer expenditures within the county.

Despite minimal economic impacts, these closures have resulted in some welfare losses. Sandy Neck is a regionally important recreational resource that is highly valued by local area residents and visitors. For these reasons, beach closures have likely resulted in some loss in welfare, both to ORV users displaced entirely, and those users whose experience is diminished due to increased congestion on a smaller area of accessible beach.

### Overview

The results of these case studies range from negligible to significant impacts. The most affected user group is ORV users, and all but one of the sites has effected restrictions that resulted (at least initially) in some loss in ORV trips. The group that has suffered the greatest losses appears to be recreational anglers. Surf fishing requires considerable gear, and the elimination of ORV access generally precludes surf fishing anglers from using a site. And in some cases comparable fishing sites are quite distant so that the loss of business may have significant revenue impacts on bait and tackle shops and other local businesses with potentially significant regional economic impacts.

Preliminary conclusions from these five case studies suggest that five key elements determine the magnitude of any economic impacts resulting from implementation of plover restrictions. First, the nature of the restrictions themselves determines whether there are likely to be significant impacts. At Assateague Island NS, Maryland Unit, the NPS imposed restrictions on access to dune areas, but retained pedestrian and ORV access to all beaches with the result that there appear to be negligible economic impacts resulting from these restrictions. At the other extreme the FWS closed the entire beach at Plum Island (Parker River NWR) to both pedestrians and ORVs, which forced thousands of annual visitors to forego beach trips or find alternative sites. Needless to say, the Plum Island closures had significant impacts on the local economy.

Second, the availability of substitutes within the local economic region determines whether economic activity is lost to another region. At Chincoteague NWR closure of

Toms Cove Hook appears to have had at most a small impact on pedestrian users, since there are miles of other beaches available to pedestrians. However, closure of the Hook to ORVs resulted in displacement of ORV users, since comparable substitute sites for surf fishing and ORV use are mostly outside Accomack County. Similarly, at Long Beach Island closure of Holgate Unit to pedestrians had minimal effect, since the Township of Long Beach operates a beach adjacent to the refuge. But closure to ORVs caused surf fishing anglers to seek alternate sites off-island at Island Beach and Brigantine. This situation is analogous in many ways to that at the Sandy Neck beach in Barnstable.

Third, the popularity of the beach environment also determines the magnitude of the impacts. Plum Island (Parker River NWR) on Massachusetts north shore has few overnight accommodations nearby and attracts primarily day trip users who spent under \$10 per visitor-day. Assateague Island, however, is a National Seashore and attracts visitors from significant distances, including large numbers from the urban areas of Baltimore, Washington, and Philadelphia. These mostly overnight visitors spend over \$70 per visitor-day. Thus, any displacement is likely to result in greater losses in spending. Sandy Neck on Cape Cod and Long Beach Island on the New Jersey shore attract a mixture of overnight (motel and rental) visitors and day trip visitors so that displacement in these areas represents a mix of overnight and day trip spending.

Fourth, the size and rate of growth of the local economy determine whether any loss in visitation caused by plover restrictions will result in any measurable net losses to the economy. Where visitor demand is strong at Cape Cod, Martha's Vineyard, the Jersey Shore, and Ocean City, Maryland, other beach users are likely to replace displaced ORV users -- at least during peak summer months. Losses in visits by surf fishing anglers and others in early spring may be more difficult to replace, although birdwatchers and other ecotourists constitute a growing element of visitation to some sites in both spring and fall.

Finally, adaptation has and will continue to mitigate economic impacts of beach closures and other restrictions. Over time local businesses have adapted to changes in demand. On Martha's Vineyard, for example, several bait and tackle shops initially lost considerable revenues from anglers displaced when beach managers first initiated beach closures. However, these businesses adapted by expanding into boat charters and guided trips to enhance revenues. Likewise, on Long Beach Island one bait and tackle shop adapted by targeting goods and services toward "tourist" anglers with far less knowledge of the sport than his "regulars" prior to the closure. Over all five case studies there is no evidence of business bankruptcies or shutdowns attributable to beach closures or other restrictions.

Since listing of the piping plover (*Charadrius melodus*) as threatened under the Endangered Species Act (ESA) in 1986, many activities have been undertaken to abet its recovery. Several Atlantic Coast beaches represent important plover breeding habitats, and as such, are managed pursuant to guidelines developed by the U.S. Department of the Interior, Fish and Wildlife Service. Existing management practices include seasonal beach closures to off-road vehicles (ORVs) and pedestrians, predator control and enclosure, and signage. Access restrictions have elicited strong opposition from user groups, commercial interests and local governments. Opponents of these restrictions predicted that local economies would suffer greatly as a result of beach closures and corresponding declines in visitation and expenditures. The purpose of this study to examine the extent to which these perceived economic effects have actually been realized.

Beaches attract a wide variety of recreationists, and their responses to closures and restrictions are likely to be correspondingly diverse. In some cases, closures due to plover nesting may displace visits to a given area entirely, if recreationists decide to alter their activities or redirect visits to other beaches that offer similar attributes. Conversely, passive recreationists (e.g. those interested in wildlife viewing), may be encouraged by access restrictions that have temporarily eliminated other competing uses of the area.

Adjustments such as these affect an individual's welfare, and to the extent that they alter the distribution and magnitude of an individual's expenditures, are likely to result in local economic impacts. Due to the interdependent nature of industries in a geographic area, reductions in visitation and expenditure have proportionally larger effects on regional output and employment. To accurately assess the potential impacts of beach closures and restrictions on the vitality of a local economy, these supplemental effects must also be accounted for.

The purpose of this study is to determine the extent to which piping plover recovery activities have resulted in measurable economic effects at several representative sites. In particular, we consider the local economic impact of beach closures and restrictions at the Parker River National Wildlife Refuge in Newburyport, Massachusetts, the island of Martha's Vineyard, Massachusetts, the Chincoteague National Wildlife Refuge and Assateague National Seashore in Virginia/Maryland, the Holgate National Wildlife Refuge in New Jersey and Sandy Neck beach in Barnstable, Massachusetts.

The remaining chapters of this report are organized as follows:

- Chapter 2 provides background information on the status of the piping plover and beach management designed to encourage recovery of this species.
- Chapter 3 provides a brief overview of the analytic methods employed in our analyses.
- Chapter 4 presents results from analysis of beach closures at the Parker River National Wildlife Refuge on Plum Island, Massachusetts.
- Chapter 5 presents results from analysis of access restrictions on the island of Martha's Vineyard, Massachusetts.
- Chapter 6 presents results from analysis of access restrictions at the Chincoteague National Wildlife Refuge in Virginia and Assateague Island National Seashore in Maryland.
- Chapter 7 presents results from analysis of protective measures enacted at the Holgate National Wildlife Refuge in New Jersey.
- Chapter 8 presents results from analysis of closures at the Sandy Neck beach in Barnstable, Massachusetts.

**OVERVIEW OF BEACH  
MANAGEMENT AND THE PIPING PLOVER**

**CHAPTER 2**

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The piping plover is a migratory bird that summers along the Gulf of Mexico and returns in early spring to breed in northern climes. The Atlantic population breeds on Atlantic beaches from North Carolina to Newfoundland. In 1986, under the Endangered Species Act (ESA), the Atlantic and Northern Great Plains populations of plovers were listed as threatened and the Great Lakes population as endangered. The U.S. Fish and Wildlife Service beach management guidelines adopted in 1994 aimed at preventing take (mortality, harm and harassment) of piping plovers. These recreation management guidelines include a number of protective measures, including where necessary, temporary closure of beaches to ORVs. Implementation of practices recommended in the guidelines began on Atlantic beaches in the late 1980s. From 1992 to 1996 estimated numbers of piping plover breeding pairs increased from 790 to 1,161 on U.S. beaches; however, additional effort will be needed to reach the U.S. goal of 1,600 breeding pairs.

**EFFECTIVENESS OF PROTECTIVE MEASURES**

Due to effects of many factors that can affect piping plover productivity and population trends (including predation, habitat degradation, oil spills and weather) and varying quality of implementation, piping plover recreation management guidelines have had mixed success in increasing plover populations. In Massachusetts the number of plover pairs has more than doubled from 213 in 1992 to 454 in 1996. In other states, however, plover populations have not increased over this time period. In Connecticut, New Jersey and North Carolina, for example, despite management efforts plover populations have actually decreased slightly from 1992 to 1996. Exhibit 2-1 summarizes the changes in plover breeding pairs from 1992 to 1996 for all the Atlantic states and the goals by region.

Exhibit 2-1						
Piping Plover Breeding Pairs, Atlantic Population, 1992-1996						
State	1992	1993	1994	1995	1996	Goal
Maine	24	32	35	40	60	
Massachusetts	213	289	352	441	454	
Rhode Island	20	31	32	40	50	
Connecticut	40	24	30	31	26	
NEW ENGLAND	297	376	449	552	590	625
New York	187	193	209	249	256	
New Jersey	134	127	124	132	127	
NY-NJ REGION	321	320	333	381	383	575
Delaware	2	2	4	5	6	
Maryland	24	19	32	44	60	
Virginia	97	106	96	118	87	
North Carolina	49	53	54	50	35	
South Carolina	0	1	0	0	0	
SOUTHERN REGION	172	181	186	217	188	400
U.S. TOTAL	790	877	968	1,150	1,161	1,600
ATLANTIC CANADA	236	236	182	199	186	400
ATLANTIC TOTAL	1,026	1,113	1,150	1,349	1,347	2,000
Source: The U.S. Fish and Wildlife Service, 1996, Piping Plover ( <i>Charadrius melodus</i> ), Atlantic Coast Population, Revised Recovery Plan, Table 4.						

## BEACH MANAGEMENT UNDER THE ENDANGERED SPECIES ACT

Section nine of the Endangered Species Act (ESA) makes it illegal for any private individuals, organizations, corporations or government entities to take any species listed as 'endangered' or 'threatened'. Take is broadly defined as any action that affects the viability of the species, ranging from purposeful hunting and trapping to habitat destruction or inadvertent actions that disrupt normal behavior. The U.S. Fish and Wildlife Service has issued guidelines to minimize "take" of piping plovers or their chicks that may occur as the result of recreational activities on beaches (U.S. Fish and Wildlife, Northeast Region, 1994). These guidelines are not legally binding, but they represent the Service's "best professional advice to beach managers and landowners regarding management options that will prevent direct mortality, harm, or harassment of piping plovers and their eggs due to recreational activities."

The liability for "take" applies to all beaches open to the public, whether owned and managed by private or public entities. Where private or public beach managers invite the public onto their property for profit or non-profit motives, they are potentially liable for a broad range of potentially harmful actions that could affect threatened or endangered species. Adherence to these guidelines serves to protect landowners and beach managers from liability under ESA.

It is quite likely that these guidelines may conflict with recreational uses allowed or promoted by beach managers, since they restrict access by ORVs and pedestrians to areas used by plovers for nesting and feeding. Local and county level public beach managers, especially, may be exposed to considerable public pressure to maintain access to recreational areas consistent with historical patterns of use, which may be in direct conflict with plover management guidelines. In contrast, state and federal beach managers may be a bit more insulated from pressures by beach users than are local beach managers. This is because state and federal managers often have legally defined objectives that are more consistent with protecting wildlife. For example, state park departments and the National Park Service own and manage beaches with the objective of preserving the resource for public enjoyment, which requires balancing the needs of people and ecosystems. State and federal wildlife agencies, including the U.S. Fish and Wildlife, manage wildlife refuges with the express objective is to preserve and protect wildlife, allowing human recreation only where it does not interfere with this primary objective



## REFERENCES

- U.S. Fish and Wildlife Service, "Piping Plover (*Charadrius melodus*) Atlantic Coast Population, Revised Recovery Plan", Hadley, MA, 1996.
- U.S. Fish and Wildlife Service, "Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take Under Section 9 of The Endangered Species Act", Northeast Region, Hadley, MA, April 15, 1994.



Beach areas are often an important part of a coastal county's economy. Changes in the attributes and accessibility of these areas may have significant effects, both from a social welfare perspective and a regional economic standpoint. The following sections discuss the concepts common to economic analysis of such changes and then introduce the methodology employed in the site-specific case study analyses presented in this report.

### **ECONOMIC IMPACT AND WELFARE ANALYSIS**

Economic effects may be measured in two ways: changes in regional economic performance and as changes in net social welfare. Measures of regional economic performance represent changes in spending or production whereas social welfare measures capture changes in national income (measured as changes in consumer or producer surplus).<sup>1</sup> Regional economic measures provide a means of assessing how beach closures or other management activities affect the economy of an area or region by quantifying changes in spending, taxes and employment. Positive economic impacts result when visitors to a region spend more money in the local economy (or visitation itself increases) generating a net gain in overall spending and other resultant tax and employment impacts. Gains or losses in a particular area are generally offset by coincident impacts in adjacent regions. As such, these impacts are distributive in nature once a new equilibrium is established.

Welfare measures quantify economic benefits or losses by comparing changes in demand or supply relationships. For example, as a result of beach closures fishermen

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<sup>1</sup> Consumer surplus refers to the sum of an individual's willingness to pay for services provided by a given natural resource, net of any costs associated with consuming those services.

may be required to travel further to find a site which offers comparable attributes, resulting in an upward shift in supply and a loss in consumer surplus. Alternatively, fishermen may shift to more expensive fishing modes, such as charters or private boats, resulting in higher costs per fishing day and a potential loss in surplus. While both of these behavioral adjustments are likely to cause welfare losses, they may have very different economic impacts on the local economy. For example, if visitors fish fewer days, this may reduce overall spending and cause negative economic impacts; whereas if visitors shift to more expensive charter fishing, this may result in an increase in overall spending with positive economic impacts.

In this study we focus on quantifying economic impacts associated with changes in spending and resultant effects on taxes and employment and tax revenues, as these most directly address the concerns of proprietors and elected officials in the case study areas. It is likely that the closures also result in some welfare losses to beach users, especially to fishermen, swimmers, and other users. To the extent possible this report attempts to quantify these changes in welfare and otherwise discusses them qualitatively.

## **METHODOLOGY**

Input/output analysis or regional economic modeling provides a means to examine the resultant economic effects of policy changes in a local area. The methodology is appropriate for our purposes, yet demanding in terms of data. In areas where sufficient data are available to accurately quantify changes in visitation and expenditures attributable to plover recovery activities, we employ the modeling techniques discussed in the following sections. In those areas where adequate data are not available or changes are less salient, we also discuss the economic impacts quantitatively, but in more general terms.

### **Overview of Input/Output Modeling**

Businesses both purchase output from and supply input to other businesses in a geographic region. As a result, when consumers purchase goods from a particular business, industries that supply goods or services to that business are also affected. For example, consider what happens when visitors to a coastal area purchase food and drink at dining establishments. A portion of the revenues from these purchases flows to food and beverage distributors, which in turn generates revenues to suppliers of raw materials (e.g. local farms, fishermen or vineyards). An increase in food and drink sales induces increases in the output and employment of these secondary industries. Conversely, a decrease in food and drink sales results in a decline in regional output and employment greater than the direct losses within the food service sector. The goal of input/output modeling is to capture these interdependencies within the local economy.

To characterize the complex linkages and interdependencies of a regional economy requires large amounts of data, carefully sorted and organized by industry. To simplify the analysis, industries that affect the economy in a similar manner are grouped into sectors. Sectors are then assembled in an *input/output matrix*, which enables tracking of flows of goods and services. The matrix demonstrates how each sector's input needs are met by the outputs of all other sectors within a specified geographic area.

Manipulation of the input/output matrix generates a set of values known as *multipliers*, which further characterize the regional economy. Multipliers quantify the relationship between the demand for a given sector's output and the corresponding output required of the regional economy. As discussed previously, consumer expenditures have a proportionally larger stimulative effect on the local economy. Increased demand and spending in a given sector ripples through all other industries linked to that sector. Similarly, some of the additional income generated is spent on locally produced goods and services. These expenditures lead to further expenditures, and so on. This cycle does not, however, continue indefinitely. Some of the revenues may be saved, or otherwise expended outside of the local economy. Savings, taxes and expenditures outside of the local economy constitute "leakages", the culmination of which is a reduction of these expenditure cycles to zero.

The multiplier value captures the effects of changes in demand/expenditure in a given sector on the local economy. For example, an output multiplier of 1.7 associated with the food service sector implies that spending \$1.00 for food and drink generates \$1.70 in total output by the regional economy (i.e. the equipment manufacturers, raw materials suppliers and all other regional industries). As this example suggests, the regional economic effects of a given industry are proportional to the size of that industry's multiplier.

An important aspect of regional economic modeling is the definition of the study area. Ideally, the area corresponds to the geographic extent of economic relationships through which proposed changes will travel. Such an area includes the actual site of the impact, the location of secondary industries, the residential location of the labor force and the appropriate pathways through which the goods and services flow. Economic data of this nature, however, are rarely available. In this analysis, county data are relied upon to approximate local economic areas, with slight modifications as necessary.

An additional geographic consideration is the definition of the "local area", a designated region surrounding the site of the impact. In this analysis, shifts in spending within the immediate local area are assumed to result in distributional impacts only. For example, residents prevented from using local beaches are likely to consume other recreation in that area. Net economic effects occur only when total spending within the local area changes, as occurs when beach users who reside outside the local area make fewer trips and spend fewer dollars in the local economy.

## **Overview of the IMPLAN Model**

To estimate the regional economic impact of changes in visitation and expenditures at areas influenced by plover management activities this study uses MicroIMPLAN (IMpact Analysis for PLANning), an input/output model designed by the U.S. Forest Service.<sup>2</sup> Many state and federal planning agencies use IMPLAN for policy planning and evaluation purposes. The IMPLAN regional economic model consolidates data from a number of federal and state entities, including the Bureau of Economic Analysis and the Bureau of Labor Statistics. To group related industries into sectors, IMPLAN utilizes the categories defined by the U.S. Office of Management and Budget's Standard Industrial Classification (SIC) code.

The results of the IMPLAN analysis are presented as changes in total regional output and employment attributable to declines in visitation and resultant expenditures in certain sectors. The model translates changes in expenditures into changes in demand for output from the affected industries, subsequent changes in demand for inputs to those industries, and so on. These effects can be described as *direct*, *indirect* or *induced*, depending on the nature of the change:

- *Direct effects* are changes in output of industries producing goods for which demand has changed. In the case of a decline in visitation to beach areas, these may represent a decrease in demand for food and recreational services, and a corresponding reduction in output.
- *Indirect effects* are changes in output of industries that supply inputs to or purchase inputs from directly affected industries. For example, reductions in demand in the food service industry will lead to a decrease in demand for inputs to that industry. This in turn will affect the suppliers of those inputs.
- *Induced effects* are changes in household consumption brought about by changes in employment (which are ultimately a result of direct and indirect effects). This may take the form of reductions in the consumption of goods and services as a result of decreased employment in the region.

## **Analytical Considerations**

There are two important caveats relevant to the interpretation of our IMPLAN model estimates. The first is that the IMPLAN model measures only those effects that are a direct result of a specified change at a point in time (in this case a reduction in demand for certain goods and services); thus, IMPLAN does not account for adjustments that may occur over time. Consumers and businesses adjust to changes. For example, a

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<sup>2</sup> The IMPLAN model is owned and maintained by the Minnesota IMPLAN Group, Inc. (MIG).

reduction in demand for recreational services may prompt suppliers to employ their resources in other endeavors, and thus moderate overall losses in employment and output. In addition, persons whose jobs are displaced as a direct result of a decrease in demand in a given sector are likely to seek employment in other industries in that region. Thus, as these examples imply, the long-run net output and employment effects may be smaller than those estimated by the model. For the purposes of our analysis, this point may be particularly relevant. In many coastal areas, service industries comprise the predominant portion of the local economy and are seasonal by nature. Relative to the manufacturing and professional sectors, adjustments to changes in output and employment may occur more efficiently in these service sectors. In addition, the IMPLAN model considers all jobs in a regional economy to be full-time in nature. As many seasonal jobs are likely to be part-time, the extent of any employment effects is also likely to be overstated.

The second caveat relates to the time period of the IMPLAN model data. IMPLAN relies upon input/output relationships derived from 1994 data (the latest year available) to approximate the regional economy in years prior to and after 1994. In this manner, the analysis freezes regional economic relationships as of 1994. To the extent that significant changes have occurred in the study areas since listing of the piping plover in 1986, our results may be sensitive to this assumption. However, the magnitude and direction of any bias introduced by this factor is unknown.

## **DATA SOURCES**

Beaches support a wide range of recreational activities, including swimming, surfing, sunbathing, fishing, shellfishing, strolling and birdwatching. In most cases data on beach usage are available from public or private entities that manage the beach. Some of these data are available in annual reports by towns and state agencies. The quality of these data may range from counts based on daily use fees or daily parking fees to estimates based on seasonal permits or parking capacity. An additional source of data for marine recreational fishing trips is the Marine Recreational Fishing Statistics Survey (MRFSS). The survey, conducted by the National Marine Fisheries Service (NMFS) combines intercept and telephone survey information to develop local measures of fishing effort and pressure (Refer to Appendix 3-A for a more detailed description of the MRFSS data).



**APPENDIX 3-A**

**Marine Recreational Fishing Survey Statistics (MRFSS) Data**



The MRFSS interviews fishermen at various sites, covering shore, boat and charter boat fishing modes. Interviews determine a measure of effort and catch, by species and size. The interviews also include an estimate of fishing pressure (number of anglers at a specific location at the time of the interview). Such data would provide site-specific estimates of trips for key months; however, NMFS has not retained these data for past years, and thus it is necessary to rely on more aggregate county level trip information from the telephone interviews.

The telephone survey, conducted by NMFS is made up of interviews with residents of coastal counties in order to estimate the total number of fishing trips. The telephone data include information at the household level (type 1), respondent level including total trips (type 2), and trip level including destination, by county (type 3). These Type 3 data, with adjustments for sampling, provide an estimate of the number of marine recreational fishing trips by month at the county level. Where beach closures lead to fewer trips within an affected county, these data may provide a useful measure of impacts.

MRFSS telephone data are collected from random telephone calls to households in coastal counties throughout the nation. The raw data comprise marine recreational fishing trips taken within a coastal county by residents of coastal counties. Since 1996 the survey captures out-of-state trips by residents of coastal counties, but prior to 1995 questions about out-of-state trips were not included in the survey. These data require three adjustments; one for sample size, a second to include trips by residents from non-coastal counties, and a third to include out-of-state residents.

Calls are made in six, two month waves, continuing throughout the year. Some northern states, including Massachusetts, are not sampled in wave 1, which is January and February. State sample sizes for each wave are in proportion to estimates of trips within the state for those months based on previous year's surveys. Thus, in northern states waves 3 (May/June), 4 (July/August), and 5 (September/October) result in greater sample sizes than waves corresponding to colder months. Within each survey wave counties are sampled in proportion to the square root of the number of households. Thus, less populous counties are proportionately oversampled relative to more populous counties. Raw data at the county level for each wave must be adjusted by applying the ratio of total coastal households/households sampled in the corresponding wave.

The raw data require additional adjustments to account for trips by fishermen from non-coastal counties within the state and trips by fishermen from out-of-state. NMFS makes these adjustments based on results from the on-site interview surveys. These interviews reveal the ratio of fishermen who reside in coastal and non-coastal counties and in-state and out-of-state.



## REFERENCES

Atlantic States Marine Fisheries Commission, "MRFSS User's Manual, A Guide to the Use of National Marine Fisheries Service Marine Recreational Fisheries Statistics Survey Database", Special Report No. 37, December, 1994.

National Marine Fisheries Service, Marine Recreational Fisheries Statistics Survey Data, Telephone Interviews, 1981-97.

Minnesota IMPLAN Group, Inc., User's Guide, Analysis Guide, Data Guide, IMPLAN Professional, Stillwater, MN, 1997.

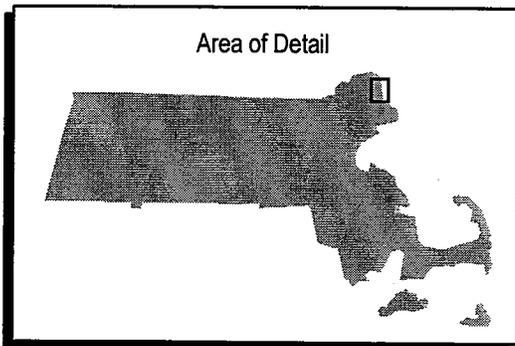
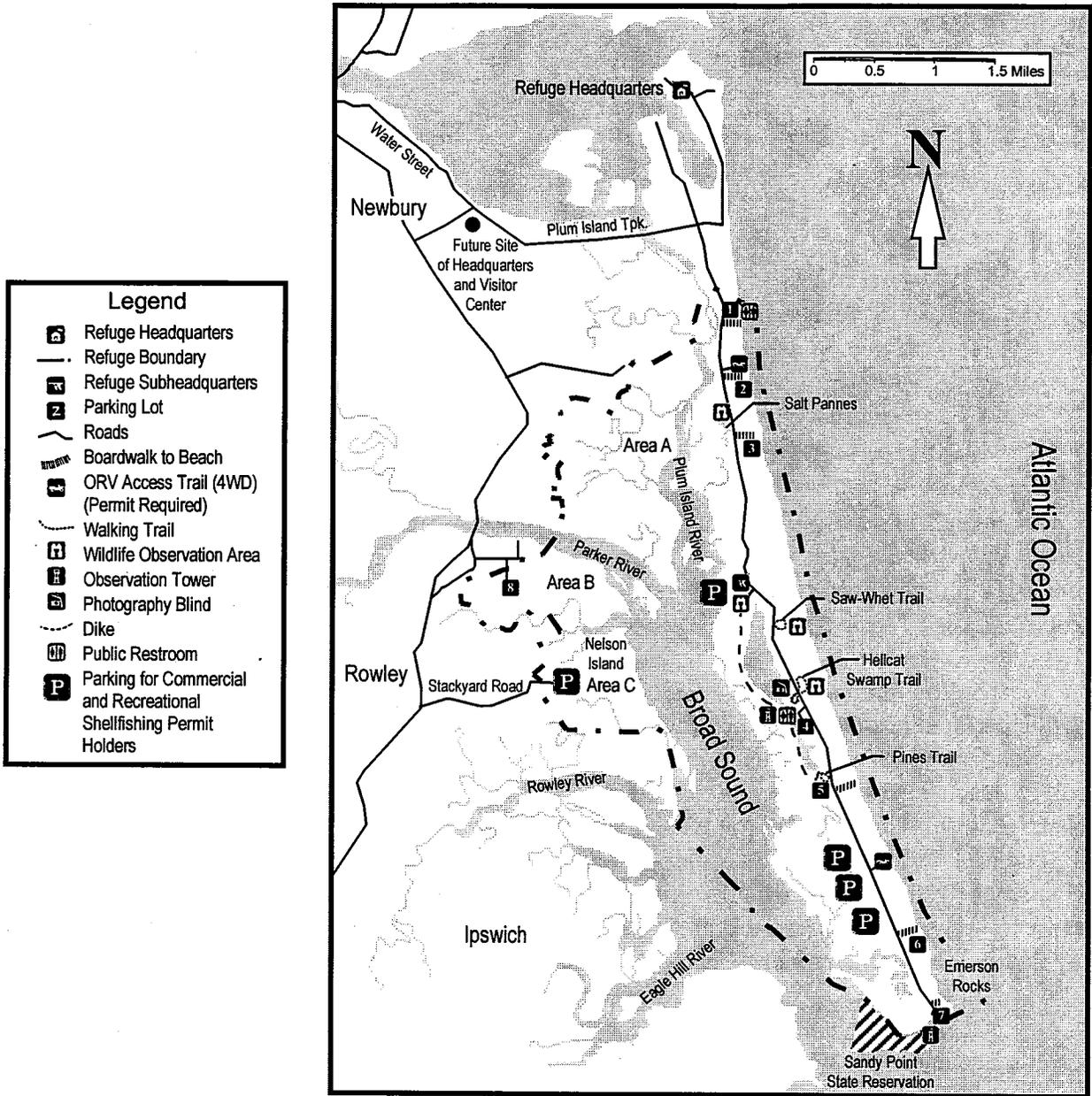


Plum Island is a barrier island, approximately nine miles in length, on the northern shore of Massachusetts between Cape Ann and the Merrimack River. Behind the island lies Broad Sound, which is fed by the Plum Island, Parker, Rowley and Eagle Hill Rivers. Plum Island Sound supports an extensive and diverse estuarine system. From north to south, Plum Island is located within the boundaries of the towns of Newburyport, Newbury, Rowley and Ipswich (refer to Exhibit 4-1). A single road and bridge, in the town of Newbury, provides access to the island.

The southernmost tip of Plum Island is occupied by the Sandy Point State Reservation, a public park which provides beach access and a limited number of parking spaces. Many seasonal and year-round residences exist on the northern end of the island, along with several stores, public beaches and parking lots maintained by the towns of Newburyport and Newbury (Plum Island Point). The most prominent feature on the island is the Parker River National Wildlife Refuge (the "refuge"), which occupies 4,662 acres and six miles of beach. The refuge attracts a diversity of visitors, from ornithologists to fishermen and beachgoers. The pristine surroundings and easy accessibility from the greater Boston area make it a popular recreational destination, especially in the hot summer months.

The refuge began implementing beach closures to protect piping plovers in 1986. As nesting became more widespread over time, so too did the closures. Local business owners and residents argued vigorously against the restrictions, citing reductions in the quality of life for members of the community, and local economic losses ranging from two to seven million dollars annually (Boston Globe, 1991 and Newburyport Daily News, 1991).

**Exhibit 4-1  
Parker River National Wildlife Refuge  
Plum Island, Massachusetts**



The following sections examine trends in visitation and access restrictions at the refuge in an attempt to isolate those changes attributable to plover recovery activities. We then employ the economic impact methodology discussed in Chapter 3 to evaluate corresponding losses to the economy of eastern Essex County. In this section we draw heavily from site-specific data collected in an intercept survey administered at the refuge between June, 1993 and May, 1994 (Gilbert, 1994). The survey elicited visitor characteristics, attitudes, and spending patterns and provides much of the basis for our economic impact analysis.<sup>1</sup>

## **DESCRIPTION OF THE SITE**

The Parker River Refuge is one of over 500 refuges managed by the U. S. Fish and Wildlife Service. It was established in 1942 primarily with the intention of protecting migratory waterfowl, and in particular the American black duck. The refuge contains many nature trails and boardwalks, observation towers, 3,000 acres of salt marsh, 1,200 acres of beach and dune area, and as a whole represents one of the "few natural barrier island complexes" on the Atlantic Coast (PRNWR, 1993). Over time the refuge has evolved to some degree. Since the 1960s, the Fish and Wildlife Service has removed recreation-oriented amenities such as bath houses, picnic tables and lifeguards. In addition, the number of parking lots in the refuge has been reduced by half.<sup>2</sup>

The primary objective of the refuge is to preserve habitat for a broad range of species, and in particular, those that are listed as threatened or endangered. The compatibility of various recreational uses with the aforementioned objective is carefully evaluated, and managed stringently thereafter. Public use is limited to designated trails, boardwalks, parking and beach areas. Watercraft, fires, pets and alcoholic beverages are prohibited within the refuge, as are any other activities which may adversely affect resident wildlife and their habitats.

Parking areas within the refuge can accommodate approximately 360 vehicles. Since 1987, the refuge has charged a daily access fee of five dollars, or one to two dollars if traveling by foot or bicycle. Normal operating hours are between sunrise and sunset, although fishermen are allowed on the beach overnight with the appropriate permits.

### **Refuge Attributes, Users, and Capacity**

The refuge is well-suited for many recreational activities and attracts a diverse group of users. The beaches are perhaps the greatest attraction to visitors during the summer months, offering an extensive, pristine area for swimming, sunbathing and other activities.

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<sup>1</sup> The authors wish to acknowledge Laura Gilbert for her assistance and contribution of data.

<sup>2</sup> All refuge information presented in this chapter is compiled from refuge reports, fact sheets, data and personal communication with John L. Fillio, refuge manager.

Wildlife observation is an increasingly popular recreational attraction at the refuge. In the last 20 years over 300 species of birds have been observed in the area, including endangered varieties such as the bald eagle, the peregrine falcon and the roseate tern. In addition, other species such white-tailed deer, foxes and rabbits are common. The observation towers and platforms within the refuge offer unobstructed views of the surrounding shrub and marsh habitats. For these reasons, the refuge is also a popular destination for environmental education classes and photographers.

In season, the refuge offers exceptional surf fishing opportunities. Anglers may catch striped bass, bluefish and other lesser species from various vantage points along the beach. In addition, off road vehicle (ORV) access is permitted under certain conditions. In 1988 fees were established for various fishing access opportunities. Permits are required for any fishing occurring between sunset and sunrise and for any ORV access. A 24-hour walk-on permit allows overnight fishing and beach access by foot for only five dollars. A 24-hour drive-on permit allows vehicle access for \$15. Finally, a 72-hour drive-on permit can be acquired for \$25. In the past, the refuge has administered as many as 1,500 permits in a single year.

The refuge offers several other types of consumptive recreation. Tidal flats are open to commercial and recreational shellfishing. In either case, fishermen must possess a valid clamming license from the Towns of Newbury, Rowley or Ipswich and acquire a refuge permit, which are issued free of charge. During the fall and winter, opportunities exist to hunt waterfowl in certain marsh areas. In addition, a controlled deer hunt is organized each fall. Approximately 100 individuals are invited to participate, as determined in a lottery, and each is charged a fee of \$20. Finally, certain areas are opened to berry picking (in particular, beach plums) each fall.

The refuge is also popular among walkers, runners, bicyclists, and under appropriate conditions, cross country skiers. An access road, paved for much of the way, extends the length of the refuge, offering an aesthetically pleasing area in which to exercise.

### **Distribution of Refuge Users**

As part of a 1993-94 intercept survey conducted at the refuge by Gilbert (1994), individuals were questioned regarding their primary reason for visiting the refuge. The most common reason was beach-related activities, cited by 32 percent of respondents. Twenty-four percent of respondents cited wildlife observation as the impetus for their trip, while an additional ten percent referred specifically to birdwatching. Sixteen percent of respondents attributed their trip to walking or other exercise. The remaining 18 percent cited either photography, fishing or other reasons as having inspired their visit to the refuge (Gilbert, 1994).

### **Refuge Capacity**

There are a total of twelve parking lots within the refuge confines. The largest is adjacent to the beach and restrooms and holds approximately 140 vehicles. Capacity is roughly equally

apportioned amongst the remaining eleven lots, although each lot is designated for specific activities. Five additional lots provide beach access (for a total of 256 vehicles), while the remaining lots are reserved for clamming, birding and wildlife observation. Parking areas at the Sandy Point State Reservation (the "reservation") provide capacity for 50 vehicles. Visitors to the reservation must travel through the refuge gate, but are not subjected to the refuge access fee. During the summer months the refuge oftentimes reaches maximum capacity. When this occurs, all public access is prohibited for a minimum of two hours. Due to the frequency of these closures, the refuge developed what they refer to as a "disappointment package" in 1991. The package of materials contains information on other comparable beach areas to visit in the vicinity, as well as information on wildlife observation and birding opportunities at the refuge, and a pamphlet describing the plight of the piping plover and current protection efforts.

### **PLOVER MANAGEMENT OBJECTIVES AND RESTRICTIONS**

According to the Fish and Wildlife Service Refuge Manual (7 RM 2.1), "protection, enhancement, and recovery of endangered and/or threatened species will receive priority consideration in the establishment of refuge objectives..." Furthermore, an objective of management (7 RM 2.2) is "to ensure that conflicts between endangered species and other wildlife management or public use programs are resolved in favor of endangered species" (PRNWR, 1993). Consistent with these principles, the refuge employs several methods to mitigate the effects of human disturbance on piping plover productivity and to educate the public about these efforts.

Between 1986 and 1989, approximately half of the refuge beach was subject to closure to provide a protective buffer around each plover nesting area. As nesting activity increased, closure of the full extent of the beach became necessary. Due to the narrow profile of the refuge beach and the territorial nature of the birds, full closures were initiated beginning in 1991 to allow returning birds to better select ideal nesting sites and prevent nesting failures due to human intrusion. The refuge staff closes the beach on April 1 of each year, and may not reopen it until August 31. Based on periodic evaluations, some sections of the beach may be opened after July 1 if deemed suitable (i.e., absence of nesting pairs, or a sufficient buffer exists and the range of adjacent broods is known). Throughout the season volunteer "plover wardens" monitor closed areas to provide information to visitors and note any violations of the closures. Other management activities include predator control, nest exclosures and plover monitoring. Exhibit 4-2 details refuge beach closures and breeding success over the last decade.

**Exhibit 4-2**

**Parker River National Wildlife Refuge Piping Plover Management Activities and Results: 1986 - 1996**

<b>Year</b>	<b>Length of Beach Closed (mi.)</b>	<b>Date Entire Beach Re-opened</b>	<b>Number of Nesting Pairs</b>	<b>Number of Fledged Chicks</b>	<b>Productivity</b>
1986	3.2	August 23	3	2	0.7
1987	3.2	June 22	1	0	0
1988	3.3	July 1	1	0	0
1989	3.0	August 18	3	4	1.3
1990	5.3	August 23	10	14	1.4
1991	6.3	August 7	5	13	2.6
1992	6.3	July 24	5	13	2.6
1993	6.3	August 20	8	15	1.9
1994	6.3	August 12	15	23	1.5
1995	6.3	August 25	21	44	2.1
1996	6.3	August 8	17	20	1.2

Source: Parker River National Wildlife Refuge data, 1997.

In 1994, the Massachusetts Department of Environmental Management (DEM), which is responsible for the management of the Sandy Point Reservation at the southern tip of the island, entered into an agreement with the Refuge to administer piping plover protection at the reservation. The DEM implements restrictions at the reservation similar to those at the Refuge, although the beach closure applies only to vehicles during the plover breeding period. In 1996 two pairs of plovers nested on reservation beaches, and successfully fledged three chicks. Since 1995, the refuge has monitored the highly-trafficked town beaches on the northern end of island for plover activity. As of 1996 only one nest had been confirmed in the vicinity. A predator exclosure and symbolic fencing were established, however, the nest was subsequently abandoned (PRNWR, 1996).

### **ANALYSIS OF RECREATIONAL VISITS**

Although many recreational and cultural opportunities exist in the greater Newburyport area, the Parker River refuge and its beaches are a prominent attraction. The refuge, and adjacent beach areas, attract a large number of visitors each summer. In this section we describe our study area and examine trends in visitation to the refuge. Finally, we develop a model to examine changes in visitation associated with beach closures implemented on behalf of the piping plover.

## **The City of Newburyport**

Newburyport was incorporated in 1851 and occupies roughly eight square miles of land northwest of Plum Island. It was originally settled in 1635 as an agricultural community and developed into a prominent port around its shipbuilding industry. In the 1960's the city initiated an extensive redevelopment program to reclaim and preserve historic neighborhoods and update infrastructure. Today, the city accommodates nearly 150 retail businesses, approximately one-third of which are eating and drinking establishments. The atmosphere is distinctively colonial, complete with cobblestone streets, wrought iron lamps, and two historical museums (Greater Newburyport Chamber of Commerce and Industry; City Information, 1997). Tourism is an integral part of the local economy, and nearly 60 percent of Newburyport's inhabitants are employed in the service or wholesale and retail trade industries (MA Dept. of Housing and Community Development, 1997). Surprisingly, few overnight accommodations exist in Newburyport.

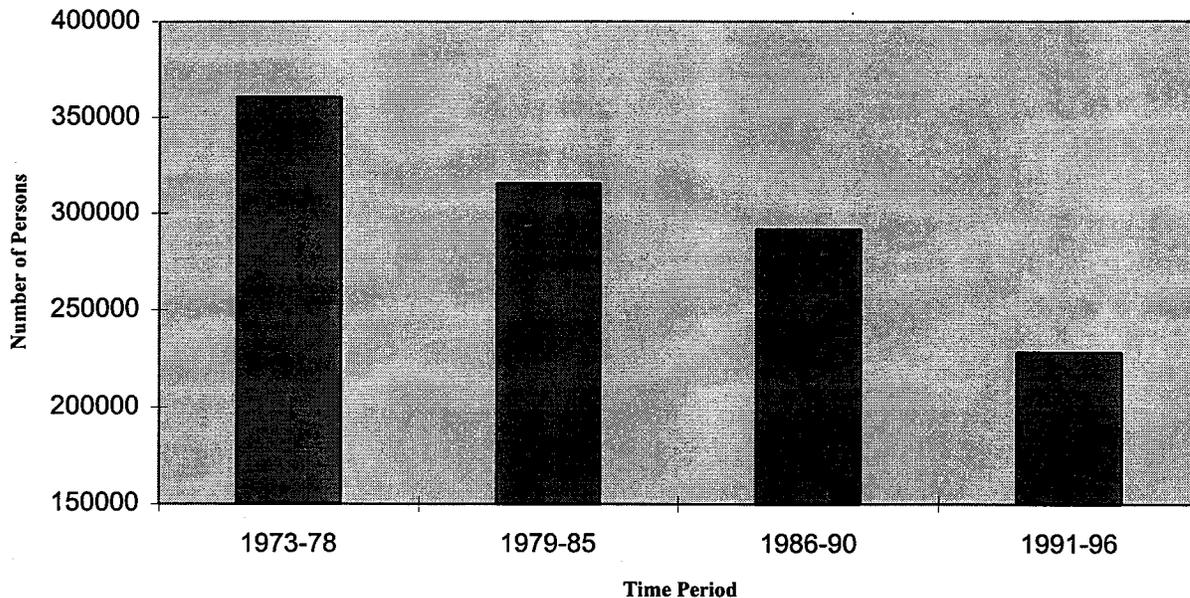
Although no official data exist, the Greater Newburyport Chamber of Commerce believes that visitation has been increasing over the past several years. Last year nearly 15,000 persons visited the information booth maintained by the organization, many of which came from other parts of the U. S., and other countries (personal communication, Joan Bouchard, Chamber of Commerce, 1997). In addition to the refuge and Plum Island beaches, many other recreational opportunities exist within close proximity to Newburyport. These include 48 acres of Audubon land (the Joppa Flats Education Center and Wildlife Sanctuary) and the Maudslay State Park.

## **Visits to the Parker River Refuge**

The refuge has collected and maintained data on annual visitation through daily vehicle counts at the entrance since 1971. Annual visitation peaked in 1977 at 408,110 persons, based on an average 2.4 persons per vehicle. Since that time, visitation on average has decreased. The advent of partial beach closures in 1986 resulted in a slight decline in visitation relative to the previous six years, but full closures in 1991 resulted in a substantial decline in visits. Exhibit 4-3 provides comparisons of average annual visitation for various time periods between 1973 to 1996.

**Exhibit 4-3**

**Average Annual Visitation to the Parker River National Wildlife Refuge, 1973 - 1996**

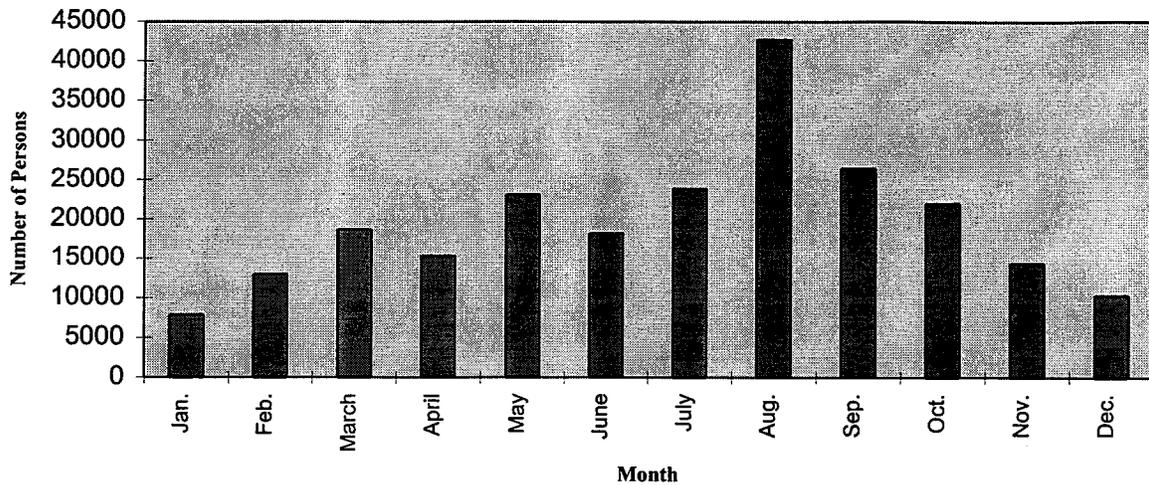


Source: Parker River National Wildlife Refuge data, 1997

Although visitation is greatest in the summer, there is significant activity in the winter months as well. Exhibit 4-4 demonstrates the seasonal distribution of visitors to the refuge in 1996. The large increase in visitation observed in August is attributable to the removal of beach access restrictions, which occurred on the eighth of that month. Since the advent of full closures in 1991 the heavy concentration of visits in August has become the norm.

Exhibit 4-4

Seasonal Distribution of Visitors to the Parker River Refuge, 1996



Source: Parker River National Wildlife Refuge data, 1997.

### Visitation at Substitute Sites: Crane Beach, Ipswich

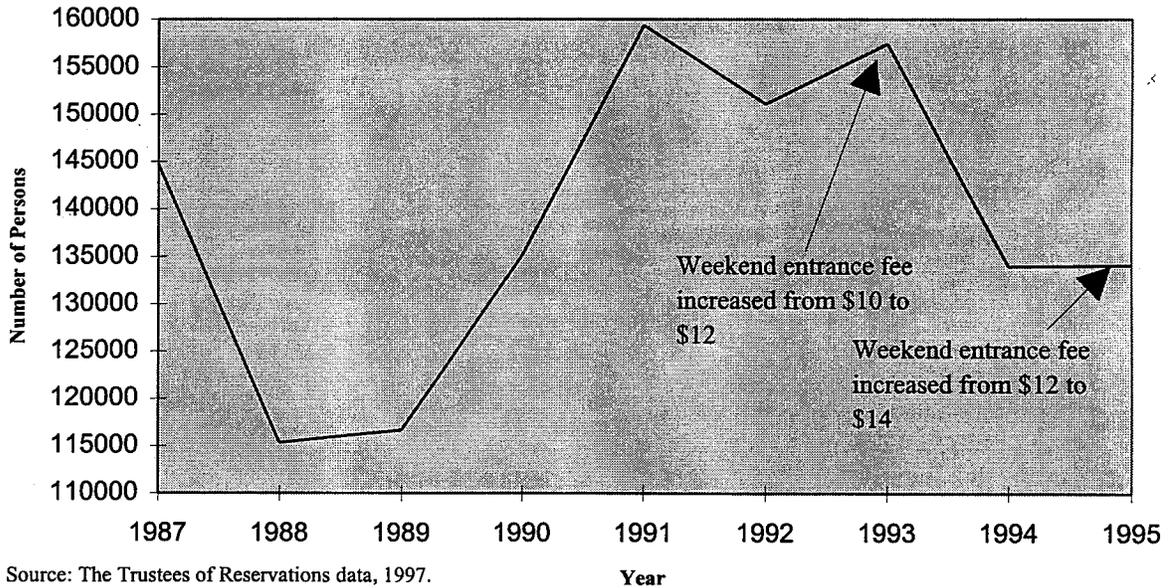
In addition to the Sandy Point State Reservation and Plum Island Point, other beach areas exist within a short driving distance of the refuge. Salisbury Beach State Park is roughly ten miles north of the refuge and provides capacity for 3,500 vehicles. Salisbury Beach, however, is an imperfect substitute for the refuge beaches due to its close proximity to substantial commercial development.

Crane Beach in Ipswich is approximately 18 miles (via road) south of the refuge. It is owned and managed by The Trustees of Reservations (TTOR) and provides parking for nearly 1,500 vehicles. Crane Beach provides a close substitute to the Parker River Refuge beaches (with respect to pedestrian usage; ORVs are not permitted on Crane Beach) because commercial development is restricted. It is closed to vehicle traffic, and offers many amenities including bathhouses, a snack bar and nature trails. Since 1985 TTOR has taken measures to protect piping plovers, including fencing off nesting areas, and restricting dune access. However, the average visitor is not affected by these restrictions (personal communication, Dave Rimmer, TTOR, 1997).

TTOR maintains vehicle count data for the beach season (roughly May through September, depending on weather). Over the period 1987 to 1995 the visitation data for Crane Beach appear highly variable with no clear trends, as shown in Exhibit 4-5. These data are also based on a 2.4 person per vehicle convention. Large increases are observed between 1990 and 1991; during these same years visitation to the Parker River refuge declined ten and fifteen percent, respectively. In general, however, no discernible pattern exists. The large drop between 1993 and 1994 cannot be fully explained by the small increase in the entrance fee.

Exhibit 4-5

Annual Visitation to Crane Beach, 1987 - 1995



### Visitation Patterns and Beach Closures at The Parker River Refuge

Visitation to the refuge continued to decline after implementation of beach closures in 1986. With the exception of a modest increase in 1989, visitation decreased throughout the period 1986 to 1991. Exhibit 4-6 below provides comparative statistics on average annual attendance relative to beach closure activities.

Exhibit 4-6

Changes in Average Annual Visitation to the Parker River National Wildlife Refuge, 1980 - 1996

Year / Closure	Average Number of Visitors per Annum	Percent Change
1980 - 1985 (no closure)	313,266	
1986 - 1990 (partial closure)	291,912	-7%
1991 - 1996 (full closure)	228,730	-22%

Source: Parker River National Wildlife Refuge data, 1997.

Given the diversity of user groups at the refuge, it would be inappropriate to attribute these declines solely to plover management restrictions. In reality many other factors, such as

weather, travel costs and changes in people's tastes and preferences are likely to influence visitation. Some of these determinants are difficult to measure; however, if we are able to explain some of the reasons that visitation changes from year to year, and compare those attributes both before and after the beach closures were implemented, we then can obtain a more reliable measure of changes specifically associated with the closures.

### **Refuge Visitation Model**

In this section we develop a simple, linear regression model in an attempt to measure the influence of the seasonal beach closures on refuge visitation. In our model, we posit annual visitation as a function of weather, fuel costs, fee structure, local population and the duration and extent of beach closures. The analysis utilizes 24 years of data, from 1973 to 1996, drawing upon information provided by the refuge, the Bureau of Economic Analysis, the Energy Information Administration and the Northeast Regional Climate Center<sup>3</sup>.

The variable constructed to measure the influence of beach closures on visitation represents the number of days of closure each year weighted by the length of beach closed (in miles). In constructing this variable we exercise a simplifying assumption: that the duration of closure extends until the *entire* beach is re-opened. Because visitors often misinterpret information regarding the extent of closures throughout the season (personal communication, Jean Bouchard, Chamber of Commerce and Jack Fillio, refuge manager, 1997) and it is the public perception of the closures that will ultimately influence visitation, this measure is appropriate. It is worth noting, however, that our model may overestimate losses by a small amount.

If indeed significant declines in visitation occur as a result of the closures, we would expect to observe a negative and significant coefficient on the constructed closure variable. In general we would expect visitation to vary inversely with gas prices, and positively with population and good weather. Finally, we consider the refuge fee, which has remained constant since its implementation in 1987 in current dollars, but has declined slightly when adjusted for inflation. We would expect that visitation is relatively insensitive to this cost.

### **Results**

Estimation results indicate that our model explains approximately 70 percent of the variation in annual visitation over the study period (Refer to Appendix 4-A for regression results). Travel cost, as approximated by gasoline prices, and the beach closures both demonstrate negative coefficients and significance at the .05 level.<sup>4</sup> The included weather and

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<sup>3</sup> Bureau of Economic Analysis data available on-line at [www.bea.doc.gov/bea/ar1.htm](http://www.bea.doc.gov/bea/ar1.htm); Energy Information Administration data available at [www.eia.doe.gov/price.html](http://www.eia.doe.gov/price.html); daily climatic data provided by the Northeast Regional Climate Center at Cornell University.

<sup>4</sup> This level of significance indicates that we are 95% confident that the coefficient is significantly different from zero.

population variables both yield negative coefficients, which was not expected, and fail to achieve significance (i.e., we can not say that the true coefficient on these variables is different from zero). The counter-intuitive signs are likely the result of these variables serving as a proxy for other economic or related trends. As expected, the variable designed to capture price response to real changes in the entrance fee is also insignificant. Tests for serial correlation proved negative, and any shortcomings of the model are likely due to omitted variables, or other unobservable influences.

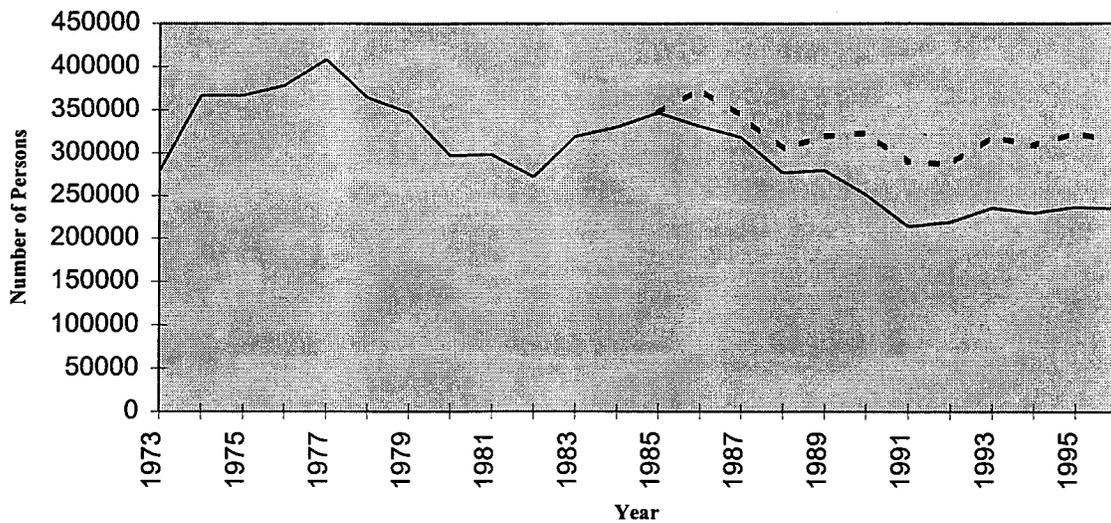
To examine declines in visitation associated only with the restrictions, we interpret the coefficient on the closure variable and evaluate it in each year that beach closures occurred. The coefficient value of negative 93 indicates that for each mile of beach closed per day, 93 trips to the refuge are lost. Closure of the entire beach, 6.3 miles, accounts for a loss of 586 trips per day. For comparative purposes, the coefficient of negative 648 on the fuel variable indicates that for each ten cent increase in gas prices, 6480 trips per year, or approximately 18 trips per day to the refuge are displaced. Exhibit 4-7 presents the number of trips lost, as determined by application of the closure coefficient to the duration and extent of beach closures from 1986 to 1996.

<b>Exhibit 4-7</b>	
<b>Annual Visitation Losses Attributable to Beach Closures at the Parker River National Wildlife Refuge, 1986 - 1996</b>	
<b>Year</b>	<b>Number of Trips Lost</b>
1986	43,000
1987	25,000
1988	28,000
1989	39,000
1990	72,000
1991	76,000
1992	68,000
1993	84,000
1994	79,000
1995	87,000
1996	77,000
Source: IEC analysis, 1997.	

For comparative purposes, Exhibit 4-8 provides annual visitation at the refuge 1973 to 1996. The dotted line indicates the level of visitation that would have occurred were it not for the closures, as predicted by our model.

Exhibit 4-8

Annual Visitation to the Parker River Refuge and Visitation Model Results, 1973 - 1996



Source: Parker River National Wildlife data and IEc analysis, 1997.

## ECONOMIC IMPACT OF BEACH CLOSURES

The results of our visitation analysis indicate that declines in overall visitation to the Parker River Refuge have occurred as a result of beach closures over the past decade. To assess the economic impact of these changes, we employ the methodology discussed in Chapter 3.

### Developing the Regional Economic Model

The IMPLAN model requires estimates of changes in direct spending associated with declines in visitation to the study area. For these estimates, we rely upon information collected in a 1993-1994 intercept survey at the Parker River refuge administered by Gilbert (1994). As described previously, the survey elicited individual's preferences and perceptions with respect to refuge management and usage, demographic information and expenditures made in the local area while visiting the refuge. These expenditures are divided into eight categories: restaurants, other food, supplies, gas and car services, amusements/recreation/sightseeing, gifts, lodging and other. Results from the survey indicate that roughly 87 percent of visitors to the refuge are on day trips. As such, we utilize average expenditures made by roughly 900 day-trip respondents in the aforementioned categories; lodging is of course excluded for day trips. Exhibit 4-9 shows that average day trip expenditures amounted to nearly nine dollars per visitor day.

<b>Exhibit 4-9</b>	
<b>Average Daily Expenditures Per Person- Visitors to the Parker River National Wildlife Refuge</b>	
<b>Category</b>	<b>Amount (1996\$)</b>
Restaurants	\$3.91
Other Food	\$1.01
Supplies (Film, suntan lotion, insect repellent, etc.)	\$0.65
Gas and Car Services	\$1.27
Amusements, Recreation, Sightseeing	\$0.36
Gifts	\$1.23
Other	\$0.55
<b>TOTAL</b>	<b>\$8.98</b>
Source: Gilbert, 1994 and 1997.	

To construct the IMPLAN model, we examine a midpoint estimate and range of visitation loss (based on +/- one standard error in our model estimates) and resultant expenditure changes on the local economy. To prevent overestimation of the economic impacts, we disregard any loss in visits by "local area" residents. As noted in Chapter 3, any reduction in beach trips by local residents is assumed to result in proportionate decreases in other goods and services with no change in total spending in the local area. Utilizing origin data from Gilbert's (1994) survey, we define the local area as eastern Essex County, corresponding to the zip code prefix of "019". Based on the survey results, we estimate that approximately 32 percent of the visits to the refuge are made by persons originating from cities and towns within this local area, and thus adjust our visitation loss estimates accordingly. Exhibit 4-10 indicates the adjusted range of lost visitation that we utilize in our IMPLAN analysis.

Exhibit 4-10		
Losses in Visitation Attributable to Beach Closures at the Parker River National Wildlife Refuge, Adjusted for Local Area Trips, 1986 - 1996		
Year	Midpoint (persons)	Range (persons)
1986	29,400	15,000 - 44,000
1987	16,800	8,000 - 25,000
1988	19,000	10,000 - 29,000
1989	26,600	13,000 - 40,000
1990	48,700	24,000 - 73,000
1991	51,500	26,000 - 77,000
1992	45,900	23,000 - 69,000
1993	56,700	28,000 - 85,000
1994	53,500	27,000 - 80,000
1995	58,700	29,000 - 88,000
1996	51,900	26,000 - 78,000
Source: IEc analysis		

### **IMPLAN Analysis Results**

Exhibit 4-11 summarizes the impacts on output and employment from the IMPLAN analysis of reduced visitation to the refuge. For each year we provide a midpoint estimate and range of output, employment and employee compensation effects.

Exhibit 4-11						
Regional Economic Impact of Parker River National Wildlife Refuge Beach Closures, 1986 - 1996						
Year	Output Impact (1996\$)		Employment Impact (persons)		Employee Compensation Impact (1996\$)	
	Midpoint	Range	Midpoint	Range	Midpoint	Range
1986	\$400,000	\$200,000 - \$590,000	9	4 - 13	\$150,000	\$70,000 - \$220,000
1987	\$230,000	\$110,000 - \$340,000	5	2 - 7	\$90,000	\$40,000 - \$130,000
1988	\$250,000	\$130,000 - \$380,000	6	3 - 8	\$100,000	\$50,000 - \$140,000
1989	\$360,000	\$180,000 - \$530,000	8	4 - 12	\$140,000	\$70,000 - \$200,000
1990	\$650,000	\$330,000 - \$980,000	14	7 - 21	\$250,000	\$120,000 - \$370,000
1991	\$690,000	\$350,000 - \$1,030,000	15	7 - 22	\$260,000	\$130,000 - \$390,000
1992	\$610,000	\$310,000 - \$920,000	13	7 - 20	\$230,000	\$120,000 - \$350,000
1993	\$760,000	\$380,000 - \$1,140,000	16	8 - 25	\$290,000	\$140,000 - \$430,000
1994	\$720,000	\$360,000 - \$1,070,000	15	8 - 23	\$270,000	\$140,000 - \$410,000
1995	\$790,000	\$390,000 - \$1,180,000	17	9 - 25	\$300,000	\$150,000 - \$450,000
1996	\$700,000	\$350,000 - \$1,040,000	15	8 - 22	\$260,000	\$130,000 - \$400,000
Source: IEc IMPLAN analysis.						

An important question to consider is whether beachgoers affected by the closures at the refuge redirected their trips to a substitute beach elsewhere in the eastern Essex County local area. If so, then there is little economic impact attributable to the Parker River closures. Crane Beach in Ipswich is the closest substitute and we examined monthly visitation data over the years 1987 to 1995. Similar to our previous specification, we model visitation as a function of weather, travel cost, local population, fee structure and the closures at the refuge. Results indicate no significant increase during the months when closures occurred at the refuge. Thus, our analysis suggests that beachgoers either made significantly fewer beach trips or redirected those trips outside the local area, resulting in the economic impacts described above.

### Interpretation

The severity of output, employment and compensation effects in a given year are proportional to the extent and duration of the beach closure.<sup>5</sup> Relative to the total annual output, employment and employee compensation in all of Essex County, MA, the estimated impacts described above are negligible. Exhibit 4-12 presents IMPLAN estimates of output, employment and compensation impacts on the four industries that experienced the greatest effects in 1996 relative to baseline output and employment. These figures are based on our midpoint estimates for that year.

Exhibit 4-12						
Economic Impact of Parker River National Wildlife Refuge Beach Closures on Selected Industries, 1996						
Industry	Regional Output		Regional Employment & Compensation			
	Output Impact (1996\$)	Percentage of Baseline Output	Employment Impact (persons)	Percentage of Baseline Employment	Compensation Impact (1996\$)	Percentage of Baseline Compensation
Food Stores	\$46,000	.02%	2	.02%	\$25,560	~ 0
Automotive Dealers and Service Stations	\$68,000	.02%	1	.02%	\$31,878	~ 0
Miscellaneous Retail	\$120,000	.02%	5	.02%	\$58,123	~ 0
Eating and Drinking	\$190,000	.05%	4	.03%	\$67,013	~ 0
<b>TOTAL</b>	<b>\$424,000</b>	<b>.02%</b>	<b>12</b>	<b>.03%</b>	<b>\$182,574</b>	<b>.02%</b>

Source: IEc IMPLAN analysis

The four industries indicated above absorb a large portion of the output and employment impacts in a given year. In 1996 these industries accounted for roughly 60 percent of total regional output effects. Within these sectors, however, output and employment effects are

<sup>5</sup> Although intuitive, this relationship is partially a function of the IMPLAN methodology.

negligible. As shown, losses in output and employment ranged between two and five one-hundredths of a percent in certain industries, and two and three one-hundredths of a percent of total baseline (for those industries combined) in 1996. With respect to earnings, however, the impacts are almost imperceptible. Total losses comprised two one-hundredths of a percent of baseline compensation within the four industries in 1996.

As discussed previously, the "local area" comprises only the eastern portion of Essex County. Within this local area (and in particular the town of Newburyport), the effects are likely to be more significant. However, below the county level the economic data and underlying structural relationships are significantly less reliable. Thus, it is difficult to isolate and accurately assess these impacts.

## **WELFARE ANALYSIS OF BEACH CLOSURES**

In this section we estimate the welfare losses associated with two primary recreational activities constrained by the refuge beach closures: beach access (swimming, sunbathing) and fishing.

### **Estimation of Fishing/Beach Days and Surplus Value per Day**

To estimate losses in consumer surplus we rely upon a "benefits transfer" method. Because initiating primary research techniques to develop values for beach access and fishing at the refuge is beyond the scope of this study, we derive values for similar commodities from the existing body of economic literature. To determine a total consumer surplus loss associated with forgone recreational opportunities at the refuge, we apply appropriate *per-day* values to estimates of lost day trips from our visitation model. To accurately apportion these visits we rely upon the distribution reported by Gilbert (1994). As indicated previously, 32 percent of visitors to the refuge cited beach access as the primary motivation for their trip. Similarly, two percent of respondents indicated that fishing was their primary purpose. Since our estimates of lost trips are associated directly with the loss of access to the beach, we adjust these percentages to account for all trips. Exhibit 4-13 provides estimates of visitation losses from our model by recreational activity.

<b>Exhibit 4-13</b>				
<b>Losses in Visitation Attributable to Beach Closures at the Parker River National Wildlife Refuge by User Group, 1986 - 1996</b>				
<b>Year</b>	<b>Beach Users</b>		<b>Fishing</b>	
	<b>Midpoint (persons)</b>	<b>Range (persons)</b>	<b>Midpoint (persons)</b>	<b>Range (persons)</b>
1986	40,800	20,000 - 61,000	2,600	1,000 - 4,000
1987	23,300	12,000 - 35,000	1,500	1,000 - 2,000
1988	26,400	13,000 - 40,000	1,700	1,000 - 3,000
1989	36,900	18,000 - 55,000	2,400	1,000 - 4,000
1990	67,500	34,000 - 101,000	4,300	2,000 - 6,000
1991	71,400	36,000 - 107,000	4,600	2,000 - 7,000
1992	63,600	32,000 - 95,000	4,000	2,000 - 6,000
1993	78,600	39,000 - 118,000	5,000	3,000 - 8,000
1994	74,100	37,000 - 111,000	4,700	2,000 - 7,000
1995	81,300	41,000 - 122,000	5,200	3,000 - 8,000
1996	72,000	36,000 - 108,000	4,600	2,000 - 7,000
Source: IEc analysis				

To determine appropriate values for fishing and beach recreation opportunities at the refuge we consider several valuation studies, as described in Exhibit 4-14. We are unaware of any studies of willingness to pay for access to an existing beach under comparable circumstances, however, Silberman and Klock (1987) and Bell and Leeworthy (1985) estimate willingness to pay for beach preservation (i.e., prevention of egregious erosion). While these values estimate surplus value in a different context, they likely represent a fair approximation for our purposes. With respect to surf fishing opportunities McConnell and Strand (1994), Norton, Smith and Strand (1983) and others estimate day and trip values for saltwater (shore) fishing days.

**Exhibit 4-14**

**Summary of Recreational Values**

<b>Activity</b>	<b>Author (date)</b>	<b>Study Location and Commodity</b>	<b>Value (\$1996)</b>
Beach Use	Silberman and Klock (1987)	New Jersey beach preservation	\$4.77 per day
	Bell and Leeworthy (1985)	Florida beach preservation	\$2.06 per day
Saltwater Shore Fishing	Huppert (1989)	Central California striped bass and chinook salmon fishing	\$183.24 per trip
	McConnell, Weninger and Strand (1994)	Eastern States saltwater fishing	\$164.47 per trip
	McConnell and Strand (1994)	Eastern states saltwater fishing, May - August	\$12.67 - \$103.24 per day
	Norton, Smith and Strand (1983)	New England striped bass fishing	\$156.94 per trip

**Estimate of Total Economic Surplus Loss**

To calculate the total welfare loss associated with the refuge beach closures we apply the appropriate per-day values to our estimates of lost beach and fishing days. Exhibit 4-15 presents lower and upper bound estimates for annual consumer surplus loss for each activity. For beach use, we present a range of losses based on our midpoint visitation estimate and the two values (\$2.06 to \$4.77 per day) described above. It is worth noting that these values are associated with beach access in Florida and New Jersey, both of which contain many substitute beach areas. Therefore, given the unique nature of the Parker River refuge beaches, these estimates are likely to underestimate the true surplus value of refuge beach days.

Since the predominant portion of visits to the refuge are day trips (Gilbert, 1994) we rely upon the range of fishing values per day by state provided by McConnell and Strand (1994) to estimate total annual surplus losses. These values range from \$12.67 to \$103.24 per day. The remaining fishing estimates are denominated in trips (some of which exceed a day in length) and would likely overstate values for a day trip. Again, given the unique nature of the refuge, the upper bound estimates are likely to be more representative of the surplus forfeited by refuge anglers due to the beach closures.

<b>Exhibit 4-15</b>				
<b>Annual Economic Surplus Losses Attributable to Parker River National Wildlife Refuge Beach Closures; Beach Access and Fishing, 1986 - 1996</b>				
<b>Year</b>	<b>Beach Use (\$1996)</b>		<b>Fishing (\$1996)</b>	
	<b>Lower</b>	<b>Upper</b>	<b>Lower</b>	<b>Upper</b>
1986	\$84,000	\$194,000	\$33,000	\$269,000
1987	\$48,000	\$111,000	\$19,000	\$154,000
1988	\$54,000	\$126,000	\$21,000	\$174,000
1989	\$76,000	\$176,000	\$30,000	\$243,000
1990	\$139,000	\$322,000	\$55,000	\$445,000
1991	\$147,000	\$340,000	\$58,000	\$470,000
1992	\$131,000	\$304,000	\$51,000	\$419,000
1993	\$162,000	\$375,000	\$64,000	\$518,000
1994	\$153,000	\$354,000	\$60,000	\$489,000
1995	\$168,000	\$388,000	\$66,000	\$536,000
1996	\$148,000	\$343,000	\$58,000	\$474,000

Source: IEC analysis; Silberman and Klock (1987), Bell and Leeworthy (1985) and McConnell and Strand (1994)

Finally, it is worth noting that although beach closures at the refuge have reduced consumer surplus enjoyed by beachgoers and anglers, it is possible that some refuge patrons have accrued welfare gains. For example, birdwatchers and other wildlife enthusiasts may now have a higher quality experience due to less crowding and vehicles.

## **ANALYSIS OF SURF FISHING PERMIT SALES**

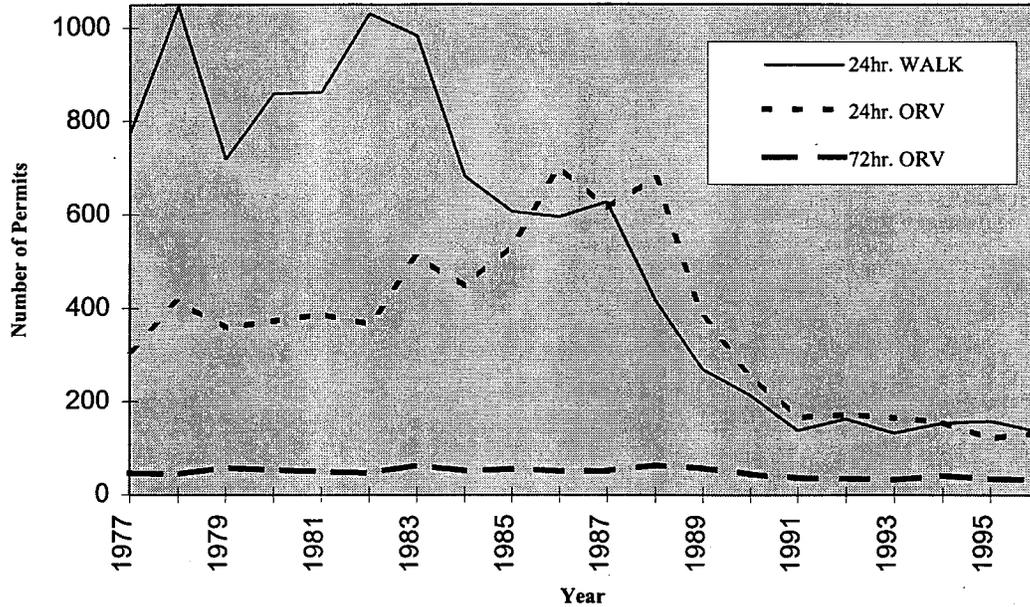
As discussed earlier, the Parker River refuge issues permits for overnight and ORV access fishing activities. In 1988 the refuge instituted fees for these permits and these fees have since constituted a source of revenue for the refuge. For this reason, it is important to examine changes in these permit sales relative to beach closure activity. In the following sections we develop a model similar to that used in our visitation analysis in an attempt to isolate changes in sales directly attributable to beach closures.

### **Trends in Surf Fishing Permit Sales**

Three different permits are available to fishermen at the refuge: a 24-hour walk-on permit, a 24-hour ORV access permit and a 72-hour ORV access permit. Sales of all three types of permits have declined over the last ten years, despite fee reductions introduced in 1991. Exhibit 4-13 presents trends in permit sales for the last twenty years.

Exhibit 4-16

Surf Fishing Permit Sales at the Parker River National Wildlife Refuge, 1977 - 1996



Source: Parker River National Wildlife Refuge data, 1997.

**Permit Sales Model**

To examine the effect of beach closures on permit sales, we construct three simple, linear regression models (i.e., one for each type of permit). We estimate annual permit sales as a function of the associated fee, local population and the extent and duration of beach closures in that year.<sup>6</sup> The analysis utilizes 20 years of permit data, from 1977 to 1996. The closure variable is identical in form to that used previously in the visitation analysis.

If declines in permit sales are attributable to beach closures, as we expect they are, the closure variable should indicate a negative and significant coefficient. In addition, we would expect that permit sales will vary inversely with the fee and positively with population.

<sup>6</sup> In addition to the explanatory variables described above we examined the effects of two additional factors: the imposition of striped bass catch and minimum size regulations in 1985 and the estimated stock size of striped bass over the study period. Neither variable demonstrated significant influence on refuge permit sales and therefore both were excluded from the model.

## Results

Estimation results indicate that in all three models the closure variable yields a negative sign and is significant at the .05 level (with the exception of the 24-hour walk-on permit model, in which the variable narrowly misses this level of significance). Refer to Appendix 4-B for detailed regression results. To determine the number of permit sales "lost" as a result of the closures, we apply a methodology identical to that used with the visitation model. We apply the closure coefficient from each model to the values of the closure variable in each year. Exhibit 4-17 summarizes the results from this analysis of permit sales lost and the accompanying loss in revenues.

Exhibit 4-17										
Losses In Surf Fishing Permit Revenues Attributable to Beach Closures at the Parker River National Wildlife Refuge, 1986 - 1996										
Year	24-hour Walk-On Permit			24-Hour ORV Access			72-Hour ORV Access			Total Loss in Revenue
	Permits Lost	Fee	Lost Revenue	Permits Lost	Fee	Lost Revenue	Permits Lost	Fee	Lost Revenue	
1986	121	\$0	\$0	320	\$0	\$0	18	\$0	\$0	\$0
1987	69	\$0	\$0	183	\$0	\$0	10	\$0	\$0	\$0
1988	78	\$5	\$390	207	\$25	\$5,175	12	\$45	\$540	\$6,105
1989	109	\$5	\$545	290	\$25	\$7,250	16	\$45	\$720	\$8,515
1990	200	\$5	\$1,000	530	\$25	\$13,250	30	\$45	\$1,350	\$15,600
1991	211	\$5	\$1,055	561	\$15	\$8,415	32	\$25	\$800	\$10,270
1992	188	\$5	\$940	500	\$15	\$7,500	28	\$25	\$700	\$9,140
1993	232	\$5	\$1,160	617	\$15	\$9,255	35	\$25	\$875	\$11,290
1994	219	\$5	\$1,095	582	\$15	\$8,730	33	\$25	\$825	\$10,650
1995	241	\$5	\$1,205	639	\$15	\$9,585	36	\$25	\$900	\$11,690
1996	213	\$5	\$1,065	565	\$15	\$8,475	32	\$25	\$800	\$10,340

Note: Revenue losses are stated in current dollars.  
Source: IEc analysis.

As shown, the most significant losses, both in number of permits and total revenue, are associated with the 24-hour ORV access permits, which since 1991 has ranged from about \$7,500 to \$9,600 per year. Across all permit types, the losses in revenue have ranged from about \$9,100 to \$11,700 over this same period. In 1995 fishing permit revenue losses of \$11,690 represented over seven percent of total refuge revenues for the year.

## SUMMARY OF ECONOMIC IMPACTS OF PIPING PLOVER MANAGEMENT

Overall, Essex County, MA, has sustained a modest loss in output and employment as a result of beach closures implemented to protect the piping plover. Since implementation of full closures in 1991, losses in output and employment averaged roughly \$710,000 and 15 persons

per year, respectively. The majority of these losses are concentrated in the eating and drinking, miscellaneous retail, automotive service and food store industries, which are most directly affected by changes in refuge attendance and visitor expenditure patterns. These estimates fall roughly between ten and 40 percent of those cited by local businesses and residents, cited at the beginning of this chapter.

In addition, beach closures have significantly reduced the number of fishing permits sold by the Parker River refuge. The most severe losses occurred in 1990 when \$15,600 in permit revenue was forfeited by the refuge. In recent years this annual revenue loss has exceeded \$10,000.

Finally, examination of appropriate consumer surplus values suggests that the refuge beach closures have generated a significant welfare loss. In the period 1986 to 1996, annual consumer surplus losses associated with restricted beach access and fishing opportunities has averaged between \$170,000 and \$660,000.

Although some economic impacts of plover recovery activities have been absorbed by local proprietors, the adversarial relationship between refuge management and local business appears to be giving way to a more cooperative atmosphere. Former head of the Greater Newburyport Chamber of Commerce Shirley Magnati commented, "What we decided to do was work together and work around it" (Vineyard Gazette, 1993). One outcome of this collaboration was the creation of the "Plover Festival" in 1993. The festival typically runs for three days in May and includes activities such as guided conservation tours, art displays, concerts, and road and bike races. The intent is to involve local businesses, attract visitors to the area, and promote wildlife conservation. In general, increased enthusiasm for wildlife-related activities at the refuge has piqued the interest of local business owners. In the Newburyport area, there exist two recently opened shops devoted solely to birdwatching and wildlife viewing. In the upcoming years, increases in "eco-tourism" may contribute more substantially to the local economy and continue to improve relations between local proprietors and refuge management. As Shirley Magnati concluded in 1995, "This is a story of four and a half years of struggling, we've all softened... We realize that we have probably one of the top ten bird sanctuaries in the country, we are going after that" (Boston Globe, 1995).



**APPENDIX 4-A**

**Regression Estimates of Visitation to the Parker River Refuge**



## REGRESSION RESULTS

Source	SS	df	MS			
Model	5.6186e+10	5	1.1237e+10			
Residual	1.7161e+10	18	953389351			
Total	7.3347e+10	23	3.1890e+09			

				Number of obs =	24
				F( 5, 18) =	11.79
				Prob > F =	0.0000
				R-squared =	0.7660
				Adj R-squared =	0.7010
				Root MSE =	30877

visits	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sunwkend	-2232.254	2607.293	-0.856	0.403	-7709.974	3245.466
fee	-5169.175	6527.838	-0.792	0.439	-18883.65	8545.303
close	-93.42795	46.66941	-2.002	0.061	-191.4767	4.620832
realgas	-648.1109	324.1281	-2.000	0.061	-1329.079	32.85688
pop	-.145943	.1721011	-0.848	0.408	-.5075139	.2156279
_cons	1331894	1005985	1.324	0.202	-781601	3445390

## VARIABLE DEFINITIONS

- SUNWKEND:** weather proxy, as defined by number of summer weekend days free of precipitation
- FEE:** refuge entrance fee, adjusted for inflation
- CLOSE:** extent and duration of beach closure, as measured by the number of beach miles closed multiplied by the number of days of closure
- REALGAS:** average gasoline price across grades, adjusted for inflation (cents per gallon)
- POP:** Massachusetts state population

## SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
visits	26	292990.5	59984.65	201170	408110
sunwkend	26	14.96154	2.734678	10	20
fee	26	1.535	2.017534	0	5
close	26	278.4423	366.2794	0	926.1
realgas	24	158.9375	33.29759	124.1	233.5
pop	26	5872475	125642.1	5738589	6092352



**APPENDIX 4-B**

**Regression Estimates of Surf Fishing Permit Issuances as the Parker River Refuge**



## REGRESSION RESULTS

<b>24-hour Walk-on Permit Model</b>						
Source	SS	df	MS	Number of obs = 20		
Model	1978192.29	3	659397.429	F( 3, 16) = 63.53		
Residual	166063.464	16	10378.9665	Prob > F = 0.0000		
				R-squared = 0.9226		
				Adj R-squared = 0.9080		
				Root MSE = 101.88		
-----						
sfwlk24	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
feewlk24	-36.12229	21.76061	-1.660	0.116	-82.25271	10.00813
close	-.2597414	.1613316	-1.610	0.127	-.601749	.0822662
pop	-.0011421	.0005113	-2.234	0.040	-.0022259	-.0000583
_cons	7448.457	2962.783	2.514	0.023	1167.637	13729.28
-----						
<b>24-hour ORV Access Permit Model</b>						
Source	SS	df	MS	Number of obs = 20		
Model	330176.334	3	110058.778	F( 3, 16) = 6.02		
Residual	292693.466	16	18293.3416	Prob > F = 0.0061		
				R-squared = 0.5301		
				Adj R-squared = 0.4420		
				Root MSE = 135.25		
-----						
sforv24	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
feeorv24	-3.029842	5.414048	-0.560	0.583	-14.50711	8.447426
close	-.6899698	.199355	-3.461	0.003	-1.112584	-.267356
pop	.0015078	.0007059	2.136	0.048	.0000113	.0030042
_cons	-8267.329	4088.731	-2.022	0.060	-16935.05	400.3924
-----						

**72-hour ORV Access Permit Model**

Source	SS	df	MS	Number of obs = 20		
Model	1331.84442	3	443.948139	F( 3, 16)	=	14.06
Residual	505.355583	16	31.584724	Prob > F	=	0.0001
Total	1837.20	19	96.6947368	R-squared	=	0.7249
				Adj R-squared	=	0.6734
				Root MSE	=	5.62

sforv72	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
feeorv72	.2129681	.1227715	1.735	0.102	-.0472959	.4732321
close	-.0389768	.0083004	-4.696	0.000	-.0565728	-.0213807
pop	.0000434	.0000294	1.478	0.159	-.0000189	.0001057
_cons	-198.0441	170.1124	-1.164	0.261	-558.6661	162.578

**VARIABLE DEFINITIONS**

- FEEWLK24: fee associated with 24-hour walk-on permit
- FEEORV24: fee associated with 24-hour ORV access permit
- FEEORV72: fee associated with 72-hour ORV access permit
- CLOSE: extent and duration of beach closure, as measured by the number of beach miles closed multiplied by the number of days of closure
- POP: Massachusetts state population

**SUMMARY STATISTICS**

Variable	Obs	Mean	Std. Dev.	Min	Max
sfwlk24	21	511.619	336.1862	132	1046
sforv24	21	351.0476	183.5994	122	702
sforv72	21	46.33333	10.37465	29	63
feewlk24	21	2.380952	2.558832	0	5
feeorv24	21	8.571429	9.765098	0	25
feeorv72	21	14.7619	17.1374	0	45
close	20	361.975	380.3932	0	926.1
pop	20	5905591	125274.4	5742923	6092352

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### **Personal Communication:**

- John L. Fillio, Manager, Parker River National Wildlife Refuge, (508) 465-5753
- David W. Rimmer, Northeast Regional Ecologist, The Trustees of Reservations, (508) 356-4351

Joan Bouchard, Newburyport Chamber of Commerce, (508) 462-6680

**On-Line Information:**

Massachusetts Department of Housing and Community Development, community profile information at <http://www.state.ma.us/dhcd/iprofile/210.htm>

Greater Newburyport Chamber of Commerce and Industry information at <http://newburyport.chamber.net/>

Newburyport information at <http://newburyport.net/>

**Newspaper Articles:**

"Plovers Get Plum Beachfront Rights", 1991. Boston Globe, 24 March.

"Miles of Plum Island Sand Remain Open to the Public", 1991. Newburyport Daily News, 12 April.

"Newburyport had its Plovers and its Political Problems; Now it has a Plover Festival", 1991. Vineyard Gazette, 26 March.

"Plover Lovers, Businesses Going 'Mellow' on Plum Island", 1995. Boston Globe, 2 April.

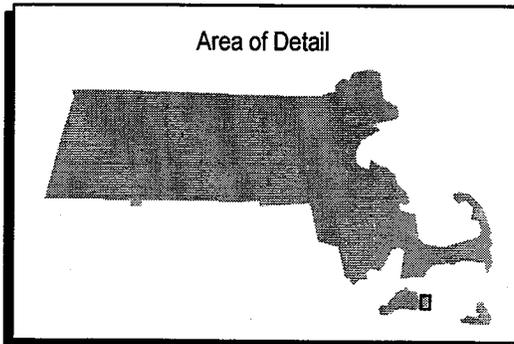
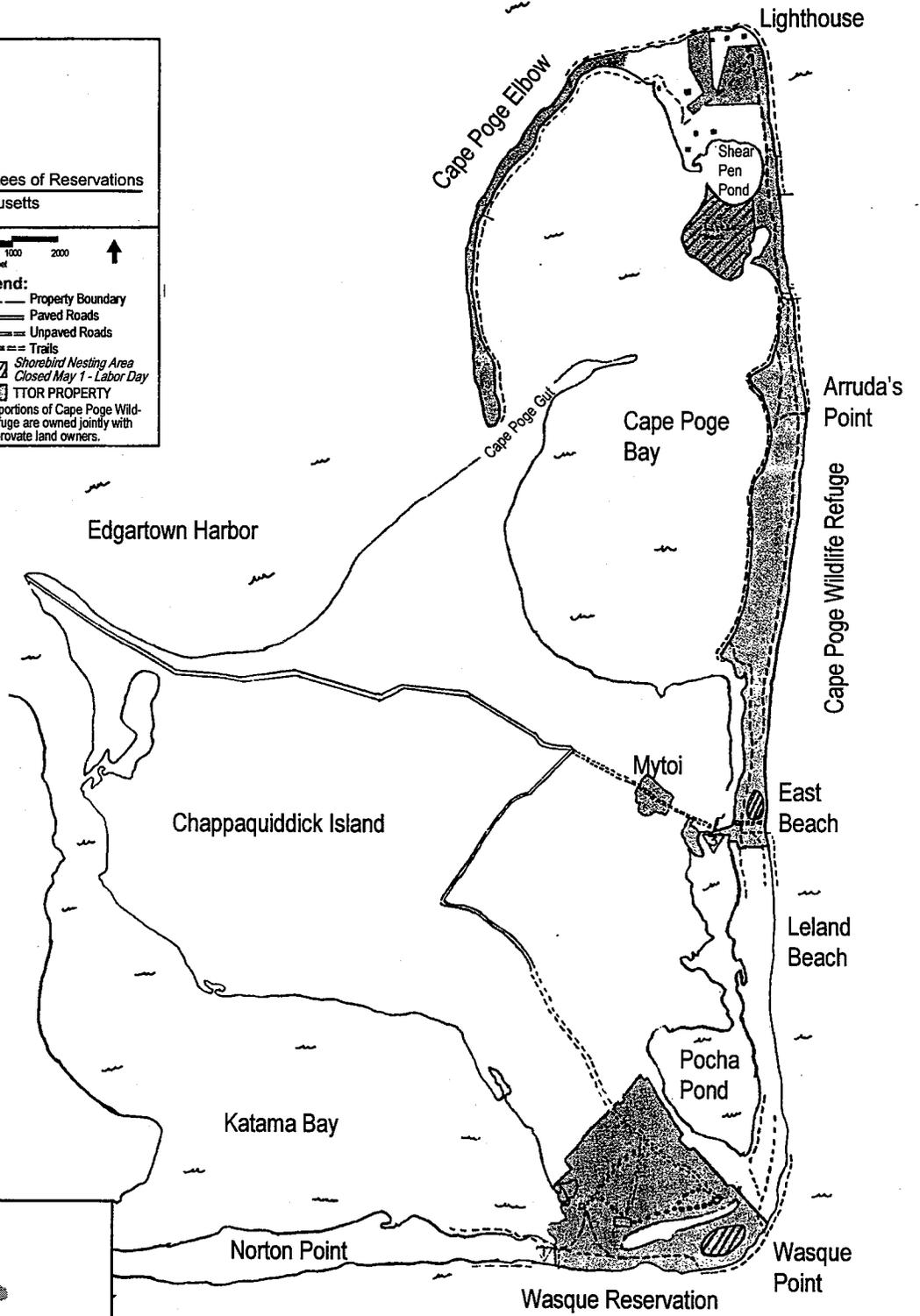
The island of Martha's Vineyard lies about 10 miles south of Cape Cod. Its permanent population is about 15,000, but in the summer seasonal residents, renters and day visitors swell the population to nearly 100,000 on peak weekends. One of the island's principal tourist attributes is its public beaches, which provide access to high quality fishing, swimming and other pursuits. Some of these beaches extend for miles and are accessible only by foot, boat, or off road vehicle (ORV) with four wheel drive. Moreover, generations of Vineyard residents and visitors with ORVs have grown up enjoying these remote beach areas. However, since 1993 portions of Norton Point Beach, Wasque Point, Leland Beach and Cape Poge Beaches have been closed to ORVs due to piping plover preservation efforts for part of the late spring and early summer (refer to Exhibit 5-1). These closures have restricted recreational usage and generated public protests and discontent among some Vineyard residents and visitors.

### **DESCRIPTION OF THE SITES**

Historically, piping plovers have nested on a number of private and public beaches on Martha's Vineyard, and the U.S. Fish and Wildlife Service with support and assistance from beach managers and other conservation volunteers has attempted to enhance their breeding success in several ways. Conservationists have erected exclosures to protect nests from predators. And beach managers have attempted to regulate beach access to allow the birds sufficient space free from humans to establish nests and to access foraging areas. In some cases the presence of plovers on narrow portions of the beach has required managers to close certain areas to vehicle traffic and to preclude pedestrian access to dune areas. The public beaches most affected by plover conservation efforts include Norton Point Beach, Wasque Point, Leland Beach and Cape Poge Beaches.

**Exhibit 5-1  
Wasque and Cape Poge Beaches  
Martha's Vineyard, Massachusetts**

 <p><b>Cape Poge Mytoi Wasque</b></p> <p>A Property of The Trustees of Reservations Edgartown, Massachusetts</p>	<p>1 1000 2000 ↑ scale in feet</p> <p><b>Legend:</b></p> <ul style="list-style-type: none"> <li>--- Property Boundary</li> <li>==== Paved Roads</li> <li>- - - - Unpaved Roads</li> <li>- · - · Trails</li> <li>▨ Shorebird Nesting Area Closed May 1 - Labor Day</li> <li>▩ TTOR PROPERTY</li> </ul> <p>Some portions of Cape Poge Wildlife Refuge are owned jointly with other private land owners.</p>
	<p><b>The Trustees of Reservations</b> <i>Conserving the Massachusetts Landscape</i></p> <p>Headquarters 572 Essex Street Beverly, Mass. 01915 (508) 921-1944</p>



### **Norton Point Beach**

Dukes County owns and manages a three mile stretch of barrier beach on the southeast corner of the Island that connects the Katama section of Edgartown with Chappaquidick Island. Norton Point Beach is bounded on the north by Mattakesett and Katama Bays and on the south by the Atlantic Ocean. The northern bay side consists of tidal flats that provide high quality feeding areas for plovers. Its southerly exposure to the ocean renders it susceptible to wave action from southerly winds, and Atlantic storms regularly erode portions of the beach. Hurricanes, especially, can cause significant changes to the beach. Norton Point Beach normally erodes in winter and builds back up again in summer as currents deposit sand from beaches further to the east. Currently, Norton Point Beach varies in width from about 400 to 550 feet, but actual width at any point in time depends on the processes of beach erosion and replenishment.

### **Wasque Point, Leland and Cape Poge Beaches**

From Wasque Point at the southeast corner of the island northward and then curving westward and southward to Cape Poge Gut lies nine miles of barrier beach. The Trustees of Reservations (TTOR) owns and operates Wasque Reservation at Wasque Point and Cape Poge Wildlife Refuge, which extends from Dike Bridge to the Cape Poge Gut. TTOR also manages Leland Beach, which extends from Wasque Point northward to Dike Bridge, on behalf of Massachusetts Division of Marine Fisheries. TTOR funds their operations by charging a small fee per adult to access their properties on foot and sells seasonal permits to access to the beach in ORVs.

Wasque Reservation, including Wasque Point, occupies the southeast corner of Martha's Vineyard. The beach area is separated from more wooded scrub terrain by a small brackish pond. The currents at Wasque Point make swimming hazardous, but result in one of the best fishing areas on the island. Surf fishing anglers commonly catch bluefish, striped bass, spanish mackerel, false albacore and bonito. Access to the beach is by ORV and by foot using a boardwalk that extends a few hundred meters from the parking lot to the beach. Currently, however, erosion has prevented ORV access around Wasque Point to Leland Beach.

Northward from Wasque Point is Leland Beach. It extends about two miles to Dike Bridge and comprises 108 acres. Leland Beach is a barrier beach, which is bounded by the Atlantic (Muskeget Channel) on the east and by Pocha Pond on the west. The western shore along Pocha Pond comprises an extensive salt marsh, which provides nesting and feeding habitat for a wide variety of waterfowl. Leland Beach is normally accessible by both ORVs and pedestrians northward from Wasque Point or southward from Dike Bridge, although currently erosion at Wasque precludes access from the south. Alternatively, there is boat access at Pocha Pond, and TTOR rents canoes at Dike Bridge. The entire beach is considered potential plover nesting habitat.

Cape Poge Wildlife Refuge is a long narrow barrier beach that begins north of Dike Bridge at East Beach and extends northward to the Cape Poge Lighthouse and then westward and southward around Cape Poge Elbow to Cape Poge Gut. The beach extends a distance of about six miles. Eastward and northward is the ocean: the Atlantic's Muskeget Channel and Nantucket Sound. Cape Poge Bay bounds the beach on the inside; the bay opens to Edgartown Harbor through a narrow channel, Cape Poge Gut, which is another popular fishing area. Plovers nest throughout the Refuge, but most plover-related closures have occurred north of the Jetties, especially on the narrow stretch of beach beyond the lighthouse called the Elbow.

## **MANAGEMENT OBJECTIVES**

Both the County of Dukes County and The Trustees of Reservations are currently managing their beaches in compliance with federal piping plover management guidelines. The Trustees accepted these guidelines early on in 1992. The County complied starting in 1993, but closure of the beach to ORVs resulted in considerable protests from beach users. The County then proposed an alternative management plan that would have allowed ORV access under strictly supervised conditions. The County spent about \$85,000 pursuing this management alternative in hearings with state regulators. An administrative law judge denied their appeal in 1995.

### **Dukes County**

The County of Dukes County operates and manages Norton Point Beach along with State Beach and Eastville Beach. Historically, the County has managed Norton Point Beach to provide a wide range of recreational opportunities for residents and non-residents. Norton Point Beach provides island residents and visitors with fishing, swimming and other beach recreation. It is the only publicly-managed beach open to off-road vehicles (ORVs), and ORV access allows users to travel to remote sections of the beach for various recreational pursuits. ORV access also allows residents and visitors to use Norton Point Beach as an alternative vehicle access way into Chappaquidick Island, avoiding the ferry which is often heavily congested on summer days.

To access Norton Point Beach there is no fee for pedestrians, and parking is free at the lot at the end of Katama Road or along Atlantic Drive; but ORV access requires a permit. The sale of seasonal ORV permits provides the only revenues to operate the beach. For the 1997 season ORV permits cost \$50 per vehicle for residents and \$75 per vehicle for non-residents. Expenditures for beach management include a part-time beach manager to regulate the beach in accordance with an approved management plan to protect threatened piping plovers. This includes identifying and monitoring nesting sites, building exclosures to protect chicks from natural predators, and routing ORVs to minimize contact with nesting plovers. The Management Plan requires minimum distances from plover chicks to the ORV trail, which generally results in closing the beach to ORVs when chicks are present.

In FY 1992 the County of Dukes County hired a part-time beach manager and in 1993 began managing Norton Point Beach in accordance with the guidelines established by the U.S. Fish and Wildlife Service. This has included monitoring plovers, stringing symbolic fencing around nests, erecting exclosures, rerouting ORVs to maintain a minimum distance from plovers and closing the beach to ORVs from the time when chicks hatch until they fledge (fly). Reduced sales of ORV permits have resulted in budget shortfalls and limited the resources available to fully comply with the guidelines.

### **The Trustees of Reservations**

The Trustees is a conservation organization whose mission is to "preserve property of scenic, historic, and ecological significance for the benefit of the public." This means that The Trustees attempt to balance preservation of wildlife and ecosystem diversity against public benefit. In 1992 TTOR initiated a plover management plan in strict compliance with federal plover management guidelines; the specifics are set forth in the Leland Beach Management Proposal (TTOR, 1992).

TTOR does encourage active human recreational use of its property. Wherever possible, TTOR maintains access to their beaches for pedestrians and ORVs. ORV access requires a seasonal permit, which is currently available for \$70 per vehicle for residents and \$110 for non-residents and allows unlimited entry at no additional charge. For pedestrian access to the beach at Wasque Point or Dike's Bridge, TTOR currently charges three dollars per adult (15 and over) per day plus there is a three dollar fee for parking at Wasque Point Reservation.

### **PLOVER MANAGEMENT RESTRICTIONS**

State and Federal guidelines for barrier beaches with nesting plovers require a number of actions to protect nesting sites and enhance chick survival. The key management actions include:

- regular nest and brood monitoring, and
- closing the beach to vehicular traffic within 300 feet of a brood.

Where beaches are narrow, or where broods forage on both the ocean and bay sides, it may not be possible to reroute ORVs so as to eliminate conflict with plover nests or broods. As a result it has been necessary to close some portions of beaches on Martha's Vineyard. Most of these closures have occurred in late May when eggs begin hatching, continuing through June as chicks hatch and begin foraging, and extending into July and sometimes into August until chicks are able to fly.

## Norton Point Beach

Norton Point Beach has been closed to ORV through traffic for a significant number of days in late spring/early summer in every year since 1993. The narrowness of the beach at the western end generally precludes siting a vehicle trail when plover chicks are present. As a result, compliance with the regulations has forced the beach manager to close the western section of the beach in every year since 1993. These closures normally begin in late May and last through the end of July. Closure of any part of Norton Point Beach to ORVs eliminates its use as an access road into Chappaquiddick Island, and beach closures have curtailed this access route from about 40 to 127 days each spring and summer since 1993. Exhibit 5-2 summarizes these closures:

Exhibit 5-2		
Beach Closures at Norton Point Beach, 1993-1997		
Dates:	Area of Closure	Number of Days
late 5/93-early 7/93	Western portion of beach	~40
5/28/94-8/12/94	Western portion of beach	76
5/30/95-8/7/95	Western portion of beach	69
6/5/96-7/26/96	Western portion of beach	51
4/23/97-8/28/97	Western portion of beach	127
4/23/97-7/19/97	Entire beach	87

Notes: Except for 1997, when erosion forced a lengthy closure of the entire beach, the easternmost portion of the beach has remained accessible to ORVs from Wasque Point.  
Source: Robert Culbert, Beach Manager, County of Dukes County, memo dated 9/15/97.

## Leland Beach

Compliance with plover management requirements has resulted in closure of portions of Leland Beach in four of the last six years. The beach has been closed from Wasque Point to Dike Bridge for 14 days in 1997 and 38 days in 1993. In 1996 The Trustees closed the inside trail for 34 days and the outside beach access trail for 15 days; the closures overlapped for eight days which precluded access to Wasque Point from the north. In 1994 TTOR closed about 200 meters of the outer beach south from Dike Bridge for 36 days, but most of the beach remained open and accessible from Wasque Point. In 1992 access at night was closed for 25 days. In 1995 Leland Beach was open the entire season. Exhibit 5-3 summarizes these closures.

Exhibit 5-3		
Beach Closures at Leland Beach, 1992-1997		
Dates	Area of Closure	Number of Days
6/20/92-7/15/92	South of Dike Bridge (night)	25 nights only
6/12/93-7/20/93	Wasque Pt to Dike Bridge	38
6/19/94-7/25/94	Outside Beach (200 m) S of Dike Bridge	36
6/2/96-6/29/96, 7/7/96-7/14/96	Inside Trail	34
6/22/96-7/7/96	Outside Beach	15
6/6/97-6/20/97	Wasque Pt to Dike Bridge	14
Source: The Trustees of Reservations.		

### Cape Poge Wildlife Refuge

In most years The Trustees of Reservations has been able to maintain ORV access to their barrier beaches in Cape Poge Wildlife Refuge as far north as the Jetties. This is a distance of several miles from Dike Bridge. For example, in 1997 the beach beyond Cape Poge Elbow was closed for 26 days and the area north of Arruda's Point was closed for 24 days. In only two years, 1996 and 1993, did plover protection require closing all daytime access north of Dike Bridge; the 1996 closure lasted 15 days while the 1993 closure lasted 42 days. Exhibit 5-4 summarizes these closures.

Exhibit 5-4		
Beach Closures at Cape Poge Beaches, 1992-1997		
Dates	Area of Closure	Number of Days
6/20/92 - 7/15/92	North of Dike Bridge (night)	25
6/12/93-7/24/93	North of Dike Bridge	42
6/21/94-7/25/94	Cape Poge Elbow	34
6/18/94-6/19/94, 7/14/94-7/21/94	Arruda's Pt. North	8
6/13/94-6/16/94	North of Dike Bridge (night)	3
6/19/94-7/25/94	S. of Dike Bridge (200 m)	36
6/13/95-7/18/95	Cape Poge Elbow	35
6/24/95-7/18/95	Arruda's Pt. North	24
6/23/95-7/18/95	Jetties North	23
5/18/96-7/21/96	Cape Poge Elbow	63
6/8/96-7/28/96	Arruda's Pt. North	40
6/22/96-7/7/96	North of Dike Bridge	15
6/19/97-7/15/97	Cape Poge Elbow	26
6/21/97-7/15/97	Arruda's Pt. North	24
Source: The Trustees of Reservations, Cape Poge Wildlife Refuge.		

## **ANALYSIS OF RECREATIONAL VISITS**

Martha's Vineyard attracts a large number of summer residents and visitors, who swell its population to nearly 100,000 on peak weekends. Its beaches are a major attraction to both residents and visitors, and beach activities include swimming, surfing, sunbathing, picnicking walking, fishing and birdwatching. This section examines visitor trends and beach usage.

### **Economic Trends**

Martha's Vineyard has rebounded strongly from the decline in property values that occurred in 1989 and the subsequent recession in 1990/91. From 1990 to 1996 the permanent population has increased 16.5 percent, from 11,541 in 1990 to 13,450 in 1996 (Martha's Vineyard Commission, 1996). In the same period annual employment has increased from 7,177 to 8,360, also an increase of 16.5 percent (*Ibid.*). Unemployment on the island has declined from over eight percent in 1991 and 1992 to about five percent in 1996 in response to greater tourism (*Ibid.*). And recently, visits by the President and his family have made the Vineyard an even more popular vacation destination.

### **Tourism Trends**

Most visitors to Martha's Vineyard arrive via the ferry. The Steamship Authority carried a record number of nearly 1.1 million passengers to the island in 1995. In the period from 1987 to 1996 passenger traffic increased from 771,410 to 1,048,041. This is an overall increase of about 36 percent, or about 3.5 percent per year. However, the decline in property values in 1989 followed by the recession years of 1990 and 1991 interrupted this growth. In 1988 visitation amounted to over 883,000, but it was not until 1992 that the number of passengers to the island exceeded this total.

Data on enplanements show that that the recession had an even larger impact on visitors arriving by air. Visitors by air peaked at over 56,000 in 1988 and had still not returned to that level in 1996.

Overall, total visitors by both ferry and air amounted to about 1.1 million in 1996, which represents an increase of about 34 percent since 1987, or about 3.3 percent per year. Since 1992, however, passenger growth has amounted to about 4.5 percent per year.

Martha's Vineyard has also seen even greater increase in the number of automobiles transported to the island. The Steamship Authority reports that autos have increased from 134,026 in 1987 to 188,908 in 1996, an overall increase of about 41 percent. As with passengers, the rate of growth slowed from 1989 to 1992 before resuming again in 1993. Exhibit 5-5 summarizes the number of ferry and airplane passengers and the number of autos ferried to the island.

<b>Exhibit 5-5</b>			
<b>Martha's Vineyard Ferry Passengers and Autos and Airplane Enplanements, 1987-1996</b>			
<b>Year</b>	<b>Ferry Passengers to Island</b>	<b>Enplanements</b>	<b>Autos Ferried to Island</b>
1987	771,410	48,302	134,026
1988	883,223	56,484	150,633
1989	847,140	47,571	157,209
1990	858,964	41,203	159,868
1991	856,587	34,339	162,347
1992	889,097	31,734	162,269
1993	946,960	43,993	168,401
1994	1,012,406	50,386	178,632
1995	1,071,984	54,418	185,583
1996	1,048,041	52,536	188,908

Note: Enplanements is number of passengers leaving island by air. Assumption is that number of passengers leaving equals number of passengers arriving by air.

Source: Martha's Vineyard & Nantucket Steamship Authority, Annual Reports, 1987-1996. The Martha's Vineyard Commission, Data Report 1996, Table 5.3.

### **Beach Visits**

Martha's Vineyard has many beaches, but relatively few are open to the public. The County of Dukes County maintains Norton Point Beach, State Beach, and Eastville Beach as free, public beaches. In addition, each of the towns has its own beach, but only Edgartown allows free, public access to its Katama (South) Beach. The Trustees of Reservations (TTOR) maintains Leland and East Beaches as public beaches, charging a daily fee for access and parking.

### **Norton Point Beach**

Norton Point Beach's three miles of barrier beach on the southeast corner of the island are open to the public. Parking and access are free to pedestrians, but there is a seasonal fee for off-road vehicle (ORV) access. Seasonal ORV permits have increased in price from \$15 in FY 1988 to \$50 for residents and \$75 for non-residents in FY 1997. The County does not own any parking areas, but beachgoers may park at no charge at the Edgartown lot at the end Katama Road or on Atlantic Avenue.

The County has no data on actual pedestrian or ORV use of the Norton Point beach. However, it does have data on the sale of ORV permits. Sale of ORV permits peaked in fiscal 1990 at 2,576, which at a price of \$25 raised \$64,400 in revenue. The recession resulted in a

decline in permit sales to 2,183 in fiscal 1991 and to 1,949 in fiscal 1992, and the County raised permit prices from \$25 to \$30 to recoup revenues. A further increase in prices from \$30 to \$50 contributed to a further decline in permit sales to 1,368 in fiscal 1993. Beach closures first affected ORV permit sales at the end of fiscal 1993, and sales in fiscal 1994 fell to 486 permits, which accounted for only \$24,300 in revenue. ORV permit sales recovered to over 600 in each of the next three years with revenues exceeding \$30,000. At this level of sales ORV permits provide about half the amount of revenue raised in the peak year, FY 1990. Exhibit 5-6 summarizes these data:

<b>Exhibit 5-6</b>			
<b>Sales of Off Road Vehicle Permits to Access Norton Pt. Beach, FY 1988-1997</b>			
<b>Fiscal Year</b>	<b>Price of Permit (\$)</b>	<b>Permits Sold (#)</b>	<b>Revenues (\$)</b>
FY 1988	15	2,336	35,040
FY 1989	15	1601	47,040
	25	921	
FY 1990	25	2,576	64,400
FY 1991	25	2,183	54,575
FY 1992	25	1257	52,185
	30	692	
FY 1993	30	1191	44,580
	50	177	
FY 1994	50	486	24,300
FY 1995	50	714	35,700
FY 1996	50	616	30,800
FY 1997	50	673	33,900
	50/75	4	
FY 1997 (through 10/5)	50	NA	14,125
	75	NA	

Note: In FY 1997 the County initiated a price structure of \$50 for residents and \$75 for non- residents.  
Source: Noreen Flanders, Treasurer, County of Dukes County, 1997.

### **Katama (South) Beach**

South Beach, owned and managed by the Town of Edgartown, comprises about one mile of ocean beach on the south coast of the island adjacent on the west to Norton Point beach. The beach includes changing facilities and a boardwalk. Unlike beaches managed by other towns on the island, South Beach is open to the public for swimming and other recreation, although no ORV access is permitted. Parking is free at lots at the east and west end of the beach and along Atlantic Drive. The left fork (east) lot at the end of Katama Road has a capacity of 300-400 cars, and the right fork (west) lot at the end of Herring Creek Road has a capacity of 100-150 cars;

Atlantic Drive can accommodate 500-700 cars. There is also a provision for overflow parking at nearby Katama Farm.

The Town was not able to provide data on numbers of visitors using the beach. However, overall parking capacity is over 1,000 cars, and thousands of beachgoers come to South Beach on peak days during the summer. Newspaper reports suggest as many as 15,000 people used the beach over Fourth of July, 1997 (Julia Wells, Vineyard Gazette, personal communication).

### **Wasque Point/Cape Poge**

The Trustees of Reservations collects data on pedestrian and ORV use of its beaches. Vehicle access fees and counts at parking lots at Wasque Point and Dike Bridge provide data on pedestrian use. TTOR estimates ORV usage based on vehicle counters on the beaches. Readers should note that Dike Bridge was in disrepair and closed to ORV access to Cape Poge from 1981 to 1994; it was also closed to pedestrian access from 1989 to 1994.

Pedestrian visits to Wasque Point and Cape Poge have increased significantly in the last ten years, as shown in Exhibit 5-7. Since 1991 admission prices have remained at three dollars per adult (15 and over); prior to that admission prices were two dollars per adult. Parking at Wasque Reservation has remained at three dollars per vehicle since the mid-1980s. Consequently, any negative effects on pedestrian visits are limited to beach access and weather. In 1987 TTOR recorded 8,438 pedestrian visits to Wasque Point and 8,732 visits to Cape Poge, a total of 17,170 visits. Closure of Dike Bridge in 1989 eliminated pedestrian access to Cape Poge and resulted in a decline in total visits to 9,306. Pedestrian visits to Wasque continued to increase during the 1989-94 period when Dike Bridge was closed. Moreover, visits and resulting revenues increased by over 30 percent from 1993 to 1994 when ORV access restrictions were first implemented. Dike Bridge reopened late in 1994, and in 1995 total visits increased significantly to 26,444, including 14,896 visits to Wasque Point and 11,548 visits to Cape Poge. Total visits dropped considerably in 1996 to 19,652 due to poor weather throughout much of the summer, but have rebounded to record levels in 1997 -- 25,819 visits (as of 9/1/97). During the period, 1989 to 1997, pedestrian revenues have grown steadily from about \$21,000 to over \$60,000 and helped compensate for declines in ORV permit revenues from 1993 to 1995..

<b>Exhibit 5-7</b>			
<b>Pedestrian Visits to Wasque Reservation and Cape Poge, 1987-1997</b>			
<b>Year</b>	<b>Visits to Wasque</b>	<b>Visits to Cape Poge</b>	<b>Total Visits</b>
1987	8,438	8,732	17,170
1988	6,374	7,374	13,748
1989	9,306	0	9,306
1990	9,511	0	9,511
1991	13,940	0	13,940
1992	13,557	0	13,557
1993	17,716	0	17,716
1994	17,516	0	17,516
1995	14,896	11,548	26,444
1996	9,692	9,960	19,652
1997 (as of 9/1/97)	13,964	11,855	25,819
Notes: 1) Dike Bridge pedestrian access was closed from 1989 to 1994. 2) Data for 1997 is through 9/1/97.			
Source: The Trustees of Reservations, September 1997.			

ORV permit sales and usage of beaches at Wasque Point and Cape Poge declined in 1993 when TTOR began closing beaches and restricting access to protect plovers. Exhibit 5-8 shows that total permits sold fell from 1,694 in 1992 to 1,060 in 1993, a decline of about 37 percent. Likewise, ORV visits declined from 18,380 to 14,659 at Wasque Point, about 20 percent, and from 6,087 to 2,882 at Cape Poge, about 53 percent. However, in the last two years the number of ORV permits sold has rebounded to over 1,600, which is near pre-1993 closure levels, and in 1996 annual ORV visits totaled about 22,700, which is only seven percent less than in 1992. In fact, ORV permit revenues in 1996 amounted to about \$145,000 compared to only about \$114,000 in 1992.

<b>Exhibit 5-8</b>				
<b>Sales of Off Road Vehicle Permits and ORV Visits to Wasque Reservation and Cape Poge, 1987-1997</b>				
<b>Year</b>	<b>Permits Sold</b>	<b>Price (\$) (res/non-res)</b>	<b>Visits to Wasque</b>	<b>Visits to Cape Poge</b>
1987	1,992	\$45	NA	NA
1988	2,061	\$45	NA	NA
1989	1,904	\$50	NA	NA
1990	1,737	\$50	17,668	NA
1991	1,791	\$50	16,510	NA
1992	1,694	\$50/\$75	18,380	6,087
1993	1,060	\$60/\$100	14,659	2,882
1994	1,440	\$70/\$110	17,371	4,714
1995	1,513	\$70/\$110	13,329	5,909
1996	1,607	\$70/\$110	12,727	9,952
1997 (as of 9/1/97)	1,595	\$70/\$110	NA	NA
Note: 1) NA is not available. 2) Dike Bridge ORV access was closed from 1981 to 1994. 3) In 1992 TTOR initiated separate ORV permit prices for residents and non residents. Source: The Trustees of Reservations, September 1997.				

### **Recreational Fishing Trips**

The Marine Recreational Fishing Statistics Survey (MRFSS) telephone survey interviews generates data on recreational trips by residents of coastal counties, including Dukes County, which comprises the islands of Martha's Vineyard and Cuttyhunk. Data on shore trips in Dukes County by Massachusetts anglers residing in coastal counties show wide year by year variability over the period 1981-1997 (through wave 4). Exhibit 5-9 shows that annual 'In County' trips (by Dukes County residents) vary from under 10,000 in 1988 and 1993 to over 50,000 in 1983. Likewise, annual trips to Dukes County by 'Out of County' residents vary from 0 in some years to over 60,000 in 1992.

The variability in the participation estimates shown in Exhibit 5-9 results from small sample sizes. Sample sizes range from under 10 in some waves to a maximum of 79. And given that a substantial proportion of the households contacted are non-fishing households, a few outliers may cause extremely high estimates. At the state level NMFS adjusts outliers to the 95<sup>th</sup> percentile by pooling data over four previous years, but such adjustments rely on larger amounts of data than are available for Dukes County.

Exhibit 5-9				
Estimated Recreational Saltwater Fishing Trips in Dukes County; Shore Trips by Coastal Residents Only (mode_fx=3)				
Survey Year	Total Annual Trips			
	Residence			Total
	In County	Out of County	Out of State	
1981	12,938	0	-	12,938
1982	43,870	3,767	-	47,637
1983	56,789	37,193	-	93,982
1984	36,015	6,762	-	42,777
1985	29,630	0	-	29,630
1986	34,273	5,279	-	39,552
1987	47,354	28,304	-	75,658
1988	8,815	1,358	-	10,173
1989	22,571	4,179	-	26,750
1990	34,333	3,785	-	38,118
1991	21,906	1,267	-	23,173
1992	27,649	63,402	-	91,051
1993	9,420	7,380	-	16,800
1994	19,907	11,827	-	31,734
1995	11,177	1,806	-	12,983
1996	43,204	15,986	11,593	70,783
1997	11,896	1,362	26,206	39,464

Note: 1997 data are through wave 4 (through August).  
Source: IEC, estimated from MRFSS telephone survey data

### **Trips by Dukes County Residents**

Given the high degree uncertainty in the year to year estimates of recreational shore fishing trips, it is difficult to discern trends. The data do, however, hint that beach closures may have affected the number of trips by Dukes County residents. From 1989 to 1992 annual trips by residents ranged from about 22,000 to 34,000. In 1993 Norton Point Beach closed for several months, and trips by Dukes County residents appear to have declined to under 10,000. Closures have continued in every year since, and trips remained under 20,000 in 1994 and 1995 and appear likely to be under 20,000 in 1997. In 1996, however, the data show trips increasing to over 40,000 despite Norton Point Beach being closed for several months.

### **Trips by non-Dukes County Residents**

The variability of the shore fishing trips by non-Dukes County residents is even greater than that for Dukes County residents, which suggests casts doubt on the reliability of the data. From 1988 to 1991 annual trips ranged from about 1,300 to 4,200. Then in 1992, the year before the County implemented beach closures, trips by non-Dukes County residents spiked to over

63,000. Trips in years 1993, 1994 and 1996 range from about 7,400 to 16,000 trips while 1995 and 1997 (extrapolated) appear to be under 2,000.

### **Recreational Shellfishing**

Martha's Vineyard has a number of bays and coves that provide excellent shellfish habitat. Katama Bay dividing Edgartown from Chappaquiddick Island and Cape Poge Bay on Chappaquiddick are two prime shellfishing areas. The Town of Edgartown issues permits for both commercial and non-commercial shellfishing in these and other nearby waters. Commercial shellfishers mostly use boats and so are little affected by beach closures, but non-commercial shellfishers generally rely on vehicles to access favorite areas.

Data from Town Reports summarized in Exhibit 5-10 indicate that sales of non-commercial shellfish permits declined significantly in 1993 and have remained at depressed levels. Non-commercial permit sales include seasonal permits for residents (\$25), resident seniors (free), and non-residents (\$125), and one-week (\$20) and two-week (\$40) permits for non-residents. Non-commercial permit sales peaked in 1992 at \$21,085, which included 505 resident (\$25) and 48 non-resident (\$125) seasonal permits. In 1993 total non-commercial revenues fell to \$16,808, a decline of about 20 percent. This decline in permit sales was spread over all categories, resident and non-resident. Even free permits available to senior citizens declined from 258 to 195. Permit sales increased slightly in 1994 to \$17,040 before falling to \$13,194 in 1995. In 1996, overall sales rebounded slightly to \$18,324, which is still about 13 percent below 1992 levels.

<b>Exhibit 5-10</b>					
<b>Town of Edgartown Sales of Non-Commercial Shellfishing Permits, 1987-1996</b>					
<b>Year</b>	<b>Seasonal Resident (\$25)</b>	<b>Seasonal Non-Resident (\$125)</b>	<b>One-week (\$20)</b>	<b>Two-week (\$40)</b>	<b>Total Revenues (\$)</b>
1987	525	25	104	5	18,554
1988	533	40	95	0	20,243
1989	508	35	96	0	19,007
1990	496	39	88	3	19,175
1991	498	50	103	0	20,722
1992	505	48	123	0	21,085
1993	442	24	137	0	16,808
1994	468	20	142	0	17,040
1995	298	22	148	0	13,194
1996	455	29	165	0	18,324

Note: 1) Fees for licenses have remained unchanged since 1987.  
 2) Total Revenues include collections for replacement licenses not reported in this table.

Source: Town of Edgartown, Annual Reports, 1987-96.

Sales of commercial shellfish permits have fallen even further due primarily to the decline in abundance of scallops. The scallop harvest has fallen from about 20,000 bushels in the late 1980s to only about 2,000 bushels today. By 1992 commercial permit sales had reached \$47,100. In 1993 this total declined to \$26,000, a reduction of 45 percent. This decline has continued through 1996, and in that year total sales amounted to only \$10,900. This represents a decline of 77 percent.

The fall in recreational shellfish permits might also be affected by declines in abundance. However, data on shellfish permits sold in Tisbury show no such decline. In fact, numbers of total permits sold have increased from 250 in 1990 to 478 in 1997, and revenues have increased from about \$5,700 to nearly \$13,300 in the same period.

## **ECONOMIC IMPACTS OF BEACH CLOSURES**

Closure of Norton Point, Leland and Cape Poge beaches in spring and early summer directly affects anglers, swimmers, sunbathers and other beach users; and the choices made by these recreational users affect revenues of owners and managers of the beaches and businesses which serve these recreational users. Dukes County, the Town of Edgartown, and The Trustees of Reservations have all incurred extra costs to manage the beaches and suffered reductions in permit sales and visitor fees. Likewise, businesses dependent on beach users, especially bait and tackle shops, may have experienced some losses in revenues. In some cases these impacts have persisted and revenues remain below pre-closure levels despite robust growth in tourist visitation since the recession years of the early 1990s. In other cases beach managers and businesses have made economic decisions that have allowed them to generate revenues and profits at or above pre-closure levels.

### **Impacts on Dukes County**

As manager of Norton Point beach, Dukes County has incurred extra costs to manage the beach while at the same time suffering a loss in revenues from the sale of ORV permits. Since the County owns no land for parking and parking is free at adjacent South Beach lots (owned by the Town of Edgartown), the County's ability to collect revenues for non-ORV beach use is limited. At the present time the only source of beach revenues is from sale of ORV permits.

As noted above in Exhibit 5-6, ORV permit sales peaked in FY 1990 and declined as the recession reduced the number of visitors in 1991 and 1992. Even at recession levels sales of ORV permits accounted for over \$52,000 in revenues in FY 1991 and FY 1992. However, beach closures starting in 1993 appear to have caused a significant decline in purchases of ORV permits, and even after substantial price increases annual revenues remain below pre-closure levels, ranging from \$24,300 to \$35,700 in the last four fiscal years.

Costs of beach management, however, have exceeded revenues since FY 1994. These costs include materials and wages for managing all three county-owned beaches. However, almost all of the increases have been attributable to piping plover management at Norton Point Beach (Robert Culbert, Beach Manager, personal communication). In 1992 the County hired a part-time beach manager to insure compliance with the plover management requirements. As a result, costs increased from under \$20,000 in FY 1991 and FY 1992 to over \$30,000 in FY 1993 and expanded considerably to nearly \$52,000 in FY 1994. Purchase of a vehicle resulted in expenditures of over \$73,000 in FY 1995, but expenditures declined to about \$56,000 in FY 1996. After the County lost its appeal to modify the beach restrictions, it cut back on beach expenses in an attempt to balance the budget in FY 1997. Eliminated were \$19,000 for sheriff's deputies and about \$4,000 for two part-time shorebird monitors. These budget cutbacks may have reduced the efficiency of beach management and contributed to the state's decision to close the beach from April to August in 1997. The budget for FY 1998 amounts to over \$74,000 in FY, but only about \$49,000 is for beach management; the remaining \$25,000 is for an erosion project on State Beach.

Exhibit 5-11 shows that the net revenues declined from a surplus of about \$32,000 to \$40,000 in the early 1990s to deficits ranging from about \$25,000 to \$38,000 in four of the last five fiscal years. Since the advent of plover management restrictions in FY 1994, Dukes County has accrued the equivalent of a loss of about \$60,000 in current dollar revenues in each year.

**Exhibit 5-11**

**Revenues and Expenses of Managing Norton Point Beach, FY  
1988-1997**

<b>Year</b>	<b>Revenues (\$)</b>	<b>Expenses (\$)</b>	<b>Net Revenues (\$)</b>
FY 1988	35,040	30,982	4,058
FY 1989	47,040	23,131	23,909
FY 1990	64,400	24,269	40,131
FY 1991	54,575	18,722	35,853
FY 1992	52,186	19,857	32,329
FY 1993	44,580	30,219	14,361
FY 1994	24,300	51,849	-27,549
FY 1995	35,700	73,447	-37,747
FY 1996	30,800	56,130	-25,330
FY 1997	33,900	32,232	1,668
FY 1998 (estimate)	15,000	49,000	-34,000

Note: 1) Revenue estimates are in current dollars. Net revenues are revenues minus expenses.  
2) In FY 1997 the county eliminated expenditures for sheriff's deputies, which were picked up by the Sheriff's Department, and two of four shorebird monitors in order to balance the budget.  
3) Revenue and expenditure figures for FY 1998 are estimates; expenditures exclude \$25,000 budgeted for an erosion project on State Beach.  
Source: Noreen Flanders, Treasurer, County of Dukes County, 1997.

The County also sustained a cost of about \$85,000 over several fiscal years trying to convince the Massachusetts Department of Environmental Protection that an alternative management plan that would have allowed for some tightly controlled ORV access would be equally protective of piping plovers (Len Jason, Dukes County Commissioner, personal communication). This expenditure, though triggered by the initiation of plover management restrictions, is not an impact resulting from compliance but a political cost resulting from an attempt to avoid or modify compliance requirements.

**Impacts on the Town of Edgartown**

Plover management restrictions have resulted in the closure of ORV access into Chappaquiddick Island via Norton Point beach. Since the closures began in 1993, the Town of Edgartown has suffered a loss in revenues from the sale of shellfish permits. In addition, elimination of access into Chappaquiddick via the beach has resulted in congestion delays at the ferry, and this has required the Town to assign police officers to direct traffic so as to lessen

congestion. In addition, closure of Norton Point beach and access to other Chappaquiddick beaches has resulted in some congestion on Edgartown's South Beach.

### Shellfish Permit Revenues

Some of the best shellfish beds are accessible only from the Norton Point beach, and closure of Norton Point beach has resulted in a loss of shellfish permit revenues to the Town of Edgartown. From 1990 to 1992 the Town realized \$19,175 to \$21,085 in revenues from sales of non-commercial shellfish permits, as shown in Exhibit 5-12. However, sales of shellfish permits declined to \$16,808 in 1993 and have increased to only \$18,324 in 1996 despite significant growth in tourist visits since the early 1990s. Assuming growth in non-resident shellfish permits at the same rate as tourism, the shortfall in revenues in three of the four years approximates \$5,000. In 1995 revenues declined to about \$13,200, which resulted in a shortfall of about \$9,000, but reasons for this decline are unclear.

Exhibit 5-12			
Estimate of Revenue Shortfall from the Sale of Shellfish Permits			
Year	Forecast Revenues (\$)	Actual Revenues (\$)	Revenue Shortfall (\$)
1990	\$19,175	\$19,175	\$0
1991	\$20,722	\$20,722	\$0
1992	\$21,085	\$21,085	\$0
1993	\$21,673	\$16,808	\$4,865
1994	\$22,005	\$17,040	\$4,965
1995	\$22,409	\$13,194	\$9,215
1996	\$22,989	\$18,324	\$4,665

Note: 1) All revenue estimates are in current dollars.  
 2) Forecast of revenues is based on the assumption that permit sales grow at the same rate as tourist visits.  
 Source: IEC, based on forecasts of revenues as explained in the text.

### Ferry Congestion

The Chappaquiddick ferry connects Edgartown with Chappaquiddick Island. During peak times two ferries run continuously, each with a capacity of three cars. The crossing requires about five minutes. On peak summer days in July and August about 750 cars use the ferry in each direction, and waiting time can occasionally exceed an hour.

In 1996 the Martha's Vineyard Commission surveyed over 1,400 ferry users for the Chappaquiddick Island Association (Rand and Jones, 1996). This survey revealed that 45

percent of the respondents waited less than five minutes, 22 percent waited 5-10 minutes, 21 percent waited 10-20 minutes, 11 percent waited 20-30 minutes, and less than four percent waited longer than 30 minutes. Of those surveyed during the period when Norton Point access was closed, 19 percent indicated they would have used the beach road if it had been open; this corresponds roughly with a waiting time of 20 minutes or more. If 19 percent of the users actually were to use the beach road instead of the ferry, this would amount to nearly 150 round trips per day. No data exist on the actual number of ORVs that use the beach road. However, telephone conversations with various people generated estimates that range from about 75 round trips per day (Hayes, Chappaquiddick Ferry, personal communication; Wells, Vineyard Gazette, personal communication) to more than 150 round trips per day (Larry Mercier, Highway Department, personal communication). Elimination of 75 to 150 round trips per day, or about 10 to 20 percent of the traffic on the ferry, would reduce congestion somewhat, but would still result in some people waiting up to 20 to 30 minutes. The conclusion is that the closure of Norton Point Beach may have resulted in some additional congestion at the Chappaquiddick ferry, but most of the congestion and waiting time is due to increased numbers of visitors trying to access Chappaquiddick.

A derivative impact of the ferry congestion is that the Edgartown police in 1996 began reassigning an officer from parking violations to help patrol the line of cars waiting for the ferry. In 1996 parking revenues in Edgartown dropped 40 percent from previous years. However, the Edgartown police chief indicated that there was a political decision prior to the tourist season to focus less on parking tickets, and this facilitated reassignment of the officer (Chief Condlin, Edgartown Police Department, personal communication). Thus, the loss in parking revenues is not attributable to ferry congestion and beach closures.

### **Congestion at South Beach**

Anecdotal evidence indicates that usage at South Beach has increased, and some attribute the resulting congestion to the closure of Norton Point beach and the long waits at the Chappaquiddick ferry to access other Chappaquiddick beaches. However, some of the increase is attributable to the increases in tourism on the Island since the end of the recession in the early 1990s. Readers should remember that Norton Point allows ORV access while South Beach does not. Consequently, South Beach is not a substitute for ORV-based beach recreation. Moreover, Norton Point has always been open to pedestrian beach users and is equally accessible from the parking lot at the end of Katama Road.

It is possible that some congestion effects at South Beach may be attributable to closures at Norton Point. However, they are not close substitutes and the amount of congestion attributable to plover management closures appears likely to be fairly small. In the absence of any data on actual usage at Norton Point or at South Beach it is not possible to assess the true magnitude of any potential congestion impacts of the Norton Point beach closure.

### **Impacts on The Trustees of Reservations**

The primary impact on The Trustees of Reservations is the loss in revenues from sale of ORV permits and the extra expenses attributable to shorebird management. Exhibit 5-8 shows that in 1992 ORV permits sold amounted to 1,694 in 1992, but dropped to 1,060 in 1993 when TTOR closed the beach entirely for 42 days from 6/2/93-7/24/93. ORV revenues dropped from \$114,230 in 1992 to \$94,781 in 1993 despite an increase in permit prices for non-residents. Since 1993 TTOR have been able to keep the beach open from Dike Bridge to Arruda's Point, and permit sales have increased to about 1,600 per year. In comparison, sales of permits ranged from 1,737 to 1,904 over the three years, 1989-91, when prices were \$50, but dropped to 1,694 when prices for non-residents increased by 60 percent. Given the markedly higher prices now in effect, a 40 percent increase for residents and a 120 percent increase for non-residents, a total of about 1,600 permits sold in the last two years is probably comparable to the number of permits sold before the closures began in 1993. And at the significantly higher prices now in effect annual revenues from the sale of ORV permits are expected to exceed \$150,000 in 1997, which greatly exceeds the revenues collected in years prior to 1993.

Overall, it appears that TTOR suffered some ORV revenue shortfall from 1993 through 1995, but that shortfall disappeared beginning in 1996. Exhibit 5-13 below compares actual revenues with predicted revenues if TTOR permit sales had remained at pre-closure levels, about 1,600 per year. Estimates of the current dollar shortfall in ORV revenues amounted to about \$48,000 in 1993, about \$17,000 in 1994, and about \$8,000 in 1995. However, the net loss is less, since pedestrian visits and corresponding revenues increased throughout the period. To the extent that ORV users substituted pedestrian for ORV visits or that restrictions on ORVs caused pedestrian users to make more visits, the shortfall in ORV revenues is reduced. Compared to prior years, pedestrian revenues in 1993 increased by about \$10,000; in addition, the sale of Trustees memberships, which allow free parking and beach access to a vehicle and its occupants, also increased by about \$4,000 from 1992 to 1993. Despite a loss in revenues from ORV sales, total TTOR revenues from the property have increased every year since 1990, and from 1992 to 1993 the growth in total revenues amounted to about 7.1 percent.

**Exhibit 5-13**

**Revenue Shortfall from the Sale of ORV Permits to Access TTOR Beaches,  
1989-1997**

<b>Year</b>	<b>Permits (#)</b>	<b>Average Fee (\$)</b>	<b>Predicted Revenues (\$)</b>	<b>Actual Revenues (\$)</b>	<b>Revenue Shortfall (\$)</b>
1989	1,904	\$50	\$95,175	\$95,175	\$0
1990	1,737	\$50	\$86,850	\$86,850	\$0
1991	1,791	\$50	\$89,540	\$89,540	\$0
1992	1,694	\$67.43	\$114,230	\$114,230	\$0
1993	1,600	\$89.42	\$143,066	\$94,781	\$48,285
1994	1,600	\$85.87	\$137,389	\$120,215	\$17,174
1995	1,600	\$90.90	\$145,438	\$137,530	\$7,908
1996	1,607	\$90.37	\$145,231	\$145,231	\$0
1997	1,595	\$89.36	\$142,535	\$142,535	\$0

Note: 1) Permit sales for 1993, 1994, and 1995 are forecasts as explained in text above.

2) All revenue estimates are in current dollars.

3) 1997 permit sales are through 9/1/97.

Source: IEC, based on data provided by The Trustees of Reservations.

In addition, the annual incremental cost of shorebird management amounts to about \$13,300 plus about \$5,000 in annual vehicle depreciation (Chris Kennedy, TTOR, personal communication). Thus, the annual incremental costs of shorebird management currently amount to about \$18,300 per year with no loss in revenues.

### **Impacts on Beach Users**

Norton Point, Leland and Cape Poge beaches have all been closed or restricted to ORV access for some number of days in late spring and summer since 1993. This has affected a large number of beach users, including swimmers, surfers, sunbathers, picnickers and anglers, who rely on ORVs to access distant sections of the beach. Closures at Norton Point are particularly disruptive, since Norton Point serves both as an access road into Wasque and other Chappaquiddick beaches, avoiding sometimes lengthy waits at the ferry.

### **Pedestrian Users**

The only available data on pedestrian use of beaches applies to TTOR beaches at Wasque Point and Dike Bridge access to Cape Poge. Data summarized in Exhibit 5-7 show that visits by pedestrians to Wasque/Cape Poge continued to increase after the closures. Visits to Wasque jumped from 13,557 in 1992 to 17,716 in 1993 despite closures of access via Norton Point. Pedestrian visits have continued to grow at Wasque/Cape Poge and now total over 25,000 annual visits.

The conclusion is that plover restrictions on ORV access have not affected beach use by pedestrians. It is even plausible that elimination of ORVs from beaches has resulted in increased social welfare benefits to pedestrian beach users due to reduced noise, pollution and risk of accidents.

### ORV Users

The impact of beach closures on ORV users is reflected in the shortfall in sales of ORV permits to access Norton Point and TTOR beaches on Chappaquiddick. There are no data on ORV trips into Norton Point or Leland Beach, but TTOR has maintained vehicle counters at Wasque Point since 1990 and at Cape Poge since 1992.

### Beach Trips to Wasque Point and Cape Poge

Analysis of TTOR permit sales indicates that beach closures accounted for a shortfall in permit sales in 1993, 1994 and 1995, but that sales were back to historical levels by 1996. Exhibit 5-14 below forecasts ORV trips to Wasque Point and Cape Poge since 1992 based on typical annual trips in pre-closure years and compares them with actual trips. Compared to pre-closure levels ORV trips to Wasque Point were depressed from 1993 through 1996. However, by 1996 there was no shortfall at Cape Poge, although ORV users may have redirected their trips toward Cape Poge from Wasque Point due to access restrictions caused by erosion. Overall, the total shortfall in trips at Wasque and Cape Poge amounted to about 6,500 in 1993, about 1,900 in 1994, about 4,800 in 1995, and about 1,300 in 1996. However, the shortfall in total ORV trips in 1996 may be partly attributable to the poor weather through much of the summer.

Exhibit 5-14							
Shortfall in ORV Trips to Wasque Point and Cape Poge Beaches Due to Closures: 1990-1996							
Year	Wasque Point Trips			Cape Poge Trips			Total Shortfall
	Forecast	Actual	Shortfall	Forecast	Actual	Shortfall	
1990	17,668	17,668	0				
1991	16,510	16,510	0				
1992	18,380	18,380	0	6,087	6,087	0	0
1993	18,000	14,659	3,341	6,000	2,882	3,118	6,459
1994	18,000	17,371	629	6,000	4,714	1,286	1,915
1995	18,000	13,329	4,671	6,000	5,909	91	4,762
1996	18,000	12,727	5,273	6,000	9,952	-3,952	1,321

Note: Forecast is an approximate mean of actual trips in pre-closure years: 1990-1992.  
Source: IEc, based on data provided by The Trustees of Reservations.

Assessing the economic impact of these lost ORV trips is problematic. This is because there are insufficient data upon which to determine whether the closure of beaches to ORVs resulted in net loss of total beach trips or in substitution of pedestrian trips to Chappaquiddick or other beaches. Conversations with beach managers suggest that most residents and vacationers find other beaches to go to. To the extent that beach users substitute pedestrian trips for ORV trips expenditures are likely to be roughly the same, except for some small reduction in fuel. Consequently, such substitutions result in little economic impact. There are, however, likely to be social welfare (i.e., consumer surplus) losses in that the benefit of an ORV trip to a less congested portion of the beach is likely to be higher than a pedestrian trip to a more crowded beach.

### **Recreational Fishing Trips**

The Marine Recreational Fisheries Statistics Survey (MRFSS) telephone data for Dukes County, which includes Martha's Vineyard and Cuttyhunk Island, provides the only data on marine recreational fishing for the island. This dataset is unbiased but highly variable and uncertain due to small sample sizes, as noted above in Section 3.3.4 above. Despite these data limitation, regressing annual shore-based recreational trips against yearly closure dummies and other variables may provide some evidence of impacts associated with beach closures. Due to data variability the analysis estimates separate models for trips by county residents and out-of-county residents.

Both models use annual shore-based recreational trips as a dependent variable. The primary analysis variable is a dummy representing the years, 1993 to 1996, when Norton Point beach was closed for a portion of the summer. Norton Point beach is the primary access highway into Chappaquiddick for shore anglers as well as a primary fishing site, and its closure is most likely to generate an impact, if there is one. The analysis tests different specifications of the closure dummies. One uses the number of months closed in each year to capture the effects of different annual closure periods, and another employs individual dummies for each year of closure. Other independent variables used to try to explain recreational fishing trips include unemployment and annual estimates of striped bass population.

Regressing annual shore fishing trips by county residents as a linear function of unemployment and annual closure dummies over the period 1981 to 1996 demonstrates no reliable evidence that closures reduced recreational fishing trips. Model 1, which used one variable to capture months of closure in each year, generated a wrong (positive) sign on the closure variable, DNP, and none of the variables were significant at 95-percent confidence levels ( $p < .05$ ). Similarly, Model 2, which used individual yearly dummies to proxy closures, yielded negative coefficients on the closure dummies for 1993 and 1995 and positive coefficients for 1994 and 1996. Only the positive coefficient for 1996 is significant. Dropping insignificant variables resulted in great instability in these coefficients, which reflects the high variability in the MRFSS survey data. These two regression results provide no defensible evidence that beach closures have affected shore trips by Dukes County recreational anglers, and the conclusion is that the variability in the data is too great to generate estimates of any precision. Results of these two regressions are in Appendix 5-A.

The same regression specifications applied to trips by non-Dukes County residents yielded similarly inconclusive results. Both Model 1 and Model 2 obtained negative signs on closure dummies, but none of the coefficients were significant at the 95 percent confidence level. Moreover, these regressions were highly unstable with negative adjusted r-square estimates. The conclusion is that these data are too uncertain to generate meaningful estimates of changes in recreational shore fishing in Dukes County by in-state visitors. The regression specifications tested may be found in Appendix 5-A.

### **Impacts on Vineyard Businesses**

Data on tourism trends and conversations with realtors suggest that rentals and motels are fully occupied during peak summer months. However, anecdotal evidence suggests that beach closures have resulted in cancellations by anglers who would otherwise come in spring, outside the peak summer vacation season. Businesses potentially hurt by these cancellations are motels and bait and tackle shops. It is important to note that these businesses are doing quite well in the current economy, and thus it is difficult to assess whether they would be doing significantly better without the closure.

### **Accommodation**

Data on occupancy rates for motels and vacation rentals on Martha's Vineyard do not exist. Consequently, there are no data available to ascertain if beach closures have affected the vacation rental market. One bait and tackle shop owner asserted that anglers had canceled trips due to beach closures and that such cancellations would have affected rentals, especially during the shoulder season in May. However, interviews with realtors and rental agents failed to uncover any evidence of cancellations related to beach closures. In fact, all of the rental agents and motel managers interviewed agreed that the closures have had no impact on their business.

## **Bait and Tackle Shops**

The businesses most affected by beach closures appear to be bait and tackle shops. There are four bait and tackle shops in or near to Edgartown. At the time of the first closures in 1993 these small enterprises provided supplies to anglers - everything from bait, lures, ice, rods, reels and other fishing equipment to snack food. When Norton Point Beach was first closed in 1993 making access into Chappaquiddick difficult, owners of these businesses reported that their businesses suffered declines in revenues (Ruth Myers, Larry's Bait and Tackle, personal communication; Cooper Gilkes, Coop's Bait and Tackle, personal communication; and Steve Morris, Dick's Bait and Tackle, personal communication). One of the owners indicated the enterprise was close to bankruptcy in 1993 and 1994. However, actual financial data to confirm these assertions are unavailable.

Since 1993 the owners report that their businesses have grown significantly. Much of this expansion is attributable to the recovery of striped bass stocks, which has stimulated interest among anglers. As a result of the increased fishing demand, some of the shops have expanded into guided fishing tours to Wasque Point and other select locations. And some shops now operate charter boat services. All of the owners interviewed report they are now doing better than they were at the time of the first closures, and one of the owners reported growing at a rate of about 20 percent per year.

That these business are better off in 1997 than in 1993 does not mean that there is no continuing financial impact of beach closures. However, it does make quantifying any impact difficult. These businesses might be growing at even higher rates if Norton Point and Chappaquiddick beaches were open at all times. To quantify such effects would require comparing growth rates of bait and tackle shops on the Vineyard, where beaches are subject to closures, with shops that serve anglers at a comparable unaffected site elsewhere. However, the data upon which to quantify any impact on the rate of growth are all proprietary and, thus, unavailable.

## **SUMMARY OF ECONOMIC IMPACTS OF PIPING PLOVER MANAGEMENT**

The most significant economic impacts of implementing federal piping plover management guidelines is on the revenues and costs of beach management. Initially, The Trustees of Reservations lost revenues from sale of ORV permits for several years, but increases in revenues from pedestrian visits and membership sales greatly lessened the net impact of the ORV revenue shortfall. By 1996 ORV permit sales had returned to approximate pre-1993 levels, given price increases. Currently, the primary revenue impact of TTOR's shorebird management program is the cost -- about \$18,300 per year.

In comparison, Dukes County has sustained a considerable loss in revenues from ORV sales and incurred substantial costs for beach management. The annual loss in revenues amounts to about \$25,000 and the increase in costs amounts to about \$35,000 for a combined loss in net revenues of about \$60,000 per year. The decline in revenues represents a real decline relative to

pre-1993 sales that is due in part to the lengthy periods of closure and in part to a rigid seasonal pricing structure that offers only seasonal permits at full price. Maintenance of this inflexible pricing structure may have operated to limit potential revenue increases, since an offer of a monthly pass at some reduced price would likely bring in substantial revenue at little extra administrative cost. On the cost side the continuing annual incremental cost of \$35,000 is more difficult to explain, since TTOR manages a much greater expanse of beach for roughly half of this amount. One possible explanation is that some of this apparent incremental cost may be more properly attributed to other beaches or to items not required for plover management. By way of comparison, TTOR made a formal bid to take over management of Norton Point Beach for \$20,000 per year (Chris Kennedy, TTOR, personal communication), which is probably closer to a true incremental cost. Thus, to date the true economic impact of implementing plover management guidelines is probably closer to \$40,000, comprising about \$20,000 in lost revenues and about \$20,000 in increased costs.

The Town of Edgartown has also incurred some negative impact on shellfish revenues as a result of beach closures. Revenues from shellfish permits are down by about \$5,000, which appears at least partially attributable to these closures. The Sheriff's Department is also incurring costs for beach rangers to patrol the beach. However, most of this cost is attributable to ORVs not to shorebirds and would be incurred even if plovers were not present.

Currently, plover management appears to generate very little economic impact on the businesses on Martha's Vineyard. Realtors, lodging managers and rental agents report that beach closures at Norton Point and Chappaquiddick have not affected their businesses. Owners of bait and tackle shops report that their businesses suffered initially, but have grown significantly since the pre-closure period. Increases in striped bass availability appear responsible for a significant increase in recreational fishing demand, and owners of bait and tackle shops have responded by offering charters and guided trips to increase sales. While these businesses have grown, it is likely that they would have grown even more if beaches were not closed in late May and June during the spring run of bluefish and striped bass. How much additional growth might have occurred is impossible to determine, given the lack of available data, but any lost growth represents a negative economic impact attributable to plover restrictions.

ORV beach users have incurred some welfare losses attributable to beach closures while pedestrian users may have accrued some benefits. These closures have forced both swimmers/surfers/sunbathers and anglers who rely on ORVs to find alternative beaches with some potential loss in economic utility; but there is no evidence that the number of trips has changed. Given little change in overall trips, expenditures probably have changed little so that economic impacts appear negligible. For pedestrian beach users elimination of ORVs may generate benefits in terms of less accident risk and improved aesthetics.



**APPENDIX 5-A**

**Regression Estimates of Marine Recreational Fishing Trips in Dukes County**



MRFSS Telephone Estimates of Recreational Fishing Trips  
 Dukes County, Massachusetts: 1981-1996  
 Dependent Variable = Estimated Annual Shore Trips by Dukes County Residents

Model: MODEL1  
 Dependent Variable: ADJ\_TRP

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	772504482.17	257501494.06	1.323	0.3164
Error	11	2140499412.8	194590855.71		
C Total	14	2913003895			
Root MSE		13949.58264	R-square	0.2652	
Dep Mean		29794.10012	Adj R-sq	0.0648	
C.V.		46.81995			

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >  T
INTERCEP	1	39092	12366.071778	3.161	0.0091
UNEMP	1	876.136047	1896.3351791	0.462	0.6531
STOCK_SB	1	-0.686839	0.51274324	-1.340	0.2074
DNP	1	286.695132	6197.0817748	0.046	0.9639

Durbin-Watson D                    2.310  
 (For Number of Obs.)            15  
 1st Order Autocorrelation    -0.291

MRFSS Telephone Estimates of Recreational Fishing Trips  
 Dukes County, Massachusetts: 1981-1996  
 Dependent Variable = Estimated Annual Shore Trips by Dukes County Residents

Model: MODEL2  
 Dependent Variable: ADJ\_TRP

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	1838146360.7	306357726.79	2.280	0.1391
Error	8	1074857534.3	134357191.79		
C Total	14	2913003895			

Root MSE	11591.25497	R-square	0.6310
Dep Mean	29794.10012	Adj R-sq	0.3543
C.V.	38.90453		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >  T
INTERCEP	1	36267	10338.283317	3.508	0.0080
UNEMP	1	2154.245528	1652.1048692	1.304	0.2285
STOCK_SB	1	-0.948373	0.43799406	-2.165	0.0623
DNP93	1	-16732	12824.497195	-1.305	0.2283
DNP94	1	6188.487225	15141.434630	0.409	0.6935
DNP95	1	-1943.711003	15136.056054	-0.128	0.9010
DNP96	1	31030	15235.941042	2.037	0.0761

Durbin-Watson D                    2.923  
 (For Number of Obs.)            15  
 1st Order Autocorrelation    -0.473

MRFSS Telephone Estimates of Recreational Fishing Trips  
 Dukes County, Massachusetts: 1981-1996  
 Dependent Variable = Estimated Annual Shore Trips by non-Dukes County MA Coastal Residents

Model: MODEL1  
 Dependent Variable: ADJ\_TRP

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	3	869144094.3	289714698.1	0.886	0.4811
Error	10	3270074519.7	327007451.97		
C Total	13	4139218614			
Root MSE	18083.34737	R-square	0.2100		
Dep Mean	13735.35523	Adj R-sq	-0.0270		
C.V.	131.65548				

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >  T
INTERCEP	1	-7586.468728	17280.799931	-0.439	0.6700
UNEMP	1	1624.973015	2502.9803437	0.649	0.5308
STOCK_SB	1	0.802670	0.67615306	1.187	0.2626
DNP	1	-10015	8037.3461023	-1.246	0.2411

Durbin-Watson D                    2.366  
 (For Number of Obs.)                14  
 1st Order Autocorrelation    -0.197

MRFSS Telephone Estimates of Recreational Fishing Trips  
 Dukes County, Massachusetts: 1981-1996  
 Dependent Variable = Estimated Annual Shore Trips by non-Dukes County MA Coastal Residents

Model: MODEL2  
 Dependent Variable: ADJ\_TRP

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	6	977214150.41	162869025.07	0.361	0.8826
Error	7	3162004463.6	451714923.37		
C Total	13	4139218614			

Root MSE	21253.58613	R-square	0.2361
Dep Mean	13735.35523	Adj R-sq	-0.4187
C.V.	154.73634		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob >  T
INTERCEP	1	-8028.859717	20435.850072	-0.393	0.7061
UNEMP	1	1850.985770	3082.1573666	0.601	0.5671
STOCK_SB	1	0.757138	0.81549988	0.928	0.3841
DNP93	1	-17305	23514.852062	-0.736	0.4857
DNP94	1	-19571	27783.964420	-0.704	0.5039
DNP95	1	-27927	27760.446325	-1.006	0.3479
DNP96	1	-10574	27937.209852	-0.379	0.7163

Durbin-Watson D                    2.282  
 (For Number of Obs.)            14  
 1st Order Autocorrelation    -0.155

## VARIABLE DEFINITIONS

ADJ_TRP	= Estimate of Shore Recreational Fishing Trips in Dukes County
UNEMP	= Massachusetts Unemployment Rate, Annual
STOCK_SB	= Stock of Striped Bass ('000) as of Jan. 1 from NMFS Virtual Population Analysis
DNP	= Months of Closure of Norton Point Beach in Each Year
DNP93	= 1993=1; Other Years=0.
DNP94	= 1994=1; Other Years=0.
DNP95	= 1995=1; Other Years=0.
DNP96	= 1996=1; Other Years=0.



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The Martha's Vineyard Commission, 1996, Data Report, Oak Bluffs, MA.

The Trustees of Reservations, 1992, Leland Beach Management Proposal, September 11.

Town of Edgartown, Annual Reports, 1985-1996.

### **Telephone interviews:**

Chris Kennedy, The Trustees of Reservations (508-693-7662)

Robert Culbert, Beach Manager, Norton Point Beach (508-693-6692)

Randi Vega, Martha's Vineyard Chamber of Commerce (508-693-0085)

Tim Carroll, Chairman, Dukes County Commissioners (508-627-5535)

Noreen Flanders, Treasurer, Dukes County (508-627-4250)

Paul Condlin, Edgartown Police Chief (508-627-4343)

Paul Bagnall, Edgartown Shellfish Constable (508-627-6175)

Peter Bettencourt, Edgartown Selectman (508-627-6180)

Larry Mercier, Highway Department, Dukes County (508-627-4004)

Roy Hayes, Chappaquiddick Ferry, (508-627-9794)

Cooper Gilkes, Coop's Bait and Tackle (508-627-3909)

Ruth Myers, Larry's Bait and Tackle (508-627-5088)

Steve Morris, Dick's Bait and Tackle (508-693-7669)

Melissa MacDonald, Martha's Vineyard Commission (508-693-3453)

Debra Swanson, plover biologist (508-693-5207)

Ed Jerome, head, fishing tournament (508-627-8510)

Christina Brown, Edgartown Planning Board (508-627-6170)

Greg Skomal, Massachusetts Division of Marine Fisheries (508-693-4372)

Nelson Sigelman, Martha's Vineyard Times (508-693-6100)

Julie Wells, Vineyard Gazette (508-627-4311)

Gina Barboza, The Steamship Authority (508-548-5011 X 204)

Len Jason, Dukes County Commissioner (508-627-6115)

Pam Dolby, Edgartown Recreation Department (508-627-6145)

Linda Bassett, Linda Bassett Realtors (508-627-9201)

Ann Floyd, Sand Castle Realty (508-627-5665)

Patti Leland, Martha's Vineyard Vacations Rentals (508-693-7711)

Manager, Edgartown Commons (508-627-4671)

Stephanie Burke, Katama Shores Inn (508-627-4747)

Sherry Purdy, Sandpiper Realty (508-627-3737)

Alice Upham, resident (508-627-3301)

John Mullin, University of Massachusetts (413-545-6629)

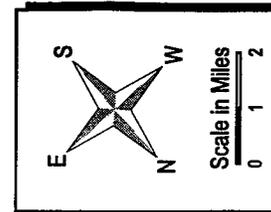
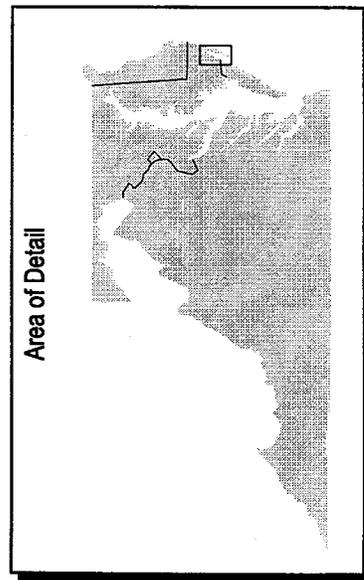
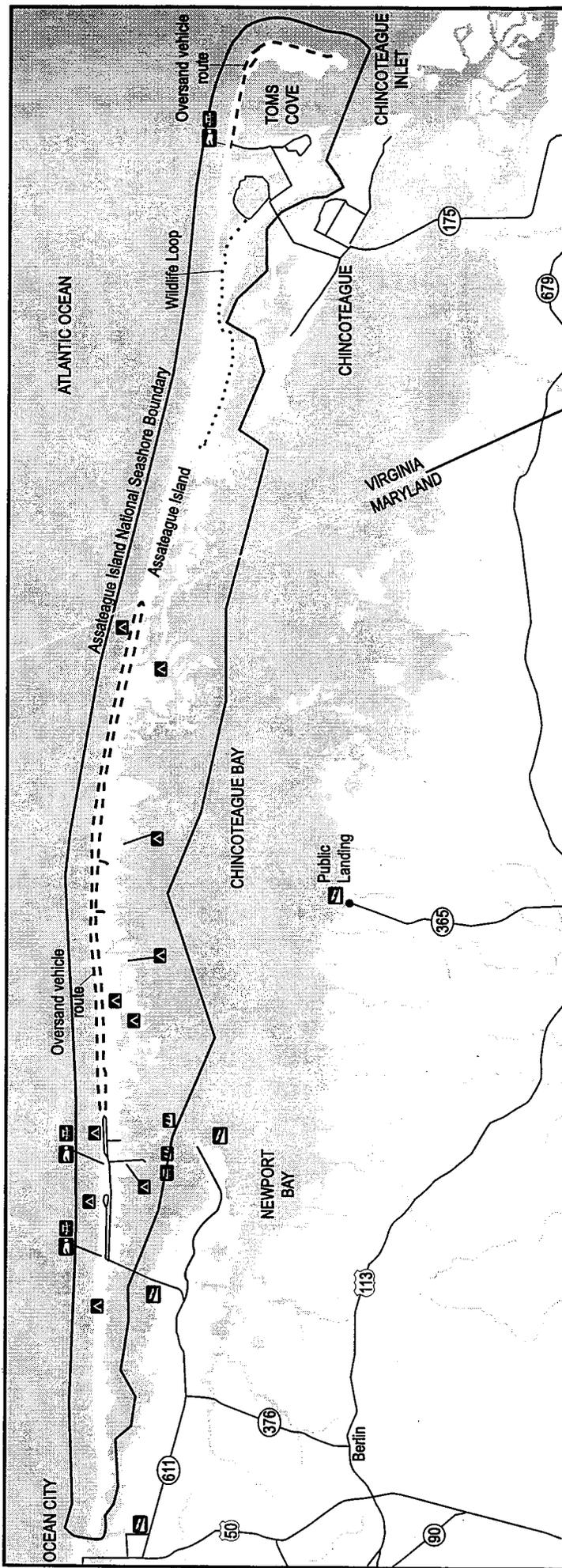
Assateague Island is a barrier island that extends 37 miles (59 km) southward from Maryland into Virginia (refer to Exhibit 6-1). About 21 miles (35 km) of island is in Maryland and about 16 miles (26 km) is in Virginia. To the north of Assateague Island lies another barrier island, which is developed and comprises the town of Ocean City, Maryland. To the west are Sinepuxent and Chincoteague Bays and the eastern shore of the Chesapeake Bay. To the east and south lies the Atlantic Ocean. There is access to the island via bridges at both the north and south ends of the island.

The island comprises three public use areas: a national seashore, a state park, and a national wildlife refuge. Assateague State Park, owned and managed by Maryland's Department of National Resources, comprises about 680 acres and extends about two miles (three km) southward from the access bridge. The remainder of the Maryland portion of the island, including about five miles (8.5 km) north of the access bridge and about 14 miles south of the state park, is owned and administered by the National Park Service (NPS) as part of Assateague Island National Seashore (NS). The Virginia portion, owned and administered by the U.S. Fish and Wildlife Service (FWS), comprises Chincoteague National Wildlife Refuge (NWR). The NPS assists the FWS in managing visitors to the seashore within the Refuge's boundaries.

Both the NPS and the FWS manage their units to protect plovers. Within Chincoteague NWR, the FWS began restricting off-road vehicle (ORV) and pedestrian access to the lower three miles of Tom's Cove Hook in 1988. On the Maryland portion of the island the NPS restricts access to areas of the dunes where plovers are present, but to date has not had to restrict pedestrian or ORV access to beaches.

The following sections examine trends in visitation and access restrictions at Assateague NS and Chincoteague NWR in an attempt to quantify the impact of those restrictions attributable to plover recovery activities on visitors. We then employ the economic impact methodology

**Exhibit 6-1**  
**Assateague Island National Seashore**  
**and Chincoteague National Wildlife Refuge**



discussed in Chapter 3 to evaluate the effects of any losses on the economy of Accomack County, Virginia, and Worcester County, Maryland.

## **DESCRIPTION OF THE SITES**

### **Assateague Island National Seashore, Maryland Unit**

Congress created Assateague Island National Seashore in 1965 as a unit administered by the NPS. The NPS owns and administers all but three km of the 37 km of the island that lies north of the Maryland/Virginia border. Access from the mainland is on Maryland route 611 which traverses Sinepuxent Bay over a short bridge. The road leads to the developed areas of Assateague State Park and the National Seashore.

Immediately south of the access bridge is a three km section owned and administered by Maryland Department of Natural Resources as Assateague State Park. This unit includes changing facilities and a campground.

The remainder of the Maryland section of the island is owned and administered by the NPS, as shown in Exhibit 6-1. Since October 15, 1997, the access fee charged for a seven day pass has been five dollars per vehicle. Immediately south of the state park the NPS maintains a developed section of the park that extends about three km and includes changing facilities and a campground. South of the developed area and extending to the Maryland/Virginia line is an undeveloped area of the island that extends about 20 km. This area is accessible by pedestrians, boats, and ORVs. The island is wide enough to allow for two parallel ORV tracks, one on the beach and one inland. Crossovers are sited every mile or so to enable the NPS to route ORVs away from plovers or other sensitive areas.

North of the state park is about two km of limited use area, which includes an administrative boat landing, dune grass nursery, and an interpretive program parking lot. Beyond that extends about nine km of primitive area of the island that is accessible only by pedestrians from the south end and by boat with landing areas midway and at the north end. The interior dune area, which supports a number of pairs of plovers, is off-limits to pedestrians and boaters.

### **Seashore Attributes**

The national seashore attracts a variety of active and passive recreational users. The beaches are the greatest attraction to visitors during the warmer months, offering miles of pristine area for swimming, surfing, and sunbathing. In addition, these beaches provide opportunities for surf fishing, shellfishing, hiking, birdwatching, and nature walks. A major attraction is the northern herd of wild ponies that frequent the island.

## **Users**

A survey done for the NPS as part of the Public Area Recreation Visitors Survey (Wright, et al., 1991) revealed that, based on data collected in 1985/86, most of the visitors to Assateague NS came from Maryland (33 percent), Pennsylvania (29 percent), New York (nine percent), Virginia (six percent), and New Jersey (six percent). The survey also revealed that most visitors stayed in the area for several days with the median stay about four days. About 50 percent of these visitors stayed in area hotels, motels, or other rentals (*Ibid.*).

Average on-site expenditures for trips by visitors to the Maryland unit amounted to about \$114 (1986 dollars) per visitor (*Ibid.*). Food accounted for about \$56, lodging for about \$22, transportation for about \$12, activities for about \$7, and miscellaneous for the remainder. Average on-site expenditures per visitor-day amounted to about \$49 for visitors to the Maryland (*Ibid.*). This amounts to about \$74 in 1997 dollars.

Users surveyed indicated that the five most popular activities were walking for pleasure (64 percent), sightseeing (55 percent), wildlife photography (48 percent), swimming (47 percent), and driving for pleasure (39 percent); about 11 percent of visitors indicated participation in saltwater fishing (*Ibid.*).

## **Capacity**

The parking lots in the developed area of the Maryland unit have considerable capacity. Even on highest volume holidays and weekends these parking lots have accommodated all visitors.

The NPS allows ORV access to the Maryland unit's 12.25 mile southern portion. The NPS regulates ORV access to a maximum of about six vehicles per half mile. Total capacity for the entire ORV zone amounts to 145 vehicles. When this ORV capacity is reached, which occurs at peak times during the summer, the NPS regulates access on a one-off/one-on basis.

## **Chincoteague National Wildlife Refuge/Assateague Island National Seashore, Virginia Unit**

Chincoteague NWR comprises the Virginia portion of Assateague Island for a length of about 20 miles. The refuge encompasses 9,931 acres of four major habitat types: salt meadows, flats and marshes, forest lands, sand-beach and dunes. The refuge, which was established in 1943 as a wintering ground for waterfowl, lies wholly on Assateague Island.

Access to the refuge is via highway 175 which crosses Chincoteague Bay and the Narrows to Chincoteague Island. The road passes through the Town of Chincoteague and across a short bridge to Assateague Island. The fee to enter the refuge currently is five dollars and allows for multiple entry for seven days. A seasonal pass is available for \$12.

The paved road passes the NWR visitor center and administration offices and ends at the beach. There is a visitor center, parking lots and changing areas at the beach. The NPS manages the beach facilities as part of the National Seashore. North of the parking lots visitors may access the beach on foot for a distance of several miles, but the dune areas are closed. South of the parking lots is Toms Cove Hook. The first 1.5 miles of the Hook is accessible by foot or ORV in all seasons, but the lower portion is open only from September through mid-March. Access is controlled so as to limit vehicle numbers to six per half mile.

### **Attributes**

The beach remains the primary attraction at the refuge. In the developed area are changing facilities and bathrooms. The parking lots in the developed area can accommodate about 950 vehicles, which means that about 3,000 visitors use the beach at peak times.

The refuge is home to a wide variety of permanent and migratory birds and waterfowl, including the threatened peregrine falcon and piping plover. The refuge ranks high in terms of species diversity and overall shorebird numbers. Mammals include the threatened Delmarva Peninsula fox squirrel, foxes, Sika and white tail deer, and the legendary wild ponies.

### **Users**

A 1985/1986 survey done for the NPS as part of the Public Area Recreation Visitors Survey revealed that most of the visitors to Assateague NS, Virginia Unit, came from nearby states: Maryland (19 percent), Pennsylvania (18 percent), Virginia (18 percent), New Jersey (10 percent), and New York (six percent) (Wright, et al., 1991). The survey also revealed that most visitors stayed in the area for several days with the median stay about four days with about 47 percent staying in area hotels, motels, or other rentals (Ibid.).

Average on-site expenditures for trips by visitors to the Virginia unit amounted to about \$192 (1986 dollars) per visitor compared to about \$114 for visitors to the Maryland unit (Ibid.). Food accounted for about \$90, lodging for about \$45, transportation for about \$15, activities for about \$30, and miscellaneous for the remainder. Given an average length of stay of about four days, average on-site expenditures per visitor-day amounted to about \$49 for visitors to the Virginia unit (Ibid.). This amounts to about \$73 in 1997 dollars.

Users surveyed indicated that the five most popular activities were swimming (56 percent), wildlife photography (48 percent), walking for pleasure (43 percent), sightseeing (42 percent), and driving for pleasure (36 percent); about 17 percent indicated participation in saltwater fishing (Ibid.).

## **Capacity**

Occasionally, on peak weekend days and holidays in the summer, the refuge's parking lots reach their capacity. Total capacity at the Virginia unit is 961 vehicles, or about 3,000 visitors. When this capacity is reached, the park operates on a one-off/one-on basis.

Likewise, the NPS regulates ORV access to the Toms Cove Hook portion of the NS at a maximum of six vehicles per half mile. A total of 1.5 miles is open from March 15 through August 31, which allows for a maximum of 18 vehicles at any one time. From September through March 14 a total of four miles is open which allows for up to 48 vehicles at any one time. When capacity is reached, which occurs frequently at peak times during the summer, the NPS operates on a one-off/one-on basis.

## **PLOVER MANAGEMENT OBJECTIVES AND RESTRICTIONS**

### **U.S. National Park Service**

The objective of the NPS is to maintain areas of unique natural resources for public enjoyment. This entails balancing preservation and visitor use. The NPS is responsible for all plover management within the Maryland unit of Assateague Island National Seashore, including the state park area owned and managed by Maryland DNR.

The NPS began systematic surveys for piping plovers on Assateague Island in 1985 and initiated a long-term monitoring and breeding study of plovers in May 1986. In 1988 the NPS initiated active management efforts to protect plovers, including closure signs and erection of nest exclosures. The NPS has tailored its plover protection program to the particular conditions found on the island.

The largest concentration of plovers is on the north end of the island, and the NPS has implemented restrictions on all access to dunes and foraging areas on the west side of the north end of the island. A storm in January 1992 removed considerable dune vegetation in the north end of the island and resulted in greatly improved plover habitat. As a result, the NPS closed all potential nesting and foraging habitat in the north end, a distance of nine km. The result of these closures in 1992 was that the ocean beach below the spring high water mark remained open to pedestrians but access to the dune and foraging area west of that high water mark was prohibited. On the west side of the north end of the island the NPS permitted two areas to remain open to boat access: one about halfway between the access road and the north end of the island and the other at the north end; however, only the north end boat landing area had access to the ocean beach via a narrow corridor. These north end restrictions have remained in place since 1992.<sup>1</sup>

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<sup>1</sup>Two recent storms in winter, 1998, have further altered the northern portion of Assateague Island. These storms overwashed about 2-3 miles of this northern section, reducing much of it to an overwash zone. This is likely to result in enhanced plover foraging area, but reduce the number of viable nesting sites. As a result plovers may move further southward, possibly necessitating changes in NPS plover management restrictions.

Until recently, few plovers have attempted to nest south of the developed area of the park, and the NPS has allowed ORVs to use this area. There are two parallel ORV trails, one on the beach and one several hundred meters inland. To date, the NPS has maintained access to all beaches in this southern section by routing ORV traffic around plover nests to avoid potential conflicts with vehicles. However, in 1996 plovers first bred successfully in the ORV zone near the Maryland/Virginia line, and it is possible in the future that the NPS may have to close the southernmost section of the ORV area, which might result in a reduction in the number of ORVs from the current level of 145.

Beginning in 1993 plover restrictions have been in effect for most of the period from early April through the end of August. Exhibit 6-2 summarizes the dates when plover restrictions took effect. Dune area closures have been in effect for 123 to 145 days in the last five years. These restrictions appear to have had a positive impact on plover productivity, although five breeding seasons is too few to draw strong conclusions. The number of breeding pairs of plovers has increased from 24 in 1992 to 61 in 1996, and the number of fledged chicks increased from 24 in 1992 to 91 in 1996 (NPS, 1997, p.4).

Exhibit 6-2			
Time Periods of Piping Plover Management Restrictions, 1993-97			
Year	Closed	Opened	Days Closed
1993	April 12	~ August 31	142
1994	April 9	by September 1	145
1995	April 15	August 21	128
1996	April 15	August 16	123
1997	April 5	August 27	144

Note: 1) In the north area these management restrictions include closures of dunes and plover foraging areas, but no closures of ocean beaches.  
 2) In the south area restrictions have routed ORVs around certain ocean beach areas, but have not limited ORV access to the full 12 miles of beach.

Source: National Park Service, Assateague Island National Seashore.

### U.S. Fish and Wildlife Service

The FWS administers its wildlife refuges for the “protection, enhancement, and recovery of endangered and/or threatened species” (7 RM 2.1) and resolves conflicts between endangered species and other management or use programs” in favor of endangered species (PRNWR, 1993). The piping plover was first added to the list of threatened and endangered species in 1986, and in the spring of 1988 the FWS first implemented restrictions at Chincoteague NWR to protect them.

There are two primary habitat areas for plovers in Chincoteague NWR. The southernmost area is known as Toms Cove Hook and extends eastward and northward about 2.7

miles from the tip of Assateague Island. The northern section includes Wild Beach and the interior overwash area known as North Wash Flats and extends northward from D Dike for about 3.7 miles. Since 1988 the refuge manager has closed all public access to these areas by pedestrians, ORVs, and boats from March 15 through August 31 -- a total of 168 days.

Before the refuge manager implemented plover management restrictions both of these sections were accessible by boat and pedestrian users. In addition, ORVs were permitted on the lower 3.7 miles of Toms Cove Hook. Prior to March 15, 1988, the refuge manager had approved six ORVs per half mile which allowed a maximum of 42 ORVs on the Hook at any one time. However, in 1988 the refuge manager closed the lower 2.7 miles of Toms Cove Hook to all use, including ORVs, boat, or pedestrian access, from March 15 through August 31. However, the ORV zone was extended a half mile north a total of 1.5 miles, which allowed for a maximum of 18 vehicles from March through August. From September through February the ORV zone now comprised a total of four miles, and its maximum capacity had increased to 48 vehicles. These restrictions have been in effect since 1988.

Plover fledge rates have increased since the refuge manager implemented the restrictions, but storms and predators have combined to constrain the number of breeding pairs. In 1987, prior to implementation of the restrictions, 16 pairs of plovers fledged only three chicks, a reproductive rate of only 0.19. Since 1988 the annual number of nesting pairs on the Hook has increased slightly, ranging from 15 to 23. However, the annual total of chicks fledged has increased dramatically, ranging from 16 to 41.

## **ANALYSIS OF RECREATIONAL VISITS**

### **Assateague Island National Seashore, Maryland Unit**

Maryland's Worcester County, especially Ocean City, provides a wide array of ocean-based recreational opportunities (including beach access and a boardwalk with various types of amusements). However, Assateague Island provides unrivaled opportunities for seashore recreation in a pristine natural setting, and many of the visitors to the area spend at least one or more days visiting the National Seashore.

#### **Ocean City and Environs**

Ocean City, MD, occupies the southern tip of the barrier peninsula that extends south from Delaware. Beaches extend the whole length of this peninsula from Delaware to Ocean City, and these beaches are open to public access. The town is the closest ocean seashore community to metropolitan centers of Washington, D.C. and Baltimore, MD. Route 50, which connects Ocean City to the mainland by a causeway over Wight Bay, extends all the way to Washington, D.C. via the Chesapeake Bay Bridge. From Route 50 it is only about 10 miles to Assateague Island.

Ocean City and its environs comprise a heavily developed seashore tourism-based economy that extends eastward several miles on Route 50 and northward several miles on Route 528. Ocean City has a permanent population of about 7,500. However, on peak summer weekends the total increases to over 300,000. The town has about 3,000 hotel/motel rooms available all year and about 9,800 rooms available from May through September. The most developed area of Ocean City is at its southern end; this section includes the widest section of beach and a boardwalk with various amusements, including carnival rides. The boardwalk extends northward for nearly three miles, and a large number of hotels, condominiums, and guest houses provide lodging all along the beachfront. In addition, various seaside amusements ranging from water slides to miniature golf courses can be found all along the "strip". In addition to the standard seaside attractions of swimming, surfing, and sunbathing, other recreational attractions include golfing, boating, fishing, and sailing in the protected bay and open ocean.

Ocean City underwent a building boom in the early 1980s, and the number of annual visitors to Ocean City expanded through the 1980s. In the 1990s the number of annual visitors has continued to increase, but at a more modest rate. Most of this growth has occurred outside of the summer season which peaked in 1990, as shown in Exhibit 6-3. Based on sewer volume "demoflush" estimates, annual visitors increased from about 6.4 million in 1984 to a peak of nearly 8.0 million in 1990. The number of annual visitors then declined during the 1991/92 recession, reaching a low of under 7.3 million in 1992. In 1993 total visitors recovered to 7.8 million and surpassed 8.0 million in 1994. In 1997 the number of annual visitors exceeded 8.1 million. However, the number of summer visitors, Memorial Day through Labor Day, peaked in 1990 at 4.5 million, before declining to 4.1 million during the 1991/92 recession. The number of summer visitors subsequently recovered to about 4.3 million in 1993, but has since declined each year to a level of under 4.1 million in 1997.

The town has encouraged off-season visitation through several festivals. Springfest, which debuted in 1990, is held in the first weekend in May, and the festival has attracted about 150,000 visitors in the last several years. In 1995 the city initiated an Art Festival on the boardwalk during the first weekend in June, and it has accounted for about 180,000 visitors each year. Sunfest, which is held in the third week in September, debuted in the late 1970s and annually attracts about 200,000 visitors. Finally, in 1994 the city began a festival of lights from about mid-November through into January, and on weekends with good weather this festival brings in about 70,000 or more visitors.

Room tax revenues reflect the growth in hotel receipts, which combine overall increased visitation at off-season rates and decreased summer visitation at peak rates. In nominal (undeflated) dollars room tax collections have increased significantly from 1988 to 1996, growing from about \$109 million in 1988 to over \$160 million in 1996, as shown in Exhibit 6-3. The influence of the recession in the early 1990s is evident in this data series, as room revenues failed to grow from 1991 to 1992, but have increased each year since 1992. However, much of this increase is attributable to increases in room rates. Data from the American Hotel and Motel

Association show that average room rates nationally have risen at about 27 percent since 1988.<sup>2</sup> Factoring out increases in room rates yields an estimate of lodging expenditures in real dollars, which provides an indicator of trends in expenditures by visitors. Real hotel expenditures grew from about \$138 to \$158 million over the period 1988 to 1991. The recession resulted in a slight drop in real hotel expenditures in 1992 to about \$155 million. Expenditures increased to about \$168 million in 1993 and remained at that level through 1995 before declining to about \$160 million in 1996. This stagnation and recent decline in real hotel expenditures is consistent with the fact that peak season visitors, who pay the highest room rates, have been declining while non-peak season visitors, who pay lesser rates, have continued to increase.

<b>Exhibit 6-3</b>				
<b>Estimates of Town of Ocean City Annual Visitors and Room Revenues, 1984-1997</b>				
<b>Year</b>	<b>Annual Visitors</b>		<b>Room Tax Revenues</b>	
	<b>Annual</b>	<b>Summer</b>	<b>Nominal Dollars (\$ millions)</b>	<b>Real 1996 Dollars (\$ millions)</b>
1984	6,407,519	3,615,509	NA	NA
1985	6,586,851	3,970,725	NA	NA
1986	6,833,215	3,960,321	NA	NA
1987	7,427,062	4,225,946	NA	NA
1988	7,591,509	4,547,055	\$108.72	\$137.77
1989	7,792,800	4,425,644	\$113.04	\$139.74
1990	7,981,690	4,579,513	\$122.46	\$147.18
1991	7,275,715	4,082,666	\$131.69	\$157.94
1992	7,496,087	4,104,528	\$131.27	\$155.22
1993	7,845,407	4,285,514	\$145.98	\$168.00
1994	8,008,647	4,249,259	\$151.58	\$167.97
1995	8,001,602	4,193,232	\$159.79	\$169.14
1996	8,134,587	4,158,485	\$160.28	\$160.28
1997	8,146,600	4,094,157	NA	NA

Notes: 1) Demoflush estimates are based on the wastewater flow from Ocean City provided by the Worcester County Sanitation Division and calculated by the MD Times Press Newspaper. The figures reported here are provided by Town of Ocean City, Public Relations Office.  
2) Room revenues are from Worcester County Treasurer, Room Tax Collections.  
3) Real room tax revenues are in constant 1996 dollars based on an index of room rates from the American Hotel and Motel Association.

<sup>2</sup>Average room rate data from the American Hotel and Motel Association reflect average rates across the United States. Applying these average rates to adjust room tax revenues from Ocean City assumes that prices of hotels and motels in Ocean City have risen comparably to rates elsewhere in the United States.

## Visits to Assateague National Seashore, Maryland Unit

### **Total Visits**

The NPS estimates total visits to the Assateague National Seashore by counting vehicles and applying an estimate of the number of persons per vehicle. Exhibit 6-4 summarizes annual total and ORV visits to the Assateague Island Maryland Unit since 1988. From 1989 to 1995 visits held fairly steady between about 600,000 to 650,000.<sup>3</sup> In 1996 and 1997, however, visits declined somewhat to about 587,000 and 554,000, respectively. The reason for this decline are unknown, but it is consistent with the decline in summer visitation at Ocean City in the last two years.

### **ORV Visits**

The Maryland unit of Assateague NS has two parallel ORV trails that extend about 12 miles to the Maryland/Virginia border. The NPS allows a maximum of 145 vehicles on these trails at any given time. From 1988 to 1997 usage doubled; ORV trips increased from about 25,000 in 1988 to over 50,000 in 1997. ORV trips have continued to increase in the Maryland unit despite the implementation of area restrictions to protect plovers in 1993 and the occasional need to reroute ORVs away from areas frequented by plovers.

Exhibit 6-4		
Assateague Island National Seashore, Maryland Total Visits and Oversand Vehicle Visits, 1980-1997		
Year	Total Visits, MD Unit	Oversand Vehicle Visits
1988	NA	25,042
1989	656,993	27,965
1990	647,483	31,701
1991	672,468	29,322
1992	625,285	26,556
1993	596,262	40,204
1994	675,115	34,997
1995	660,735	50,102
1996	586,778	45,452
1997	554,325	50,456

Notes: 1) NPS estimates visitor numbers based on car counts and applies an estimate of 2.9 visitors per car.  
2) Data are not available prior to 1989 due to changes in numbers and placement of car counters.

Source: 1) U.S. National Park Service, Assateague Island National Seashore, Monthly Public Use Report.  
2) U.S. National Park Service, Assateague Island National Seashore, Oversand Vehicle Use from 1988-1997.

<sup>3</sup> Visitation data for 1988 exists, but it is not consistent with later data due to changes in car counters.

## **Chincoteague National Wildlife Refuge/Assateague Island National Seashore, Virginia Unit**

Virginia's Accomack County begins south of the Maryland/Virginia border on the eastern shore of the Chesapeake Bay. To the south is Northampton County and access to the western shore at Norfolk via the Chesapeake Bay Bridge-Tunnel. Accomack County includes Chincoteague Island and the southern section of Assateague Island. Chincoteague and Assateague islands provide a rich estuarine and barrier island environment with unparalleled opportunities for nature study, wildlife viewing, and seashore recreation in a pristine natural setting.

The bridge from Chincoteague to Assateague was completed in 1962 and opened the lower portion of the island to tourism. Establishment of Assateague Island National Seashore in 1965 spurred the development of a tourist-based economy. Chincoteague NWR and Assateague National Seashore attract large numbers of tourists to this area from April through October, and the Town of Chincoteague depends heavily on these visitors to support its economy.

### **The Town of Chincoteague**

The Town of Chincoteague is situated on Chincoteague Island just across the causeway over Chincoteague Narrows. The town has a permanent population of about 4,000, including a significant number of retirees attracted by the natural and recreational attributes of the area. The economy of the town depends heavily on tourism. During the warmer months, June to September, visitors come to enjoy the beaches, and the population swells to about 20,000. In the spring and fall the refuge also attracts a large number of birdwatchers and other visitors attracted by the natural attributes of the refuge. These visitors support a number of hotels, guest houses, restaurants, and other tourist businesses.

There are no data for Chincoteague on trends in overall expenditures by visitors. However, a room tax of four percent on overnight lodging revenues became effective on July 1, 1985, and revenues collected from this tax provide an indication of trends in overall visitor expenditures. When the room tax became effective, the Town and the County each collected two percent of the room revenues generated within the incorporated (Town) portion of Chincoteague island, and the County collected four percent of the room revenues from the unincorporated portion of the island. Effective July 1, 1989, the Town annexed the unincorporated portion of the island, and from that time onwards the Town and County each received two percent of all room tax revenues generated from Chincoteague Island.

Exhibit 6-5 shows room tax revenues from the Town of Chincoteague over the period, FY 1986 to FY 1998. From 1986 through 1990 fiscal years extended from Sept. 1 through Aug. 30. FY 1991 amounted to only 10 months due to a switch to a new fiscal year which started July 1, 1991. Starting with FY 1992 all fiscal years have begun on July 1 and ended June 30. Data for FY 1998 are through February, a total of eight months. Exhibit 6-5 uses data on monthly collections to estimate adjusted totals for FYs 1991 and 1998 to approximate a full 12 months.

Adjusted room tax revenues in nominal dollars have grown from about \$50,900 in FY 1986 to about \$230,000 in the 1998. Part of this increase is due to additional revenues from annexing the unincorporated portion of the island on July 1, 1989. As a result, revenues expanded from about \$64,800 in FY 1988 to about \$121,600 in FY 1989, which included revenues from the expanded area for the peak summer months of July and August, and then to about \$159,400 in FY 1990, the first full year of expanded revenues from the annexed area. This annexation approximately doubled the amount of room tax revenues for the Town of Chincoteague.

After adjusting for increases in room prices, room tax revenues reveal the trends in overnight visitors and associated expenditures. Exhibit 6-5 uses average room rates reported by the American Hotel and Motel Association to deflate room tax revenues.<sup>4</sup> Average room rates have increased from \$49.45 in 1985 to \$74.03 in 1997, an increase of about 40 percent in 13 years. Assuming the rate of increase in national room rates reflects the rate of increase for room rates at Chincoteague's lodging places, adjusting room tax revenues by these prices will yield real room tax revenues in constant 1997 dollars and provide a measure of changes in real lodging expenditures by overnight visitors.<sup>5</sup>

Exhibit 6-5 shows that in constant 1997 dollars room tax revenues grew to about \$243,500 in FY 1991, the second full year of collections after the annexation. Revenues then declined somewhat in the recession years of FY 1992 and FY 1993. FY 1993 may also have suffered as a result of storms during the winter of 1992 that may have affected tourism that summer. Revenues then recovered to about \$251,700 in FY 1994. However, since then real room tax revenues have declined and are expected to amount to about \$230,000 in FY 1998.

What is interesting about these room tax figures is that real room tax revenues (in 1997 dollars) continued to increase even after the implementation of plover management restrictions, including closures at Toms Cove Hook. In FY 1988, the first full year of closure, real room tax revenues amounted to about \$91,200 in real terms, an increase of about nine percent over FY 1987. The effect of the closure in subsequent years is masked by the expansion of the tax base resulting from the annexation. However, real revenues did continue to grow through 1994, reaching a total of \$251,700 in that year. Since then, however, real room tax collections have not increased, which means that there has been no real growth in lodging expenditures by overnight visitors.

A regression model can provide a means of disentangling the effects of the annexation from the beach closures, although the amount of data available provides limited degrees of freedom. A simple semi-log specification of real room tax revenues as a function of a unemployment and binary variables to capture the effect of the annexation and the effect of the

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<sup>4</sup> Data on room rates at Chincoteague are unavailable. The use of national average room rates may result in some bias, but the magnitude and direction of any are unknown.

<sup>5</sup> This increase of 35 percent is somewhat below price increases reported by Chincoteague's Island Motor Inn, whose summer rates increased from \$58-\$88 in 1988 to \$88-\$150 in 1997, an increase of 51 to 70 percent. A higher rate of increase in room prices results in higher estimates of real room tax revenues in earlier years and reduced estimates of rate of growth of lodging expenditures.

closure of Toms Cove Hook revealed that since the closure, real room tax revenue collections have been growing rather than declining. The coefficient on the closure variable was positive and significant, and its magnitude indicates that since 1988 real room tax revenues have increased by about 22 percent annually. The coefficient on the annexation variable was also positive and significant, and its magnitude indicates that the annexation resulted in about an 86 percent increase in real room tax revenues. The coefficient on the unemployment had a wrong (positive) sign, but was insignificant. The results of this regression is are reported in Appendix 6-A.

The results are suggestive at best, given the limited years of data and the need to adjust for changes in fiscal years and to control for the annexation. Nevertheless, they do not support a finding that room tax revenues, or lodging expenditures, have declined since the refuge manager began implementing closures of Toms Cove Hook in the spring of 1988.

**Exhibit 6-5**

**Estimates of Town of Chincoteague Room Tax Revenues, FY 1986-1998**

Fiscal Year	Room Tax Revenues		
	Unadjusted	Adjusted	Real: 1997 dollars
1986	50,930	50,930	76,246
1987	57,927	57,927	84,019
1988	64,802	64,802	91,238
1989	121,562	121,562	163,712
1990	159,416	159,416	209,433
1991	118,186	190,623	243,475
1992	183,453	183,453	233,833
1993	181,026	181,026	227,489
1994	205,774	205,774	251,668
1995	206,349	206,349	243,016
1996	206,449	206,449	232,236
1997	221,930	221,930	235,852
1998	163,216	229,852	229,852

Notes: 1) The room tax rate is four percent of lodging costs. Two percent goes to the Town of Chincoteague and two percent goes to Accomack County. The unadjusted data reported in this table represents the Town's share of room tax revenues from Auditor Reports.

2) From 1986 through 1990 fiscal years ran from Sept. 1 to Aug.31. FY 1991 ran from Sept. 1 to June 30, only 10 months. Starting with FY 1992, fiscal years ran from July 1 to June 30. FY 1998 data is through February 1998, only eight months.

3) Adjusted room tax revenues are estimates for a 12 month period for FY 1991 and 1998.

4) Effective July 1, 1989, the town annexed the unincorporated area of the island, expanding the tax base.

5) Real room tax revenues are inflated to constant FY 1998 dollars based on average room rates for the U.S. reported by the American Hotel and Motel Association.

Source: Industrial Economics, Inc., based on data supplied by the Town Manager, Town of Chincoteague, VA,

**Visits to Chincoteague NWR and Assateague NS Virginia Unit**

The FWS estimates total visits to Chincoteague NWR and the National Seashore, Virginia Unit, by counting vehicles entering the refuge. Since cars may enter more than once in a day, these counters record total vehicle visits. The FWS translates vehicle-visits into person-visits by applying an estimate of 3.2 persons per vehicle.<sup>6</sup> These estimates of person-visits overstate the actual number of daily visitors by some amount.

<sup>6</sup> The data on visits reported by the FWS and the NPS vary slightly year by year due to different estimates of the number of persons per vehicle.

The NPS patrols the National Seashore and is responsible for regulating ORV access to the 1.5 mile ORV zone. Vehicles must have a permit to enter the zone, and these permits may be purchased either through the FWS or the NPS. As the agency that controls the access into the ORV zone, the NPS collects data on visits to Toms Cove Hook. The NPS has had that responsibility for the last several years, although the FWS controlled access for a period in the early 1990s. Data on ORVs include the length of time of closure of the zone due to exceeding the 18 vehicle quota, waiting times, and number of vehicles waiting to enter the ORV zone, and the number which get "fed up" and leave. From these daily data sheets rangers estimate the number of visits each month (Mel Olsen, NPS, personal communication). Exhibit 6-6 summarizes annual total refuge visits, permit sales, and ORV visits since 1977.

Overall refuge visitation increased from about 1.2 to nearly 1.6 million over the period 1977 to 1987. From 1987 to 1992 total visitation has declined by about 300,000, reaching a low of about 1.2 million in 1992. This decline followed the stock market crash in October 1987, the decline in housing values in 1988/89, and the resulting recession in the early 1990s. Since 1992 annual visitation at Chincoteague NWR has been fairly stable, varying by about 100,000 from about 1.3 to 1.4 million visits.

Sales of ORV permits have declined significantly since beach access was first restricted to protect plovers in 1988. From 1983 to 1987 permit sales increased from 1,160 to 2,696. This increase occurred despite an increase in annual permit prices from \$15 to \$30 in 1986 (the price of a seven day permit remained unchanged at \$10). It appears that most of the growth in permit sales during this period was attributable to purchases of seven day permits, since the increase in permit sales, about 2,500, approximated the increase in total visits from 10,819 to 13,113. In 1988 implementation of plover management restrictions that reduced the maximum number of ORVs from 42 to 18 (48 in the off season) resulted in about a 49 percent decline in permit sales to 1,383 while ORV visits dropped about 27 percent to under 9,600. Permit sales remained at over 1,300 through 1992; during that time ORV trips ranged from 11,600 in 1989 to under 8,300 in 1991. In 1993 an increase in the price of annual permits to \$40 and elimination of the seven day permit resulted in a further decline in permit sales to 1,252, but ORV trips increased by about 26 percent to 12,140. Permit sales held steady at about 1,250 through 1995, and ORV trips varied from about 11,900 to 12,600. In 1996 a 50 percent increase in the price of an annual permit to \$60 (with a 30 day permit available at \$40) resulted in a further decline in permits sold to 1,046; however, ORV trips increased by seven percent to over 13,500. Elimination of the 30 day permit in 1997 resulted in a further decline in permit sales to 958, but ORV trips increased by over 20 percent to nearly 16,400. It is interesting to note that in 1997 the average permit holder made 17 trips compared to only about five in 1987. This probably reflects a shift in ORV usage away from short term visitors in favor of residents.

Exhibit 6-6			
Chincoteague National Wildlife Refuge/Assateague Island NS, Virginia Unit			
Total and Oversand Vehicle Visits, 1977-1997			
Year	Total Visits	Oversand Vehicle Permits	Oversand Vehicle Visits
1977	1,186,424	NA	6,620
1978	1,259,609	NA	11,704
1979	1,157,292	NA	11,327
1980	1,312,226	NA	13,851
1981	1,391,163	NA	12,897
1982	1,296,166	NA	10,879
1983	1,451,669	1,160	10,819
1984	1,476,708	1,411	10,763
1985	1,521,161	2,069	11,267
1986	1,547,482	2,287	11,986
1987	1,568,604	2,696	13,113
1988	1,421,566	1,383	9,583
1989	1,382,775	1,382	11,603
1990	1,366,990	1,353	8,996
1991	1,394,128	1,348	8,272
1992	1,247,170	1,315	9,401
1993	1,415,830	1,252	12,140
1994	1,342,751	1,252	11,888
1995	1,365,054	1,240	12,657
1996	1,345,295	1,046	13,548
1997	1,437,587	958	16,365

Notes: 1) Estimates of total visits compiled by the FWS are based on a vehicle counter located at the entrance and application of 3.2 persons per vehicle.  
2) Number of permits sold includes both annual and 30 day permits.  
3) Estimates of ORVs are based on counts by NPS and the FWS personnel at the point of access and on the beach.

Source: 1) U.S. Fish and Wildlife Service, Chincoteague National Wildlife Refuge, Annual Refuge Visitation, selected years.  
2) U. S. Fish and Wildlife Service, Chincoteague National Wildlife Refuge, Summary Oversand Vehicle Use, Toms Cove District

### Visitation at Substitute Sites

Both the Maryland Unit and the Virginia Unit of Assateague Island are close substitutes in their recreational attributes. Both offer pristine beaches and a wide variety of opportunities for beach recreation wildlife viewing. Chincoteague offers a wider variety of wildlife viewing, while the Maryland unit offers greater ORV opportunities. However, the Maryland unit is about an hour closer to visitors coming from Washington, Baltimore, and points north.

Beyond Assateague Island nearby Ocean City and Delaware beaches further to the north and Virginia Beach, two hours to the south, also provide additional opportunities for seashore recreation. However, only Assateague Island offers pristine beaches on an undeveloped barrier island.

### **Seashore Visitation Model**

Recreation visits to seashore sites depend on site-specific attributes, weather, and trends in the economy that affect visitors. This analysis measures the impact of beach closures on total visits and total ORV visits. These data are collected monthly by NPS and the FWS staff, and annual totals are shown in Exhibits 6-4 and 6-6 above.

The primary analysis variable is the time period of plover restrictions, including closure of beaches. At Assateague Island's Maryland unit the NPS instituted restrictions on access to plover areas beginning in 1993, and these restrictions have generally been enforced from early April through late August, as shown in Table 6-2. Likewise, at Chincoteague NWR the refuge manager has closed access to the lower portion of Toms Cove Hook beginning in 1988 from March 15 through August 31. The analysis below employs a binary variable equal to one during time periods when closures were in effect at the two areas.

Site-specific attributes at Assateague Island include weather and entry fees. The weather data are from a meteorological station at Ocean City, MD. The variable used for analysis is days of rain. In general, fewer visitors come to the beach under rainy conditions so that this weather variable should be negatively associated with visits. Likewise, increases in real entry fees make it more costly to visit a site, and this variable should also be negatively associated with visits. However, where entry fees are fairly low, as is the case on Assateague Island NS where a seven day pass only costs five dollars, this variable may prove to have minimal effect on visits.

In addition, gasoline prices affect the cost of auto travel to the site, and employment levels provide a measure of economic prosperity and ability to pay for vacation trips. Real gasoline prices were high in the late 1970s, but have generally declined since then. Recreational visits should be negatively correlated with higher real gasoline prices. Likewise, higher unemployment is associated with recessionary conditions, especially lower consumer confidence and less disposable income; consequently, recreation visits should also be negatively correlated with high unemployment levels. In analyzing ORV visits the number of sport utility vehicles on the road is likely to be positively associated with ORV visits to the island.

## **Maryland Unit Visitation Model**

The NPS provided data on total visits to the Maryland portion of Assateague Island for the years 1989 through 1997, a total of only nine years.<sup>7</sup> As a result, any regression analysis that relies on annual data will have limited degrees of freedom. Preliminary analysis using various specifications indicated extreme instability in the coefficients. Consequently, analysis was undertaken at the monthly level.

The monthly specification has more degrees of freedom, but requires more disaggregate data. It employs monthly binary variables to control for variation in visitation by month and binary closure variables in months with plover restrictions, as well as other variables described above. After testing various models, the best results came from a specification that included variables for weather, unemployment, real gas prices, and real entry fees. The monthly closure variables for May, June, and July were negative, but insignificant, while coefficients on April and August were positive and insignificant. These regression results do not support any significant negative effect on visitation associated with the months during which the park implements plover restrictions. The results of this regression are reported in Appendix 6B.

The NPS data on ORV visits to the Maryland unit span 10 years from 1989 to 1997. Analysis of these data did not reveal any effect of plover restrictions on ORV visits. Regressing monthly ORV visits on a closure variable and other variables generated a positive and insignificant coefficient on the closure variable. In this regression unemployment is negative, but insignificant, while only sport utility vehicle registrations had the correct (positive) sign and achieved significance at over 95 percent confidence. The results of this regression are also reported in Appendix 6C.

That these regressions results do not provide any evidence of an effect of plover restrictions is not surprising because of the limited impact of plover restrictions on recreation at the Maryland Unit. Despite the restrictions pedestrian visitors have access to all beaches. And for ORV visitors the number of ORVs allowed in the ORV zone is unchanged, and ORV users continue to have access to beaches all the way to the Maryland/Virginia line with only minimal inconvenience of rerouting ORVs around beach areas closed to protect plovers. The most significant impact of these restrictions is on boaters who can no longer access ocean beaches on the north end from anywhere on the bay side, and boaters are not counted in these car visits.

## **Virginia Unit Visitation Model**

The FWS data on total visits to the Virginia portion of Assateague Island exist for the years 1978 through 1997, a total of 20 years. A linear regression specification of total annual visits versus a binary closure variable, weather, unemployment, and real gasoline prices yielded correct signs on all variables and a negative coefficient on the closure variable. This finding using annual data prompted a more detailed investigation using monthly level data.

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<sup>7</sup> Data exist prior to 1989, but they are inconsistent due to changes in car counters used to collect the data.

Analysis of the data at the monthly level confirmed the significance of a closure effect and refined the magnitude of the effect. Regressing monthly visits versus monthly and closure binary variables, and other independent variables (with a Cochrane-Orcutt correction for serial correlation) found negative and moderately significant (90 percent) coefficients on the closure variables for the months of June and August. Coefficients for the months of March, April, May, and July were positive and insignificant. The result of this regression analysis suggests that there may be a small negative impact attributable to plover restrictions and that it occurs in June and August, but not in other months.

The magnitude of the coefficients implies a loss of about 15,250 visits in June and about 13,900 visits in August. The overall impact is a loss of over 29,000 visits per year.<sup>8</sup> The t-statistics for the coefficients on the June and August binary variables were -1.807 and -1.760, respectively, which corresponds to significance at the 93 and 92 percent confidence levels.<sup>9</sup> The unemployment, entry fee, and fuel cost variables all had correct signs, but only the entry fee variable was significant at a 95 percent level of confidence. The results of this regression are reported in Appendix 6D.

Analysis of the ORV visits to Chincoteague NWR also utilized data for 20 years from 1978 to 1997. The model employed a specification of ORV visits as a function of unemployment, sport utility vehicle registrations, permit fees, entry fees, and binary variables for storm/administrative closures. A monthly specification generated correct signs on all the regressors and significant coefficients on unemployment and sport utility vehicle registrations. In addition, the regression coefficients on the binary closure variables for April, May, June, July, and August were all negative and highly significant. The coefficients on these variables imply a loss of 22 trips in March, 415 trips in April, 730 trips in May, 638 trips in June, 1271 trips in July, and 1357 trips in August, for a total loss of about 4,400 trips per year. Applying one standard error to this estimate yields a range of about 3,400 to 5,400. Readers should note that this estimate of the loss in ORV visits is already included in the estimates for the loss of total visits, since ORVs are counted in the total visitation data. These regression specifications are reported in Appendix 6E.

The closure of the lower portion of Toms Cove Hook affects primarily ORV users, since there are miles of beach still available to pedestrians. Thus, the results of the ORV regression reported above are quite plausible. And various business people in the Town of Chincoteague mentioned the loss of business from anglers since the closure of the Hook (Scott Chesen, Driftwood Motor Inn, personal communication; Donna Leonard, The Refuge Motor Inn, personal communication; Reggie Stubbs, Island Motor Inn, personal communication; Peter Wallace Fishtails Fishing Center, personal communication).

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<sup>8</sup> As noted above, this figure overstates visitor-days, since some visitors go in and out more than once in the same day.

<sup>9</sup> Given the expected negative sign, a one-tail test would yield significance at the normally accepted 95 percent confidence interval.

Finding a closure effect on total visits is more surprising, since the restrictions had little impact on non-ORV beachgoers. However, the confidence levels on the coefficients provide some uncertainty about the validity of the relationship. If the loss of ORV visits is not replaced by pedestrian visits, then the regression on total visits should reflect the loss in ORV visitors. This shortfall is more likely to persist in the spring months of April and May prior to the swimming season. However, the regression on total visits did not find closure effects in the spring months, but rather in June and August, which is a bit surprising. Possibly, this represents an effect attributable to fewer visits by non-fishing ORV users. In addition, the magnitude of the coefficients indicates that the closure effect applies to more visitors than just ORV users, despite the fact that the beach closures do not appear to affect the great majority of users. In comparison, the evidence from the analysis of room tax revenues does not support evidence of a closure effect for overnight visitors. Thus, evidence of a closure effect on total visits is mixed, although the closure has clearly affected ORV visits.

## **ECONOMIC IMPACT OF BEACH RESTRICTIONS**

### **Assateague Island National Seashore, Maryland Unit**

The results of the regression analyses indicate that existing restrictions adopted to protect piping plovers implemented since 1993 have had no impact on total visits or on ORV visits. Consequently, there is no evidence of any negative impacts on the economy of nearby Ocean City, Maryland or Worcester County. Likewise, ORV visits have increased dramatically since the early 1990s, and it is apparent that plover restrictions have had no impact on revenues from ORV usage at the Maryland Unit.

### **Chincoteague NWR/Assateague Island National Seashore, Virginia Unit**

The results of the quantitative analyses are mixed. An examination of room tax revenue data suggests that the closure of the lower part of Toms Cove Hook has not affected lodging expenditures by overnight visitors, whereas the regression analysis of visits to the refuge suggests that the closure may have resulted in a loss in visits during the months of June and August. That only two of the five closure months seem to be affected is surprising. Moreover, qualitative information from hotel and motel owners led to an expectation that the elimination of fishing during the spring season would affect visitation in April and May. The remainder of this section proceeds to estimate the economic impacts resulting from the loss of visits in June and August. However, given the greater uncertainty applicable to the regression coefficients and the contrary evidence from room tax revenues, our conclusion that the closures have resulted in negative economic impacts is far from certain.

## **Visitor Expenditures**

The National Park Service commissioned a survey of visitors to Assateague Island as part of its Public Area Recreation Visitor Study (PARVS) program. Implemented by researchers at The Ohio State University, this project surveyed nearly 6,000 visitors nationwide, including 957 visitors to Assateague in 1985/86. The researchers conducted interviews throughout the year, but the sampling design weighted monthly sample sizes by monthly visitation. Thus, about 52 percent of the Assateague sample comprised visitors surveyed in July and August. About 62 percent of the Assateague interviews (593) were conducted at the Maryland unit and about 38 percent (364) at the Virginia unit. Included in this survey were questions about expenditures on-site, i.e. within easy access to the refuge.

The survey found that visitors to the Virginia unit spent on average about \$192 per trip, which amounts to about \$49 per visitor per day, as shown in Exhibit 6-7. Lodging comprised about 23 percent of these expenditures, food about 47 percent, and transportation, activities, and miscellaneous comprise the remainder. After adjusting to 1997 dollars using the Consumer Price Index for northeast cities, expenditures per visitor per day amount to about \$17 for lodging, about \$34 for food, about six dollars for transportation, about five dollars for activities, and about \$12 for miscellaneous, which amounts to a total of about \$74.

<b>Exhibit 6-7</b>			
<b>On-Site Visitor Expenditures at Assateague Island, Virginia Unit</b>			
<b>Category</b>	<b>Average Expenditures per Trip (\$1986)</b>	<b>Average Expenditures per Visitor-Day (\$1986)</b>	<b>Average Expenditures per Visitor-Day (\$1997)</b>
Lodging	\$44.76	\$11.42	\$17.22
Food	\$89.68	\$22.88	\$34.50
Transportation	\$15.23	\$3.88	\$5.85
Activities	\$12.46	\$3.18	\$4.80
Miscellaneous	\$30.17	\$7.69	\$11.60
<b>Total</b>	<b>\$192.30</b>	<b>\$49.05</b>	<b>\$73.97</b>
Notes: 1) Average trip expenditures are from Trip Related Expenditures -- On Site, pp. 30/31. 2) Estimate of expenditures per visitor-day reported on p. 31. 3) Estimates of expenditures per visitor-day are converted to 1997 dollars using the Consumer Price Index - Northeast Urban Consumers, Not Seasonally Adjusted, where 1997=167.6 and 1986=111.1.			
Source: Wright, Pamela A., Mullins, Gary W. and Van Horne, Merle J., The Public Area Recreation Visitor Study and National Park System, Characteristics and Expenditures of Visitors to Assateague National Seashore, September 1991.			

### **Loss in Annual Visitor-Days**

The loss in visits estimated by the model requires two adjustments to yield the loss in visitor-days and expenditures per visitor-day. First, it is necessary to factor out any reduction in trips by local area inhabitants, since expenditures by local residents do not represent an increment to local expenditures. There are no data that identify the percentage of trips accounted for by local residents. A reasonable estimate by refuge personnel is that the total is probably less than five percent. This analysis employs 2.5 percent as an adjustment to eliminate expenditure impacts by local residents.

Second, the analysis requires an adjustment to eliminate counting visits by the same visitors more than once per day. The refuge estimates that a high proportion of visitors make more than one visit per day to the refuge and adjusts visits using a factor of 1.75 visits per visitor per day (John Schroer, Chincoteague NWR, personal communication).

The coefficients on months of closure to protect piping plovers represent a combined annual loss of 29,143 visits with a standard error of 16,333. Applying both adjustments to the coefficient and the standard errors yields a midpoint estimate of a loss of about 16,000 visitor-days. The range for this midpoint estimate is about 7,000 to 25,000 visitor-days, which represents about plus or minus one standard error.

### **Regional Economic Impacts: IMPLAN Analysis Results**

The IMPLAN model determines the changes in output, employment, and earnings in Accomack County that would result from the loss in spending attributable to any reduction in numbers of visitors to Chincoteague NWR. The total direct spending loss for the midpoint estimate of 16,000 lost visitor-days amounts to about \$0.8 million in 1986 dollars. In addition, multiplier effects result in additional indirect and induced losses, as explained in Chapter 3. IMPLAN inflates these lost expenditures to 1994 dollars. The assumption implicit in these IMPLAN modeling results is that the loss in trips to Chincoteague is a net loss in spending to the county; that is, visitors do not substitute trips to another beach or recreation area in the county for trips to Chincoteague. Likewise, the analysis interprets the PARVS survey data to mean that all spending by visitors to the Virginia Unit occurs within Accomack County; to the extent that some spending occurs elsewhere, Ocean City for example, the model overstates impacts within the county.

Exhibit 6-8 reports the results of the IMPLAN model in 1994 dollars. It shows that Accomack County has a baseline output of about \$1.2 billion, employment of about 16,900, and employee compensation (earnings) of about \$328 million. Exhibit 6-8 then summarizes the impacts on output, employment, and earnings for a midpoint of 16,000 lost visitor-days and for a range of 7,000 to 25,000 visitors days. The midpoint scenario generates a loss of about \$6.0 million in output, about 127 jobs, and about \$1.8 million in earnings. The range around these estimates is a loss of \$2.6 to \$9.3 million in output, 56 to 198 jobs, and \$0.8 to \$2.8 million in earnings.

To put these losses in perspective it is useful to compare them with the baseline. The midpoint estimate of about \$6.0 million in lost output represents about 0.5 percent of total county output. The loss of about 127 jobs represents about 0.7 percent of total county employment, and the loss of about \$1.8 million in earnings represents about 0.5 percent of total county earnings.

The assumption used in this analysis is that any loss in trips represents a net loss in spending within the county. To the extent that some visitors substitute other sites within Accomack County for fishing or other beach trips, such behavior only transfers expenditures within the county. Any transfers reduce the economic impacts attributable to plover restrictions at Chincoteague NWR. However, the most comparable substitute sites, including Assateague's Maryland Unit, Virginia Beach, and Cape Hatteras are not only out-of-county, but out-of-state.

The estimates of losses in output, employment, and earnings are fairly high and represent a significant effect on the overall economy of the county. These results are driven by the fact that the county depends heavily on tourism, and each visitor spends about \$74 per day (1997 dollars). However, the magnitude of these estimated losses is driven primarily by the estimates of visitor-days lost, and the precision of the regression estimates generates a wide range in the estimates. Moreover, the mixed evidence in support of closure effects suggests that the range of economic impacts should include zero as a lower bound.

<b>Exhibit 6-8</b>			
<b>Annual Regional Economic Impacts and Baseline: Accomack County, VA Attributable to Plover Restrictions at Chincoteague NWR</b>			
<b>Estimate</b>	<b>Output (\$ millions)</b>	<b>Employment (# persons)</b>	<b>Earnings (\$ millions)</b>
Midpoint	6.0	127	1.8
Low	2.6	56	0.8
High	9.3	198	2.8
Baseline	1,177.3	16,879	328.4
Notes: 1) The IMPLAN model applies expenditures, by category, to estimate spending changes by industry.			
2) Dollar estimates of losses in output and earnings are in 1997 dollars.			
Source: IEc, based on IMPLAN Model results.			

## **WELFARE ANALYSIS OF PLOVER RESTRICTIONS**

To the extent that the closure of Toms Cove Hook to all users has affected the number of visits to the refuge, it is likely to generate welfare effects with some loss in utility. This welfare loss results from a loss in utility from trips not taken or from extra costs incurred to access substitute sites. There are several studies that provide estimates of welfare for beach-trips and ORV beach-trips. However, it is essential to translate these estimates into appropriate per visitor-day estimates.

The section below estimates the welfare losses associated with three primary recreational activities that may have been affected by plover restrictions and closures at the Chincoteague NWR: pedestrian beach trips (swimming, sunbathing, walking), ORV beach trips, and ORV surf fishing trips.

### **Surplus Value per Trip**

To determine appropriate consumer surplus values for fishing and beach recreation opportunities at Chincoteague we consider several valuation studies, as described in Exhibit 6-19. We are unaware of any studies of willingness to pay for access to an existing beach under comparable circumstances, however, Silberman and Klock (1987) and Bell and Leeworthy (1985) estimate willingness to pay for beach preservation (i.e., prevention of egregious erosion). Values range from about two to five dollars per visitor-day in 1996 dollars.

While these values estimate surplus value in a different context, they likely represent a fair approximation for our purposes. To estimate the value of lost surf fishing opportunities we consider values provided by McConnell and Strand (1994), Norton, Smith and Strand (1983) and others. These studies estimate per trip and per day values for saltwater shore fishing and are associated with species similar to those sought by anglers at Chincoteague. The McConnell and Strand (1994) study provides the most appropriate values for surf fishing on Assateague Island. These values range from about \$13 to \$103 per day.

Finally, we rely upon an estimate provided by Bergstrom and Cordell (1991) for off-road driving to value ORV trips to the refuge. Estimates of the benefit of an ORV trip range from about \$20 per day to \$30 per trip. Again, assuming a one-day trip this equates to \$20 to \$30 per visitor-day.

Exhibit 6-9			
Summary of Recreational Values			
Activity	Author (date)	Study Location and Commodity	Value (\$1996)
Beach Use	Silberman and Klock (1987)	New Jersey beach preservation	\$4.77 per day
	Bell and Leeworthy (1985)	Florida beach preservation	\$2.06 per day
ORV Access	Bergstrom and Cordell (1991)	Offroad Driving	\$19.98 per day; \$30.39 per trip
Saltwater Shore Fishing	Huppert (1989)	Central California striped bass and chinook salmon fishing	\$183.24 per trip
	McConnell, Weninger and Strand (1994)	Eastern States saltwater fishing	\$164.47 per trip
	McConnell and Strand (1994)	Eastern states saltwater fishing, May - August	\$12.67 - \$103.24 per day
	Norton, Smith and Strand (1983)	New England striped bass fishing	\$156.94 per trip

### **Estimation of Trips Lost**

The analysis above suggests that the overall loss in beach trips may have amounted to about 16,000 visitor-days. The PARVS survey found that 16.8 percent of visitors reported participating in saltwater fishing as part of their recreation experience (Wright, et al., 1991). Applying this percentage, approximately 2,700 of the total visitor-days lost are saltwater fishing days. The analysis further assumes that all salt water fishing requires an ORV trip. While this assumption is reasonable given the geography of the Chincoteague NWR, it may overstate losses slightly.

ORV trips caused by the closure of the lower portion of Toms Cove Hook comprise a significant portion of the overall visitor-days lost. The regression results indicate that annual visits declined by about 4,400 per year. Assuming three persons per ORV trip and no need to adjust visits to eliminate multiple entries, this amounts to a midpoint estimate of 13,200 ORV visitor-days lost. Subtracting total ORV surf-fishing visitor-days lost from the estimate for total ORV visitor-days lost yields an estimate of 10,500 non-fishing ORV visitor-days lost. Subtracting ORV visitor-days lost from total visitor-days lost yields an estimate of about 2,800 non-ORV (pedestrian) visitor-days lost. Exhibit 6-10 summarizes the loss in visitor days by activity and mode of access.

## **Estimate of Total Economic Surplus Loss**

To estimate losses in consumer surplus we rely upon a "benefits transfer" method, relying on values for similar commodities from the existing body of economic literature summarized in Exhibit 6-10. To determine a total consumer surplus loss associated with forgone recreational opportunities at the refuge, we apply appropriate *per visitor-day* values to estimates of lost visitor-days estimated from our visitation model.

Exhibit 6-10 combines the loss in visitor-days with estimates of lost surplus for each activity to calculate annual welfare losses. We establish a range based on the midpoint visitation estimate from our model and the range of per-day values gleaned from the literature. For each activity, we rely upon estimates for similar commodities denominated in days. In these studies it is unclear how many days comprise a trip, and thus are likely to overstate losses. As indicated below, these calculations yield estimates of total consumer surplus loss that range from approximately \$250,000 to \$500,000 per year. Most of this loss is attributable to ORV users, both anglers and non-anglers. The welfare losses to these users are real, given the reductions on ORV capacity effected by the closure of the lower portion of the Hook. Reiterating, given the mixed evidence for a loss in total visits, the range of effects on pedestrians should include zero as a lower bound.

<b>Exhibit 6-10</b>			
<b>Annual Welfare Losses due to Lost Visitor-Days at Chincoteague NWR (1996 \$)</b>			
<b>Mode/Activity</b>	<b>Surplus Value (\$/visitor-day)</b>	<b>Midpoint Visitation Estimate (#)</b>	<b>Welfare Loss Range (\$ 000)</b>
ORV			
Surf fishing	\$12.67 - \$103.24	2,700	\$34,200 - \$278,800
Non-fishing	\$19.98	10,500	\$209,800
Pedestrian	\$2.06 - \$4.77	2,800	\$5,800 - \$13,400
Total		16,000	\$249,800 - \$502,000
Notes: 1) Estimate of surf fishing visitor-days lost assumes 16.8 percent of all visitor-days lost are for surf fishing. It also assumes all surf fishing trips are in ORVs.			
Source: IEc analysis.			

## **SUMMARY OF ECONOMIC IMPACTS AND WELFARE EFFECTS**

Assateague Island National Seashore consists of two separate units. Plover restrictions at the Maryland Unit have resulted in minimal disruption to historical recreational use patterns, and as a result the analysis found no evidence of economic impacts.

At the Virginia Unit restrictions to protect plovers, including the closure of the lower 2.7 miles of Toms Cove Hook to pedestrian, ORV, and boat access, has definitely resulted in welfare effects to ORV users, especially surf fishing anglers who rely on ORVs to haul their gear to the best fishing areas on the Hook. However, the evidence of losses in total visitor-days is less

certain. Analysis of visitation data compiled by the refuge demonstrate a loss of about 16,000 visitor-days during June and August, but the confidence interval for these estimates is less than the normally accepted 95 percent. In addition, analysis of annual room tax revenues shows continued growth in overnight expenditures through the closure period and offers no evidence of a loss in revenues attributable to closing the lower portion of the Hook. Rather, these room tax data suggest the possibility that the loss in ORV visitors has been replaced by other visitors with no effect on expenditures.

There is strong evidence is that closing the Hook has reduced the number of ORV visitors with consequent welfare effects on these users. However, evidence of economic impacts due to a net loss in spending is less clear. If the loss in spending by ORV visitors has been compensated by increased spending by non-ORV beach users, then the economic impact estimates represent an upper bound, and the actual effect of the closure, if any, may be closer to zero.

**APPENDIX 6-A**

**Regression Results: Town of Chincoteague**

**Room Tax Revenues**



## REGRESSION RESULTS

Source	SS	df	MS			
-----				Number of obs = 12		
Model	5.56559178	3	1.85519726	F( 3, 8) = 756.17		
Residual	.019627225	8	.002453403	Prob > F = 0.0000		
-----				R-squared = 0.9965		
Total	5.585219	11	.507747182	Adj R-squared = 0.9952		
-----				Root MSE = .04953		
-----						
lnTAX	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-----						
ANNEX	.8601217	.0408214	21.070	0.000	.7659874	.9542559
CLOSE	.2226704	.048203	4.619	0.002	.1115141	.3338267
UNEMP	.0018028	.0131901	0.137	0.895	-.0286136	.0322192
_inter	11.27794	.0664124	169.817	0.000	11.12479	11.43109
-----						
rho	-0.7365	0.1965	-3.749	0.003	-1.1689	-0.3041
-----						

## VARIABLE DEFINITIONS

- ANNEX: binary variable, assigned the value of one in the years since annexation of the unincorporated portion of the island
- CLOSE: binary variable, assigned the value of one during years of closure
- UNEMP: Virginia unemployment rate



**APPENDIX 6-B**

**Regression Results: Assateague NS, Maryland Unit**

**Total Visits**



## REGRESSION RESULTS

Source	SS	df	MS	Number of obs = 106		
Model	1.9904e+11	20	9.9520e+09	F( 20, 85) = 79.66		
Residual	1.0620e+10	85	124936761	Prob > F = 0.0000		
				R-squared = 0.9493		
				Adj R-squared = 0.9374		
Total	2.0966e+11	105	1.9968e+09	Root MSE = 11178		

mdvisit	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mdu	940.2679	1327.751	0.708	0.481	-1699.656	3580.192
mdfee	-1198.273	2260.071	-0.530	0.597	-5691.9	3295.354
rain	-265.5289	389.6353	-0.681	0.497	-1040.228	509.1705
govshut	-23763.92	21390.78	-1.111	0.270	-66294.51	18766.68
jan	-80651.69	5467.95	-14.750	0.000	-91523.44	-69779.94
feb	-81370.21	5439.121	-14.960	0.000	-92184.64	-70555.78
mar	-75383.73	5577.989	-13.514	0.000	-86474.26	-64293.19
apr	-58400.24	6752.142	-8.649	0.000	-71825.31	-44975.18
may	-42425.29	7509.158	-5.650	0.000	-57355.51	-27495.07
jun	-5642.998	6836.403	-0.825	0.411	-19235.6	7949.602
jul	42998.11	7172.132	5.995	0.000	28737.99	57258.23
aug	33340.61	6649.229	5.014	0.000	20120.16	46561.06
oct	-50054.54	5357.808	-9.342	0.000	-60707.3	-39401.79
nov	-69291.86	5333.518	-12.992	0.000	-79896.32	-58687.4
dec	-80501.45	5582.774	-14.420	0.000	-91601.5	-69401.39
mapr	8194.712	11207.99	0.731	0.467	-14089.78	30479.2
mmay	-1905.497	8320.481	-0.229	0.819	-18448.84	14637.85
mjun	-8370.565	7680.331	-1.090	0.279	-23641.12	6899.991
mjul	-11474.19	7875.356	-1.457	0.149	-27132.5	4184.131
maug	9347.856	9009.746	1.038	0.302	-8565.933	27261.64
_cons	92999.14	13132.99	7.081	0.000	66887.23	119111

## VARIABLE DEFINITIONS

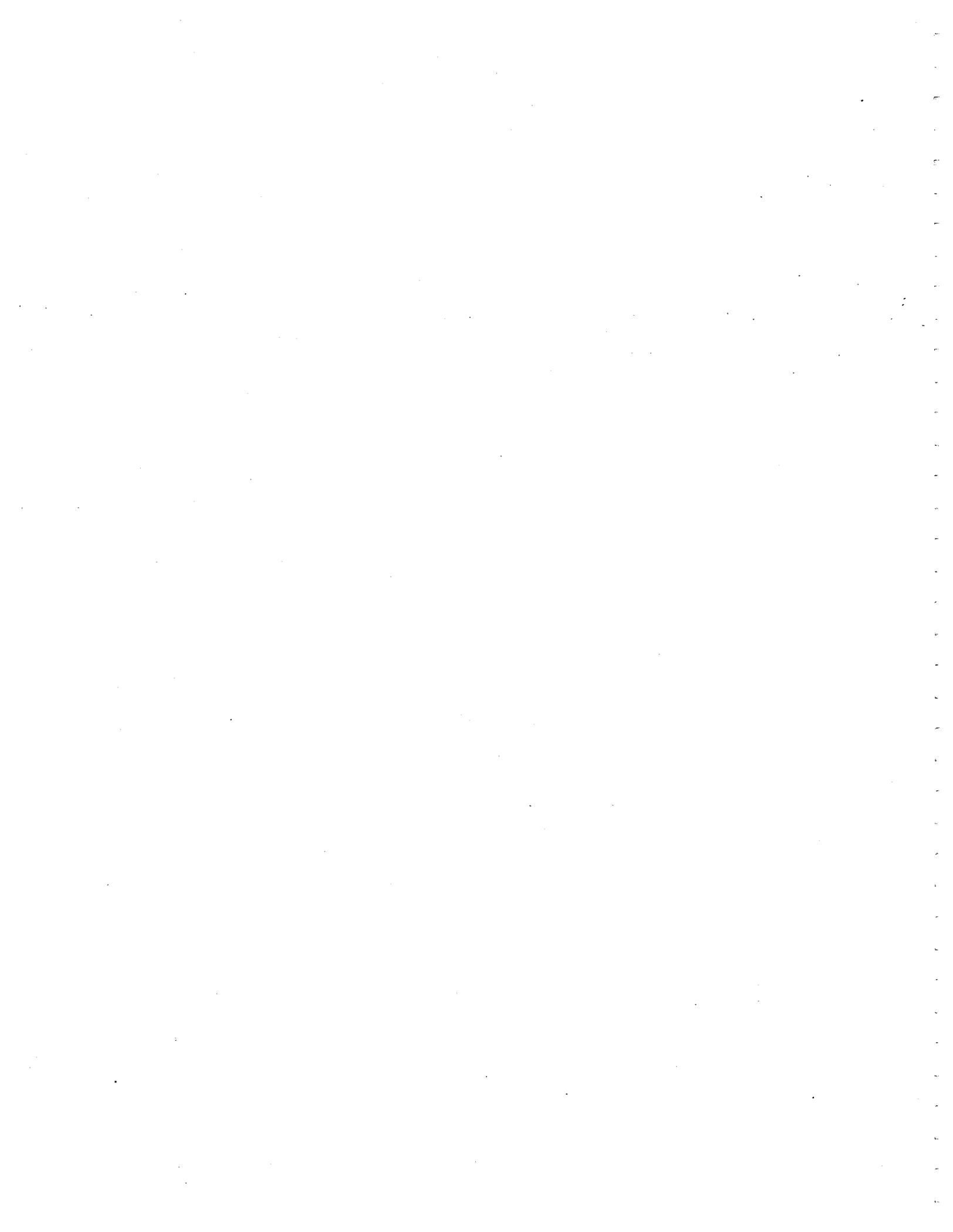
- MDU: Maryland unemployment rate
- MDFEE: Maryland unit entrance fee
- RAIN: weather proxy, as defined by number of days of precipitation during the summer season
- GOVSHUT: binary variable, assigned the value of one during the period of government closure
- MAPR-MAUG: binary variable, assigned the value of one when closures are in effect



**APPENDIX 6-C**

**Regression Results: Assateague NS, Maryland Unit**

**Oversand Vehicle Visits**



## REGRESSION RESULTS

Source	SS	df	MS			
Model	610510919	23	26543953.0	Number of obs = 119		
Residual	63618407.0	95	669667.442	F( 23, 95) = 39.64		
				Prob > F = 0.0000		
				R-squared = 0.9056		
				Adj R-squared = 0.8828		
				Root MSE = 818.33		
Total	674129326	118	5712960.39			

mdorv	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
govshut	-2529.088	1611.993	-1.569	0.120	-5729.299	671.1227
mdstorm	-1458.792	443.8844	-3.286	0.001	-2340.014	-577.5696
mdfee	1315.398	343.738	3.827	0.000	632.992	1997.804
suvreg	-.0001309	.0001196	-1.095	0.276	-.0003683	.0001065
mdu	183.817	134.5893	1.366	0.175	-83.37658	451.0106
orvfee	-2.686322	18.63887	-0.144	0.886	-39.68915	34.3165
rain	-3.300045	26.24524	-0.126	0.900	-55.40342	48.80333
jan	-3372.26	378.7241	-8.904	0.000	-4124.123	-2620.398
feb	-3411.744	387.5181	-8.804	0.000	-4181.064	-2642.423
mar	-3080.236	398.5087	-7.729	0.000	-3871.376	-2289.096
apr	-2389.23	464.3639	-5.145	0.000	-3311.109	-1467.351
may	-1612.167	463.1567	-3.481	0.001	-2531.649	-692.685
jun	-1154.449	466.1881	-2.476	0.015	-2079.949	-228.9484
jul	-462.0237	483.9251	-0.955	0.342	-1422.737	498.689
aug	474.0213	449.3149	1.055	0.294	-417.9816	1366.024
oct	-1958.095	377.008	-5.194	0.000	-2706.55	-1209.639
nov	-2888.139	376.3313	-7.674	0.000	-3635.251	-2141.027
dec	-3716.829	385.4047	-9.644	0.000	-4481.955	-2951.704
mapr	888.7737	813.6961	1.092	0.277	-726.6173	2504.165
mmay	449.8522	549.7642	0.818	0.415	-641.5677	1541.272
mjun	1991.6	549.4964	3.624	0.000	900.7123	3082.489
mjul	5288.792	562.2957	9.406	0.000	4172.494	6405.09
maug	3498.347	649.6854	5.385	0.000	2208.559	4788.136
_cons	451.7312	1173.575	0.385	0.701	-1878.109	2781.572

## VARIABLE DEFINITIONS

- GOVSHUT:** binary variable, assigned the value of one during the period of government closure
- MDSTORM:** binary variable, assigned the value of one during periods of violent storms that required closure of the beach
- MDFEE:** Maryland unit entrance fee
- SUVREG:** number of sport-utility vehicles registered nationwide

MDU: Maryland unemployment rate

ORVFEE: price of required ORV permit

RAIN: weather proxy, as defined by number of days of precipitation during the summer season

MAPR-MAUG: binary variable, assigned the value of one when closures are in effect

**APPENDIX 6-D**

**Regression Results: Chincoteague NWR/Assateague NS, Virginia Unit**

**Total Visits**



## REGRESSION RESULTS

Source	SS	df	MS	Number of obs = 238		
Model	1.0996e+12	22	4.9982e+10	F( 22, 215) = 180.27		
Residual	5.9610e+10	215	277257468	Prob > F = 0.0000		
				R-squared = 0.9486		
				Adj R-squared = 0.9433		
				Root MSE = 16651		
Total	1.1592e+12	237	4.8912e+09			
vavisit	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
vau	-2167.57	1688.235	-1.284	0.201	-5495.181	1160.041
govshut	-27915.53	33251.64	-0.840	0.402	-93456.48	37625.42
vafee	-2863.467	1372.216	-2.087	0.038	-5568.186	-158.7477
rain	107.8828	353.9859	0.305	0.761	-589.8443	805.6099
fuel	-117.5026	62.07787	-1.893	0.060	-239.8618	4.856524
jan	-128541.3	5757.443	-22.326	0.000	-139889.6	-117193.1
feb	-123474	5661.308	-21.810	0.000	-134632.8	-112315.2
mar	-120162.1	6822.167	-17.613	0.000	-133608.9	-106715.2
apr	-78025.48	7127.3	-10.947	0.000	-92073.81	-63977.15
may	-51124.86	6965.36	-7.340	0.000	-64853.99	-37395.72
jun	21162.94	6900.217	3.067	0.002	7562.203	34763.67
jul	96467.12	6769.04	14.251	0.000	83124.94	109809.3
aug	127019.5	6136.868	20.698	0.000	114923.3	139115.6
oct	-65351.6	4774.687	-13.687	0.000	-74762.79	-55940.41
nov	-101060.3	5414.937	-18.663	0.000	-111733.4	-90387.13
dec	-130629.3	5713.515	-22.863	0.000	-141891	-119367.6
vmar	940.4153	8041.746	0.117	0.907	-14910.34	16791.17
vapr	5128.565	8366.091	0.613	0.541	-11361.49	21618.62
vmay	2310.945	8471.372	0.273	0.785	-14386.63	19008.52
vjun	-15257.49	8443.492	-1.807	0.072	-31900.11	1385.136
vjul	2517.259	8388.045	0.300	0.764	-14016.07	19050.59
vaug	-13885.72	7890.445	-1.760	0.080	-29438.26	1666.81
_inter	194813.6	13377.22	14.563	0.000	168446.3	221180.9
rho	0.2628	0.0627	4.192	0.000	0.1393	0.3862

## VARIABLE DEFINITIONS

- VAU: Virginia unemployment rate
- GOVSHUT: binary variable, assigned the value of one during the period of government closure
- VAFEE: Virginia unit entrance fee
- RAIN: weather proxy, as defined by number of days of precipitation during the summer season

**FUEL:** average gasoline price across grades, adjusted for inflation (cents per gallon)

**VMAR-VAUG:** binary variable, assigned the value of one when closures are in effect

**APPENDIX 6-E**

**Regression Results: Chincoteague NWR/Assateague NS, Virginia Unit**

**Oversand Vehicle Visits**



## REGRESSION RESULTS

Source	SS	df	MS			
Model	95755228.5	23	4163270.81	Number of obs = 239		
Residual	19625621.6	215	91281.9609	F( 23, 215) = 45.61		
				Prob > F = 0.0000		
				R-squared = 0.8299		
				Adj R-squared = 0.8117		
Total	115380850	238	484793.488	Root MSE = 302.13		
vaorv	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
orvf	-1.656285	4.517414	-0.367	0.714	-10.56038	7.247805
vaf	-23.89562	32.6817	-0.731	0.465	-88.31317	40.52194
vastorm	-255.0863	250.4385	-1.019	0.310	-748.7154	238.5428
vau	-62.91317	29.60034	-2.125	0.035	-121.2572	-4.569151
govshut	-376.2565	608.1482	-0.619	0.537	-1574.952	822.4394
suvreg	.0000682	.0000242	2.825	0.005	.0000206	.0001158
jan	-1421.818	102.1023	-13.925	0.000	-1623.068	-1220.568
feb	-1395.302	100.528	-13.880	0.000	-1593.449	-1197.156
mar	-1365.707	121.6203	-11.229	0.000	-1605.428	-1125.986
apr	-886.6322	124.9775	-7.094	0.000	-1132.97	-640.2942
may	-370.2052	124.4043	-2.976	0.003	-615.4135	-124.9969
jun	-36.9236	124.1855	-0.297	0.767	-281.7005	207.8533
jul	1111.986	121.6774	9.139	0.000	872.1525	1351.819
aug	1300.415	111.8387	11.628	0.000	1079.975	1520.856
oct	-742.5919	86.66606	-8.568	0.000	-913.4159	-571.768
nov	-1160.799	96.45675	-12.034	0.000	-1350.921	-970.6774
dec	-1386.325	99.43732	-13.942	0.000	-1582.322	-1190.328
vmar	-22.44884	143.8754	-0.156	0.876	-306.0358	261.1381
vapr	-415.7297	150.9542	-2.754	0.006	-713.2694	-118.19
vmay	-730.1499	152.2334	-4.796	0.000	-1030.211	-430.0888
vjun	-638.3258	152.0163	-4.199	0.000	-937.959	-338.6926
vjul	-1271.163	150.837	-8.427	0.000	-1568.471	-973.854
vaug	-1357.089	143.2118	-9.476	0.000	-1639.368	-1074.81
_inter	1733.772	187.5346	9.245	0.000	1364.13	2103.413
rho	0.2371	0.0630	3.766	0.000	0.1131	0.3611

## VARIABLE DEFINITIONS

- ORVFEE: price of required ORV permit
- VAFEE: Virginia unit entrance fee
- VASTORM: binary variable, assigned the value of one during periods of violent storms that required closure of the beach

VAU: Virginia unemployment rate  
GOVSHUT: binary variable, assigned the value of one during the period of government closure  
SUVREG: number of sport-utility vehicles registered nationwide  
VMAR-VAUG: binary variable, assigned the value of one when closures are in effect

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**EDWIN B. FORSYTHE NATIONAL WILDLIFE REFUGE,  
HOLGATE UNIT CASE STUDY**

**CHAPTER 7**

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The U.S. Fish and Wildlife Service (FWS) owns and manages the Edwin B. Forsythe National Wildlife Refuge on the New Jersey shore just north of Atlantic City. The refuge consists of several discontinuous units bordering Great Bay and Little Egg Harbor. Holgate Unit comprises roughly 256 acres of barrier island environment at the southern tip of Long Beach Island (refer to Exhibit 7-1).

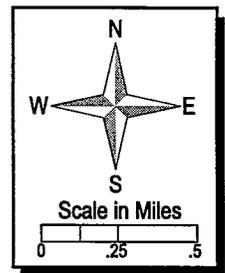
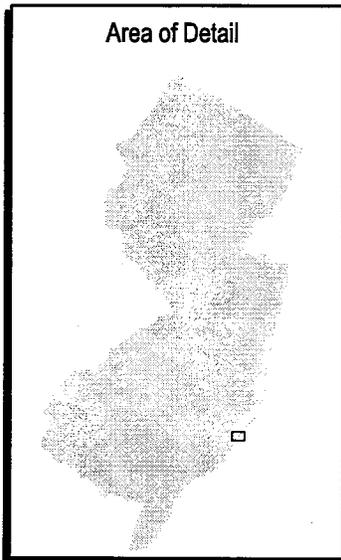
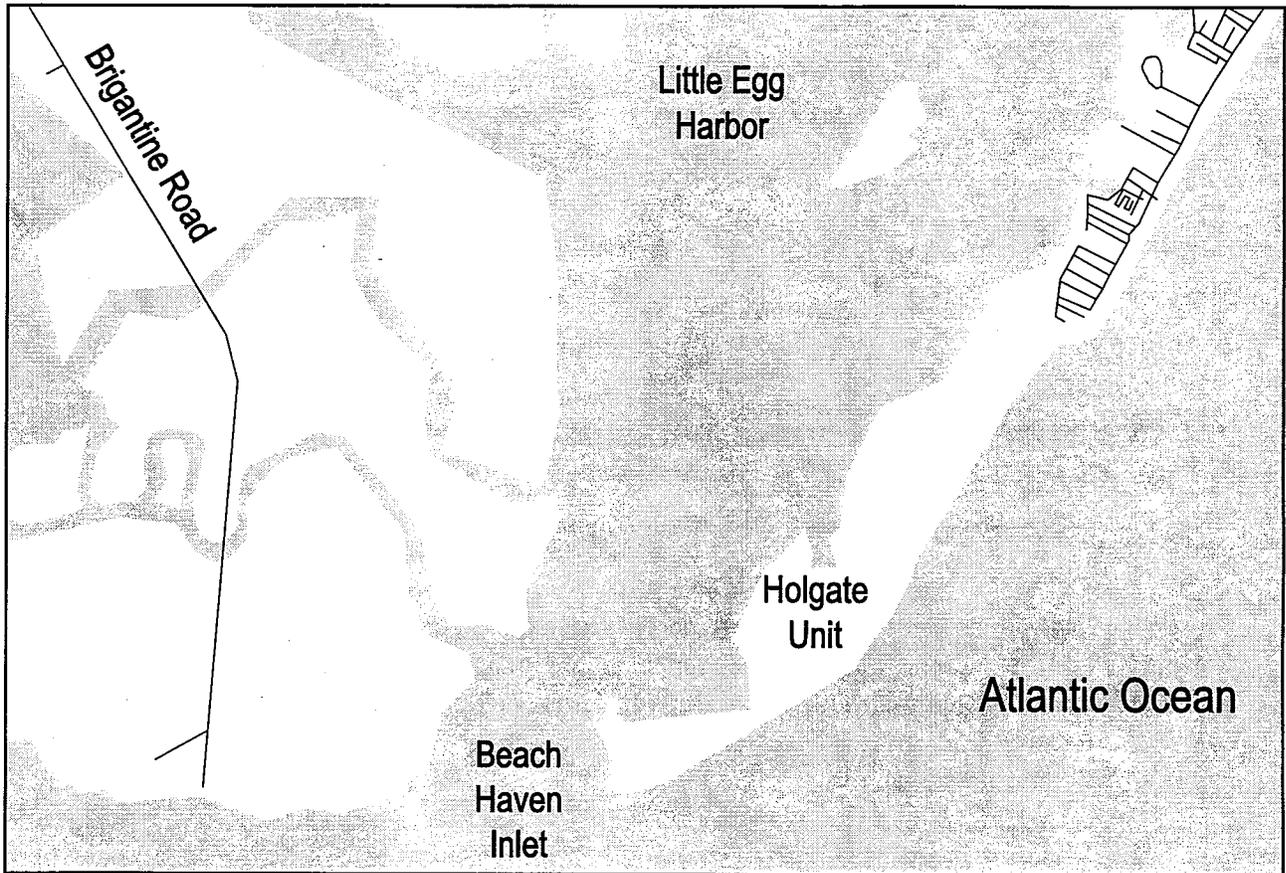
Long Beach Island is a barrier island which extends about 18 miles in length and has a maximum width of about a half-mile. All but the southern tip of Long Beach Island is developed with housing, lodging, and other services for year-round and seasonal residents and vacationers. The wildlife refuge occupies the southernmost 2.75 miles of the island. The FWS manages the Holgate Unit to protect piping plovers and other migratory birds, and in 1988 the refuge manager initiated closures of the entire refuge to ORV and pedestrian access. The refuge has remained closed from April to August every year since 1988.

The following sections examine trends in visitation and access restrictions at the Holgate Unit in an attempt to identify and quantify the economic impact of those restrictions on visitors. We then evaluate the effects of any impacts on the economy of Long Beach Island and Ocean County, New Jersey.

**DESCRIPTION OF THE SITE**

The FWS owns and administers the Holgate Unit as part of a much larger area, the Edwin B. Forsythe National Wildlife Refuge. Forsythe NWR consists of two discontinuous divisions. The Brigantine Division occupies the marshy areas along the southwestern edge of Great Bay,

**Exhibit 7-1**  
**Forsythe National Wildlife Refuge**



and the Barnegat Division lies along the western edge of Little Egg Harbor. The Holgate Unit lies at the southern tip of Long Beach Island and is geographically separate from both divisions. The Unit is part of the Brigantine Wilderness but is administered by the Barnegat Division. Donated by the Audubon Society in 1960, the Holgate Unit comprises 256 acres of beach, dunes, and marsh on a barrier island that extends approximately 2.75 miles. It is the only barrier island environment within the Forsythe NWR.

Atlantic Boulevard terminates at the south end in a parking lot maintained by the Town of Long Beach. Access to the town beach and Holgate NWR is through this parking lot. The first 200 meters of beach is owned and operated by the Township of Long Beach as a public beach. Beyond the town's beach lies the refuge property. The demarcation line is marked by a sign. When the refuge is open, September to April, ORVs may access the refuge via a short sand ramp from the parking lot that extends along the beach edge of the dune.

### **Seashore Attributes**

New Jersey's shore extends from Asbury Park to Cape May, a distance of over 100 miles. Long Beach Island lies about 15 miles north of Atlantic City. The Garden State Parkway provides access from the high density urban areas of northern New Jersey and New York City, and the Atlantic City Expressway provides access to nearby Atlantic City from Philadelphia and its suburbs. Route 72 provides direct access to the island from the Garden State Parkway.

Long Beach Island is one of several barrier islands along the New Jersey shore that provides access to pristine beaches for swimming, surfing, sunbathing, fishing, hiking, and other forms of active and passive recreation. The island is almost fully developed with residences, lodging units, and other services occupying most of the island. However, the beach is public property, and access is limited only by availability of parking.<sup>1</sup>

Holgate's expanse of undeveloped barrier beach and dunes provides opportunities for a variety of active and passive recreational uses. The beach offers several miles of pristine area for swimming, surfing, and sunbathing. In addition, the miles of beaches provide opportunities for hiking, birdwatching, and nature walks. Surf fishing is particularly good at the southern point where the waters of Great Bay and Egg Harbor meet the Atlantic. Striped bass and bluefish are targeted species in the spring and fall, and in summer flounders inhabit the shallow waters of the bay.

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<sup>1</sup> Under New Jersey law the state owns the tideland area between mean high water and the low water mark as a trustee for the public.

## Users

There are no data available on the numbers or characteristics of visitors to the Holgate Unit. However, because of the unit's isolation and distance from the rest of Forsythe NWR most of the visitors are likely to be local or seasonal residents from the island or nearby towns or visitors to the beach during the warmer months. Expenditure data for Holgate visitors is also unavailable.

## Capacity

There are no capacity restrictions on access to Holgate or the town beach. However, since parking is not permitted on-street and most visitors come by car, the capacity of the parking lot provides an effective constraint on the capacity of the beach area. The parking lot currently has space for 57 vehicles, including two handicapped spaces, but it is being expanded in 1998.

## **PLOVER MANAGEMENT OBJECTIVES AND RESTRICTIONS**

The FWS administers its wildlife refuges for the "protection, enhancement, and recovery of endangered and/or threatened species" (7 RM 2.1) and resolves conflicts between endangered species and other management or use programs in favor of endangered species (PRNWR, 1993). The piping plover was first added to the list of threatened and endangered species in 1986, and in the spring of 1988 the FWS implemented restrictions at Forsythe's Holgate Unit to protect plovers.

The Holgate Unit is an important refuge area in New Jersey for shorebirds and provides good habitat for piping plovers. Most plover pairs prefer to nest in the southernmost 0.75 mile of the island. Some birds also nest on nearby Little Beach Island, which is undeveloped. Beginning in 1988 the refuge manager initiated closures of public access to the Holgate Unit by pedestrians, ORVs, and boats from early April through late August 31. In the first two years, 1988 and 1989, only the lower 2.4 miles of beach was closed (about 0.33 mile remained open), but beginning in 1990 the entire 2.75 miles of the refuge were closed. Closures have ranged from 139 to 164 days, as shown in Exhibit 7-2. In addition, a small section of the beach on the western side around the point is closed in September and October to protect migrating shorebirds that occupy the area.

Before the refuge manager implemented closures in 1988, the beach area of the Holgate Unit was open to pedestrians, ORVs, and boats. ORVs were allowed to access Holgate on a trail at the edge of the dunes, but have always been excluded from the town beach during the summer season from June through August. Access to the dunes has always been forbidden to pedestrians and ORVs.

Since 1988 plovers have demonstrated moderate breeding success at Holgate Unit, but storms and predators have combined to constrain the number of nests and fledglings. Prior to the implementation of closures in 1986, seven pairs of plovers fledged 13 chicks, and in 1987 11 pairs fledged nine chicks. Breeding success reached a peak in 1991 and 1992 with 19 and 21 nesting pairs and 22 and 17 chicks fledged, respectively. Since 1992 breeding success has declined somewhat due to weather and predation. Over the period 1995 to 1997 the number of breeding pairs has ranged from 11 to 12 with numbers of chicks fledged ranging from seven to 14.

Exhibit 7-2			
Holgate Unit Closures, 1988-97			
Year	Closed	Opened	Days Closed
1988	April 15 (2.4 miles)	September 1	139
1989	April 15 (2.4 miles)	September 1	139
1990	early April (all, 2.75 miles)	~September 1	~140
1991	April 1 (all)	September 1	153
1992	April 1 (all)	August 27	148
1993	April 1 (all)	August 27 (1.5 miles)	148
		September 10 (all)	162
1994	April 4 (all)	August 28	146
1995	April 3 (all)	August 24	147
1996	April 1 (all)	August 28 (2.25 miles)	149
		September 12 (all)	164
1997	April 1 (all)	August 29	150
Source: U.S. Fish and Wildlife Service, Holgate Unit, Edwin B. Forsythe NWR.			

## ANALYSIS OF RECREATIONAL VISITS

New Jersey's seashore from Asbury Park to Cape May provides a wide array of ocean-based recreational opportunities for millions of visitors each year. Along this coast recreational opportunities abound, ranging from pristine, undeveloped beaches to highly developed beach areas with boardwalks, amusement parks, and even casinos in Atlantic City.

## **Long Beach Island and Environs**

Long Beach Island comprises five boroughs: Barnegat Light, Harvey Cedars, Surf City, Ship Bottom, and Beach Haven, and the Township of Long Beach. The Township of Long Beach actually comprises four non-contiguous areas on the island. The township and boroughs on the island have a permanent population of about 8,600. However, on peak summer weekends the total approaches 100,000.

Beaches extend the whole 18 mile length of the island, but access to most of these beaches is limited by availability of parking. The Township and boroughs operate their own public beaches. Access requires a beach badge, which sells from about three dollars for a day to \$15 to \$17 for the season. Each town/borough sells its own badges and these are not valid for beaches in other jurisdictions.

The Township of Long Beach operates four public beaches, including the beach adjacent to the Holgate Unit. Parking at the Township's public beaches costs three dollars per day, and the four parking lots have capacity for about 275 vehicles. Beach badges cost three dollars per day from mid-June through Labor Day, or \$15 for a seasonal badge.

In August 1987 wastes dumped at sea washed up on some New Jersey beaches. As a result, many vacationers abandoned New Jersey beaches for other states. The stigma of this pollution event affected the economies of most New Jersey shore communities toward the end of the 1987 season and for several years thereafter. The timing of this event overlaps the last year that Holgate was open during the summer and the first several years of closure, which makes analysis and interpretation of any existing data difficult.

The economy of Long Beach Island has also been affected by New Jersey's Coastal Area Facility Review Act (CAFRA) enacted in 1973 and amended in 1993 (N.J.A.C. 7:7, 1994). The 1993 Amendments significantly constrain the ability of homeowners and developers to build and expand properties in coastal areas, which includes Long Beach Island. The Act mainly affects expansions and alterations of houses or duplexes located on beaches or dunes or within 150 feet of the water line. It does permit rebuilding after storms. Nearly all of the developed properties on the island are situated on dunes and are therefore subject to CAFRA regulation. The Act's constraints on property expansions or alterations may affect property values and potential sales. Despite its desirable seashore location, the Township of Long Beach actually declined in population from 1980 to 1990, and CAFRA may be continuing to exert some negative impact property values and sales, but seasonal rentals continue to grow in revenue (Ken Smith, RE/MAX, personal communication).

### Visits to Holgate Unit, Edwin B. Forsythe NWR

There are no historical data for beach visits on Long Beach Island, since neither the towns nor the refuge compile data. The only data that exist are revenues from Township parking lots, but these data are not readily available. Nor do they pre-date the closure at Holgate. The Township official in charge of these parking lots remembered that in 1988, the first year they collected parking fees, collections at the Holgate parking lot amounted to about \$6,200. By 1997 collections at this lot had increased to about \$15,000 (Frank Pescatore, Township of Long Beach, personal communication). At three dollars per vehicle this is an increase from about 2,067 vehicles to about 5,000 vehicles per year over the ten year period when the Holgate unit was closed. However, there are no data prior to 1988 to assess usage prior to the closure of the Holgate Unit. Moreover, there is no basis for estimating how many visitors came to use the Township beach versus the refuge.

Similarly, there are no estimates of beach use by ORVs, but an examination of permit sales suggests that the Holgate closure may have acted to constrain potential growth in ORV license revenues. However, data problems preclude a formal quantitative analysis. Beach buggy (ORV) licenses cost \$50 per season. Exhibit 7-3 shows that in 1985 and 1986, license sales amounted to about \$39,000 in revenues, but declined to about \$32,000 in 1987 when beach pollution first affected tourism. In 1988 and 1989, after closure of the Holgate refuge, beach buggy licenses still accounted for over 30,000 in revenues. Revenues declined to about \$24,900 in 1990 in response to the recession. From 1991 through 1994 revenue totals remained at depressed levels. Embezzlement of licensing revenues by a Township employee during some of this period accounts for some of this revenue shortfall, but how much was taken over what period is not precisely known (Mary Ann Mayo, Tax Collector, personal communication). By 1997 revenues from beach buggy licenses grew to exceed pre-closure levels. Given the growth in the popularity of sport utility vehicles, one might have expected significant growth in beach buggy licenses in the last 10 years, and this lack of growth is probably some indication that closures at Holgate have resulted in some revenue loss to the Township.

Exhibit 7-3	
Township of Long Beach, Beach Buggy License Revenues, 1988-97	
Year	Revenues (\$)
1985	\$38,925
1986	\$39,600
1987	\$31,950
1988	\$30,100
1989	\$31,425
1990	\$24,903
1991	\$20,000
1992	\$18,900
1993	\$16,700
1994	\$21,875
1995	\$25,050
1996	\$25,300
1997	\$33,925

Note: 1) License funds are unaccounted for in 1992 and 1993. Financial irregularities may also affect collections from 1991 and 1994. For these reasons these data should be considered questionable.

Source: Tax Collector, Township of Long Beach.

## ECONOMIC IMPACT OF BEACH RESTRICTIONS

Evidence of the economic impact of closing the Holgate Unit refuge to pedestrians and ORVs from April through August must rely on qualitative information gleaned from interviews with public officials, business owners, and private citizens. In general, the consensus of various persons interviewed by telephone is that closures of the Holgate Unit have had negligible impact on the overall economy of Long Beach Island. However, some businesses at the southern end of the island nearest to the refuge appear to have suffered some loss in revenues in the spring when the closure of Holgate caused surf fishing anglers to seek substitute sites. In addition, the closures have prevented residents and vacationers from utilizing the refuge during the warmer months for fishing, hiking, birdwatching, and other activities with consequent effects of social welfare.

## **Overall Economic Activity**

Long Beach Island has a permanent population of about 8,600 which swells to over 50,000 on peak weekends in the summer months. The island supports 31 hotels and motels plus seven bed and breakfast inns (Southern Ocean County Chamber of Commerce, 12/10/97) and about 5,000 condominiums and other rental units. Overall, the island's hotels, motels, and other lodging facilities total approximately 6,000 units. In addition, the guide for "Places to Eat" lists 39 restaurants and other eating establishments on the island (Southern Ocean County Chamber of Commerce, 12/13/97).

The exact size of the Long Beach Island economy is not known, but a reasonable guess is that it amounts to roughly \$500 million per year. New Jersey Division of Travel and Tourism's Travel Research Program determined that in 1995 the island ranked eleventh of all New Jersey destinations and attracted about one million overnight visitors per year (Longwoods International, 1995; Jeanne DiPaola, Southern Ocean County Chamber of Commerce, personal communication). Overnight visitors to New Jersey stay an average of 3.2 days and spend about \$114 per person per day, which amounts to a total of \$365 million per year for the island. In addition, day trip visitors accounted for about 47 percent of the expenditures by travelers in Ocean County (NJ Division of Travel and Tourism, 1995). This would add an additional \$171 million for a total of about \$536 million annually. Gambling expenditures inflate the state average, and visitors to the island probably spend closer to \$500 million

## **Economic Impacts of Closing Holgate**

Evidence from data and interviews with town officials and business people indicates that the impact of closing the Holgate Unit refuge from April through August represents a negligible impact on the overall economy of the island. However, the Township of Long Beach and a few lodging and other businesses at the south end of the island may have suffered some loss in revenues.

What data there are for parking lot use at Holgate show a 250 percent increase since 1988, the year when the refuge manager first closed the refuge. A Long Beach public official stated that in his opinion the closure has had no effect on the overall economy of the island, although a number of residents and visitors, especially surf fishing anglers, have suffered (Frank Pescatore, Township of Long Beach, personal communication). Similarly, one of the realtors on the island reported that business is booming in sales and rentals and that the closure has had no significant impact on the overall business climate (Ken Smith, RE/MAX, personal communication). The Executive Director of the Southern Ocean County Chamber of Commerce felt that the primary impact of the closure of Holgate has been to prevent the island from developing an eco-tourism business based on the refuge and cited the failure of Black Skimmer

Tours, a start-up business that hoped to run birdwatching tours (Jeanne DiPaola, Southern Ocean County Chamber of Commerce, personal communication).

### **Impacts on the Township of Long Beach**

Data on revenues from beach buggy licenses revealed revenues of about \$33,900 in 1997 compared to nearly \$32,000 in 1987, prior to the closure of Holgate refuge. Data problems preclude a formal quantitative analysis of these data, but the growth in popularity in sport utility vehicles suggests that in the absence of Holgate's closure sales of these licenses might be expected to be higher now than ten years ago. How much revenue loss might be attributable to Holgate's closure is impossible to estimate. However, a town official suggested that if Holgate were opened demand would be so great it would probably be necessary to ration access (Frank Pescatore, Township of Long Beach personal communication).

### **Impacts on Lodging**

The summer season from Memorial Day to Labor Day accounts for 80 percent or more of revenues for most hotels and motels on the island. Closure of Holgate appears to have had little effect on business during this summer season. However, the closure at Holgate has had a negative effect on occupancy and revenues during the spring and fall for at least one south end motel. The owner of the Sea Spray Motel reported that prior to the closure he used to rent 90 to 125 room-nights from April through Memorial Day, primarily to anglers, but the closure of Holgate eliminated this business; at an average room rate of \$65 per night and loss of 100 overnights amounts to a shortfall of about \$6,500, or about five to 10 percent of the motel's annual revenues (Jeff Connor, Sea Spray Motel, personal communication).

The Jolly Roger Motel has existed at its current location adjacent to the Holgate parking lot for 18 years. The motel includes 12 units and a store, which sells food, beverages, and souvenirs to beachgoers. The manager stated that the closure of Holgate has mainly affected anglers; however, since the motel is endeavoring to attract more upscale customers, such as birdwatchers, the closure has had no impact on their business over the last several years (Michelle Cadmus, The Jolly Roger Motel, personal communication). The manager was unable to provide information on whether the closure affected business in 1988 and 1989.

Panzone's Pizza and Pasta Restaurant is located about two miles north of Holgate. The owner reported that the loss of angling customers has definitely hurt his business, but could not pinpoint an amount (Frank Panzone, Panzone's Pizza and Pasta Restaurant, personal communication).

The owner of Lorry's Island End Motel, which is located a few miles north of the refuge, reported that most of his revenues come from summer beach visitors and that the closure of Holgate has not affected this business (Mark Ross, Lorry's Island End Motel, personal communication). He did note that the motel's guests do use the town's public beach adjacent to Holgate, but do not seem to be affected by the closure. However, he has owned the motel for only a few years and is unable to compare the current market with that prior to the closure.

### **Impacts on Fishing Supply Businesses**

The best surf fishing on the island is at Holgate, and prior to 1988 a large number of local residents and visitors fished the waters near the tip of the island. With the closure of Holgate from April through August a significant number of serious anglers abandoned the island to fish at Brigantine and Island Beach. In addition, the closure precludes more casual summer vacation anglers from accessing the best site for catching flounder in the bay.

There are currently about 10 fishing supply businesses on the island, and all are probably impacted by the Holgate closure to some extent. However, the greatest effect is probably on the two bait and tackle shops located at Beach Haven Inlet nearest to Holgate: The Ancient Mariner and Jingle's Bait and Tackle.

The Ancient Mariner is the nearest bait and tackle shop to Holgate refuge; it is located about one mile to the north. After the refuge manager closed Holgate in 1988 the owner reported that his business declined by 30 to 50 percent, despite the sale and closure of a competing bait and tackle shop nearby (Bill Ohler, The Ancient Mariner, personal communication). It was nearly five years before revenues returned to pre-1988 levels. The business today is considerably different from pre-1988, relying more on off-shore and boat anglers and far less on surf fishing enthusiasts. Due to the lack of customers the owner now doesn't open until the end of May, whereas pre-1988 the shop opened in mid-March. He also reported losing a lot of summer vacation business from anglers who targeted flounder in the bay.

Jingle's Bait and Tackle is located about 3 miles north of Holgate and has existed in the same location since 1976. The owner reported that prior to 1988 the shop opened March 1 for the spring run of striped bass, but now the shop does not open until Easter, usually in mid-April (Margaret O'Brien, Jingle's Bait and Tackle, personal communication). She felt the closure of Holgate represented a significant loss in business to her enterprise, but she had no way to estimate the impact in dollars. However, Ms. O'Brien did report she had conducted an informal survey of anglers in 1988 after the closure and found that each angler spent about \$100 per trip on the island, an amount now lost to the economy of Long Beach Island.

Telephone calls to other fishing supply businesses further up-island did indicate that sales of surf fishing supplies have suffered from the closure. Fishermen's HQ, which is located about

mid-island, derives revenues from both charters and surf fishing sales. The owner estimated the loss in revenues attributable to the Holgate closure at about \$40,000 to \$50,000 per year, which amounts to about five percent of the business (Stan Kudnick, Fishermen's HQ, personal communication). The owner of Bruce and Pat's Bait and Tackle concurred that the closure at Holgate has cost them business, but could not quantify the effect in dollars (Bruce Hoagland, Bruce and Pat's Bait and Tackle, personal communication).

## **SUMMARY OF ECONOMIC IMPACTS OF PIPING PLOVER MANAGEMENT**

Closing the Holgate Unit at the south end of Long Beach Island from April through August appears to have had little impact on the overall economy of the island. This is because there are 18 miles of beaches on the island and the refuge represents a small percentage of the overall beach area with limited parking capacity. As a result, the popularity of the island as a beach vacation destination has been relatively unaffected by the closure.

The Township of Long Beach and the other five boroughs rely heavily on summer beach tourists, with millions of annual visitors generating roughly \$500 million in revenues annually. Most of the tourists come between Memorial Day and Labor Day, and the island's businesses capture a very high percentage of their annual revenues during this period. There are no available data that support evidence of any negative effect on the overall economy of the island. However, interviews with local officials and business people indicate that the elimination of ORV and pedestrian access to the refuge did affect some businesses, especially on the south end of the island.

Businesses serving anglers appear to have suffered the greatest impact. Comparable fishing areas do not exist on the island, and as a result of this closure, a significant number of surf fishing anglers abandoned Holgate to fish at Brigantine and Island Beach. As a result, most fishing supply businesses on the island probably suffered some loss in revenues. However, the two bait and tackle shops at the southern end of the island reported significant revenue shortfalls. One reported losing as much as 30 percent of their revenues for a number of years after the closures were implemented. In addition, some lodging establishment and restaurants near to Holgate also reported losing some business, primarily in the spring between March and late May. However, all of these businesses survived the closure and continue to be viable.

Data on beach buggy license revenues suggest that the closure of Holgate may have depressed license sales by the Township of Long Beach. Sales in 1997 are no greater than ten years ago despite considerable growth in the popularity of sport utility vehicles. However, problems with the data preclude a more precise estimate of any shortfall.

The closure of Holgate has also resulted in social welfare losses to both residents and visitors. Island residents, especially, have incurred a significant loss in utility, since the closure

likely means fewer ORV and pedestrian trips for fishing, birdwatching, hiking, and other uses. For surf fishing anglers, whether residents or visitors, lack of access to Holgate probably means fishing fewer days or traveling longer distances to alternate sites that may be less productive. For other beach users substitute sites are likely to be significantly less pristine and more congested.

In conclusion, there are insufficient data to quantify any economic impacts on output, employment, or earnings. However, anecdotal evidence from local town officials and businesses suggests that these impacts are probably negligible relative to the overall economy of the island. What losses there are appear to be attributable primarily to the loss of business from anglers. However, if reports are true that many of the surf fishing anglers have moved to Island Beach State Park or Brigantine, or other sites within Ocean County, then any economic impacts from loss of expenditures by anglers represent merely a geographical transfer of expenditures within Ocean County with no net loss at the county level.



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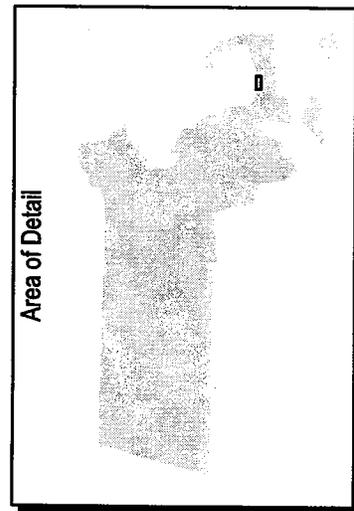
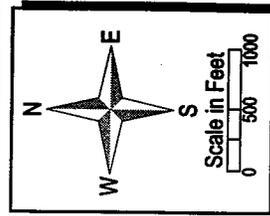
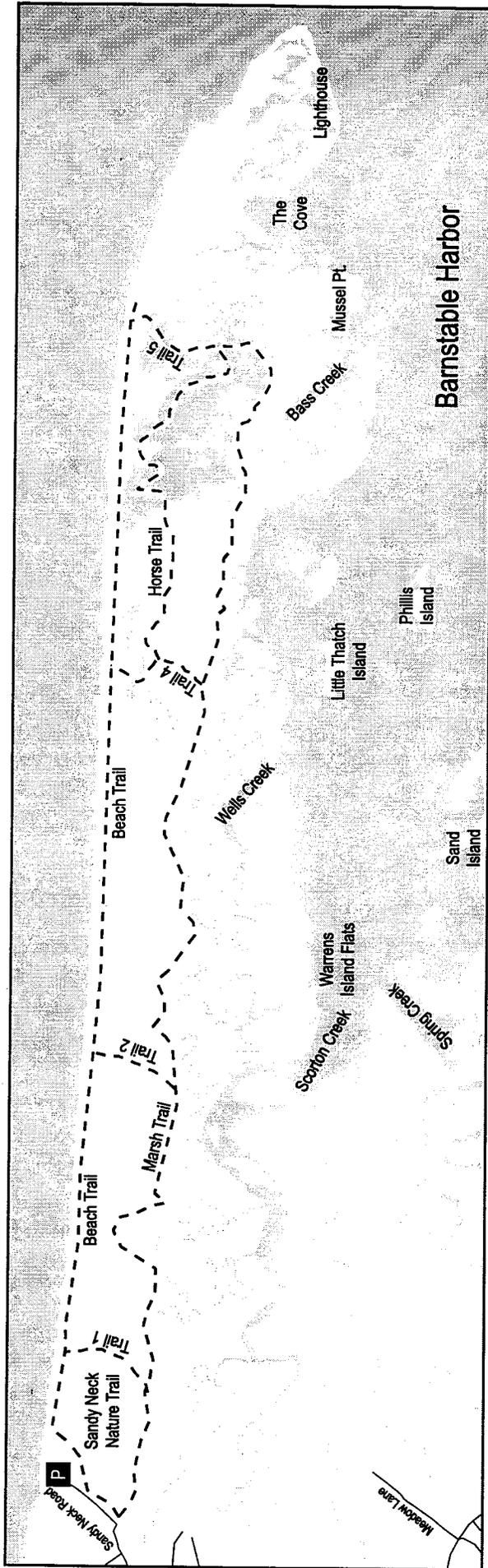
Sandy Neck is a barrier beach, roughly six miles in length, that extends eastward into Cape Cod Bay. The beach exists almost entirely within the boundaries of the town of Barnstable. The very westernmost portion extends into the town of Sandwich and is privately owned. The beach varies from 200 feet to one-half a mile in width, including a generous beach profile, a well-developed dune system, and shrub and pitch pine forest in some areas. An extensive marsh system thrives behind the beach. These are referred to as the Great Marshes, which eventually give way to Barnstable Harbor (refer to Exhibit 8-1). Prevailing winds and currents have elongated the beach slowly over time, as material has eroded from the outer beach and been deposited on the eastern tip.

Sandy Neck is a popular destination for beachgoers and ORV enthusiasts. A public parking area and ORV trail system provide access for swimmers, anglers and campers. In addition, the area is regarded as a unique and valuable research resource by local scientists and historians. Sandy Neck accommodates a diverse population of wildlife and vegetation, including nine endangered, threatened, or otherwise designated varieties.

Beach closures and access restrictions to abet piping plover recovery have been enforced at Sandy Neck since 1990. Nesting activity has increased substantially over the last six years, oftentimes leaving only one mile of available recreational area for much of the season. As a result, sales of ORV permits have declined significantly, and the Recreation and Human Services Department of the Town of Barnstable has had difficulty recovering beach management costs over the last several years.

The following sections examine trends in usage and access restrictions at Sandy Neck in an attempt to isolate those changes attributable to plover protection measures.

**Exhibit 8-1  
Sandy Neck Barrier Beach  
Barnstable, Massachusetts**



We then discuss the implications of these effects on the local economy, revenues to the Town of Barnstable and welfare of beach users.<sup>1</sup>

## **DESCRIPTION OF THE SITE**

Aside from the Cape Cod National Seashore, Sandy Neck is the largest barrier beach complex between Rhode Island and Cape Ann. In 1978 Sandy Neck and Barnstable Harbor were designated an Area of Critical Environmental Concern (ACEC) by the Massachusetts Secretary of Environmental Affairs (one of 22 ACECs in the state). In addition to the ecological services that it provides, Sandy Neck is recognized as a resource with significant cultural and historical value. Originally acquired in two purchases from Native American tribal leaders, Sandy Neck has since been the site of whale rendering operations, salt manufacturing and cranberry and salt hay harvesting. During the early 1900s hunters frequented the area and erected many "gunning camps;" many of these camps still exist. Although the entire area is considered a single site by the Massachusetts Historical Commission, there are several valuable archaeological features on Sandy Neck.<sup>2</sup>

Approximately 300 species of birds and 250 species of plants and flowers have been observed at Sandy Neck. White tail deer, foxes and coyotes are also common in the area. In addition, the area supports several threatened and rare species identified by the Massachusetts Natural Heritage Program such as the Diamondback Terrapin and the Eastern Spadefoot toad. Sandy Neck is an important nesting area for the Diamondback Terrapin, which, like the plover, lays eggs in the foredune area (typically twice a year, in May and again in August). ORV activity also interferes with terrapin nesting, causing females to engage in false nesting, increased chances of predation of migrating hatchlings, and increased chances of being directly crushed by vehicles. Biologist Peter Auger has performed considerable research on the Diamondback Terrapin on Sandy Neck, in part with the Sandy Neck Ecology Project, a research consortium organized under the direction of the Barnstable Public Schools.<sup>3</sup> Complementing a diversity of wildlife research, Sandy Neck has been utilized in several studies investigating barrier beach and marsh development.<sup>4</sup>

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<sup>1</sup> The authors wish to acknowledge Interim Chief Ranger, Steven Tucker and Assistant Town Accountant Mary Blake of the Town of Barnstable for their assistance in providing information and data for this chapter.

<sup>2</sup> All background information on Sandy Neck provided in this chapter is from materials provided by Steven Tucker, including the 1964 Sandy Neck Inventory and Plan, 1995 Management Plan, Sandy Neck Sentinel, Massachusetts Natural Heritage Program and Areas of Critical Environmental Concern information and other sources. For more information on Sandy Neck cultural resources refer to Dunford, Frederick J., "A Management Plan for the Cultural Resources of the Sandy Neck Conservation Area, Barnstable, MA", December, 1982.

<sup>3</sup> For example, Auger, P.J., Principal Investigator, "On the Fringe of Existence", 1982.

<sup>4</sup> For example, Redfield, A.C., "Development of a New England Salt Marsh", 1971; Heteren, S.V. and Plassche, O.V., "Influence of Relative Sea-Level Change and Tidal-Inlet Development on Barrier-Spit Stratigraphy, Sandy Neck, Massachusetts", 1997.

## **Beach Attributes, Users, and Capacity**

Sandy Neck offers abundant recreational opportunities. With the appropriate permits, ORV access and overnight camping (with properly outfitted vehicles) are permitted on the beach. Striped bass, bluefish, mackerel and flounder are popular sportfishing species available in the surrounding waters. In addition, soft shell clams, quahogs, mussels and sea clams are available for both recreational and commercial harvest, although the predominant portion of shellfishing activity is recreational.<sup>5</sup> Finally, the area offers migratory waterfowl and pheasant hunting in season. Beach managers have also organized controlled deer hunts in the past.

Beach amenities are located adjacent to the access road and parking lot and include a concession area and bathhouse (this area is known as Bodfish Park). Lifeguards are on duty during the months of July and August and recently a ramp and observation deck were constructed to provide beach access to the physically challenged. Additional recreational activities enjoyed on Sandy Neck include birdwatching, horseback riding and berry picking.

Approximately 30 cottages are clustered on the eastern tip of Sandy Neck, both privately owned and leased. Some are used as summer residences and others purely for recreational purposes. A supplemental ORV trail (which borders the marsh, on the lee side of the barrier) provides access to the cottages during plover nesting periods. Also near to the colony of cottages is a lighthouse dating from 1857; it is currently privately owned.

In addition to the research efforts described previously, educational tours and interpretive work are encouraged at Sandy Neck. The town owns a "Conservation Camp" which is used primarily by high school and college biology students. In addition, a "self-guided" interpretive trail is currently being constructed.

All access to Sandy Neck is through a gatehouse at the end of Sandy Neck Road which is staffed throughout the year. A paved parking area adjacent to the beach accommodates approximately 180 vehicles. During the summer months, demand regularly exceeds capacity in the parking lot. ORV capacity is currently 550 vehicles. In the past limits have ranged from 500 to 600 vehicles.<sup>6</sup>

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<sup>5</sup> All persons must have a valid shellfishing permit administered by the Town of Barnstable.

<sup>6</sup> The maximum number of vehicles allowed on the beach at a given time when the entire beach is open.

## **Administration of the Resource**

In 1981 an Act of State created the Sandy Neck Governing Board (SNGB) and vested in it managerial authority and jurisdiction of the area. As such, the Sandy Neck Rangers became their own entity within the town of Barnstable. Conflicting interests among board members led to significant debate regarding the appropriate management of the resource during the mid 1980s. The reconciliation of recreation and conservation agendas received considerable attention in local press.<sup>7</sup> In 1990, as part of a general town reorganization, Sandy Neck administration was incorporated into the town Department of Natural Resources. Also at this time, the structure of Barnstable's town government changed from a "Board of Selectmen" to a town council and town manager. Later, in 1994, Sandy Neck operations were reassigned to the town Department of Recreation and were reduced to a "section" (a division of the department). The Sandy Neck Division currently includes several year round staff, as well as a number of seasonal rangers and gate attendants.

## **Summary of User Fees and Permits**

Sandy Neck administration accrues revenue in three principal areas: from the sale of ORV permits (and collection of daily and camper fees), fees collected for parking in the Bodfish Park area (parking stickers for all town beaches are also offered by the Town of Barnstable) and from the leasing of aforementioned cottages on Sandy Neck. ORV permits may be acquired on an annual or seasonal basis and are differentiated by resident and non-resident status. Exhibit 8-2 summarizes relevant permits and fees for the years 1986 to 1996.

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<sup>7</sup> See for example, "Old Feud Divides Sandy Neck Board- It's Recreation versus Conservation," The Register, August 1, 1991.

Exhibit 8-2								
Summary of Sandy Neck Permits and Access Fees, 1986 - 1996								
Year	Annual ORV		Seasonal ORV		Daily Fee		Camper Fee	
	Resident	Non-Resident	Resident	Non-Resident	Resident	Non-Resident	Resident	Non-Resident
1986	\$20.00	\$40.00	NA	NA	NA	\$2.00	\$2.00 - \$6.00	\$2.00 - \$6.00
1987	\$30.00	\$60.00	NA	NA	NA	\$2.00	\$4.00 - \$12.00	\$8.00 - \$24.00
1988 to 1990	\$30.00	\$60.00	\$15.00	\$30.00	NA	\$2.00	\$4.00 - \$12.00	\$8.00 - \$24.00
1991 to 1996	\$40.00	\$80.00	\$20.00	\$40.00	\$1.00	\$2.00	\$5.00	\$10.00
<p>Note: Seasonal permit is valid from Labor Day to April 15. Reduced cost permits are offered to cottage owners and residents of the town of Sandwich. An additional fee is also assessed for horse registration (not mentioned above). Daily parking at Bodfish park is currently \$10.00 per weekend day and \$8.00 per weekday; residents may acquire annual stickers to waive this fee.</p> <p>Source: Sandy Neck Barrier Beach Regulations, 1986 - 1996.</p>								

## PLOVER MANAGEMENT OBJECTIVES AND RESTRICTIONS

Sandy Neck has been the site of the longest running piping plover study in the country. In 1982, Eric Strauss, in pursuit of his doctoral degree from Tufts University, began to investigate the effects of human disturbance on plover productivity. In 1986 predator exclosures were constructed on the beach; formal ORV closures began in 1990.<sup>8</sup> Dr. Strauss utilized the privately owned westernmost portion of the beach as a control site to measure human influence on nesting on the larger, public portion. Since the implementation of the closures, the number of nesting pairs on Sandy Neck has increased by a factor of five, while no significant increase has occurred on the western portion (confirming Dr. Strauss's hypotheses regarding the deleterious effects of human and ORV intrusion on nesting areas).

Piping plover protection at Sandy Neck is administered pursuant to Natural Heritage and Endangered Species Program (an agency of the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement) guidelines and ultimately the guidelines established in 1996 by the Atlantic Coast Piping Plover Recovery Team and the U.S. Fish and Wildlife Service. The state has established an abundance objective for Sandy Neck of 67 pair; this represents the second most aggressive goal in Massachusetts (second only to an objective of 96 pair on South Monomoy Island). Exhibit 8-3 provides information on the number of pairs, nests and fledged chicks over time at Sandy Neck.

<sup>8</sup> These closures do not apply to pedestrian access.

Exhibit 8-3			
Piping Plover Activity at Sandy Neck Beach, 1982 - 1996			
Year	Number of Pairs	Number of Nests	Fledged Chicks/Pair
1982	3	3	0.00
1983	8	8	0.38
1984	14	14	0.36
1985	10	14	0.50
1986	6	12	0.00
1987	7	12	0.00
1988	3	6	0.33
1989	5	5	2.00
1990	5	5	1.40
1991	5	6	2.80
1992	10	12	2.10
1993	15	15	2.46
1994	18	19	2.11
1995	25	33	1.96
1996	29	31	2.55
Source: Town of Barnstable			

Plover nesting on Sandy Neck is typically initiated on the eastern portion of the beach. As population increased, nesting pairs expanded westward. Because habitat is less suitable and human disturbance more frequent on the western portion of the beach, nesting in that area is typically less successful. This configuration is beneficial with respect to beach access in that the closures expand from east to west incrementally. However, as the westernmost pairs require a greater degree of protection and are the last to fledge chicks, these latter nests often preclude access to the rest of the beach, even if chicks have been successfully fledged on eastern portions.<sup>9</sup> In the past, the area available to ORV users has been reduced to as little as one mile. The duration of closures has ranged from 22 to 53 days in the past four years. Typically this period encompasses the fourth of July (historically the busiest weekend for camping and overall visitation) and in some years closures have remained in effect beyond Labor Day (the second most popular weekend).

## ANALYSIS OF ORV PERMIT SALES AND VISITATION

During the 1980s, Sandy Neck experienced rapid growth in ORV permit sales and trips. Growth rates in trips reached 45 to 50 percent in some years (The Register, 1985). Peak volumes were experienced in 1989. Visitation and permit sales began to decline after this point, in part due to increased fees, more stringent regulations and general economic downturn (The Register, 1992). The advent of plover restrictions in 1990 has

<sup>9</sup> Vehicles cannot travel around and therefore beyond nests.

further contributed to this decline. Due to the relatively high cost of ORV permits, families and individuals are likely to choose one beach to patronize for a season. Because the accessible area at Sandy Neck is now limited for much of the season and conditions are crowded, many of these patrons have abandoned Sandy Neck and are likely purchasing permits elsewhere or switching to other modes of recreation. Due to accounting and administrative changes, it is not possible to assemble a complete series of ORV permit revenues or trips over the period of the closures. However, certain statistics indicate that significant changes in visitation and revenues have occurred over the last several years. For example, between 1991 and 1992, the number of ORV trips at Sandy Neck declined by 38 percent. This was followed by a decline of 10 percent between 1992 and 1993. In 1995 this trend began to change, as vehicle usage grew roughly two percent between 1995 and 1996. However, as of 1997 ORV trips and permit revenues remain at about half of their peak levels in the late 1980s.

## **ECONOMIC IMPACT OF BEACH CLOSURES**

Although insufficient data exist to establish a statistical relationship between the access restrictions implemented at Sandy Neck and the coincident decline in ORV permit sales, anecdotal evidence suggests that the two are indeed causally related. This reduction in permit sales and number of ORV trips to the area may have manifested itself in two types of economic impacts. The first involves the consequences of decreased revenues to the town of Barnstable and more specifically, the Sandy Neck Division of the Recreation Department, the entity responsible for management of the resource. The second type of impact is the effect on the economy in the area surrounding Sandy Neck. As described in Chapter 3, reductions in visitation and subsequent expenditures can have multiplicative effects on output and employment in a given area. The following sections address each of these potential impacts.

### **Implications of Lost Revenue to the Town of Barnstable**

Three years ago the Barnstable town council set "recovery objectives" for departments that required the Sandy Neck division to become fully self-sufficient. As a result of declining permit revenues, which comprise the predominant portion of total revenues, the Sandy Neck division has been unable to recover its management costs over the last several years.<sup>10</sup> In the past three fiscal years, recovery rates have been 63, 76 and 86 percent, respectively. Although improving, this shortfall has imposed constraints on the division.

These cost recovery problems have contributed to pre-existing budgetary issues (namely the shuffling of administrative authority and funding) and resulted in dramatic

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<sup>10</sup> For example, in the last three years, ORV fees have constituted roughly 65 to 75 percent of total revenues to the Sandy Neck Division.

reductions in staff available to the Sandy Neck division. During the peak years of visitation in the late 1980s, management responsibilities were spread over nearly double the current number of gate attendants and rangers. During that time, staffing was sufficient to maintain 24-hour oversight of the beach year round. Today, only an eight hour shift can be maintained. This raises concerns among the rangers about the ability to respond to emergency situations and effectively enforce beach regulations (including plover and other rare species legislation).

### **Impacts on the Local Economy**

The beach closures at Sandy Neck appear to have had little effect on the local economy in Barnstable and adjacent areas. Several factors support this conclusion. First, there is evidence of some decline in ORV visits since the advent of closures, but pedestrian visits appear unchanged. The closures at Sandy Neck do not infringe upon pedestrian usage, and evidence of full parking lots throughout most of the summer indicates that pedestrian usage is unaffected by the closures. Pedestrian users, in fact, may be experiencing some increase in utility attributable to reductions in ORVs on the beach.

The second factor is that the area surrounding Sandy Neck is primarily residential. Thus, there are few local proprietors affected by any loss in spending by ORV visitors. Those possibly affected include food stores, gas stations and tackle shops.

Third, ORV users displaced by closures at Sandy Neck have substitute sites available within Barnstable County, which comprises Cape Cod. Nauset Beach on the southern portion of Cape Cod National Seashore is perhaps the closest (physically and geographically) substitute. In addition, there are ORV accessible areas on Race Point near Provincetown. More distant substitutes outside the county are in Plymouth (although no overnight camping is allowed in Plymouth) and Duxbury.<sup>11</sup> These sites are likely absorbing most of the supplanted visitors to Sandy Neck. Where visitation and spending are redirected at sites on the Cape (within the county), economic impacts represent merely a redistribution effect with respect to consumer expenditures.

In general, Cape Cod is characterized by high demand for recreation in the summer months (perhaps best evidenced regularly by the miles of cars backed up at the Bourne and Sagamore bridges leading on Cape Cod). Because trips lost to Sandy Neck are likely compensated for by visitation and expenditure elsewhere in Barnstable County (which includes all of Cape Cod), net regional economic impacts associated with access restrictions at Sandy Neck are likely to be negligible.

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<sup>11</sup> Don Fillman, Sandy Neck Representative of the Massachusetts Beach Buggy Association, suggests that the greatest number of displaced ORV trips are those otherwise taken by persons within a one hour (travel time) radius of Sandy Neck.

## **WELFARE EFFECTS OF BEACH CLOSURES**

To compensate for reductions in accessible area at Sandy Neck, managers have allowed increased numbers of ORVs on the beach, effectively doubling the density of vehicles. In addition to ORV, fishing and camping trips displaced by the closures, there is likely some loss in welfare to beach users associated with this increased congestion (and diminished aesthetic experience). Patrons of Sandy Neck may be inclined to favor other beach areas offering similar attributes and recreational opportunities, thus mitigating some of the welfare losses. However, to some (particularly inhabitants of the local area) Sandy Neck is likely a unique destination. As discussed previously, pedestrian users may in fact accrue some welfare gains as a result of the beach closures due to decreased vehicle traffic.

## **SUMMARY OF ECONOMIC IMPACTS OF PIPING PLOVER MANAGEMENT**

The advent of beach closures on behalf of the piping plover at Sandy Neck beach has exacerbated existing administrative problems for the Sandy Neck division of the Barnstable Department of Recreation. To the extent that these closures impose further budgetary constraints on the division (or some redistribution of funds within the town does not occur), managerial capacity may be further compromised.

Closures are also likely to result in some loss in welfare to ORV beach users, in two areas: 1) visitors displaced or incurring greater travel time and costs to visit a substitute site, 2) loss associated with a diminished experience due to crowding on the beach. These losses may be mitigated to some extent by welfare gains accrued to pedestrian users, who now enjoy more amenable beach conditions.

A final category of effects worthy of note is potentially adverse ecological effects associated with the concentration of human impacts in a small area of the beach during closures. To the extent that this increase in density has caused increased erosion, this may be manifested in management difficulties in the future.

Interim Chief Ranger, Steven Tucker is optimistic that increased merchandising opportunities and promotion of nonconsumptive recreation at Sandy Neck may improve revenues in the future.<sup>12</sup> Despite this diversification (which ultimately may require further staffing in the division to implement successfully), traditional recreational and ORV permit revenues constitute a significant and perhaps indispensable portion of total revenues. To the extent that plovers continue to expand their nesting area westward on the beach and render further closures necessary, generating sufficient revenue to maintain the area will become increasingly difficult, if not impossible without budgetary reallocation within the town government.

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<sup>12</sup> Concessions and other programs contributed over \$6,000 in revenues in FY 1997.

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