

AN ASSESSMENT OF THE GAME MAMMALS
AND BIRDS AND SMALL MAMMALS OF
THE PINELANDS

Prepared for the
NEW JERSEY PINELANDS COMMISSION

by
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EXECUTIVE SUMMARY

The game, furbearing and small mammal species of the Pinelands are a valuable resource to the region as well as the state as a whole. The existence of these species in the Pinelands of New Jersey provide a great deal of recreation and economic benefit to the residents of the state. In addition they are an integral part of the ecosystem. A planned approach to human utilization of the Pinelands will assure the continued availability of these wildlife related values. As open space is lost in other areas of the state, the full potential of this resource in the Pinelands will become increasingly apparent. The maximization of wildlife-oriented benefits can only be accomplished through habitat protection, active wildlife management and progressive management of human use of the resource. The utilization of the wildlife resource will not conflict with other economic, cultural, aesthetic and ecological factors identified as being valuable by the Pinelands legislation.

VALUES

The area designated as the Pineland region is the largest contiguous area of open space found in New Jersey. In a highly urbanized state like New Jersey with a current population of approximately 7.4 million, open space for recreation is a very important resource. The Pinelands area is composed of a mosaic of ecological habitats and surface waters of very high quality. These two features of the Pinelands result in a diverse group of wildlife and make the Pinelands a very desirable area for both consumptive and nonconsumptive recreation. Currently

62 game or furbearing animals and 19 nongame small mammals are found in the Pinelands region. The high quality of the surface water creates areas in the Pinelands which are extremely attractive to migratory waterfowl and aquatic furbearers.

The game and furbearing wildlife of the Pineland region have traditionally provided a considerable amount of recreational and economic benefit to area residents as well as to residents of the entire state. Historically, the residents of the Pinelands have based their livelihoods on the natural resources of the region, i.e., bog iron, firewood, blueberries, etc. Hunting and trapping played an integral part in this culture. These pursuits have changed from being a necessary subsistence activity to more of a leisure time pursuit. There does, however, still remain a section of the population which derives a portion of their annual income and food from hunting and trapping.

Besides these traditional wildlife related activities, other non-consumptive activities such as nature observation, nature study, and nature photography have become important uses of the wildlife resource. All of these activities generate economic benefit either directly (through the sale of wild fur) or indirectly (through the purchase of equipment, travel cost, rental fees, food and lodging costs).

Residents of the state annually spend an average of \$27.9 million pursuing wildlife oriented recreation in the Pinelands (US FWS 1977). Hunters and trappers spend approximately 65% of this money; non-consumptive utilizers of the resource (nature observers and photographers) spend approximately 35% (Hahn 1977, Penkala 1977). The trapping of furbearers in the Pinelands region annually provides an income of approximately \$902,000 from the sale of raw furs (Hahn 1977).

Almost 1 million residents statewide pursue their outdoor avocation in the Pinelands region. Of this total an estimated 100,000 hunt and trap and an estimated 900,000 are involved in wildlife observation activities. These persons expend an average 5 million recreation days each year.

These figures reflect the current value of this open space in terms of recreation days and dollar value. However, it is hard to evaluate the true worth of a day spent afield. Surely, a day spent away from the pressures of today's fast paced society has benefits far beyond the monetary value indicated.

OVERVIEW GUIDELINES

Wildlife values can be protected and maintained through the following actions:

1. Protection of wildlife habitat and open space.

Justification: To exist wildlife needs food, water, cover, and living space. The combination of these factors are called "habitat". In general the greater quantity of habitat available, the greater the wildlife resource available.

2. Protection of unique habitats or those in short supply.

Justification: Certain of the habitat types found in the Pinelands are unique or in short supply. Because of the scarcity of these habitats, the wildlife associated with them are in precarious position. Therefore, these habitat types should be given a high priority for protection.

3. Lowland areas (those with a shallow water table) should be given a priority for protection.

Justification: In general lowland areas in the region are in short supply and support a greater diversity of wildlife species than upland areas.

4. Environmental quality should be maintained.

Justification: The ability of a given habitat type to support wildlife can be greatly affected by environmental quality. Factors such as air and water quality are examples of significant environmental quality factors.

5. Vegetational diversity should be maintained.

Justification: the faunal diversity of an area is a function of the vegetative diversity. Additionally, the interface between two different habitat types commonly called "edge" is an area where faunistic diversity normally reaches its maximum. Species diversity has been identified as an important component of ecosystem stability and an important dimension of recreational use.

6. Maintain wildlife populations at levels compatible with the carrying capacity of the habitat available.

Justification: Negative human-wildlife interactions usually occur at times when the population level of a given species exceeds the carrying capacity. These negative interactions can take the form of destruction of agricultural crops and personal property and diseases which may be transmitted from wild animals to man and his domestic animals. In addition, populations which are above carrying capacity can cause long term damage to their habitat and adversely affect the populations of other species.

7. Encourage compatible land uses.

Justification: A variety of land uses are compatible with the perpetuation of wildlife and provide additional economic benefit. This approach of multiple use insures that the maximum benefit will be derived from the land.

8. Human use and understanding of the wildlife resource of the Pinelands should be promoted.

Justification: The wildlife resource of the Pinelands can provide a multiplicity of benefits to the residents of the state. There is a current demand for wildlife-oriented recreation that will increase in the future. Full realization of the potentials of this resource will be aided through a better public understanding of the role of wildlife in the Pinelands.

9. The cultural role of wildlife in the Pinelands should be maintained.

Justification: Wildlife has played an important role in the culture of the Pinelands. This particular dimension of life in the Pines should be perpetuated.

10. Areas of public open space should be expanded.

Justification: The state, federal and local governmental agencies will have to provide recreational opportunity when the private sector cannot.

11. Promote research concerning the wildlife of the Pinelands and their habitat. Research into the human dimensions and wildlife management should be promoted.

Justification: Better protection of the wildlife values of the Pinelands can be accomplished through a better understanding of the ecosystem. Changes over time in the habitat and human use of the area will necessitate continued research to meet the information needed to properly manage such a dynamic system.

JUSTIFICATION

1. Wildlife habitat and areas of open space owned by the private sector should be protected through land use controls whenever possible. In particular the use of zoning, the purchase of easements, and extension services to the land owner should be employed to protect wildlife habitat. Zoning can be used to discourage development in sensitive areas (lowland forest, cedar bogs, etc.) and encourage cluster development in suitable upland sites. In areas where zoning is not suitable, the purchase of easements could be used to limit development on areas of open space.

Extension agencies should be encouraged to contact land owners and provide information on improving their land in terms of wildlife habitat. These improvements in habitat could increase the potential wildlife-oriented recreation and economic benefits available to the land owner.

2. Development should be prohibited in habitats which are unique or in short supply. This can be accomplished through appropriate land use controls. Other activities such as agricultural and forest management should be carefully evaluated to determine their impact on the unique or rare habitat. Offsite activities which would significantly change the ecology of the habitat in question or endanger the environmental quality of the habitat should be prohibited. An example of a unique habitat type would be the pygmy forest, an example of a habitat in short supply is the cedar swamp type.

3. Development in lowland areas should be prohibited. This can be accomplished through appropriate land use controls. Offsite activities which would adversely affect environmental quality in lowland areas should be prohibited. A buffer zone surrounding lowland habitat types should be established. The size of this zone should be sufficient to protect the ecological integrity of the area.

4. The environmental quality of Pinelands should be maintained at its present level. Zoning ordinances should be drawn which would limit the types of development which would have adverse effects on the air and water quality. It is recommended that environmental impact statements be required for any major development within the Pinelands region. The maintenance of environmental quality of the Pinelands region will insure the health of the wildlife populations of the area.

5. The vegetational diversity of the Pinelands in areas of extensive monotypic upland forest should be increased. These large tracts of upland habitat support relatively low populations of wildlife since they produce very little food and cover. The use of established wildlife management concepts on areas throughout the Pinelands both privately and publicly owned would increase habitat diversity. In particular fire, clearing, mowing and buffer zones should be used as methods of delaying succession in the stages most valuable to wildlife. Fire has historically been a major factor in the development and maintenance of the Pinelands. Fire is a cost effective method of delaying succession and producing browse, edge and cover while reducing major fire hazards by reducing fuel accumulations.

Buffer zones maintained around sensitive environmental areas through zoning and easements also increase vegetational diversity.

6. Population levels should be controlled through regulated hunting and trapping. When agricultural damage is excessive and for situations in which species which are not hunted or trapped are involved, special control measures should be permitted. Special control measures to protect private property and the public health and to enhance forest production should also be permitted. Hunting, trapping and special control measures should be in accordance with the Fish and Game Code and statutes. Programs to reestablish indigenous species, such as the wild turkey, should be encouraged. The introduction of exotic wildlife should be prohibited unless no adverse environmental impact can be demonstrated.

7. Compatible land uses such as agriculture, forest management, and outdoor recreation should be encouraged in appropriate areas of the Pinelands. These activities often increase wildlife habitat and food while providing both recreational and economic benefits. These land uses have historically been important to the economy of the area and should be encouraged to continue.

Agriculture on suitable areas provide edge habitat as well as food for wildlife. Certain agricultural practices provide acres of valuable wetland habitat through irrigation systems and cranberry bogs.

Lumbering in most of the upland forest areas provides edge, browse and cover in otherwise poor wildlife habitat. All lumbering operations should be monitored by the state forester assigned to the area. The state forester will limit lumbering activities so that areas of critical habitat (cedar bogs, forested areas critical to the watershed, etc.) are not permanently disturbed in any way.

Housing should be encouraged to be of the cluster type so that large acreages of huntable land will not be eliminated by scattered dwellings. Wherever feasible from a fire hazard standpoint, native vegetation should be allowed to remain surrounding housing development.

Outdoor activities such as camping, canoeing, hunting and trapping should be encouraged since they have great recreation and economic potential while having little adverse effects on the habitat or wildlife. The practice of stocking pheasant and quail on state wildlife management areas should continue since these areas are subject to intensive recreational pressures. These stocked birds provide additional recreation where the native fauna would only provide limited opportunity.

8. The human use of the wildlife resources, both consumptive (hunting and trapping) and non-consumptive (nature observation and photography) should be encouraged. Proper access to the Pinelands should be provided for (roads, parking areas,

boat ramps, etc). The recreational value of the natural resources of this area would be greatly diminished if they are not accessible to the residents of the state. The potential of this area for wildlife-oriented recreation and education is almost unlimited. At the present time, the opportunity for consumptive wildlife recreation is regulated by the Division of Fish, Game and Wildlife. Each year the Division determines the season lengths and bag limits on the game species of the state.

The use of the Pineland region as an outdoor classroom should be encouraged. The educational potential of this area with its unique flora and fauna is unlimited. Resources should be allocated to provide educational materials on the Pinelands to interested educators statewide.

9. Historically, the wildlife of the Pinelands has been utilized by the residents of the region to supplement their diets and incomes. Even though today, hunting and trapping are largely recreational activities, there is still a segment of the population that depends on these activities for food and income. It is recommended that the cultural heritage of hunting and trapping be perpetuated. These activities should continue to be carried out during prescribed seasons and with bag limits set by the Division of Fish, Game and Wildlife. The Division shall continue to determine season lengths and bag limits in accordance with its policy to maintain healthy wildlife populations that the habitat can comfortably support.

10. The system of public open space in the Pinelands should be expanded. More specifically, the wildlife management area system should be expanded. Expected increase in demand for outdoor recreation would justify the approach. The minimum size of wildlife management areas in upland areas should be 2,000 acres. Experience has shown this size to be the smallest area on which to effectively manage wildlife and establish a sound recreational program. There is no minimum size on

wildlife management areas in lowland areas. Lowland areas are in short supply and provide a greater amount of recreational opportunity. Areas with existing facilities (roads, parking areas, boat ramps, etc.) should be given high priority. The presence of these existing facilities low initial costs of recreational development on the area. Areas of diverse habitat should be given priority because of their high recreational values. Buffer zones of one-half mile around wildlife management areas should be maintained. Experience has shown that this is a reasonable buffer to eliminate conflicts between area users and adjacent property owners.

11. Research should be conducted to investigate several facets of the wildlife resource of the Pinelands. Public use of wildlife in the Pineland should be surveyed by methods yet to be developed. The survey should determine levels of utilization and discover ways in which present and future demands on the resources of the area might be better met.

Also, in-depth species and habitat specific research projects should be designed and conducted to better ascertain the intricacies of the ecology of the habitats and fauna of the Pinelands. Understanding the interrelationships of the wildlife resources will better facilitate the management of the wildlife resource.

The game and furbearing wildlife species of the Pinelands have played an important role in the human history of the region (Regensburg 1978, Burke et al. 1978,) as well as in the formation of the ecosystem recognized as the Pine Barrens.

The pursuit of game for food and the pelts of furbearing animals were critical subsistence activities for both aboriginal and early occupants of this region. Certain impacts of wildlife species on the vegetative community, such as deer (Odocoileus virginianus) on white cedar (Chamaecyparis thyoides) have been documented (Little et al. 1958). The Pinelands have had a hand in shaping the wildlife community and the wildlife has played an equal role in shaping the Pinelands.

In modern times the pursuit of game and furbearing species has become primarily a recreational activity. At the same time the ranks of hunters, trappers and fishermen have been joined by a new and ever increasing group of utilizers of the wildlife resource, namely the bird watcher, nature observer, and wildlife photographer. The wildlife resources of the Pinelands generate millions of man-days of wildlife oriented recreation each year. These activities result in the expenditure of tens of millions of dollars annually. These recreational and economic benefits are not only realized by residents of the region, but by residents of the entire state.

While these figures are impressive, they are only a small portion of the potential recreation and recreationally related economic benefit derived from the wildlife resources of New Jersey's Pinelands. Future predictions are

for an almost geometric growth in the demand for outdoor recreation (New Jersey D.E.P. 1977). With this increased demand and the loss of open space in other areas of the state the wildlife resources of the Pinelands will become even more valuable to residents of the state.

Wildlife is not always a positive component of the system. Wildlife damage to agricultural crops can be devastating. Wildlife harbored diseases also pose serious threats to man and his domestic livestock.

The balancing of human and wildlife interactions and activities to minimize negative effects and maximize positive benefits are accomplished through the art and science called Wildlife Management. The realization of the total potential of any natural resource is only accomplished through careful management.

Game species are those birds and mammals which are hunted for food and sport. Furbearer refers to those mammals which are sought for their pelts which are used in the manufacture of garments. In the Pinelands there are 18 mammals which fall into these two categories. Under current regulations (N.J. Division of Fish, Game, and Shellfisheries 1978), five species are hunted only, five are trapped only, four are both hunted and trapped, and four are protected. Forty-four species of birds are hunted. All but four of these species are migratory. The order Anseriformes contains the largest number of species which are hunted in the Pinelands. This group includes the ducks, geese, and swans.

2.1 Species Status

The status of the game species will be listed in two forms. The first will be a relative indicator of the population level of the species in the Pinelands. The second will indicate the status of the species relative to the 1978-79 Game Code (N.J. Division of Fish, Game and Shellfisheries 1978).

Definition of Population Status Designations

Abundant: The species reaches its highest population levels in the Pinelands when compared to other areas of the state. Population levels are in number of individuals of a given species per unit area.

Common: The species population is at a population level consistent with the habitat available in the Pinelands but the density per unit area found in the Pinelands is exceeded in other areas of the state.

Uncommon: The species population level is below the potential of the Pinelands habitat to support it or because of a scarcity of habitat the species is rarely encountered.

Peripheral: The species reaches an extreme of its distribution in the Pinelands. The species may be uncommon to abundant. The peripheral designation will be used in conjunction with a second status designation.

Extirpated: Those species which have occurred in the Pinelands within the last 300 years but no longer occur there. These species exist in other areas of their range.

Accidental: This designation will be used primarily for the status of the anseriforms. It will be used to designate species whose normal range is not in the Pinelands. These species are usually accidental visitors during migration.

Definition of Game Code Status Designation

Hunted: Species which it is currently legal to hunt for and reduce to possession. These species are commonly called game species.

Trapped: Species which it is currently legal to trap for and reduce to possession. These species are commonly called furbearers.

Protected: Species for which hunting or trapping is not currently permitted but which have historically been hunted or trapped for.

2.1 Species List

Game Mammals of the Pinelands

<u>Marsupialia</u>	<u>Population Status</u>	<u>Game Code Status</u>
Opossum Didelphis virginiana	C	H+T
<u>Carnivora</u>		
Raccoon Procyon lotor	C	H+T
Longtailed weasel Mustela frenata	C	T
Mink Mustela vison	C	T
River otter Lutra canadensis	C	P
Striped skunk Mephitis mephitis	C	T
Red fox Vulpes fulva	C	H+T
Grey fox Urocyon cinereoargenteus	A	H+T
Black bear Ursus americanus	Ex	P
Bob cat Lynx rufus	Ex	P
Eastern coyote Canis latrans	P	P
<u>Rodentia</u>		
Grey squirrel Sciurus carolinensis	C	H
Red squirrel Tamiasciurus hudsonicus	A	P
Woodchuck Marmota monax	Uc	H
Beaver Castor canadensis	C	T
Muskrat Ondatra zibethicus	C	T
<u>Lagomorpha</u>		
Eastern cottontail Sylvilagus floridanus	C	H
<u>Artiodactyla</u>		
Whitetailed deer Odocoileus virginianus	C	H

Game Birds of the Pinelands

<u>Anseriformes</u>	<u>Populations Status</u>	<u>Game Code Status</u>
Mute swan	C	P
<i>Cygnus olor</i>		
Whistling swan	C	P
<i>Olor columbianus</i>		
Canada goose	C	H
<i>Branta canadensis</i>		
Atlantic brant	C	P
<i>Branta bernicla</i>		
Snow goose	C	H
<i>Chen hyperborea</i>		
Mallard	C	H
<i>Anas platyrhynchos</i>		
Black duck	C	H
<i>Anas rubripes</i>		
Gadwall	C	H
<i>Anas strepera</i>		
Pintail	C	H
<i>Anas acuta</i>		
Green-winged teal	C	H
<i>Anas carolinensis</i>		
Blue-winged teal	C	H
<i>Anas discors</i>		
American widgeon	C	H
<i>Mareca americana</i>		
Shoveller	C	H
<i>Spatula clypeata</i>		
Wood duck	C	H
<i>Aix sponsa</i>		
Redhead	C	H
<i>Aythya americana</i>		
Ring-necked duck	C	H
<i>Aythya collaris</i>		
Canvasback	C	H
<i>Aythya valisineria</i>		
Greater scaup	C	H
<i>Aythya marila</i>		
Lesser scaup	C	H
<i>Aythya affinis</i>		
American goldeneye	C	H
<i>Bucephala clangula</i>		
Bufflehead	A	H
<i>Bucephala albeola</i>		
Oldsquaw	C	H
<i>Clangula hyemalis</i>		
Common eider	C	H
<i>Somateria mollissima</i>		

Game Birds of the Pinelands

<u>Anseriformes</u>	<u>Populations Status</u>	<u>Game Code Status</u>
King eider Somateria spectabilis	Uc	H
White-winged scoter Melanitta deglandi	C	H
Surf scoter Melanitta perspicillata	C	H
Common scoter Oidemia nigra	C	H
Ruddy duck Oxyura jamaicensis	C	H
Wooded merganser Lophodytes cucullatus	C	H
American merganser Mergus merganser	C	H
Red-breasted merganser Mergus serrator	C	H
<u>Galliformes</u>		
Ruffed grouse Bonasa umbellus	C	H
Bobwhite Colinus virginianus	A	H
Ring-necked pheasant Phasianus colchicus	Uc	H
Turkey Meleagris gallopavo		P
<u>Gruiformes</u>		
Clapper rail Rallus longirostris	C	H
Virginia rail Rallus limicola	Uc	H
Sora Porzana carolina	Uc	H
Common gallinule Gallinula chloropus	Uc	H
American coot Fulica americana	C	H
<u>Charadriiformes</u>		
American woodcock Philohela minor	C	H
Common snipe Capella gallinago	C	H

Game Birds of the Pinelands

<u>Passeriformes</u>	<u>Populations Status</u>	<u>Game Code Status</u>
Common crow	C	H
<i>Corvus brachyrhynchos</i>		
Fish crow	C	H
<i>Corvus ossifragus</i>		

The game and furbearing species of the pinelands do not have a uniform distribution throughout the region. Each species has specific habitat requirements which are only found in specific vegetation communities. Tables (1 through 6) depict the distribution of species by habitat type (McCormick 1970), county, and watershed. These tables only indicate presence or absence. The maps included with each of the species discussions indicate relative abundance in a spatial framework.

Key to Vegetational Association, County, and Watershed Codes

Vegetation Associations

PO	Pine-oak
OP	Oak-pine
PPL	Pitch-pine lowlands
C	Cedar swamp
HDW	Hardwood swamp
Bog	Bogs (shrubby wetlands)
M	Coastal wetlands
IM	Inland Marsh
Water	Streams, ponds, lakes
NPB	Non-Pine Barrens Forest
AGR	Agricultural
URB	Urban
NF	Non-Forested
Bay	Tidal Estuary
Ocean	Open ocean
BP	Borrow pit
OF	Old field

(McCormick and Jones 1973)

Counties

A Atlantic
B Burlington
CA Cape May
CM Camden
CU Cumberland
GL Gloucester
O Ocean

Watersheds

NBRC North Branch Rancocas River
SBRC South Branch Rancocas River
TR Toms River
CC Crosswicks Creek
MR Lower Maurice and Manumuskin River
DC Dennis Creek
LMR Lower Mullica River
BR Batsto River
WR Wading River
MA Mechesactauxin and Atsion Rivers
FR Forked River
LGE Lower Great Egg Harbor River
UGE Upper Great Egg Harbor River
TR Tuckahoe River
AD Doughty, Absecon and Patcong Creek
SIC Sloop Creek
CDC Cedar Creek

Table 1. Distribution of Game and Furbearing Mammals by Habitat.

	PO	OP	PPL	C	HDW	WATER	BOG	TM	M	NPB	AGR	URB	NF	BP	OF	OCEAN	BAY
Opossum	X	X	X	X	X		X	X	X	X	X	X					
Raccoon	X	X	X	X	X		X	X	X	X	X	X					
Longtailed weasel	X	X	X	X	X		X	X	X	X	X						
Mink	X	X	X	X	X		X	X	X	X	X						
River otter						X	X	X	X					X			
Striped skunk	X	X	X	X	X		X	X	X	X	X	X					
Red fox	X	X			X					X	X						
Grey fox	X	X	X		X												
Black bear *	X	X	X	X	X		X	X			X						
Bob cat*	X	X	X	X	X				X								
Eastern coyote *	X	X	X	X	X				X	X	X	X					
Grey squirrel	X	X			X					X	X	X					
Red squirrel	X	X			X												
Woodchuck					X					X	X						
Beaver			X	X		X	X	X			X						
Muskrat			X	X		X	X	X			X						
Eastern cottontail	X	X	X							X	X						
White tail deer	X	X	X	X							X	X					

*Potential habitat

Table 2. Distribution of Game Birds by Habitat

	PO	OP	PPL	C	IDW	WATER	BOG	IM	M	NPB	AGR	URB	NF	BP	OF	OCEAN	BAY
Mute swan						X	X	X	X					X			X
Whistling swan					X												X
Canada goose					X		X	X	X		X			X		X	X
Atlantic brant																X	X
Snow goose																X	X
Mallard					X		X	X	X		X			X			X
Black duck					X		X	X	X								X
Cadwall					X		X	X	X					X			X
Pintail					X		X	X	X					X			X
Green-wing teal					X		X	X	X					X			X
Blue-wing teal					X		X	X	X					X			X
Am. widgeon					X		X	X	X					X			X
Shoveller					X		X	X	X					X			X
Wood duck					X		X	X	X					X			X
Redhead					X												X
Ring necked duck					X		X	X	X								X
Canvasback					X												X
Greater scaup					X												X
Lesser scaup					X												X
Am. goldeneye					X												X
Buffelhead					X												X
Old squaw					X											X	X
Common eider																X	X
King eider																X	X
White-winged scoter																X	X
Surf scoter																X	X
Common scoter																X	X
Ruddy duck						X										X	X
Hooded merganser					X		X		X								X
Am. merganser					X												X
Red breasted merganser					X												X
Ruffed grouse		X	X	X	X												X
Bob white		X	X	X													X
Ring-necked pheasant		X	X														X
Turkey		X	X		X												X

Table 2. Distribution of Game Birds by Habitat (cont.)

	PO	OP	PPL	C	HDW	WATER	BOG	IM	M	NPB	AGR	URB	NF	BP	OF	OCEAN	BAY
Clapper rail									X								
Virginia rail							X	X	X								
Sora rail							X										
Common gallinule					X		X	X									
American coot					X		X	X									
American woodcock				X	X												
Common snipe							X	X	X								
Common crow	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X
Fish crow														X			X

Table 3. Distribution of Game and Furbearing Mammals by Watershed.

	NBRC	SBRC	TR	CC	MR	DC	LMR	WR	BR	MA	FR	I.GE	UGE	TR	AD	SIC	CDC
Opossum	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Raccoon	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mink	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
River otter	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Striped skunk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red fox	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grey fox	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black bear*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bobcat*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern coyote *	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grey squirrel	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red squirrel	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Woodchuck	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Beaver	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Muskrat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern cottontail	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Whitetailed deer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Longtailed weasel	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Potential habitat

Table 4. Distribution of Game Birds by Watershed.

	NBRC	SBRC	TR	CC	MR	DC	LMR	WR	BR	MA	FR	LGE	UGE	TR	AD	SIC	CDC
Mute swan	X			X	X	X	X	X	X		X	X	X	X	X	X	X
Whistling swan	X			X	X	X	X				X	X	X	X	X	X	X
Canada goose	X			X	X	X	X				X	X	X	X	X	X	X
Atlantic brant							X				X	X	X	X	X	X	X
Snow goose					X	X	X				X	X	X	X	X	X	X
Mallard	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Black duck	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gadwall	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pintail	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Green-wing teal	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Blue-wing teal	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Am. widgeon	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Shoveller					X	X	X				X	X	X	X	X	X	X
Wood duck	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Redhead							X				X	X	X	X	X	X	X
Ring necked duck				X	X	X	X	X	X	X	X	X	X	X	X	X	X
Canvasback				X	X	X	X				X	X	X	X	X	X	X
Greater scaup				X	X	X	X				X	X	X	X	X	X	X
Lesser scaup				X	X	X	X				X	X	X	X	X	X	X
Am. goldeneye				X	X	X	X				X	X	X	X	X	X	X
Buffelhead				X	X	X	X				X	X	X	X	X	X	X
Old squaw				X	X	X	X				X	X	X	X	X	X	X
Common eider				X	X	X	X				X	X	X	X	X	X	X
King eider				X	X	X	X				X	X	X	X	X	X	X

Table 4. Distribution of Game Birds by Watershed (cont.)

	NBRC	SBRCTR	CC	MR	DC	LMR	WR	BR	MA	FR	LGE	UCE	TR	AD	SIC	CDC
White-winged scoter		X		X	X	X				X	X	X	X	X	X	X
Surf scoter		X		X	X	X				X	X	X	X	X	X	X
Common scoter		X		X	X	X				X	X	X	X	X	X	X
Ruddy duck		X	X	X	X	X				X	X	X	X	X	X	X
Hooded merganser	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Am. merganser		X	X	X	X	X				X	X	X	X	X	X	X
Red breasted merganser		X		X	X	X				X	X	X	X	X	X	X
Ruffed grouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Bobwhite	X	X	X	X	X	X	X	X	X		X	X	X	X		
Ring-necked pheasant	X	X	X	X	X	X	X									
Turkey	X	X		X		X	X	X	X	X	X	X	X			
Clapper rail		X		X	X	X				X	X	X	X	X	X	X
Virginia rail	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Sora rail		X		X	X	X					X	X	X	X	X	X
Common gallinule		X	X	X	X	X	X	X		X	X	X	X	X	X	X
American coot	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
American woodcock	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common snipe	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Common crow	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish crow		X		X	X	X	X	X	X	X	X	X	X	X	X	X

Table 5. Distribution of Game and Furbearing Mammals by County

	A	B	CA	CM	CU	GL	O
Opossum	X	X	X	X	X	X	X
Raccoon	X	X	X	X	X	X	X
Longtail weasel	X	X	X	X	X	X	X
Mink	X	X	X	X	X	X	X
River otter	X	X	X	X	X	X	X
Striped skunk	X	X	X	X	X	X	X
Red fox	X	X	X	X	X	X	X
Grey fox	X	X	X	X	X	X	X
Black bear*	X	X	X	X	X	X	X
Bob cat*	X	X	X	X	X	X	X
Eastern coyote*	X	X	X	X	X	X	X
Grey squirrel	X	X	X	X	X	X	X
Red squirrel	X	X	X	X	X	X	X
Woodchuck	X	X	X	X	X	X	X
Beaver	X	X	X	X	X	X	X
Muskrat	X	X	X	X	X	X	X
Eastern cottontail	X	X	X	X	X	X	X
Whitetail deer	X	X	X	X	X	X	X

*Potential Habitat

Table 6. Distribution of Game Birds by County in the Pinelands.

	A	B	CA	CM	CU	GL	O
Mute swan	X	X	X	X	X	X	X
Whistling swan	X			X	X		X
Canada goose	X			X	X		X
Atlantic brant	X			X	X		X
Snow goose	X			X	X		X
Mallard	X	X	X	X	X	X	X
Gadwall	X	X	X	X	X	X	X
Black duck	X	X	X	X	X	X	X
Pintail	X	X	X	X	X	X	X
Green-wing teal	X	X	X	X	X	X	X
Blue-wing teal	X	X	X	X	X	X	X
Am. widgeon	X	X	X	X	X	X	X
Shoveller	X			X	X		X
Wood duck	X	X	X	X	X	X	X
Redhead	X			X	X		X
Ring necked duck	X	X	X	X	X	X	X
Canvasback	X			X	X		X
Greater scaup	X			X	X		X
Lesser scaup	X	X	X	X	X	X	X
Am. goldeneye	X			X	X		X
Buffelhead	X			X	X		X
Old squaw	X			X			X
Common eider	X			X			X
King eider	X			X			X
White-winged scoter	X			X			X
Surf scoter	X			X			X
Common scoter	X			X			X
Ruddy duck	X			X	X	X	X
Hooded merganser	X	X	X	X	X	X	X
Am. merganser	X	X	X	X	X	X	X
Red breasted merganser	X			X	X		X
Ruffed grouse	X	X	X	X	X	X	X
Bob white	X	X	X	X	X	X	X
Ring-necked pheasant		X	X		X	X	
Turkey*		X	X			X	X
Clapper rail	X	X	X	X	X	X	X
Virginia rail	X	X	X	X	X	X	X
Sora rail	X			X			X
Common gallinule	X	X	X	X	X	X	X
American coot	X	X	X	X	X	X	X
American woodcock	X	X	X	X	X	X	X
Common snipe	X	X	X	X	X	X	X
Common crow	X	X	X	X	X	X	X
Fish crow	X	X	X	X	X	X	X

*Potential habitat

2.3 Wildlife Management Areas

The areas of publicly owned open space in New Jersey have become an increasingly important recreational resource (New Jersey DEP, 1977). These areas consist primarily of State Parks, Forests and Fish and Wildlife Management Areas. The New Jersey Division of Fish, Game, and Shellfish administers 175,000 acres of Wildlife Management Areas statewide. Of the total held in public trust approximately half (73,373 acres) is in the Pinelands region (Figure 1). In total there are 18 areas varying in size from just over 100 acres to over 12,000 acres (Table 7). These areas have vegetation communities of every habitat type found in the Pinelands region. Maps and brief descriptions of the Wildlife Management areas in the region can be found in Appendix I.

These areas are managed primarily for hunting, fishing and trapping. This type of management also produces spinoff benefits for the non-consumptive user (birder, wildlife photographer) as well as other non-wildlife related recreational users. A study by Applegate (1975) of a typical Wildlife Management Area demonstrated that more man-days of non-consumptive recreation were generated by current management practices than consumptive recreation.

Table 7

Wildlife Management Areas In the Pinelands National Reserve

<u>Area Name</u>	<u>Acreage</u>
Absecon	3,548
Butterfly Bogs	103
Beaver Swamp	2,700
Colliers Mills	12,212

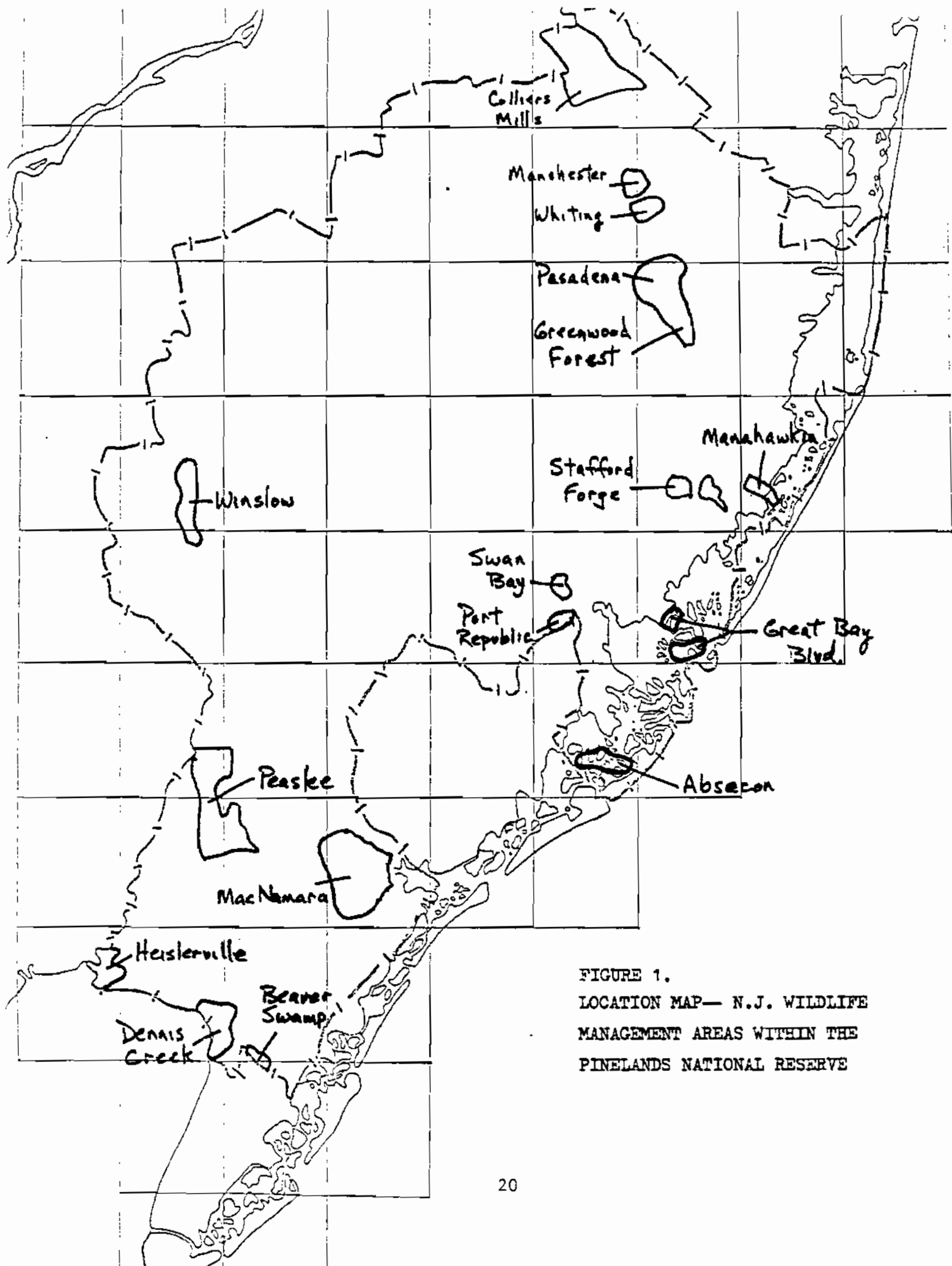


FIGURE 1.
 LOCATION MAP— N.J. WILDLIFE
 MANAGEMENT AREAS WITHIN THE
 PINELANDS NATIONAL RESERVE

Dennis Creek	5,109
Heislerville	3,844
Greenwood Forest	9,000
Lester G. MacNamara	12,438
Great Bay Boulevard	4,141
Manchester	2,376
Manahawkin	965
Pasadena	3,100
Peaslee	4,276
Port Republic	755
Stafford Forge	2,788
Swan Bay	1,078
Whitings	1,200
Winslow	5,940

In most cases the management activities on the areas can be grouped into habitat diversification and increasing public access. In addition to the on-site manipulation, there is a game bird stocking program for quail and pheasants carried out on these areas. Carlson and Penkala (1977) discuss the recreational value of this program. Commonly used habitat management techniques are clearing land, controlled burning, planting, mowing and constructing water control devices. Public access is maintained and improved through road maintenance and construction and on parking lot construction. The specific discussion of the various habitat management techniques can be found in the "Wildlife Management" section.

These areas are the only tracts of state owned open space actively managed for wildlife. Other non-conflicting activities

are encouraged but wildlife oriented recreation is emphasized. The recreational use of wildlife is compatible with many other forms of outdoor recreation.

This type of recreation could fit well into the multiple use plans of other state and federal tracts of public open space. Considering the future demand for this type of recreation, additional wildlife management areas will be needed.

The system of wildlife management areas has also served to preserve critical and representative portions of Pine Barrens habitat. The preservation and management has benefited all of the 250 species of vertebrate wildlife found in the Pine Barrens proper, as well as the approximately 500 species found in the preserve area.

The criteria for site evaluation of potential Fish and Wildlife Management areas are as follows:

1. Areas containing high vegetative diversity are desirable.
2. Areas containing water (lakes, ponds, streams) or lowland areas (swamps, bogs, marshes, white cedar bogs) are priority areas.
3. Existing physical facilities (parking lots, unimproved roads, agricultural fields, boat launching facilities) are desirable but not necessary.
4. Residential or commercial development should not border any of the proposed boundaries. A buffer strip of one-half mile is desirable if it can be maintained through land use controls.
5. A desirable minimum size for upland areas is 2,000 acres. Experience has shown this size to be a minimum for effectively managing wildlife and providing recreation.

6. No minimum size limit should be set for water or lowland areas or for critical areas or for areas containing endangered species. These areas should be protected regardless of size.

2.4 Wildlife Habitats

McCormick and Jones (1973) group the vegetation of the Pinelands into eleven categories and recognize three general land use categories. Compared to other vegetation communities in the northeast, the vegetation of the Pinelands is largely monotypic and with the exception of several habitat types is generally lacking in diversity. Vast expanses of similar species and similar structure are the rule rather than the exception. A well-known axiom of wildlife biology is that the soil, climate, and human activity determine the vegetation on a site and that the vegetation determines the wildlife species present. In general the greater the diversity of the vegetation on a site the greater the faunal diversity will be. Consideration of the above indicates that the vast upland areas of pine-oak and oak-pine associations are important habitats but in general support fewer wildlife species.

Certain habitats are much more diverse vegetationally and are in much shorter supply than upland areas. Lowlands areas are representative of this type of habitat. They are in short supply and they, along with their interface with neighboring habitats, support the greatest diversity of wildlife species. The specific habitats in this category are cedar swamps, hardwood swamp forest, pitch pine lowland forest, bay, streams, ponds, lakes, bogs and intertidal marshes (McCormick and Jones 1973).

Agricultural land is an important habitat type. It is capable of supporting a diversity of species. An interspersed of agriculture and native

vegetation is highly desirable from a wildlife point of view. Urban lands can also support a variety of wildlife species but this particular land use type is by no means unique or in short supply.

Identifying specific critical habitats for a group of species as diverse as those found in the Pinelands is quite difficult. Each specie has a unique set of ecological requirements which must be met if it's existance is to continue. Every habitat is critical to some species of wildlife. Therefore, only general statements and recommendations can be made concerning the criteria used to identify critical habitats. Any habitat that is unique, in short supply, contains endangered species, or is environmentally sensitive should be protected by any means available, including easements or out right purchase.

2.5 Wildlife Management

Wildlife management is the science and art of changing the characteristics and interactions of habitats, wild animal populations and men in order to achieve specific human goals by means of the wildlife resource (Giles 1971).

The first step in any management plan is the establishment of broad goals. The goals used by the Bureau of Wildlife Management of the New Jersey Division of Fish, Game and Wildlife in managing the wildlife resources of the state are as follows:

1. To maintain the faunal diversity of the state.
2. To maintain wildlife populations at levels compatible with the carrying capacity of the available habitat.
3. To minimize wildlife damage to agricultural crops and personal property.
4. To minimize the risk of transmission of wildlife harbored diseases to man and his domestic livestock.

5. To maximize the recreational potential to be derived from the wildlife resource by the citizens of the state.
6. To maximize the economic benefits to be derived from the wildlife resource by the citizens of the state.

Once broad goals have been established, a management plan to achieve more specific goals can be constructed.

Common management practices include manipulation of the habitat, the wildlife population, human activities, and their interactions.

Manipulation of the habitat would include activities such as clearing, burning, planting, mowing, water management, and water control devices. All of these procedures are being, and historically have been, carried out in the Pinelands. In many instances the objective of this management has not been the management of wildlife, but rather agricultural or timber production, and reduction of fire hazard. The more specific objectives of this type of management, when carried out for wildlife management, are to provide edge (an area where two different vegetative types meet), to provide structural and species diversity in the vegetation community, or to provide specific or additional quantities of food, water and cover required by certain wildlife species. McCormick (1970) reports that two of these manipulations, burning and cutting, have played critical roles in the development of the vegetation complexes found in the Pinelands. These two methods are the most economical methods of accomplishing habitat changes in the region. The species or community being managed for is the primary consideration in selecting the habitat management technique.

The manipulation of a wildlife population can be accomplished in several different ways. The population level can be changed through modification of the mortality rate or by changes in the age structures or sex ratios. Populations can be artificially bolstered through the stocking of propagated species, or a new population can be established, where one had originally existed, through reintroduction, as in the case of the wild turkey (Eriksen 1978).

Sport harvest and various regulations controlling sport harvest are the most common methods of manipulating population levels, age structure, and sex ratios (N.J. Division of Fish, Game and Shellfisheries 1978). An example of stocking would be the liberation of game farm pheasants currently carried out by the New Jersey Division of Fish, Game and Wildlife. These liberations cause no long-term changes in the population. They merely temporarily increase populations for recreational purposes.

An example of reintroduction is the proposed re-establishment of the eastern wild turkey in the Pinelands (Eriksen 1978). The wild turkey was once a member of the Pinelands wildlife community. The habitat available at the present time is believed to be capable of supporting wild turkeys. Presently 15 wild-trapped birds have been liberated in the Pinelands in hopes of re-establishing a breeding population. The re-establishment of the wild turkey will greatly enhance the character of the Pinelands.

Methods of manipulating the human impacts on wildlife population consist of regulations controlling the use of the wildlife (game codes), land use regulations (local zoning), the attendant law enforcement to insure compliance with regulations, and information and education to attempt to influence public opinion and foster an understanding of the natural system and the results of human impact on it. The current wildlife management practices being used in the Pinelands meet the criteria and objectives outlined.

2.6 Recreation and Recreation Economics

The game and furbearing wildlife of the Pinelands provide a considerable amount of recreational and recreationally related economic benefit to residents of the region as well as residents of the entire state of New Jersey. Hunting and trapping historically have played an integral role in the "Pinelands Culture." These pursuits have changed from being primarily a necessary subsistence activity to more of a leisure time activity. This is not to say that a certain segment of the resident population of the Pinelands does not currently derive a significant portion of their annual food and monetary incomes from hunting and trapping; rather, these activities are now primarily recreational in nature.

In addition to the traditional activities of hunting and trapping, nature observation and nature photography have become important uses of the wildlife resource. All of these activities generate economic benefit either directly (as in the case of trapping) or indirectly through the purchase of related equipment, travel costs, rental fees, and food and lodging costs.

An estimated annual average of \$29.7 million are spent by New Jersey residents pursuing wildlife oriented recreation in the Pinelands (Penkala 1977, USFWS 1977). Hunters and trappers spend an annual average of \$19.2 million; persons involved in nature observation and nature photography spend approximately \$10.5 million. The income derived from the sale of the pelts of furbearing animals trapped in the region is approximately \$902,000 annually (Hahn 1977).

Many residents of the state pursue their outdoor avocation in the Pinelands. Almost one million persons visit the area each year in search of

wildlife oriented recreation. Of this total 80,000 hunt and trap and 900,000 are involved in wildlife observation activities (Hahn 1977, Penkala 1977, USRWS 1977). These persons expend an average of 5 million recreation days each year.

These figures reflect the current value of the region as an open space area. Properly managed and administered wildlife oriented recreation would not impair any other of the biological, physical, cultural or aesthetic values of the Pinelands region. This type of recreation is perfectly compatible with other values of importance which have been designated for preservation. Regulations should be designed to enhance and encourage recreational use of the wildlife.

2.7 Species Comment

2.7.1

OPOSSUM (Didelphis marsupialis)

Population Status - Common
Game Code Status - Hunted
and trapped

The opossum is a medium-sized marsupial mammal with a heavy body and short stout legs. The muzzle is extremely pointed, the ears are naked, white, and edged with black. The tail is long and hairless, black at the base, and flesh colored for the remaining length. The fur is coarse and long. The body fur is white with black tips, giving the impression of a silver or grizzled color. The head and underfur is pale yellow to white (Godin 1977). Males are larger than females. Measurements range from 38 to 51 cm; tail, 23 to 51 cm; weight, 4 to 5.9 kgs. Usual home range is 6-16 hectares (Burt and Grossenheider 1976).

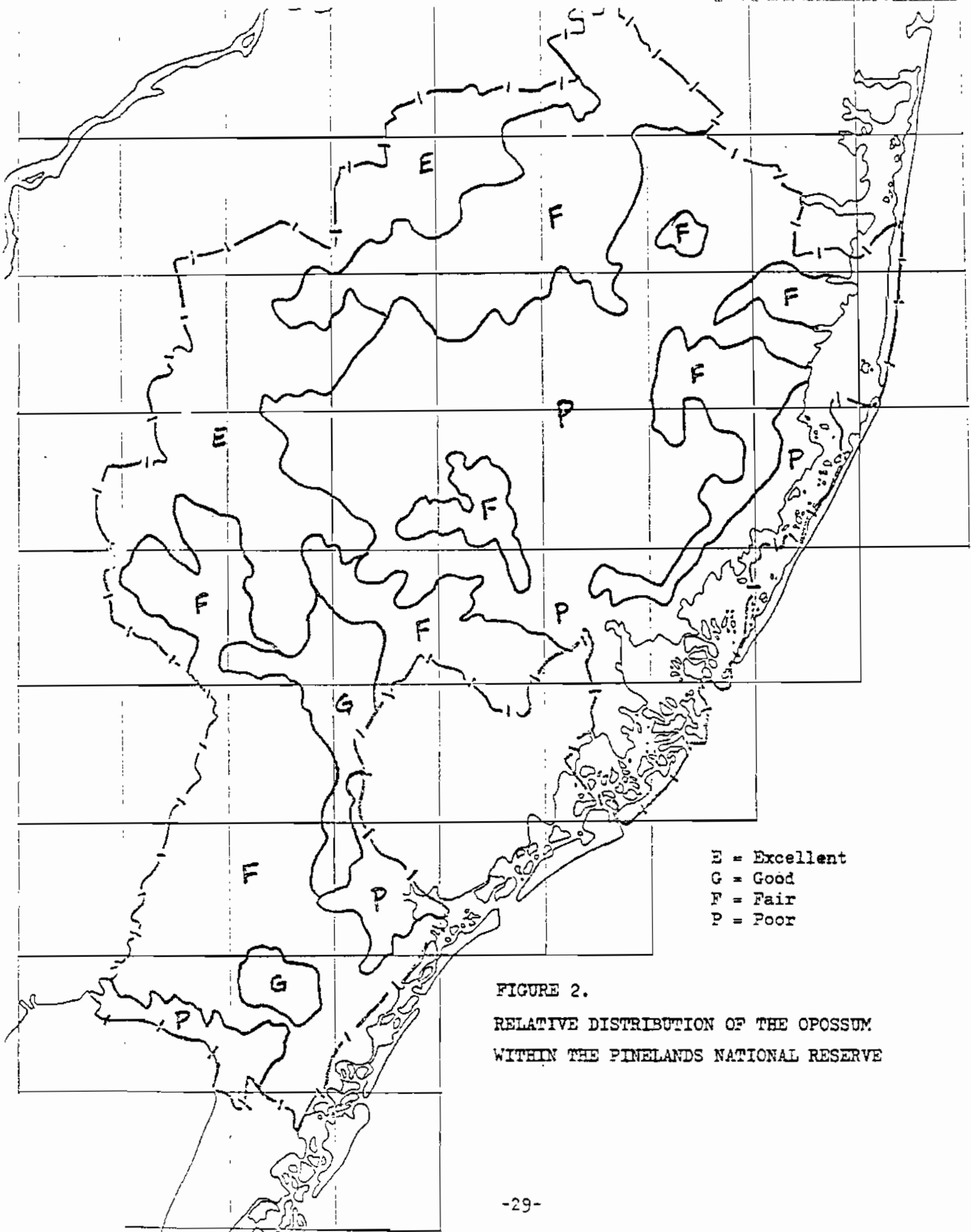


FIGURE 2.
 RELATIVE DISTRIBUTION OF THE OPOSSUM
 WITHIN THE PINELANDS NATIONAL RESERVE

Opossums are omnivores and will eat almost anything they encounter. Their diet consists mainly of animal matter, chiefly carrion and insects; however, they will eat quantities of fruit and grain when available.

The opossum is found in a wide variety of habitats; most frequently near areas of water (streams, swamps and marshes). The opossum is found throughout the Pinelands near areas of water (Fig. 2). The opossum is frequently captured in traps set for fox or raccoons. Even though the price is relatively low when compared to other furbearers, there is a steady demand for the long-haired pelt. Trappers annually take an average of 4,100 opossums from the Pinelands.

Any development in wetland areas of the Pinelands will have a negative effect on the opossum.

2.7.2

RACCOON (Procyon lotor)

Population Status - Common
Game Code Status - Hunted and
Trapped

The raccoon is a medium-sized mammal about the size of a small dog. It has a pointed muzzle with a mask of dark hair over the eyes. The tail is bushy with alternating black and yellow rings. The body fur is a salt and pepper mixture with the underfur ranging from yellowish to dark brown. The color of the sexes is alike with little seasonal color variation, although the winter fur is more lustrous, thicker, and longer (Godin, 1977). Raccoons measure 94 to 118 cms. from the nose to tip of tail. Weight of adult raccoons ranges from 4.1 to 11.8 kgs. The normal home range for an adult raccoon is an established territory of approximately 320 hectares (Burt and Grossenheider, 1976).

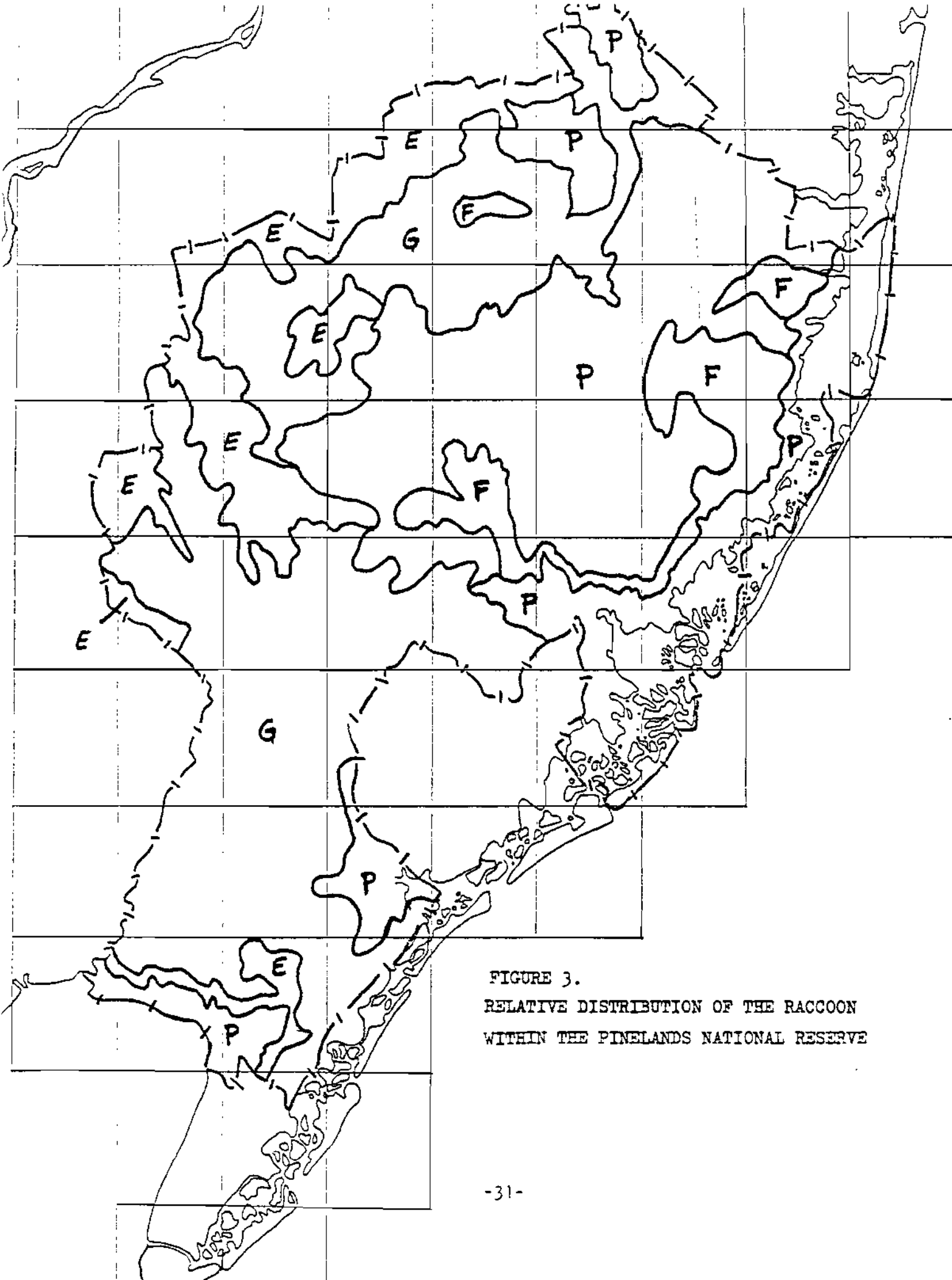


FIGURE 3.
 RELATIVE DISTRIBUTION OF THE RACCOON
 WITHIN THE PINELANDS NATIONAL RESERVE

Raccoons are opportunists, eating both animal and plant foods. In spring and early summer their diet is predominately animal matter, and in the fall and winter they feed mainly on fleshy fruits, domestic crops, and mast. Their diets include apples, acorns, corn, oats, berries, grapes, tomatoes, grass, crayfish, frogs, snakes, small mammals, insects, carrion, and refuse.

Raccoons inhabit hardwoods and oak-pine regions interspersed with agricultural fields and wetlands. They rarely occur in stands of dense pine-oak or pitch pine lowlands. They prefer fairly open, mature hardwood areas with hollow trees near streams, rivers, bogs, marshes, or lakes (Godin, 1977). The distribution of raccoons in the Pinelands can be found in Figure 3.

Hunting and trapping of raccoons provide numerous hours of recreation. Each year in the Pinelands, trappers harvest approximately 11,500 raccoons. In addition to providing recreation, this harvest of raccoons also serves as a component of natural mortality which keeps the population at a level where canine distemper, sarcoptic mange, and rabies will not have the potential to reach epizootic proportions.

Raccoons are extremely tolerant of human activity. This trait is probably responsible for the raccoon being the second most commonly harvested furbearer in the state. Continued success of the raccoon population depends on maintenance of preferred habitats.

2.7.3

LONGTAIL WEASEL (Mustela frenata)

Population Status - Common
Game Code Status - Trapped

The longtail weasel is the only weasel known to occur in the Pinelands. The pelage is short, fine and sparse. The sexes are colored alike and show tremendous seasonal variation. During the summer the body hair is a uniform

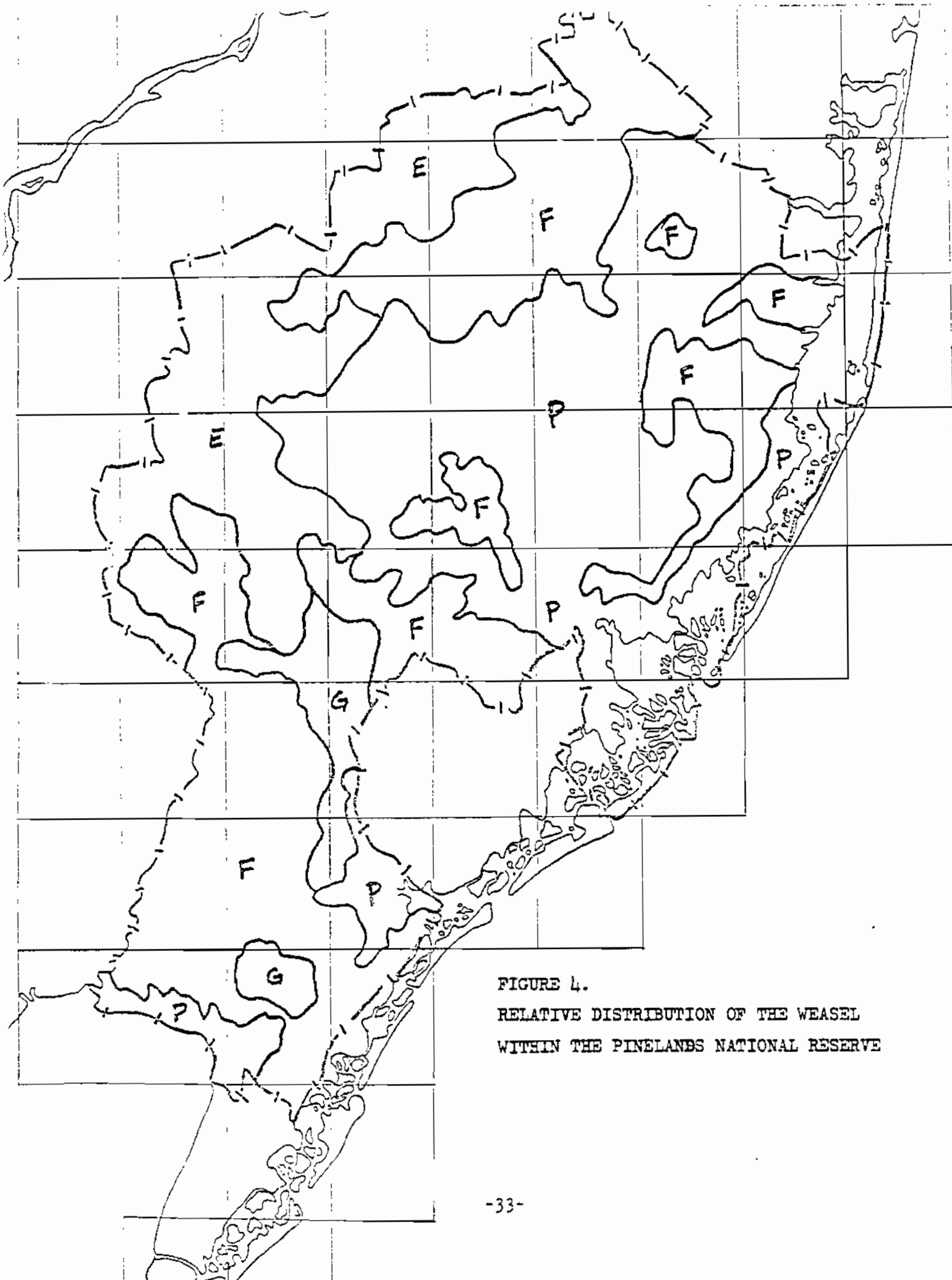


FIGURE 4.
RELATIVE DISTRIBUTION OF THE WEASEL
WITHIN THE PINELANDS NATIONAL RESERVE

dark brown, while the underparts are yellowish white. During the winter the hair may turn partially white. Males are much larger than females. Measurements range from 203-266 mm; tail, 76-152 mm; weight, is 85 to 340 grams. The home range varies from 12-16 hectares (Burt and Grossenheider 1976).

Weasels feed on a variety of small mammals, aquatic animals, insects, birds, and carrion.

Longtail weasels are found in a wide variety of habitats located near water (Figure 4). McCormick (1970) listed the longtail weasel as frequent along streams. It provides little recreation as a furbearer, but it is important in controlling rodents. Any development along the waterways of the pinelands could endanger this species.

2.7.4

MINK (Mustela vison)

Population Status - Common
Game Code Status - Trapped

The mink is a large weasel-like animal, approximately as large as a house cat, though very slender. The body is elongated with short legs and a bushy tail. The pelage is thick and dense. The coloration is uniformly rich dark brown with the exception of a white throat patch. The males are much larger than the females. Measurements range from 46 to 68 cms; tail, 15 to 24 cms. Weights vary from 0.5 to 1.1 kgs. (Godin 1977). Home ranges of mink depend on sex and time of year; average is about 1,000 to 3,000 hectares.

Mink are chiefly aquatic animals and prey on fish, frogs, crayfish, clams, turtles, snakes, lizards, earthworms, insects, small mammals, and some vegetation.

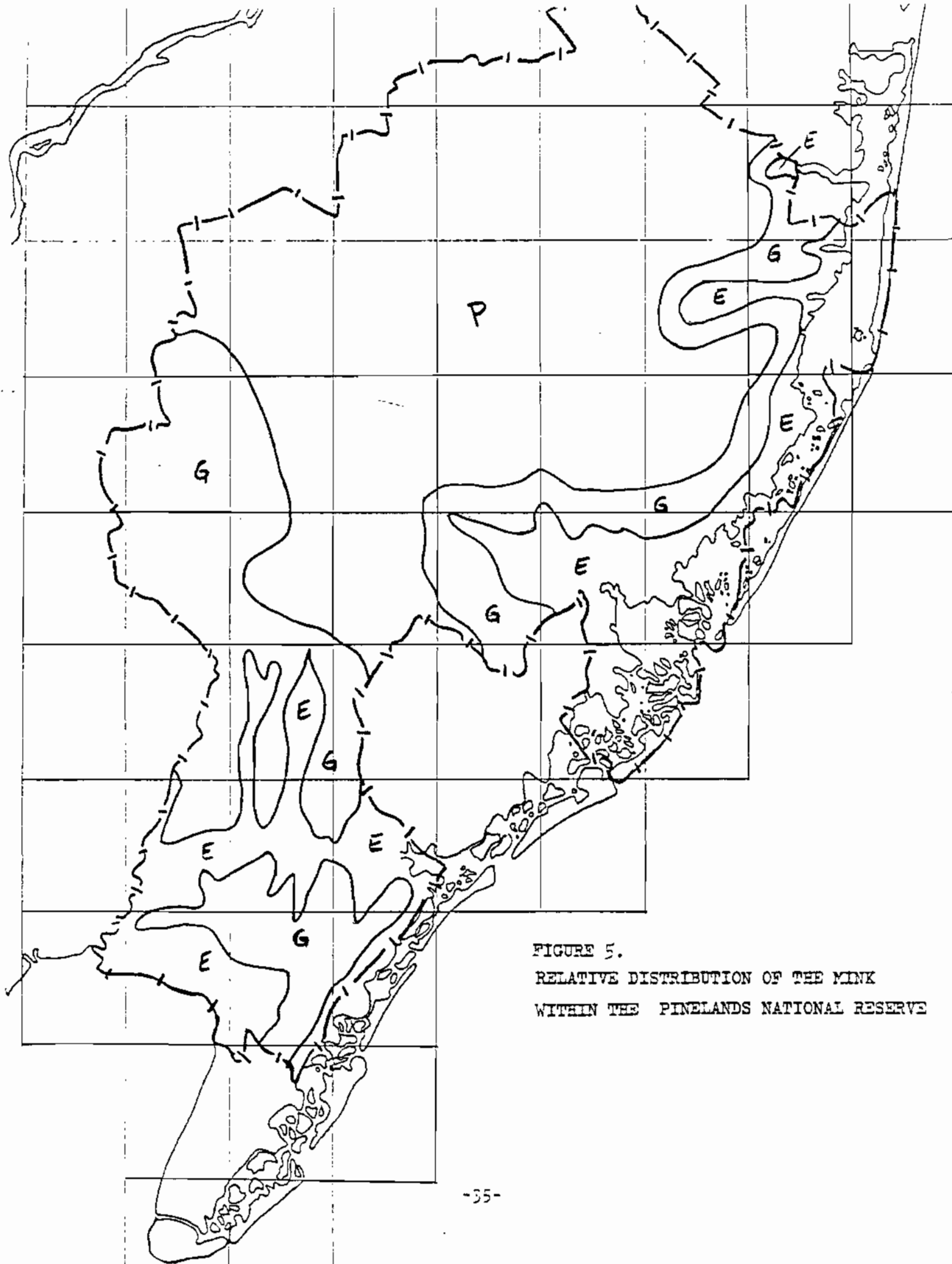


FIGURE 5.
RELATIVE DISTRIBUTION OF THE MINK
WITHIN THE PINELANDS NATIONAL RESERVE

Mink are found along streams, rivers and lakes, and along the salt marsh. The relative density of mink can be found in Figure 5. The mink, although not abundant because of its extensive range, is relatively common in the Pinelands. Its pelt is still sought by fur buyers, even with the large production of mink ranches, because of its "wild" quality. The wild mink still provides many hours of recreation to those trappers who pursue it. Annually trappers harvest about 200 from the Pinelands. Any development of the Pinelands in the wetlands areas could be severely detrimental to the mink population.

2.7.5

RIVER OTTER (Lutra canadensis)

Population Status - Common
Game Code Status - Protected

The river otter is a large weasel-like animal (96-130 cms total length). Average adult otters weigh from 4.5 to 11.4 kgs. The pelage is rich brown above with a pale silvery sheen below. The ears are small and the snout is broad and somewhat flattened. The feet are webbed.

River otters feed chiefly on fish and other aquatic animals. The remainder of their diet is composed of turtles, salamanders, snails, birds, earthworms, snakes, and some plant material. The home range of the otter is a minimum of 24 kilometers and is usually much greater.

Otters occur along streams, sloughs, swamps, rivers, lakes, and, not infrequently, near brackish water. This species has never been abundant, even in excellent habitat with no pressure from man (Godin, 1977). The presence of the river otter in the Pinelands (Fig 6) is probably linked to the abundance of clean waterways. It is of critical importance to the stability and health of the otter population that the watershed areas of the Pinelands

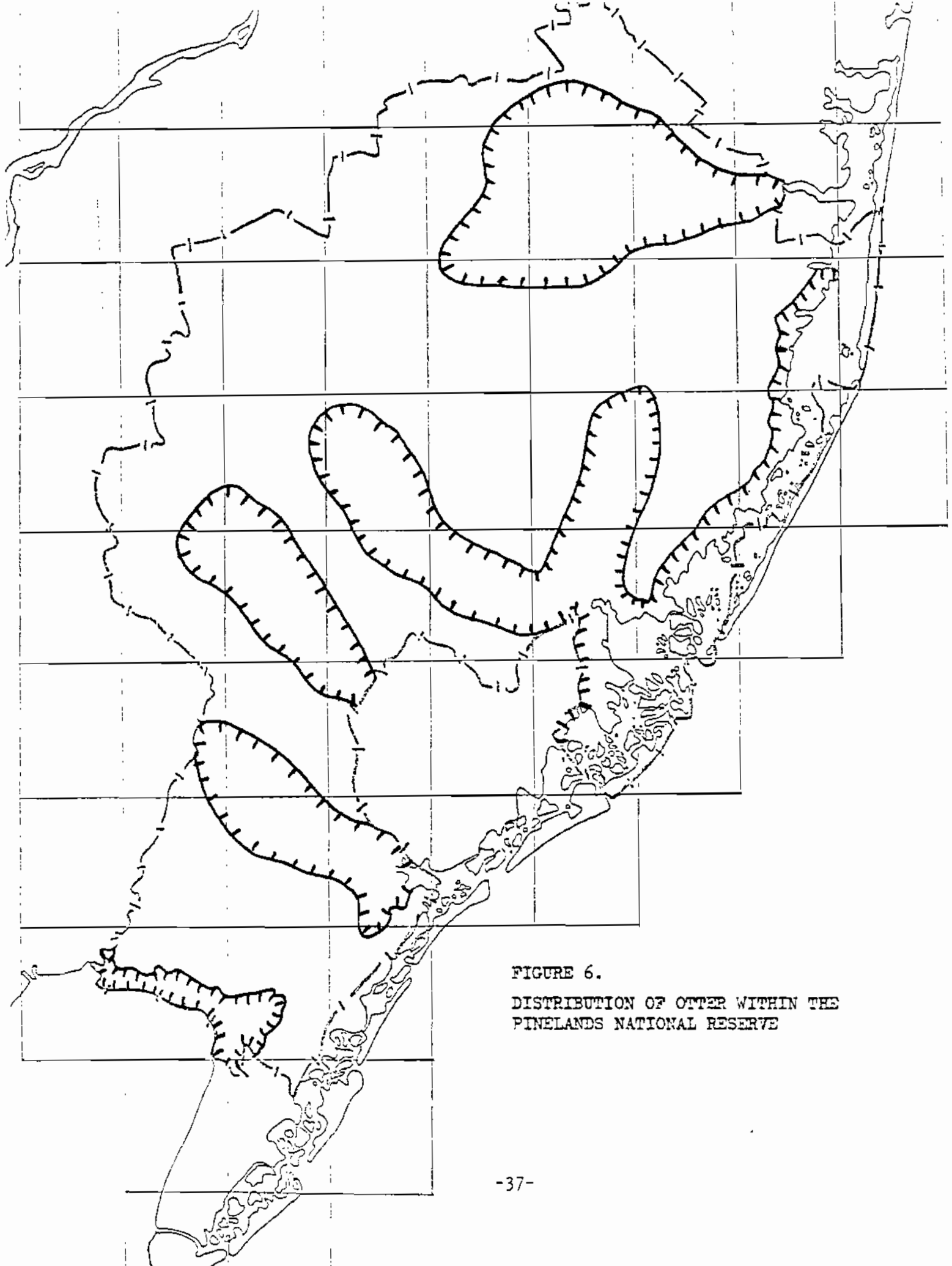


FIGURE 6.
DISTRIBUTION OF OTTER WITHIN THE
PINELANDS NATIONAL RESERVE

remain undisturbed and the water remain clean. The otter can provide extensive recreation through trapping. The data gathered from the harvested animals will provide invaluable information on the ecology of these animals.

2.7.6

STRIPED SKUNK (Mephitis mephitis)

Population Status - Common
Game Code Status - Trapped

The striped skunk is about the size of a house cat with a small head, wide rear end, short legs, and bushy, long-haired tail. The pelage is long and thick with soft underfur and coarse, shiny guard hairs. The sexes are colored alike with no seasonal variation. The color is black with a broad white stripe that runs from the crown of the head, branching at the shoulders, along the upper sides to the rump. Males are slightly larger than females. Measurements range from 54 to 67 cm in length; tail, 18 to 29 cm; weight, 1.1 to 3.4 kg. (Godin 1977).

Striped skunks feed on insects, worms, snails, nuts, grain, berries, grasses, eggs, frogs, snakes, rodents, carrion, and garbage.

The striped skunk is widely distributed, occupying many habitat types, including weedy fields, fencerows, wooded ravines, drainage ditches, mixed woods, and brushland (Fig. 7).

Skunks provide many hours of trapping recreation. Trappers take an average of 1,200 skunks per year from the Pinelands. The skunk is also valuable in rodent control.

2.7.7

RED FOX (Vulpes fulva)

Population Status - Common
Game Code Status - Hunted and
Trapped

The red fox has the appearance of a small dog with a pointed muzzle, erect ears, and long bushy tail. The pelage is normally of a reddish yellow

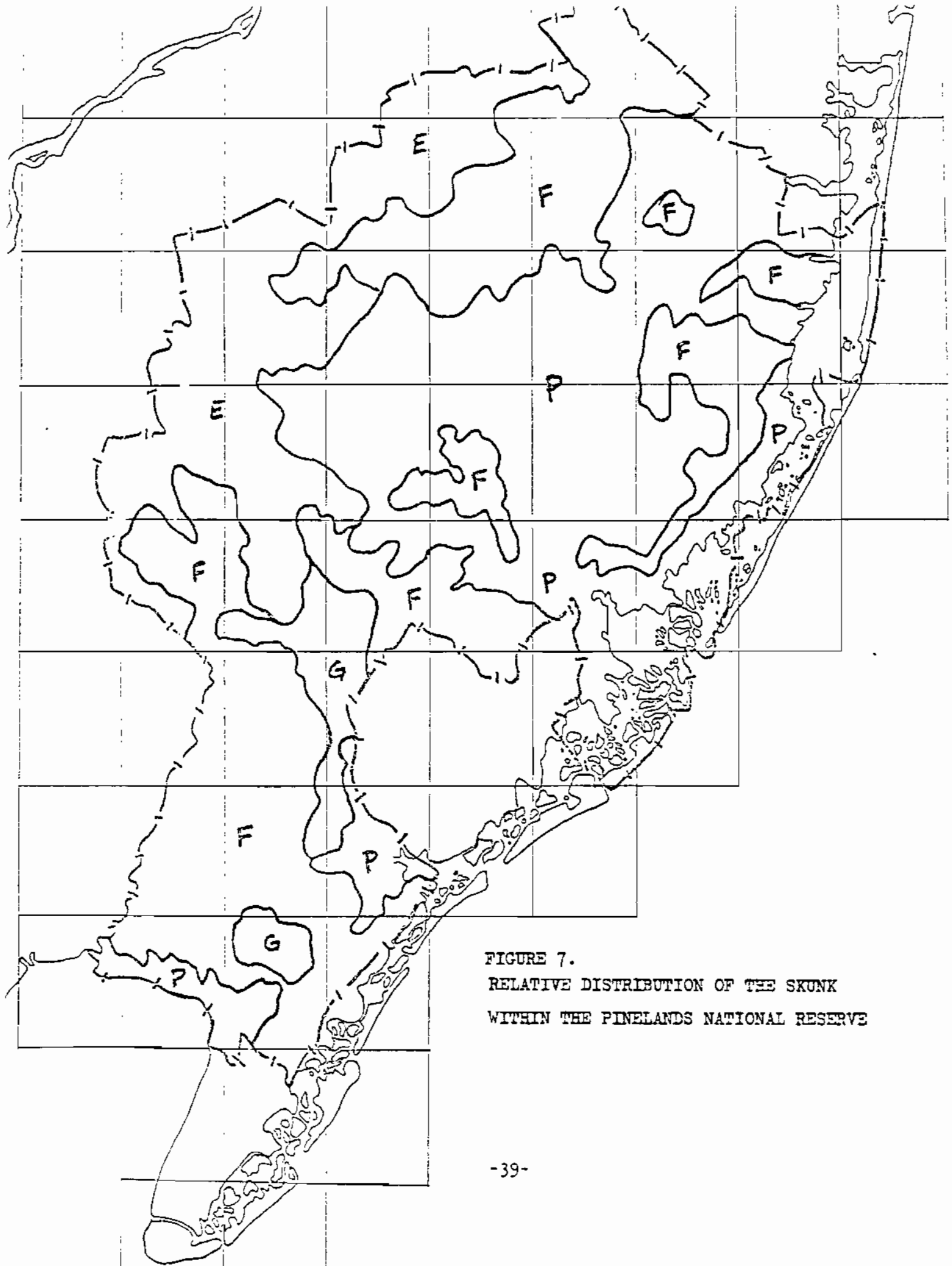


FIGURE 7.
RELATIVE DISTRIBUTION OF THE SKUNK
WITHIN THE PINELANDS NATIONAL RESERVE

color, with black legs and feet, and a white tip on the tail. There are many color variations, including cross, with a strip of dark fur down the back and across the shoulders; black (silver), black with white tipped body hairs; and countless variations between these phases (Burt and Grossenheider, 1976). Adult red fox vary from 91 to 104 cm in length. Weights range from 4.5 to 6.7 kgs. Home range is 259 to 518 hectares, but red fox often travel greater distances depending on sex, season, and availability of food.

Red fox will feed on almost anything that is available. Their diets include carrion, small mammals, birds, fruit, grain, aquatic animals, and insects. The red fox is an edge species. It lives in areas of mixed hardwoods, rolling farmland, coastal areas, pastures, and brushlands. and avoid open areas lacking cover, as well as areas of dense forest. (Godin, 1977).

The greatest concentrations of red fox occur in the western portion of the Pinelands where agriculture is interspersed with hardwood forests. There are also healthy populations of red fox along the coastal areas (Fig. 8). Red fox provide many hours of recreation through hunting and trapping. Trapping and hunting help to maintain healthy populations by harvesting excess animals. Trappers harvest about 1,300 red fox annually from the pinelands. Red foxes suffer from a variety of diseases. These diseases include rabies, sarcoptic mange, canine distemper, heartworms, and tularemia. Any development in the western agricultural or eastern coastal areas would decrease the number of red fox found in the Pinelands.

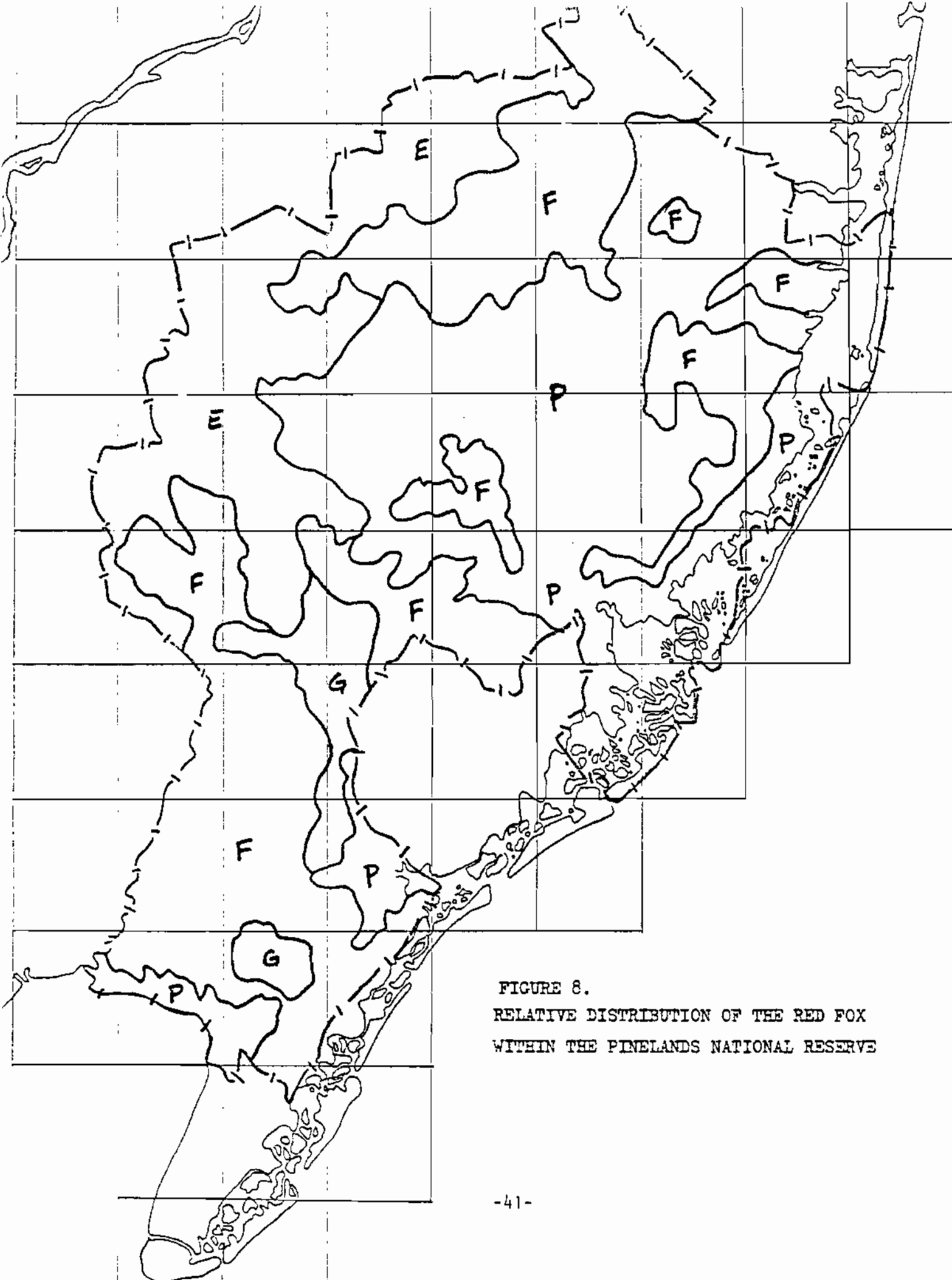


FIGURE 8.
 RELATIVE DISTRIBUTION OF THE RED FOX
 WITHIN THE PINELANDS NATIONAL RESERVE

GREY FOX (Urocyon cinereoargenteus)

Population Status - Common
Game Code Status - Hunted and
Trapped

The grey fox is a medium-sized, dog-like animal. Adult animals range from 81 to 143 cm in length and weigh from 3.2 to 5.8 kgs. The grey fox is somewhat smaller than the red fox, with shorter legs and a smaller muzzle. The pelage is salt and pepper colored on the sides and back with a mane of short black hairs. The tail is bushy with a black tip. The sides of the neck, back of the ears, a band across the chest, and the inner surfaces of the legs are reddish brown. The cheeks, throat, and belly are white (Godin, 1977). The home range varies from 250 to 1,300 hectares according to season, habitat, and availability of food.

Gray foxes are opportunists and feed on just about anything that is available. Their diets include birds, small mammals, aquatic animals, fruit, insects, acorns, and carrion.

The grey is typically a forest mammal inhabiting dense hardwoods and mixed pine and oak woods, swamps, dense thickets, and briars. The grey fox usually dens in dense cover under logs, in cavities of stumps and hollow trees, or under abandoned buildings, brush or sawmill piles (Godin, 1977).

The grey is the most common fox found in the Pinelands (Fig. 9). Although the grey fox is very secretive by nature, it is markedly easier to catch than the red fox. This fact, coupled with usually abundant numbers, causes the grey fox to be a very important part of trapping in the Pinelands. Approximately 1,700 are harvested in the Pinelands by trappers every year, generating thousands of dollars of income to the trappers. The harvesting of

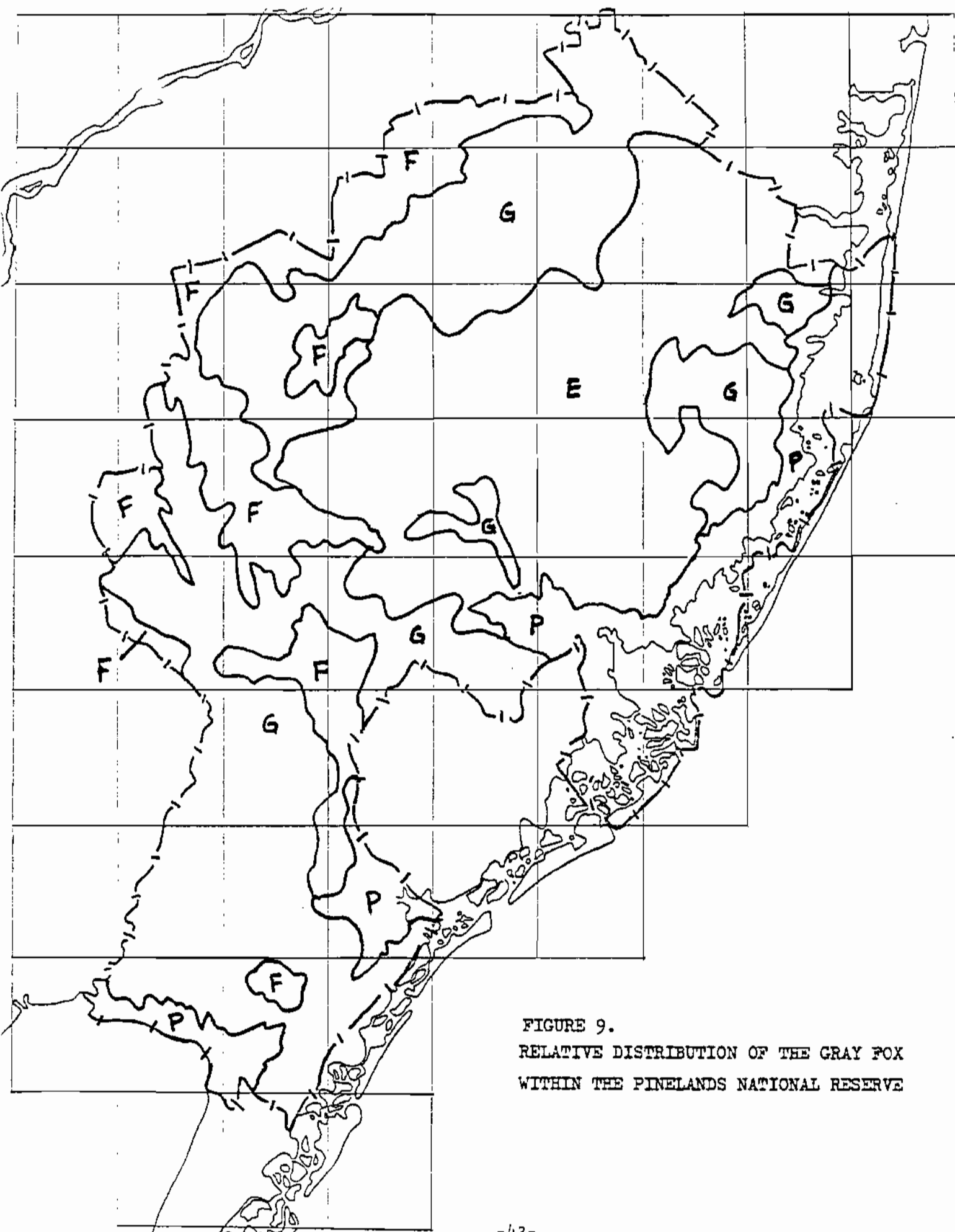


FIGURE 9.
RELATIVE DISTRIBUTION OF THE GRAY FOX
WITHIN THE PINELANDS NATIONAL RESERVE

the foxes, along with natural mortality, serves to maintain the fox population at a level which reduces the possibility of widespread outbreak of diseases such as canine distemper, sarcoptic mange, and rabies.

2.7.9

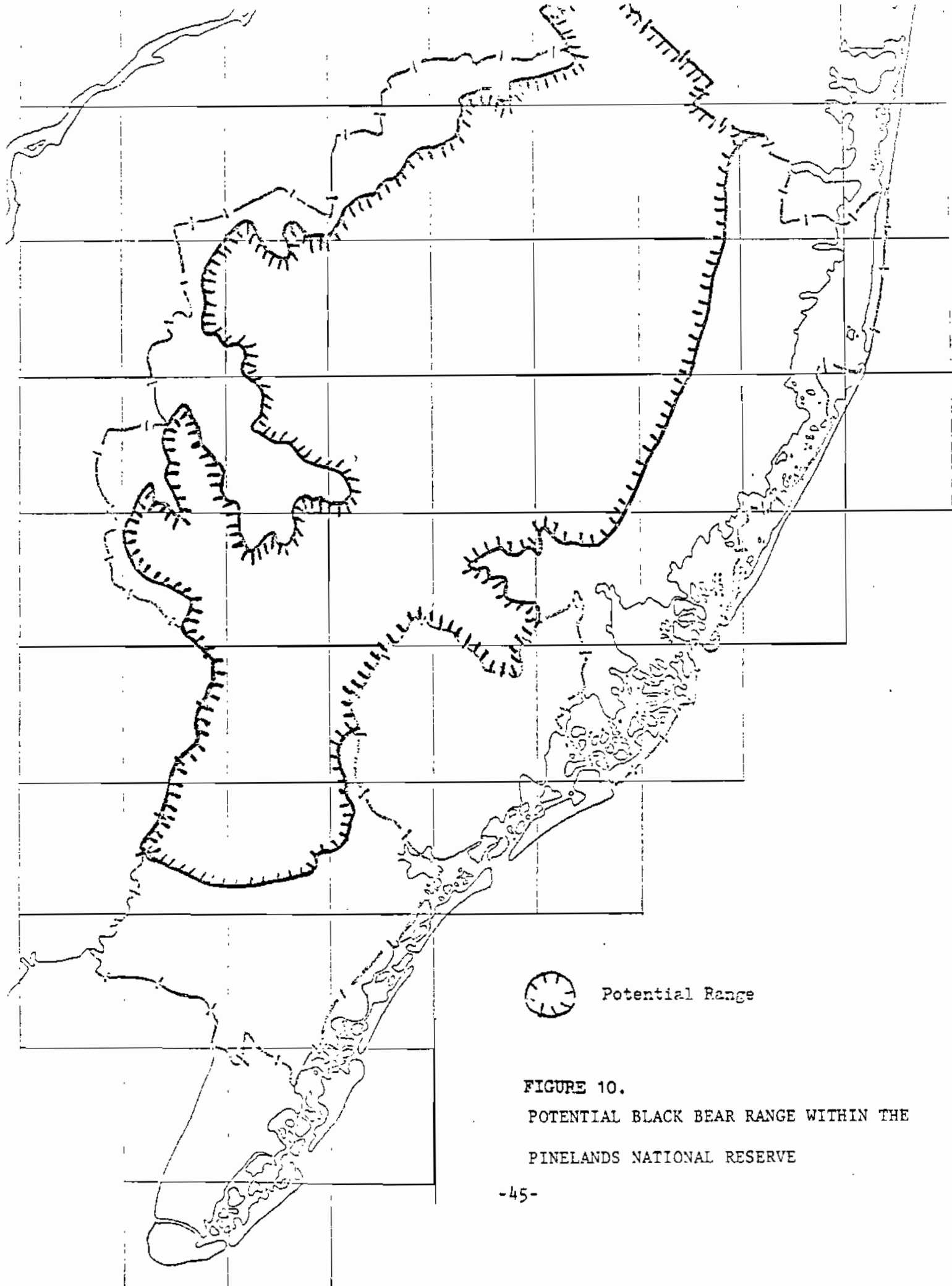
BLACK BEAR (Ursus americanus)

Population Status - Extirpated
Game Code Status - Protected

The black bear is New Jersey's largest carnivore. It is a heavyset animal with short, rounded ears, a long muzzle, powerful legs, and a short tail. The hair is thick and long. Sexes are colored alike and seasonal variation is a change in length and thickness of the fur. The hair is usually black or brownish black but may be all brown, with a tan muzzle. Males are slightly larger than females. Measurements range from 127 to 178 cm in length; tail, 8 to 13 cm; weight, 102 to 272 kg. Home range varies depending on available food, breeding season, and other factors, and can be as great as 30 square kilometers (Godin 1977).

Black bears are opportunists; they feed on whatever is available including insects, berries, grapes, apples, nuts, fish, mice, frogs, carrion and garbage.

Bears inhabit forested wilderness and swamps, preferring mixed stands of hardwoods and conifers, with dense understory, near water (Fig. 10). In New Jersey, black bears are generally rare. They occur in the northwestern counties. One sighting of a bear cub occurred in Camden County, but it was most likely released or escaped (Lund, 1977a). Probably no bears occur in the Pinelands, though they did at one time. Where black bears presently occur in New Jersey they create problems due to conflict with human activities.



Potential Range

FIGURE 10.
POTENTIAL BLACK BEAR RANGE WITHIN THE
PINELANDS NATIONAL RESERVE

2.7.10

BOBCAT (Lynx rufus)

Population Status - Extirpated
Game Code Status - Protected

The bobcat is the only member of the family Felidae found in New Jersey. The bobcat looks very much like a large house cat with a short tail. The ears are slightly tufted and the face fur is long. The body fur is short, dense, and very soft. The pelage varies from buff to brown with dark spots or streaking. Measurements range from 71 to 120 cm; tail, 9 to 20 cm. Weights vary from 6.7 to 15.9 kgs. (Godin 1977). Home range depends on sex, food availability, and the season; it varies from 3 to 8 square km.

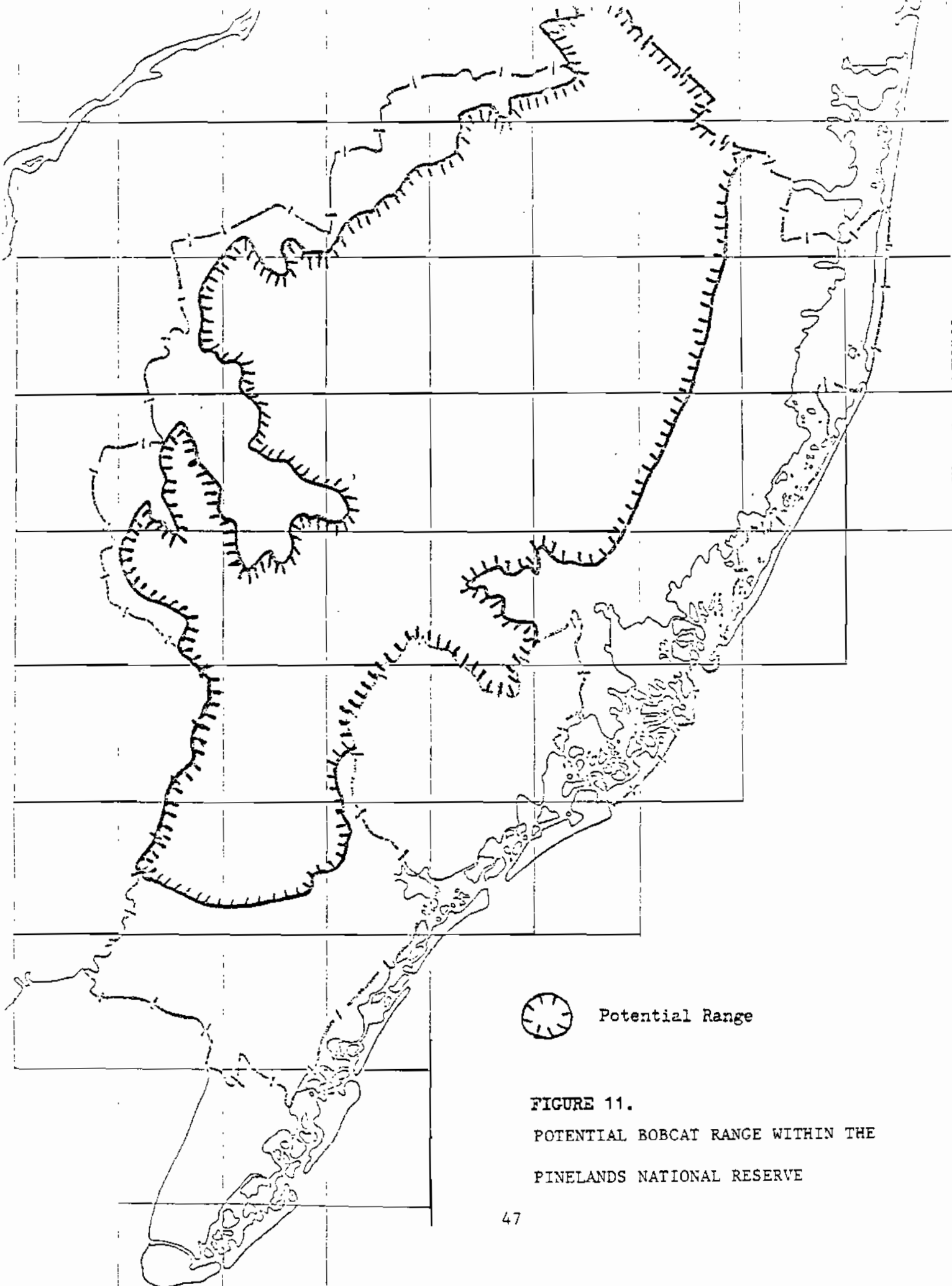
Bobcats feed chiefly on small mammals, birds, eggs, snakes, fishes, insects, carrion, and some plant material. Bobcats roam wild areas of forest intermixed with roads, farmland, and swamps (Fig. 11). In New Jersey bobcats are generally rare. They occur mainly in the rocky northwestern counties. Historically, bobcats were found in the Pinelands areas. However no confirmed sightings have been made in recent years.

2.7.11

EASTERN COYOTE (Canis latrans var.)

Population Status - Peripheral
Game Code Status - Protected

The coyote resembles a small German shepard but is slender in build, with a bushy drooping tail. The pelage is dense, long and coarse. Coloration varies greatly among individuals. Most coyotes are a mixture of grey to cinnamon brown. The underparts range from buff to deep grey. Males are slightly larger than females. Measurements range from 114 to 132 cm; tail, 29 to 39 cm. Weights vary from 9.1 to 13.6 kgs. (Godin 1977). Home range is approximately 16 square km but will vary according to food supply, sex, and season.




 Potential Range

FIGURE 11.
POTENTIAL BOBCAT RANGE WITHIN THE
PINELANDS NATIONAL RESERVE

The eastern coyote's diet includes small mammals, birds, eggs, insects, fruit, and aquatic animals. They are quite opportunistic and will take whatever is available. In the east, coyotes mainly inhabit brushy country bordering edges of second growth hardwood forests, old fields, marshes, and mixed oak-pine forests (Fig. 12).

The first known record of coyote occurrence in New Jersey was recorded near Lambertville in 1939. It was not until 1948 that a second animal was reported in Cape May County. In 1959 the first specimen of what is currently referred to as the eastern coyote was shot by a deer hunter in Passaic County. The information for nine New Jersey coyote specimens was collected between 1958 and 1975. During 1976 four additional sightings of eastern coyotes were recorded. Since 1976 numerous sightings have occurred and dead animals have been examined. Despite its relative scarcity and possible confusion resulting from the occasional escape or illegal release of captive western coyotes, available evidence indicates that the eastern coyote has become an established resident in New Jersey and appears to be increasing in both its range and population density within the state (Lund 1977b). As the eastern coyote extends its range southward, its status may change in the Pinelands from peripheral to common. This change will only take place if the proper habitat remains available in the Pinelands.

2.7.12

EASTERN GREY SQUIRREL (Sciurus carolinensis)

Population Status - Common
Game Code Status - Hunted

The grey squirrel is a medium-sized tree squirrel with a bushy tail. The pelage of the grey squirrel is short and coarse. The color of the sexes

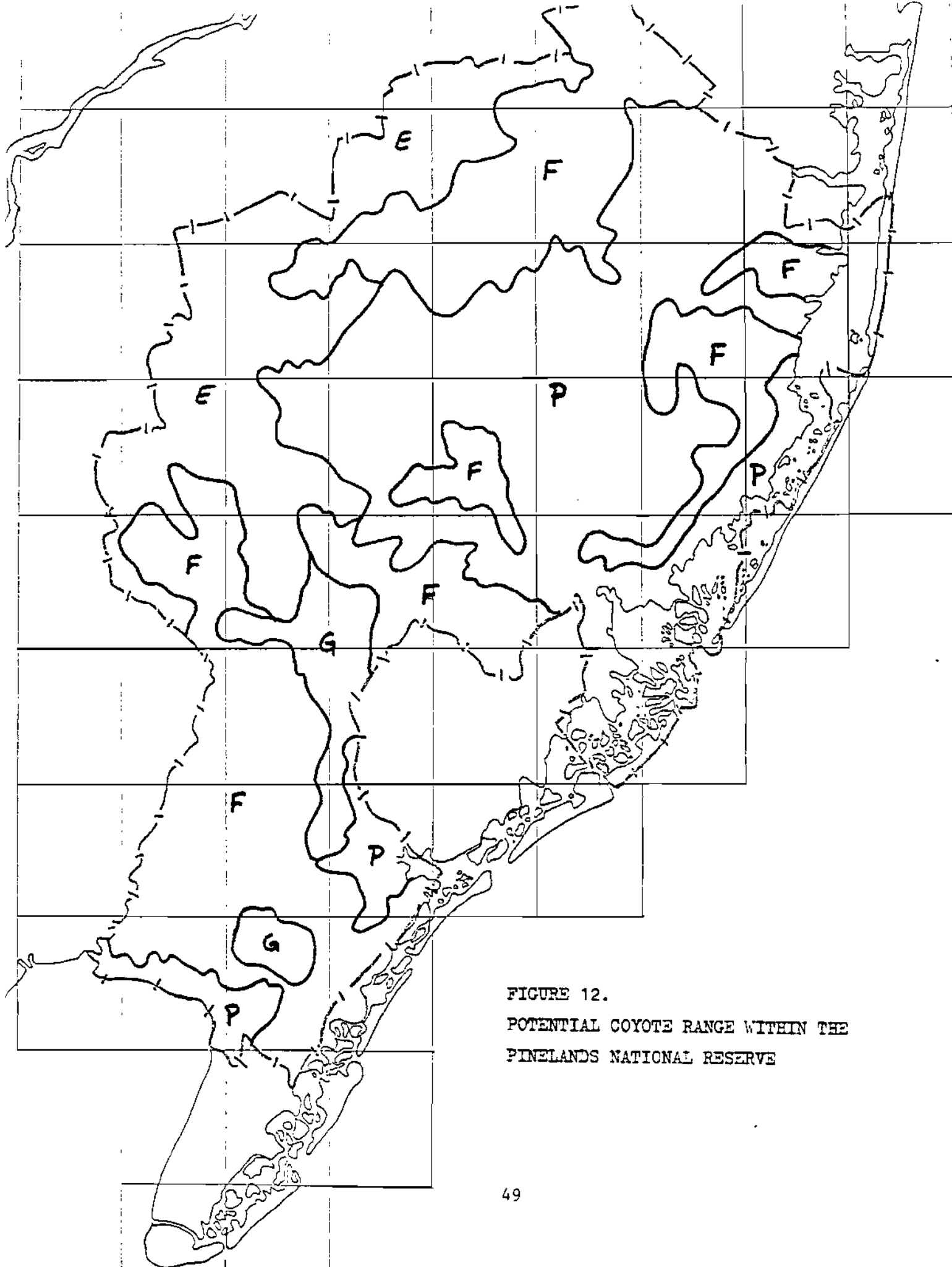


FIGURE 12.
POTENTIAL COYOTE RANGE WITHIN THE
PINELANDS NATIONAL RESERVE

is alike and shows some seasonal variation. The upper body is usually a dark grey with the undersides ranging from buff to chestnut. There is a white ring around the eye. Adult grey squirrels weight from 340 to 726 grams and are from 20 to 25 cm long.

The grey squirrel is primarily arboreal in nature and rarely ventures far from trees. Squirrels feed on a great variety of nuts, seeds, grain, fruits, and often the cambium layer of trees. The home range of grey squirrels varies from 0.8 to 2.8 hectares (Burt and Grossenheider, 1976).

Grey squirrels occur in hardwood and mixed coniferous-hardwood forests, particularly in areas of good mast production. They also occur in the brushy undergrowth along river bottoms, small farm woodlots, and city parks. The distribution of the grey squirrel in the Pine Barrens can be found in Figure 13.

Except for marshlands and areas of monotypic pine the grey squirrel is found throughout the Pinelands. Grey squirrels do not have specific areas of critical habitat. Any development which will eliminate adult mast producing or den trees will have an adverse effect on the grey squirrel population.

Grey squirrels in the pinelands provide considerable recreation through hunting and aesthetic qualities. Sportsmen harvest an estimated 26,800 gray squirrels annually in the Pinelands National Reserve from mid-October to mid-February.

2.7.13

RED SQUIRREL (Tamiasciurus hudsonicus)

Population Status - Abundant
Game Code Status - Protected

The red squirrel is about half the size of an adult grey squirrel. Sexes are colored alike. The pelage is rusty brown above. The underparts,

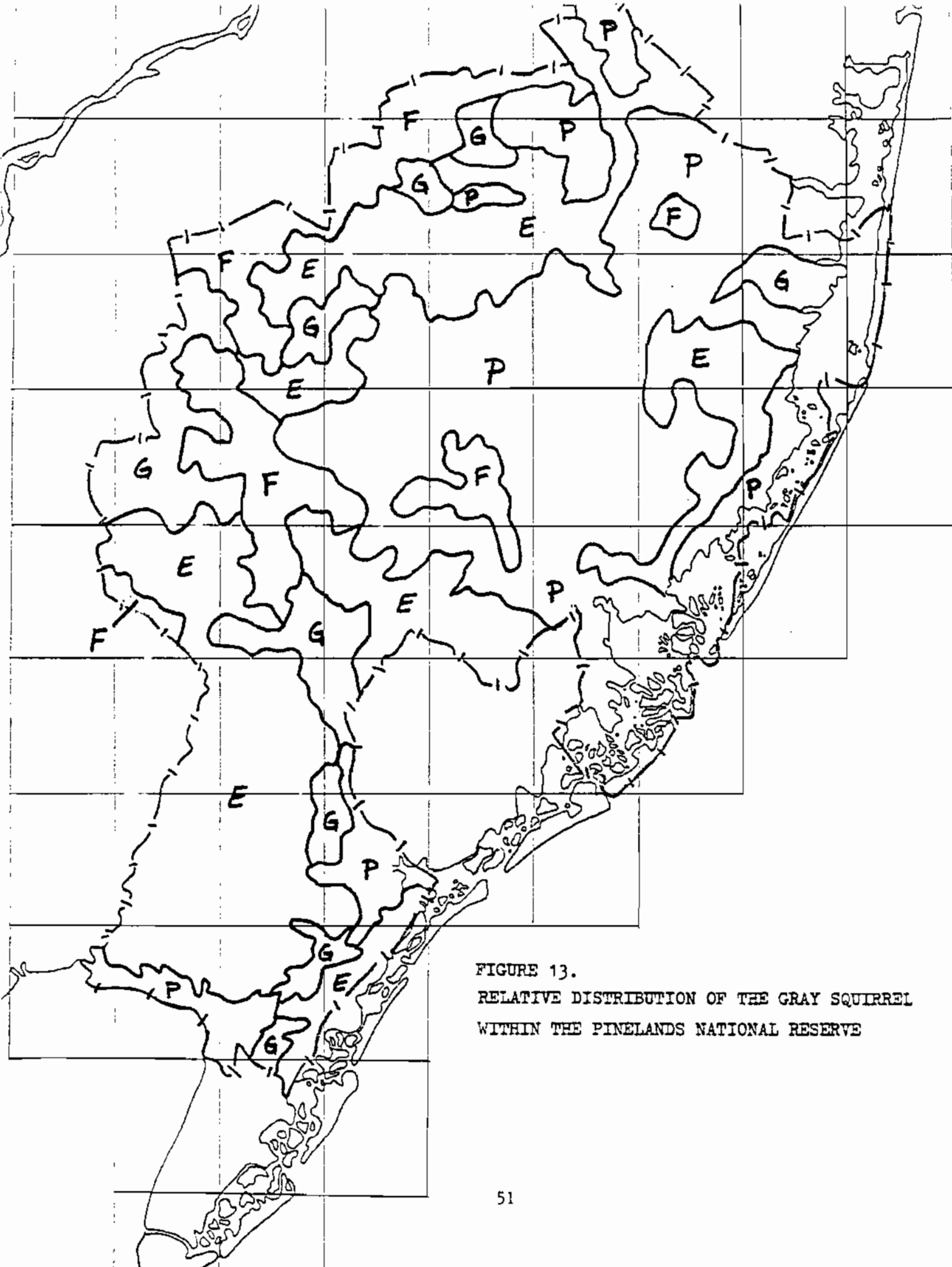


FIGURE 13.
 RELATIVE DISTRIBUTION OF THE GRAY SQUIRREL
 WITHIN THE PINELANDS NATIONAL RESERVE

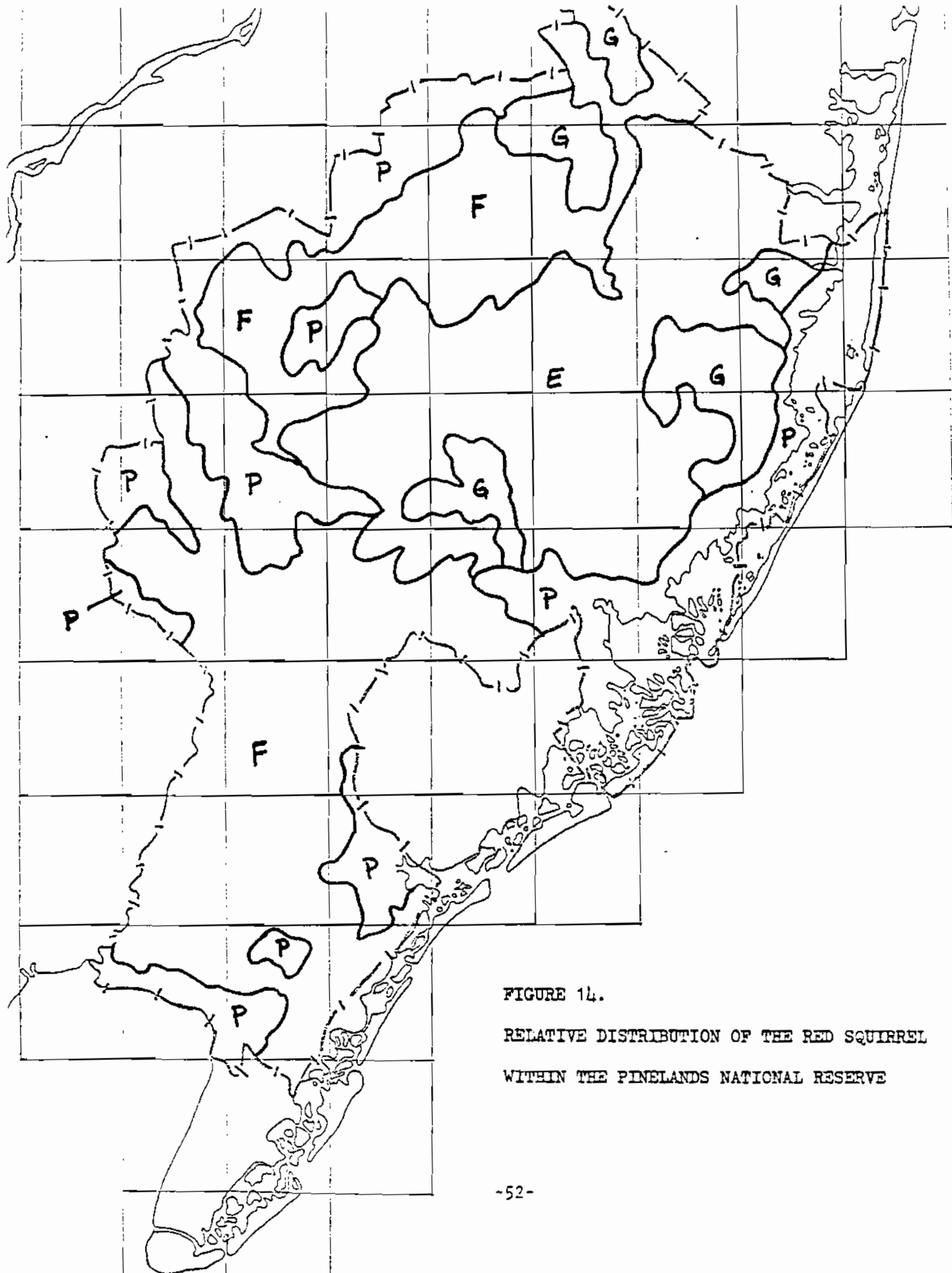


FIGURE 14.

RELATIVE DISTRIBUTION OF THE RED SQUIRREL
 WITHIN THE PINELANDS NATIONAL RESERVE

chin, throat and rings around the eyes are whitish. There is a narrow black stripe along the sides (Godin 1977). The sexes are the same size. Measurements range from 17 to 20 cm in length; tail, 10 to 15 cm; weight, 198 to 250 grams. Usual home range is approximately 1.2 hectares.

The red squirrel feeds on a variety of foods but prefers the seeds of conifers. Other food items eaten include nuts, eggs, and fungi.

This species occurs principally in pine forests and to a lesser extent in hardwood forests (Fig. 14). McCormick (1970) lists the red squirrel as common throughout the Pinelands.

2.7.14

WOODCHUCK (Marmota monax)

Population Status - Uncommon
Game Code Status - Hunted

The woodchuck, or ground hog as it is commonly known, is a short, heavy-bodied member of the squirrel family. The legs are heavily muscled and equipped with stout claws for digging. The pelage is generally grizzled brown with a slight reddish cast to the rear guard hairs. The underfur is pale brown; the feet are dark brown or black. Adult animals weigh from 2.2 to 6.1 kg, and measure from 50 to 71 cm in length. The home range varies from 16.2 to 65 hectares.

Woodchucks feed mainly on pasture and small grain crops. They also occasionally take insects and rarely eat meat. Woodchucks inhabit areas of pasture or agricultural production bordered by woods or hedgerows. Woodchucks can only be found on the edges of the Pinelands since the loose, sandy, outer coastal plains soils are unsuitable for extensive burrow systems. The woodchuck is occasionally found in the western section of the Pinelands in the agricultural areas (McCormick 1970) (Fig. 15).

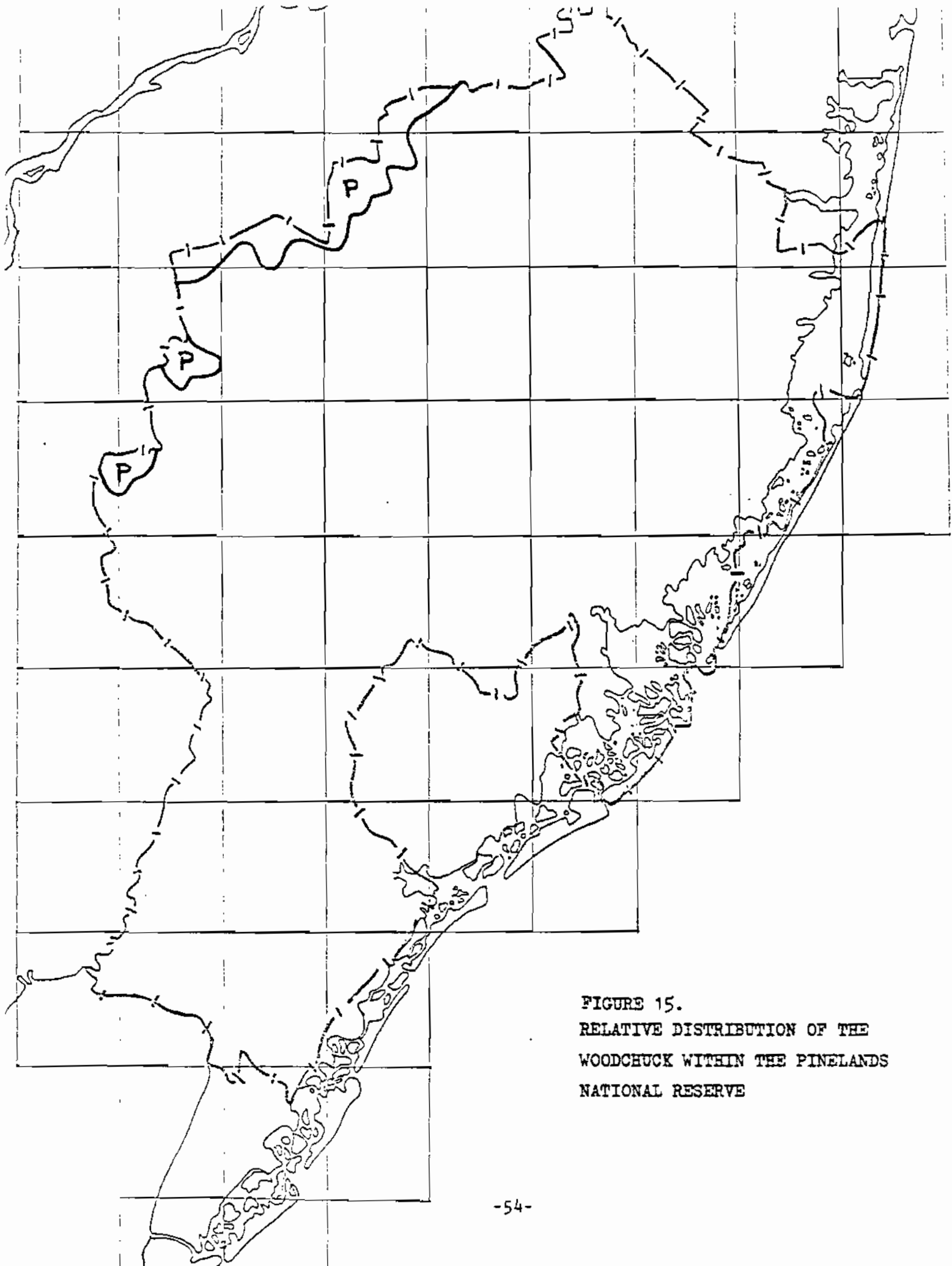


FIGURE 15.
RELATIVE DISTRIBUTION OF THE
WOODCHUCK WITHIN THE PINELANDS
NATIONAL RESERVE

The beaver is a compact, heavy-bodied animal, with short legs, webbed hind feet and a broad, flattened tail. The pelage consists of extremely dense, short, soft underfur overlaid by coarse guard hairs that are long and shiny. The sexes are colored alike with rich, brownish black body hair and paler underfur. Measurements range from 85 to 174 cm. Weights vary from 13.5 to 27 kg.

Beaver live in family units called colonies. A colony will consist of an adult male and female and their offspring. A colony may contain up to 12 members but 5 to 6 is usual. Once a colony has established, a territory and built a lodge and dam, members of the colony will stay within 500 meters of the pond. Young adults being driven from the colony by the adults, prior to the next litter being born, may travel as far as 46.4 kilometers searching for a new place to live.

Beaver are vegetarian animals. They generally prefer the bark of deciduous trees but will eat herbaceous plants and grasses. In spring and summer beavers feed on bulrush, cattails, sedges, the bark of poplar, willow, birch, red oak, red maple, white cedar, pitch pine, cherry, and viburnum.

The beaver occur along gently sloping streams and rivers and small quiet lakes bordered by stands of small deciduous timber such as red maple, poplar, birch, willows, and white cedar. New Jersey conducts an annual census of beaver colonies in the state. The locations of these colonies within the pinelands are shown in Figure 16 (Spinks and Ferrigno, 1977).

Beaver in the Pinelands provide excellent opportunities for trapping. Even though beaver pelts are valued at less than other furbearers, many trappers are willing to spend the hours necessary to catch a beaver since it is considered by many as a trophy catch. The Pinelands yields about 50 beaver per year to trappers.

Many species of wildlife are attracted to beaver ponds. In the Pinelands such ponds provide excellent fishing opportunities. Also, these ponds provide excellent nesting and resting areas for waterfowl. The ponds that beavers create also stabilize stream flow, conserve water, prevent rapid runoff, and control soil erosion (Godin 1977).

The beaver in the Pinelands is a valuable wildlife resource which should be conserved by the protection of the watershed areas in which it lives.

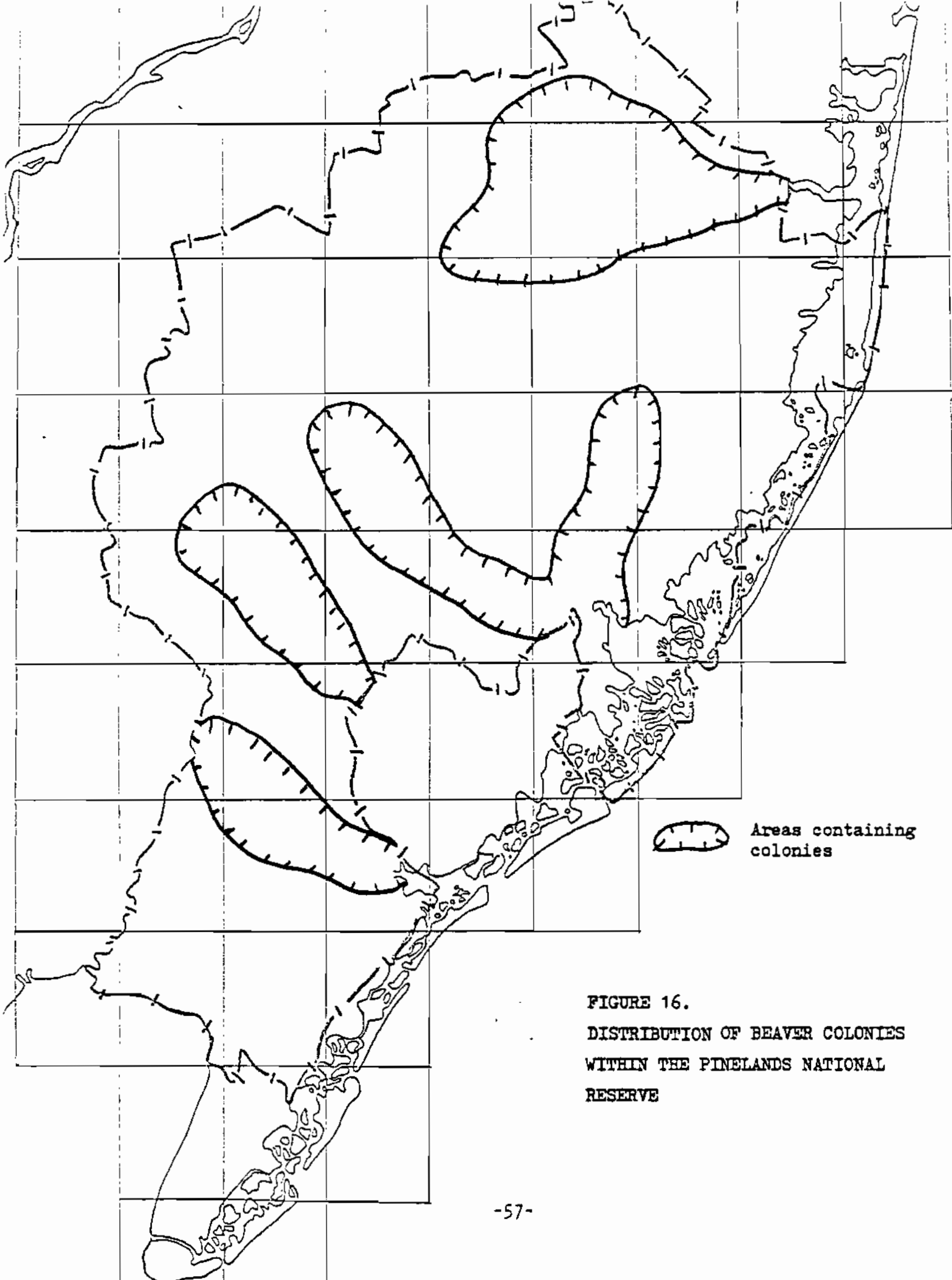


FIGURE 16.
DISTRIBUTION OF BEAVER COLONIES
WITHIN THE PINELANDS NATIONAL
RESERVE

Site specific information on the location
of beaver colonies (pp. 58-65) deleted.
Contact the Division of Fish, Game, and
Wildlife for information on individual
site locations.

The muskrat is about half the size of a cottontail rabbit. It has a long, compressed tail, sparsely haired and covered with small scales. The head is broad and blunt with small, beady eyes and short ears covered with fur. The feet are partially webbed and adapted for swimming. The pelage consists of dense, soft, gray underfur, overlain by long, glossy brown, guard hairs. The sexes are colored alike and show little seasonal variation. The underparts are considerably lighter, varying from light brown to pale silver. The average adult muskrat measures from 75 to 96 cm, head to tail. The weight of the average muskrat is from 0.68 to 1.82 kg. The home range of a muskrat in a stable body of water is approximately 3.2 hectares.

Muskrats feed on a variety of aquatic plants including cattails, arrowhead, bulrushes, and water lilies. They supplement their diets with corn, clover, alfalfa, soybeans, clams, snails, mussels, frogs, reptiles, fish, young birds, and carrion.

Muskrats are semiaquatic furbearers. They are found in heavy growths of herbaceous vegetation near slow-running water, swamps, marshes, and bogs. They are also found in the banks of ponds, lakes, salt water marshes, rivers, and creeks. All of the salt marsh, and most of the fresh water estuaries and rivers found in the pinelands are extremely important to this furbearer resource (Toth 1975) (Fig. 17). Any disturbance of these areas would endanger the most valuable furbearer resource in the state.

Trappers annually harvest an estimated 93,600 muskrat from the area encompassed by the Pinelands National Reserve. The income from muskrat

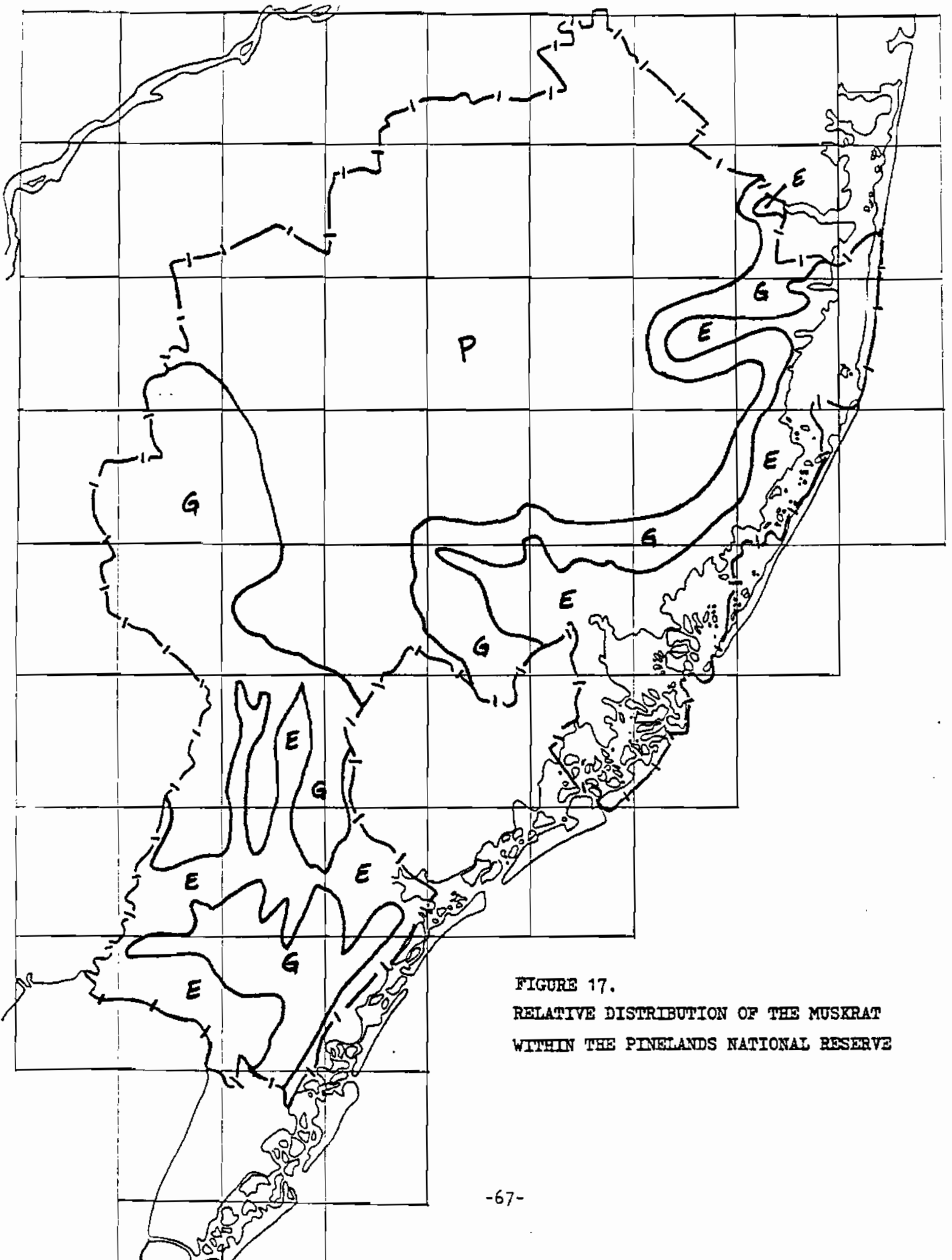


FIGURE 17.
RELATIVE DISTRIBUTION OF THE MUSKRAT
WITHIN THE PINELANDS NATIONAL RESERVE

trapping in these areas often provides supplemental money to low income families.

2.7.17

EASTERN COTTONTAIL RABBIT (Sylvilagus floridanus)

Population Status - Common
Game Code Status - Hunted

The pelage of the cottontail rabbit is long and coarse and varies from reddish brown mixed with black to greyish brown. The nape of the neck has a distinctive rusty cinnamon patch. The tail is a fluffy cotton-white and the feet and legs are a cinnamon rufous color. The average cottontail is from 35 to 43 cm long and weighs from 0.9 to 1.8 kg.

The cottontail is a vegetarian, feeding on green vegetation during the summer on bark and twigs during the winter. The home range of a cottontail varies from 1.2 to 8 hectares, depending on the sex and age of the rabbit, the time of year, and the habitat.

Eastern cottontail rabbits are found in fields, meadows, farmlands, dense high grass, wood thickets; along fencerows, stone walls overgrown with brush, forest edges, and the edges of swamps and marshes. They are seldom found in extensive stands of mature forest (Godin, 1977).

The status of the cottontail rabbit in the Pinelands ranges from abundant to scarce, dependent on the habitat type. Its relative distribution throughout the Pinelands can be found in Figure. 18. Each year the Division of Fish and Game conducts a census of the cottontail population. The results serve as an index to population trends. Figure 19 shows the results of this census for the last 10 years (N.J. Division of Fish, Game and Shellfisheries 1970a-79a).

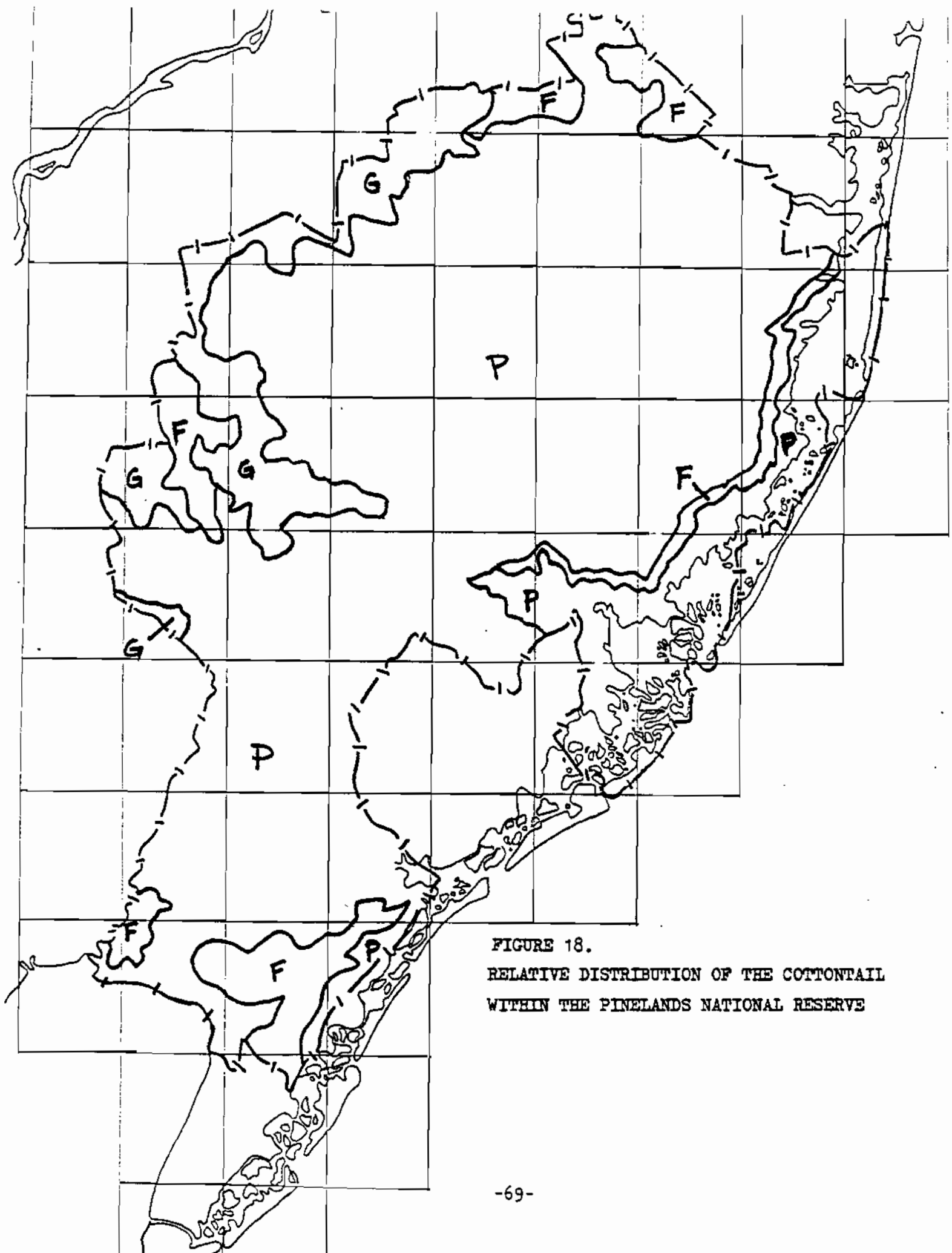
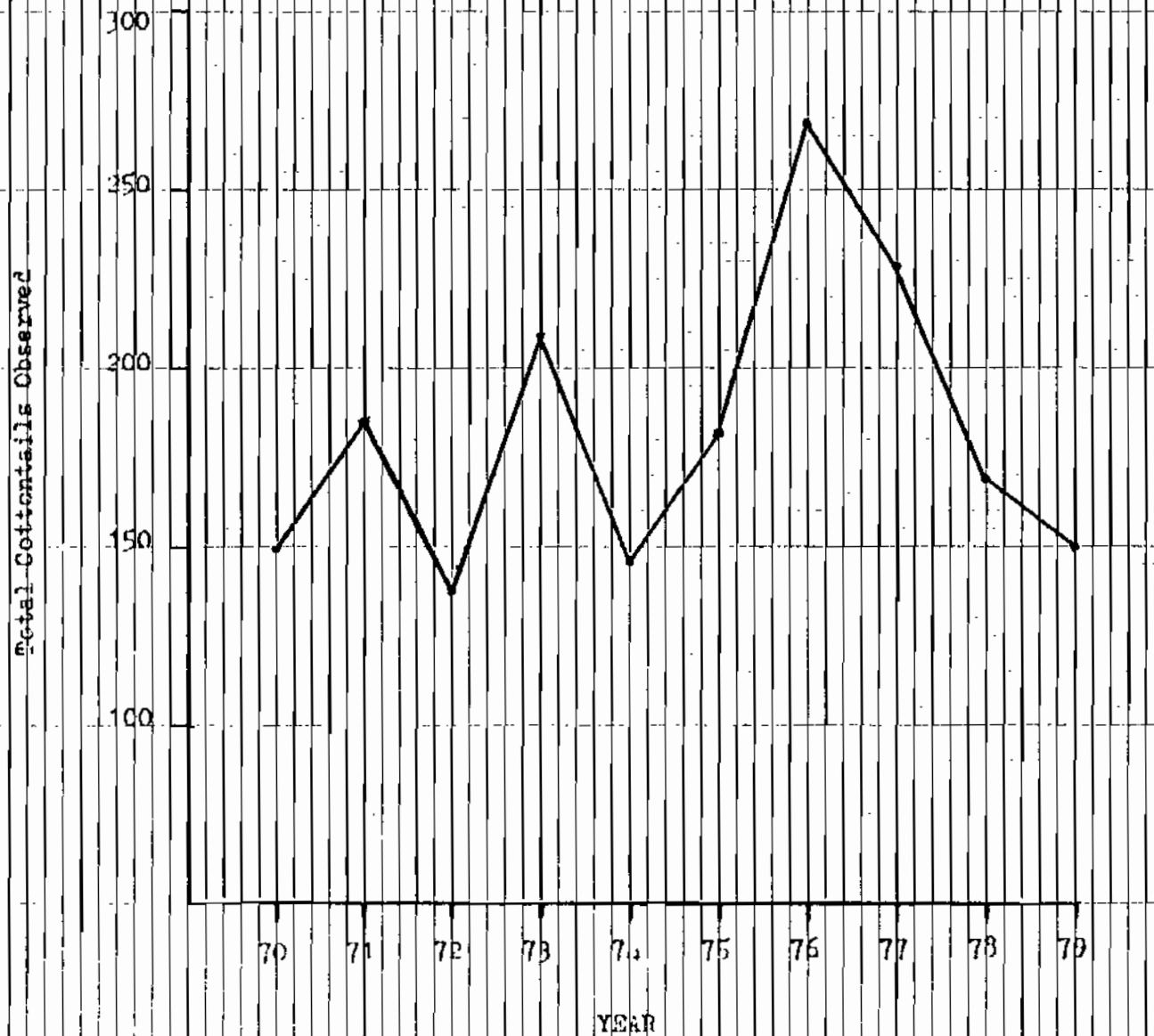


FIGURE 18.
RELATIVE DISTRIBUTION OF THE COTTONTAIL
WITHIN THE PINELANDS NATIONAL RESERVE

FIGURE 19. TOTAL NUMBER OF COTTONTAILS OBSERVED ON CENSUS ROUTES WITHIN THE
PINELANDS NATIONAL RESERVE, 1970-79



Since the eastern cottontail rabbit is found throughout the Pineland region, areas of critical habitat need not be identified. However, this does not mean that the cottontail is not sensitive to development. Rabbits, like most small game or upland furbearers, are edge species requiring mixtures of food, cover and water in a relatively small area. Any development which will eliminate areas of "edge" habitat will severely decrease or eliminate cottontail rabbits in the effected area. Cottontail rabbits are an important source of outdoor recreation for thousands of people in the Pinelands areas. An estimated 104,100 cottontails are harvested annually from within the area designated as the Pinelands National Reserve during the hunting season from early November to mid-February.

2.7.18

WHITETAIL DEER (Odocoileus virginianus)

Population Status - Common
Game Code Status - Hunted

The whitetail deer is distinguished by its long legs, conspicuous ears, bushy white tail and, in males, antlers. Sexes are colored alike and show marked seasonal variation. During the summer the pelage is reddish brown, during the winter the pelage is greyish or greyish brown. The underparts, throat patch, and underside of the tail are white during both seasons (Godin 1977). Bucks, or male deer, are usually larger than does (females). The total length of adult bucks averages 210 cm including tail. Weights vary considerably with age, sex, range condition, and time of year. Average weights vary from 22.5 to 112.5 kg. The average home range of the whitetail is usually less than 260 hectares.

Whitetail deer are chiefly browsers but may graze occasionally on grasses and other nonwoody plants. Preferred browse includes apple, basswood, black cherry, northern white cedar, red maple, red oak, smooth sumac, staghorn

sumac, and wintergreen. Species commonly browsed are beech, dogwood, honeysuckles, viburnum, mountain laurel, birch, pitch pine, poplar, shadbush, white oak, and willows (Godin 1977).

The whitetail deer is essentially a forest-edge animal. They prefer brushy thickets alternating with open, sunny glades and abandoned fields. Deer are seldom found in remote, extensive, dense forests, unbroken by old fields or active agriculture. Normally deer move freely throughout their range. However, during severe winters with deep snow deer are restricted to a much smaller area commonly referred to as a deer "yard". A yard consists of a network of packed deer trails formed by deer constantly seeking food and shelter within the area. In the pinelands these yards are often found in dense white cedar swamps. These areas of critical habitat are outlined in Figure 20. The development of any of these swamps would place an additional strain on the Pinelands deer herd since it would not only destroy favorite wintering areas, but eliminate a preferred food source. The relative density of deer in the Pinelands is described in Figure 21.

The white-tailed deer was an important animal to the Lenape Indians, 7,000 years before the white man established his first colony in North America. Venison was used for food. The hides were used for clothing and in the construction of shelters, deerskin thongs were used for tying, securing and fastening. Bones provided raw materials for tools and weapons.

The early colonists also found the deer an important source of food and clothing. Through their lumbering and agricultural activities, and accompanying fires, colonists unknowingly improved the habitat for deer. However, this was offset by increased exploitation of deer by both white man and

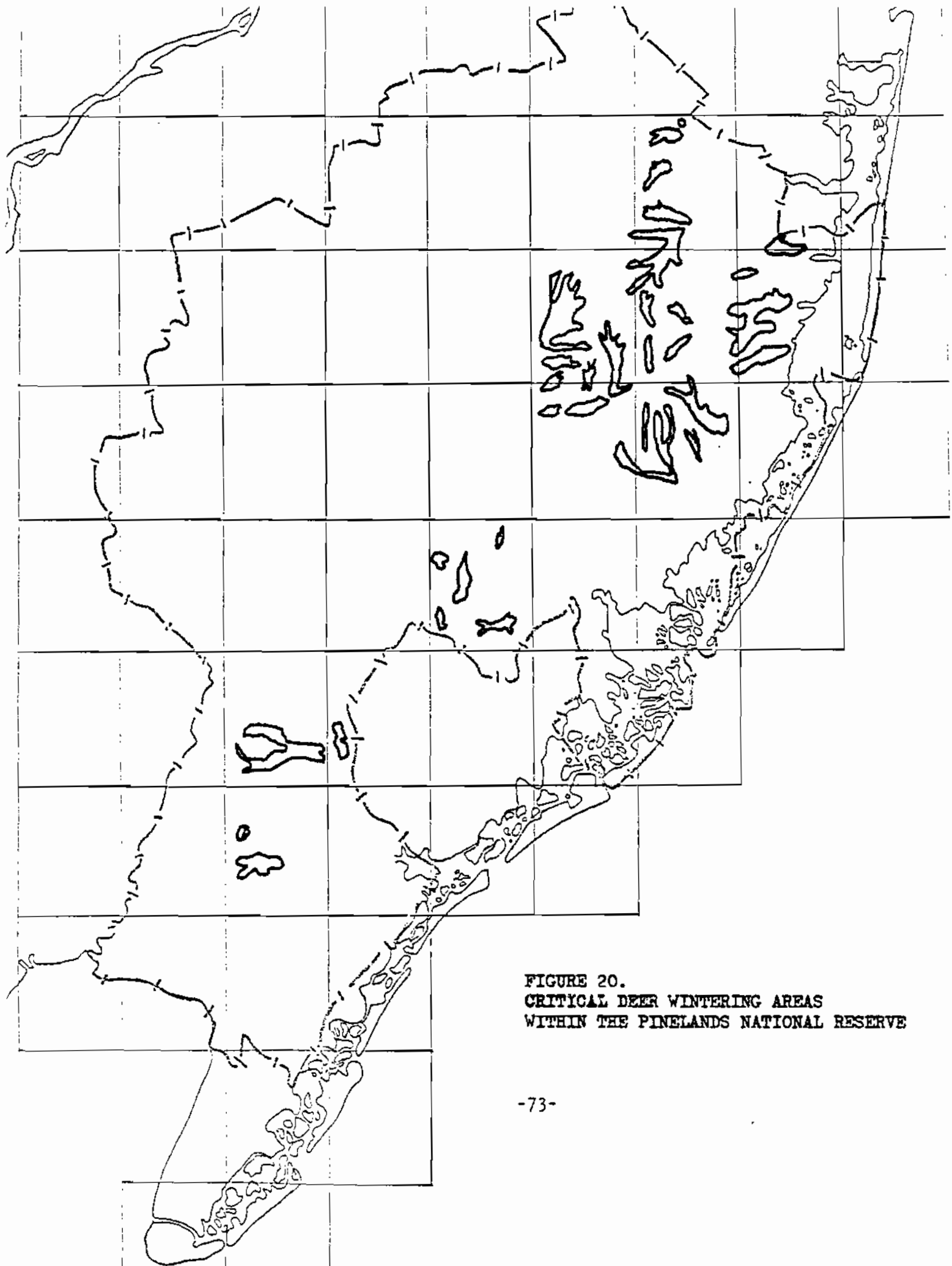


FIGURE 20.
CRITICAL DEER WINTERING AREAS
WITHIN THE PINELANDS NATIONAL RESERVE

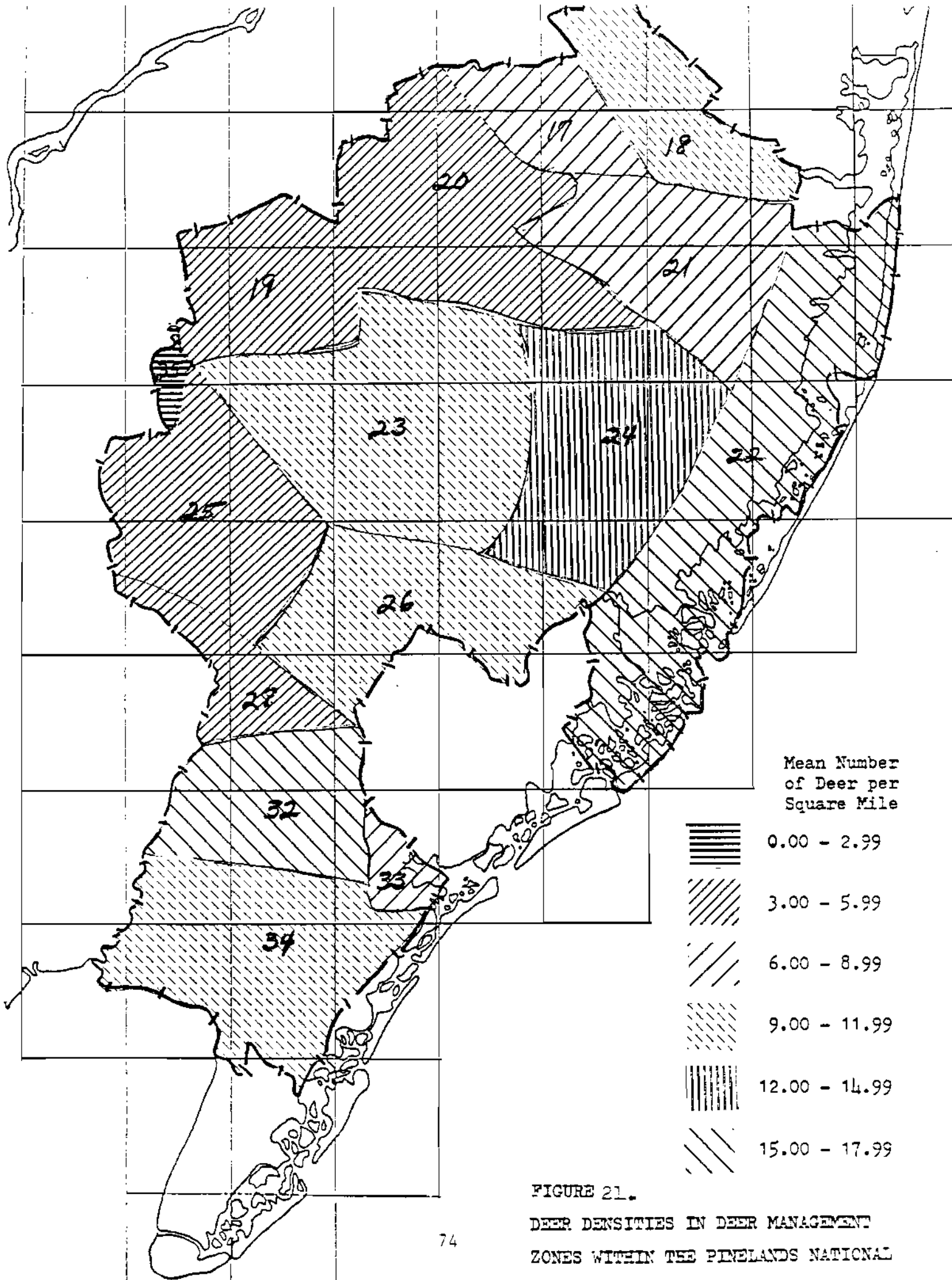


FIGURE 21.

DEER DENSITIES IN DEER MANAGEMENT ZONES WITHIN THE PINELANDS NATIONAL RESERVE

Indian. Trade in venison hams and buckskin eventually depressed the population to the point where many people began to realize that something had to be done.

The first deer law was passed in 1679. It prohibited the export of skins from deer that had been killed by Indians. Beginning in 1722, a series of laws were established to control harvest. Specific seasons were set, hunting methods were restricted and penalties for violations established.

Despite efforts to protect the deer, the population continued to decline as the human population grew and man's exploitation of the land intensified. Between 1853 and 1902, additional laws were enacted prohibiting the killing of deer in certain counties and eventually the entire state. In spite of these efforts, New Jersey's deer resource was reduced to no more than a few small groups on protected estates and in the pine-oak woodlands of South Jersey.

The deer hunting season was closed by an act of the General Assembly from 1902 through 1908. During this period, deer obtained from outside the state, as well as those obtained from private enclosures within New Jersey were released to provide a nucleus population for reestablishment.

Efforts were successful and the population increased rapidly. As early as 1912, deer damage to agricultural crops was reported. The hunting season was reopened in 1909 with a reported harvest of 86. [In comparison, the total reported harvest for 1977 was 14,419.]

Sound laws and effective enforcement were major elements in the restoration effort. One of the most important early laws was the so-called "buck law." Passed in 1909 and later modified [1928], it restricted the harvest to

bucks having at least three-inch antlers. This law prohibited the taking of female deer which allowed for maximum population increase in the shortest period of time. Undoubtedly, the buck law was an important element in the restoration of New Jersey's deer resource. However, it resulted in a philosophy of "bucks only" management that was to soon lead to problems of deer overpopulation as the herd reached and then exceeded the carrying capacity of its habitat. The result was overbrowsing and destruction of native food plants and increased damage to agricultural and nursery crops. Unfortunately, the philosophy of "bucks only" was so deeply engrained in many New Jersey deer hunters, that efforts to control populations through the controlled harvest of does and fawns were continually thwarted.

Early reaction to deer overpopulation took the form of treating symptoms and not causes. Chemical repellents, fencing, diversionary food patches and finally permits to shoot nuisance deer were all tried in an effort to control the increasing reports of deer damage. Few realized that the day of "bucks only" was over and that increased harvests of does and fawns would be necessary to control the increasing herds.

Between 1940 and 1949, extensive research was conducted to explore means of reducing deer damage to agricultural crops. However, the tendency of treating symptoms and not causes prevailed. Not until January of 1951 was a limited deer of either-sex season held in response to the increasing pressure from farmers and landowners demanding relief. Only a token harvest of 472 deer was taken and attempts at population control through the use of either-sex hunting were temporarily abandoned.

Extensive deer damage in the central and northern counties prompted the reinstatement of an either-sex season in 1959. A total of 3,571 deer were reported taken. No season was held in 1960. However, in January 1962, the first statewide, either-sex season since 1915 was held.

Though either-sex seasons have been held annually since 1962, opposition from some sportsmen's groups has essentially eliminated either-sex hunting from most of the southern counties. As a result, while the northern and central deer herds have maintained their populations at a relatively stable level, the Pine Barrens' populations have shown marked variation in the reported harvest.

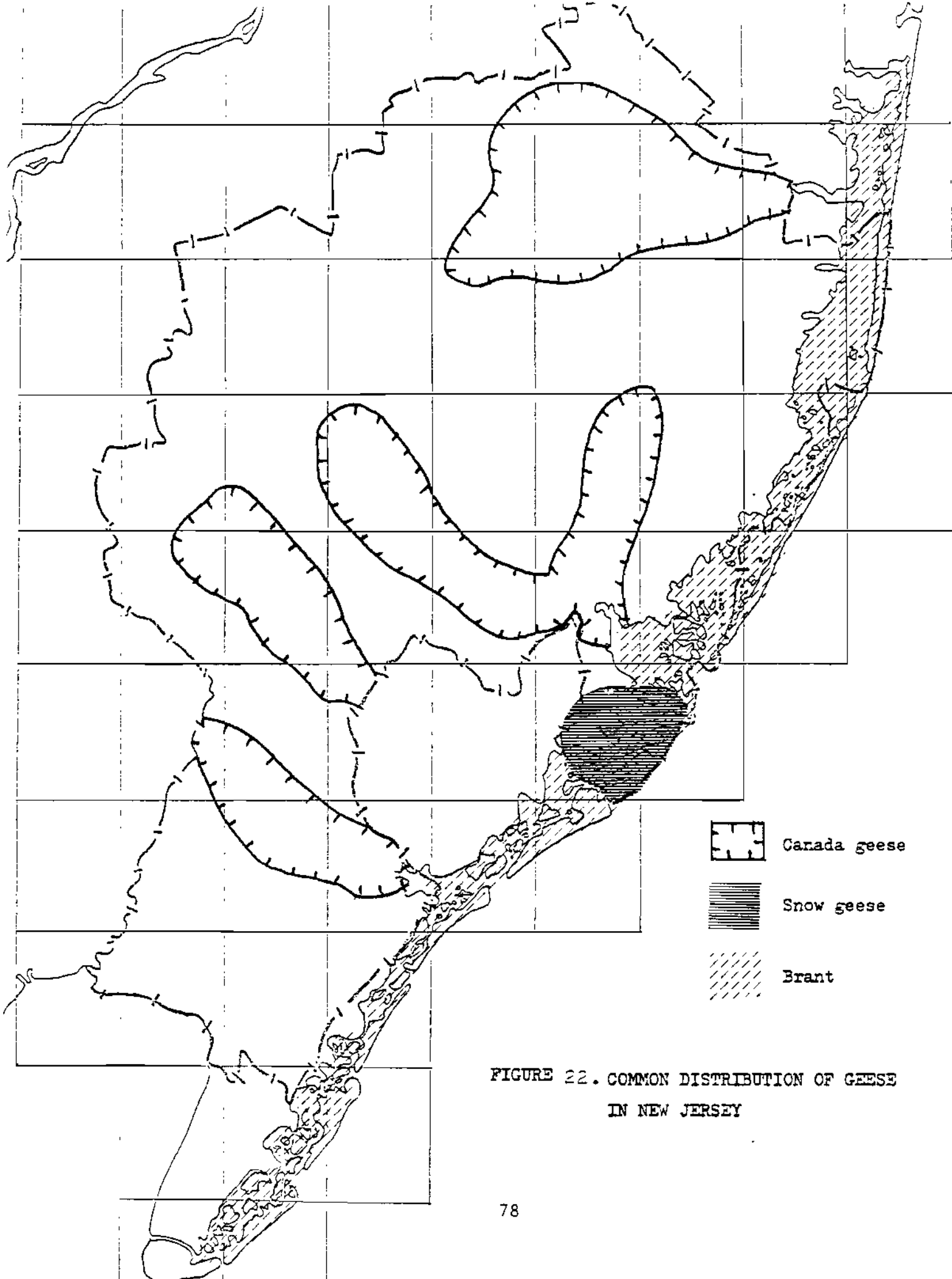
There are still many problems to overcome, but the success of New Jersey's overall deer management program in providing quality recreation for a substantial number of our citizens cannot be denied. In 1909 the reported legal deer harvest was 86 compared to 14,419 reported for 1977. Between 1909 and January 1979, 322,567 deer have been reported legally harvested in New Jersey. In the area of the Pinelands National Reserve, the deer harvest for all seasons in 1978 was 2,243.

2.7.19

GEESE

Canada Goose	<u>Branta canadensis</u>
Brant	<u>Branta bernicla</u>
Snow Goose	<u>Chen hyperborea</u>

Geese are intermediate in size between swans and ducks. Geese are much heavier than ducks and have longer necks. Their legs are positioned more toward the front of their bodies than either ducks or swans. The






-  Canada geese
-  Snow geese
-  Brant

FIGURE 22. COMMON DISTRIBUTION OF GEESE
IN NEW JERSEY

position of the legs is an adaptation for grazing on land. Coloration of the sexes is alike. When migrating, geese usually travel in large noisy flocks. Geese feed on grains, grass, sprouts, marine vegetation and some marine animals. These birds provide a great deal of recreation through hunting and casual observation (Toth and Widjeskog, 1975). Geese frequent the coastal areas of the Finelands and may travel inland to larger lakes and to agricultural areas to graze (Figure 22).

2.7.20

SURFACE FEEDING DUCKS

Mallard	<u>Anas platyrhynchos</u>
Black Duck	<u>Anas rubripes</u>
Pintail	<u>Anas acuta</u>
Gadwall	<u>Anas strepera</u>
Widgeon	<u>Mareca americana</u>
Shoveler	<u>Spatula clypeata</u>
Blue-Winged Teal	<u>Anas discors</u>
Green-Winged Teal	<u>Anas carolinensis</u>
Woodduck	<u>Aix sponsa</u>
Hooded Merganser	<u>Lophodytes cucullatus</u>

Surface feeding ducks are the common ducks of shallow fresh and salt water marshes. They are agile fliers and leap directly out of the water on take off. Their legs are positioned toward the middle of the body to facilitate walking on land. Most feed in shallow water and dive rarely. Most feeding is done by tipping end up and dabbling. Males and females usually have different plumage. In early summer after breeding, males moult into a

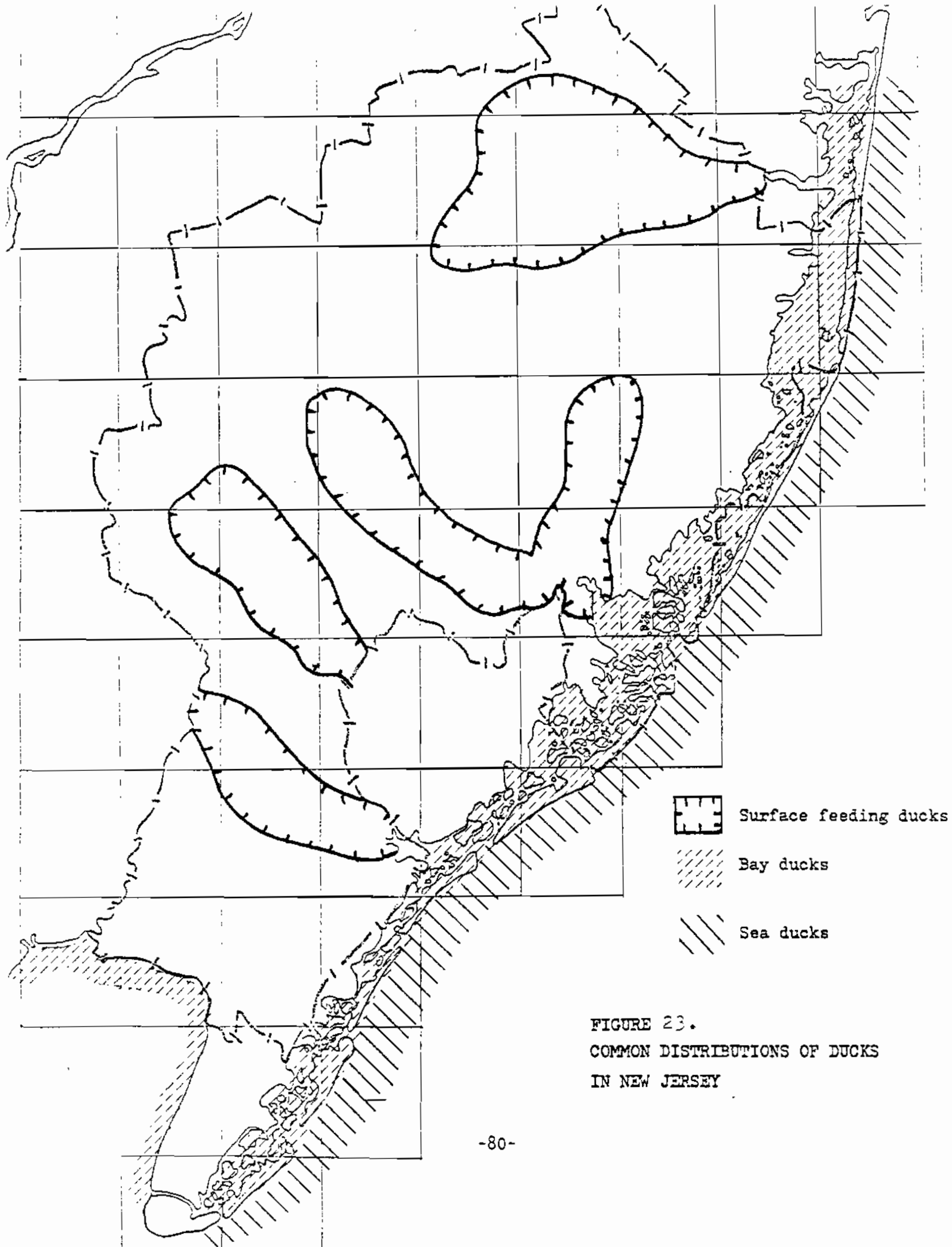


FIGURE 23.
COMMON DISTRIBUTIONS OF DUCKS
IN NEW JERSEY

drab eclipse plumage. A second moult restores the male to his breeding plumage by fall. Most surface feeding ducks have a bright distinctive rectangle of color (the speculum) on the hind edge of each wing. Surface feeding ducks are mainly vegetarians, though they may supplement their diets with some mollusks, insects, and small fish.

Ferrigno et al. (1975) conducted aerial surveys of wintering waterfowl on appropriate wetlands. Their report indicates that sections of the Pine-lands are important wintering areas for thousands of waterfowl each year.

These ducks provide both consumptive and non-consumptive recreation in the forms of hunting and observational activities. Any disturbance to the wetlands that these ducks inhabit would greatly increase the vulnerability of these ducks since they depend on these areas for food and rest during migration and breeding. Distribution of these birds is depicted in Figure 23.

2.7.21

BAY DUCKS

Redhead	<u>Aythya americana</u>
Canvasback	<u>Aythya valisineria</u>
Ring-necked Duck	<u>Aythya collaris</u>
Greater Scaup	<u>Aythya marila</u>
Lesser Scaup	<u>Aythya affinis</u>
Common Merganser	<u>Mergus merganser</u>
Common Goldeneye	<u>Bucephala clangula</u>
Red-breasted Merganser	<u>Mergus serrator</u>
Bufflehead	<u>Bucephala albeola</u>
Ruddy Duck	<u>Oxyura jamaicensis</u>

Bay ducks are commonly found in coastal bays, river mouths, and inlets. They are heavy-bodied birds with legs set well back on their bodies. Their feet are large and fully webbed. These characteristics facilitate the bay duck's ability to dive and swim underwater.

These birds provide both consumptive and non-consumptive recreation through hunting and bird watching. Distribution of these birds is depicted in Figure 23. Winter waterfowl surveys indicate that areas included in the Pinelands Reserve are vital wintering areas for large concentrations of bay ducks (Ferrigno et al. 1975).

2.7.22

SEA DUCKS

Common Eider	<u>Somateria mollissima</u>
King Eider	<u>Somateria spectabilis</u>
Oldsquaw	<u>Clangula hyemalis</u>
Common Scoter	<u>Oidemia nigra</u>
White-Winged Scoter	<u>Melanitta deglandi</u>
Surf Scoter	<u>Melanitta perspicillata</u>

Sea ducks are heavy, rather large, short-necked, diving ducks. They are commonly seen along the coast, and rarely inland unless driven by storms. In winter they often occur in large mixed flocks. Most of these ducks live on mollusks and aquatic vegetation depending on availability. These birds provide both consumptive and non-consumptive recreation through duck hunting and birding. The distribution of these birds is mainly along the Atlantic Coast (Fig. 23).

The ruffed grouse is a medium sized grouse, with a fan-like tail. The coloration varies from light, grey-brown to rufous-brown mottled with white. There is a black ruff of feathers, used by the male during display, at white. There is a black ruff of feathers, used by the male during display, at the base of the neck. Grouse are approximately 35 cm in length and weigh from 454 to 766 grams.

Grouse feed on a variety of vegetation and insects during the summer, and turn to buds and nuts during the winter. The home range of the ruffed grouse varies from 2.8 to 10.5 hectares (Johnsgarel, 1973).

Good grouse range includes three distinct plant groups: (1) hardwoods, (2) shrubs and grasses, (3) conifers or brush and vine tangles. Better grouse covers will include swamps or streams with heavy brush. Since a majority of the Pinelands is unbroken pine-oak or oak-pine forests, this area provides only good to fair habitat. For excellent grouse areas the mature forests must be interspersed with old fields or logged areas for raising broods. For a distribution of grouse in the Pinelands area see Figure 24. Grouse are extremely sensitive to development and agriculture. They do, however, respond readily to management. Maintaining small (1.2 to 2 hectares) cleared plots on a rotational basis by bulldozing, burning, or logging will maintain a healthy grouse population in the hardwood and oak-pine areas of the Pineland.

The ruffed grouse annually provides many mandays of recreation in the Pinelands. An estimated 7,700 grouse are harvested each year in the area of the Pinelands National Reserve from early October to mid-February.

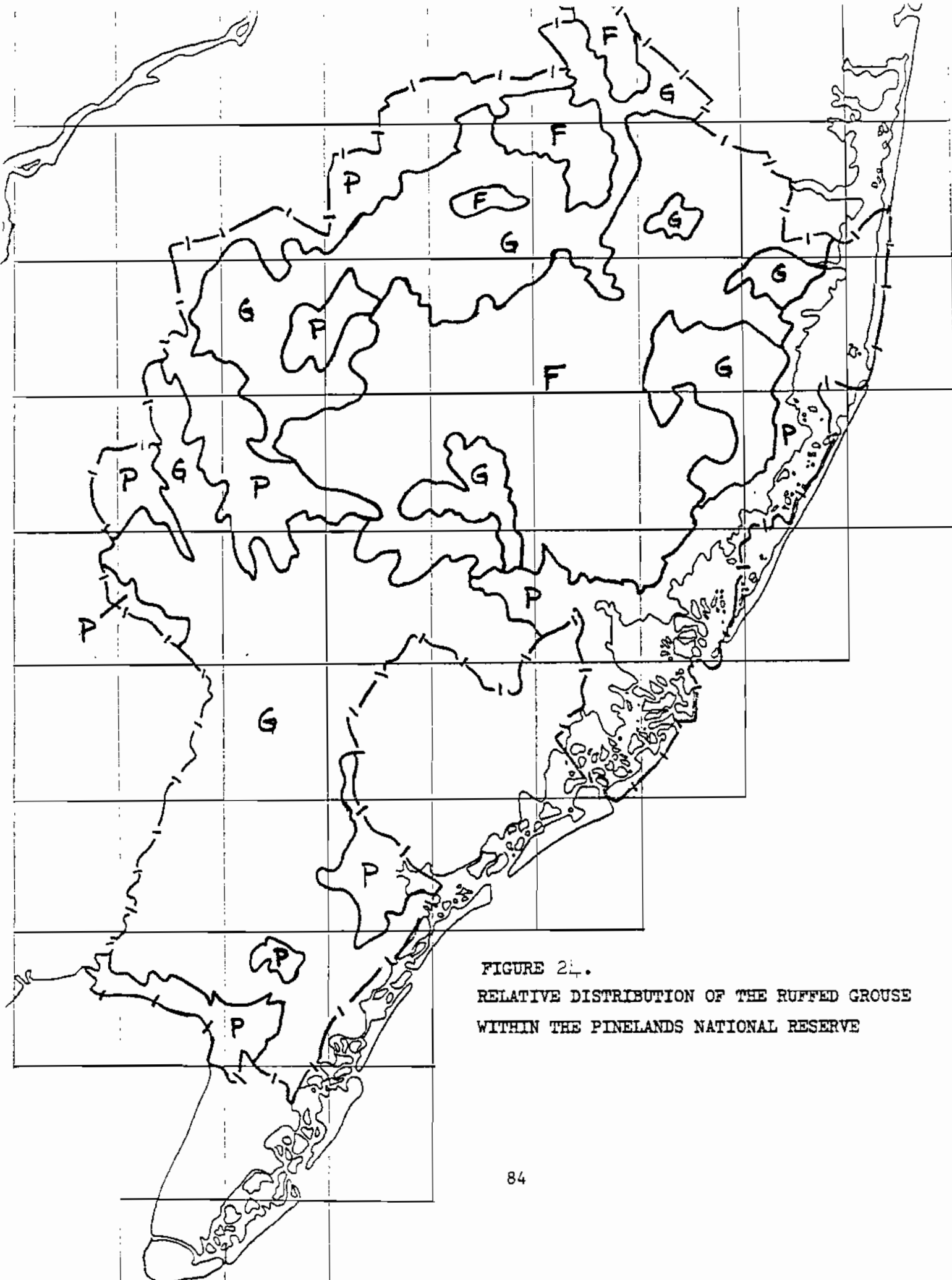


FIGURE 21.
 RELATIVE DISTRIBUTION OF THE RUFFED GROUSE
 WITHIN THE PINELANDS NATIONAL RESERVE

BOBWHITE QUAIL (Colinus virginianus)

Population Status - Abundant
 Game Code Status - Hunted

The bobwhite quail is a small rufous-brown, chicken-like bird, near the size of a dove. The male bird shows a conspicuous white throat and stripe over the eye; on the female these are buff colored. Typically, quail gather together in coveys in early fall and stay together until spring. These coveys may be as large as 30 birds. Quail range in length from 20.3 to 25.4 cm, and weigh from 140 to 224 grams. The home range of a covey of quail is from 20 to 40 hectares.

Quail feed on a wide variety of seeds, plant foods and insects. Domestic small grains, weed seeds, and mast compose the largest part of the quail's diet.

Quail are found in varied habitats, from open inelands to brushy farmland and mixed oak and pines. In the Pinelands the bird can be found wherever an adequate amount of food and cover is found. Quail distribution in the Pinelands can be found in Figure 25. Any extensive development in the agricultural areas of the Pinelands would have an adverse effect on the quail population.

The quail, though physically small, is easily the most important upland game bird in the Pinelands. Quail provide thousands of hours of recreation annually. Approximately 59,600 quail are harvested annually from the Pinelands National Reserve area. The Division of Fish and Game releases thousands of quail to the Pinelands National Reserve area every year during the hunting season to provide additional recreational opportunity for sportsmen. An indication of population trends is obtained by conducting an annual quail

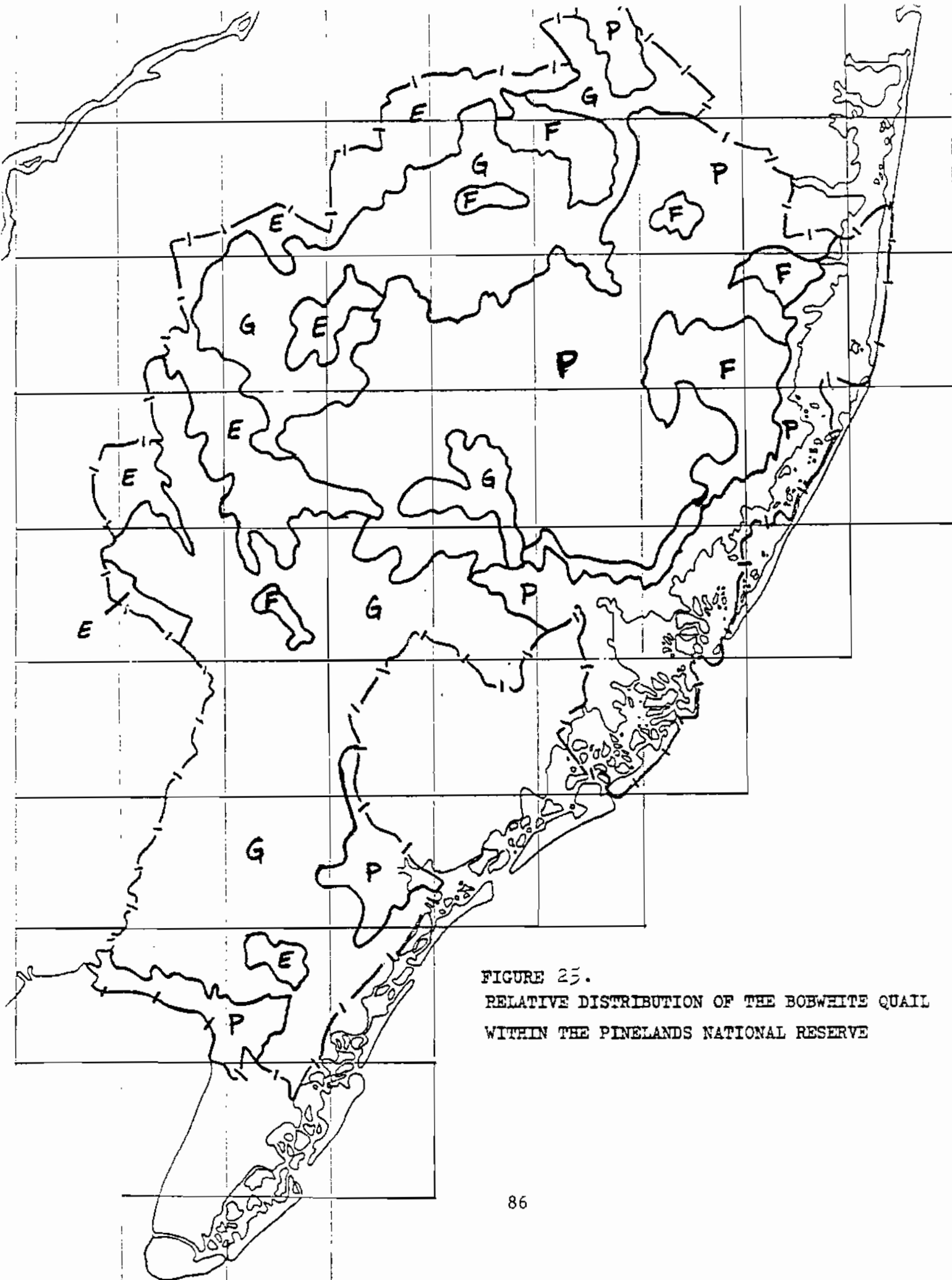
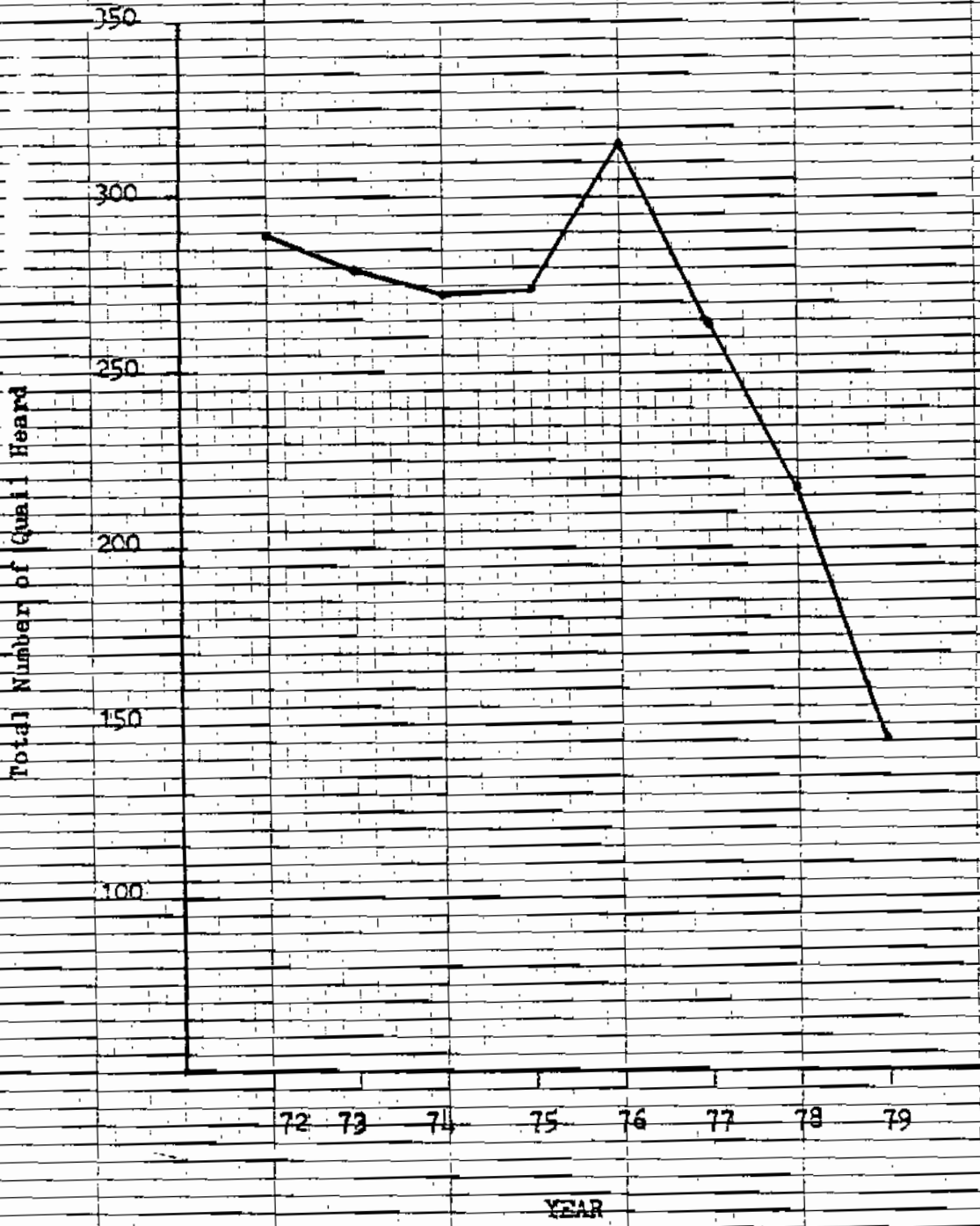


FIGURE 25.
 RELATIVE DISTRIBUTION OF THE BOBWHITE QUAIL
 WITHIN THE PINELANDS NATIONAL RESERVE

FIGURE 26.

TOTAL NUMBER OF QUAIL HEARD ON CENSUS ROUTES
WITHIN THE PINELANDS NATIONAL RESERVE, 1972-79



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whistling cock census (Figure 26). (N.J. Division of Fish, Game, and Shellfisheries 1972c-79c). The severe decline in the listening counts during the past three years is attributed to high chick mortality due to cold wet springs. One or two normal breeding would probably return the populations to the normal level.

2.7.25

RINGNECK PHEASANT (Phasianus colchicus)

Population Status - Uncommon
Game Code Status - Hunted

The coloration of the ringneck pheasant is quite variable. The male birds are characteristically brilliant metallic colors - green, purple, copper, yellow, red, and grey. The white collar is variable in size or completely lacking on some birds. The females are a dull mixture of browns, and buff with dark markings. The birds are approximately 68 cm in length and weigh from 0.95 to 1.23 kg.

The major portion of the pheasant's diet consists of vegetable matter, though insects are extremely important to chick growth. Since the pheasant is an adaptable feeder, usually feeding on the most accessible foods, and the majority of the pheasant populations are concentrated in grain producing areas, cultivated crops are usually predominant in the diet.

Pheasants are abundant in areas of high soil fertility where a large percentage of the land is under cultivation and there exists a good interspersion of food and cover types. There is only a small area of land on the western side of the Pinelands that meets these requirements. The pheasant population in the Pinelands inhabits only marginal habitat (Figure 27). Since this section of the Pinelands just barely meets the habitat requirements of the ringneck pheasant, any disturbance would mean the total elimination of the pheasant from the region.

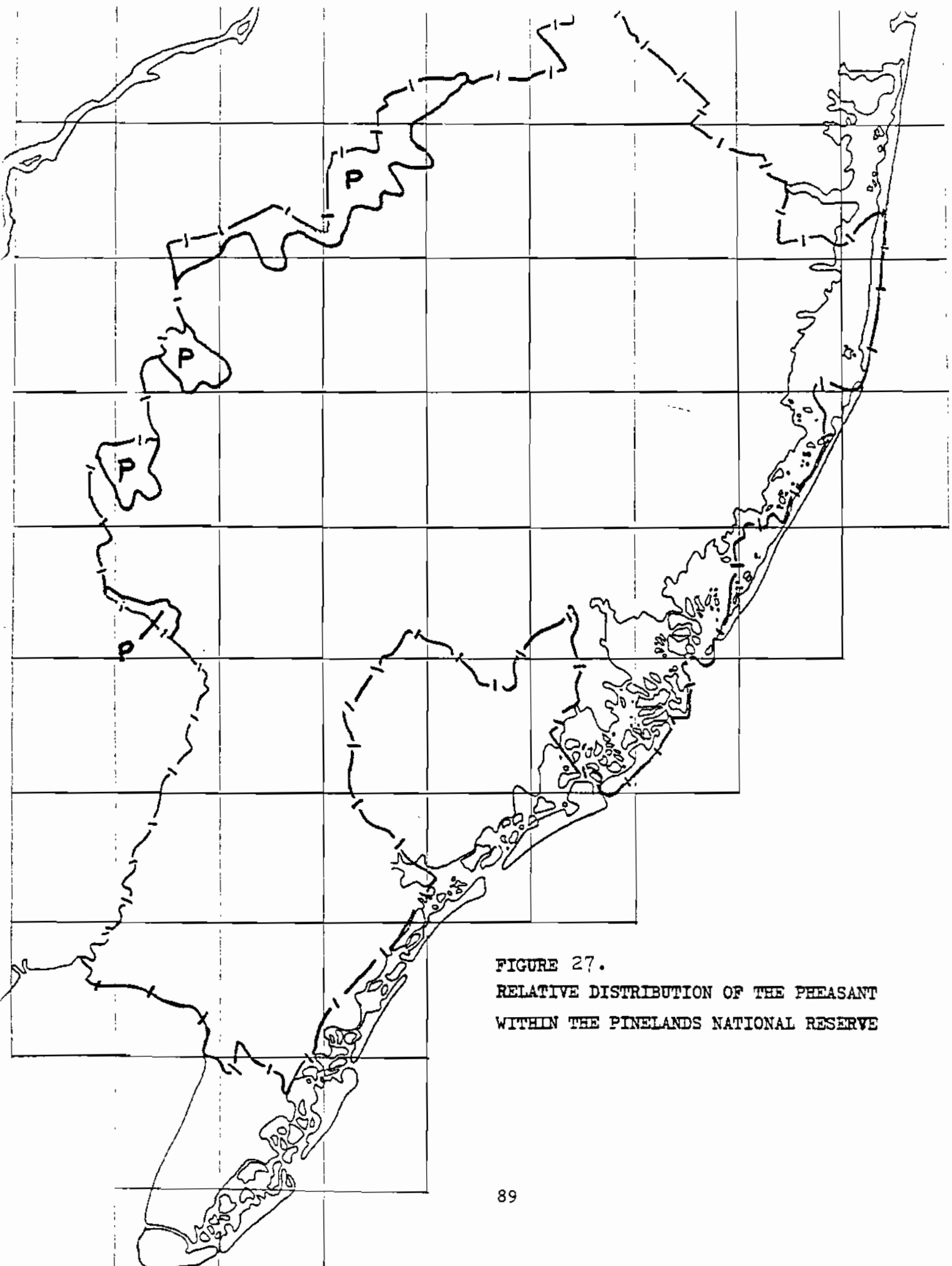
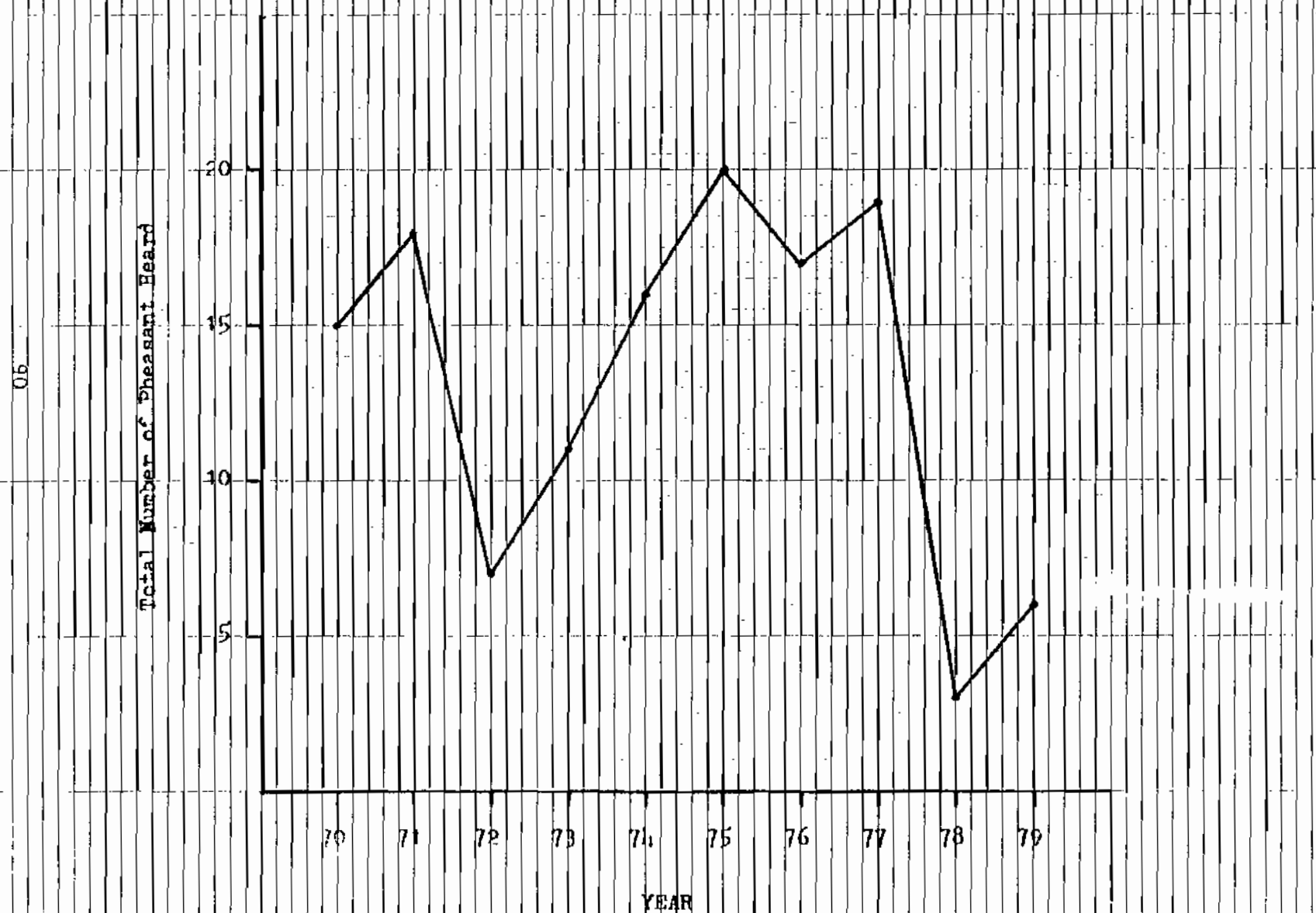


FIGURE 27.
RELATIVE DISTRIBUTION OF THE PHEASANT
WITHIN THE PINELANDS NATIONAL RESERVE

FIGURE 28. TOTAL NUMBER OF PHEASANT HEARD ON CENSUS ROUTES WITHIN THE PINELANDS NATIONAL RESERVE, 1970-79



Approximately 42,700 pheasant are taken annually by sportsmen in the Pinelands National Reserve area. The vast majority of these are birds released by the Division of Fish and Game and by private hunting clubs to provide pheasant hunting recreation in areas where pheasant are not naturally available.

Each spring a census of crowing pheasants is conducted. This serves as an index to the population trend. Figure 28 presents the census results for the past 10 years within the Pinelands (N.J. Division of Fish, Game, and Shellfisheries 1970b-79b).

2.7.26

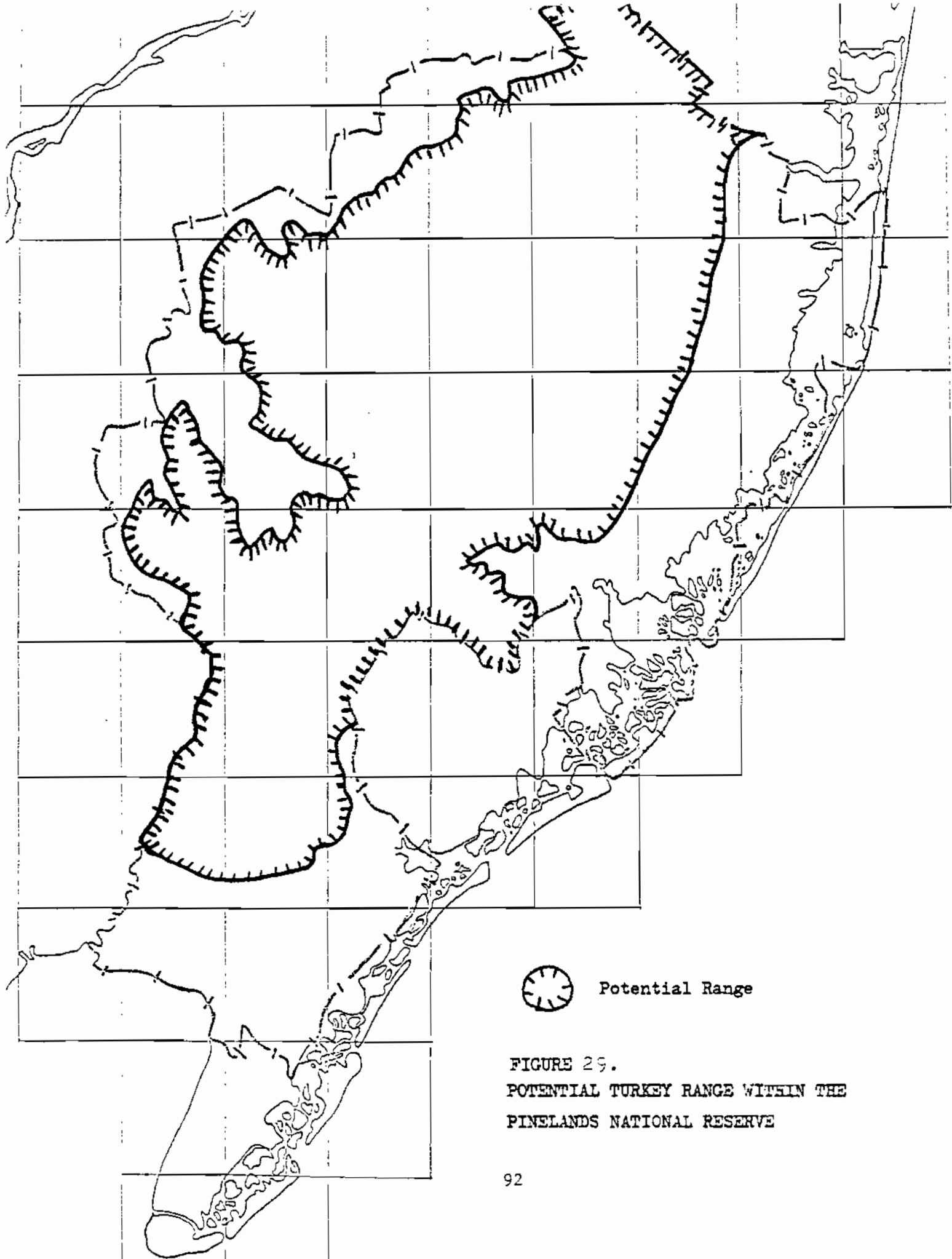
TURKEY (Meleagris gallopavo)

Population Status - Recently
Reintroduced
Game Code Status - Protected

The wild turkey is a slimmer version of the barnyard turkey. The feathers are iridescent browns and black with rusty-colored tips. The male has bright red wattles and a bluish head. Males are considerably larger than females. Males measure up to 122 cm in length; females, 91 cm (Peterson, 1947).

Turkeys have strong well developed legs and prefer running as a means of escape. They roost in trees at night. Turkeys feed on a wide variety of seeds, fruit, acorns, nuts, and some insects.

The eastern wild turkey is believed to have been common throughout New Jersey. It was extirpated in the early 1900's as a result of habitat change and over-exploitation. Several attempts were made to re-introduce the wild turkey to New Jersey (McCormick, 1970). Recently the wild turkey was successfully re-introduced into northwestern New Jersey by the state Division of





 Potential Range

FIGURE 29.
 POTENTIAL TURKEY RANGE WITHIN THE
 PINELANDS NATIONAL RESERVE

Fish, Game and Wildlife. There are approximately 500 square miles of habitat in that portion of the state. The Pinelands provides approximately 1500 additional square miles of turkey habitat (Fig. 29). The Division of Fish, Game, and Wildlife has currently released 15 wild trapped turkeys from north Jersey into this potential range in hopes of establishing a breeding population in the Pinelands. Available statewide habitat could support an estimated 5,000 turkeys which could provide an estimated 150,000 mandays of recreation to hunters annually (Eriksen, 1978). In addition, a considerable amount of non-consumptive recreation would be generated.

2.7.27

RAILS

Virginia Rail	(<u>Rallus limicola</u>)
Sora	(<u>Porzana carolina</u>)
Clapper Rail	(<u>Rallus longirostris</u>)

Rails are plump, long-legged, marsh birds. They are rather secretive and are more often heard than seen.

The clapper rail is a large (35 to 40 cm), slate-colored rail of the coastal marshes. It has a long bill, short tail, and weak flight. When flying, the legs dangle below. Clapper rails nest in coastal salt marshes (Widjeskog and Shoemaker, 1974) (Figure 30). The clapper rail feeds on small marine animals and vegetation. Any development in the salt marsh area of the Pinelands would be extremely detrimental to the clapper rail. The clapper rail provides a limited amount of recreation in the form of hunting.

The Virginia rail is a common but elusive rail of fresh and brackish marshes and swamps (Fig. 30). The plumage of the Virginia rail is reddish

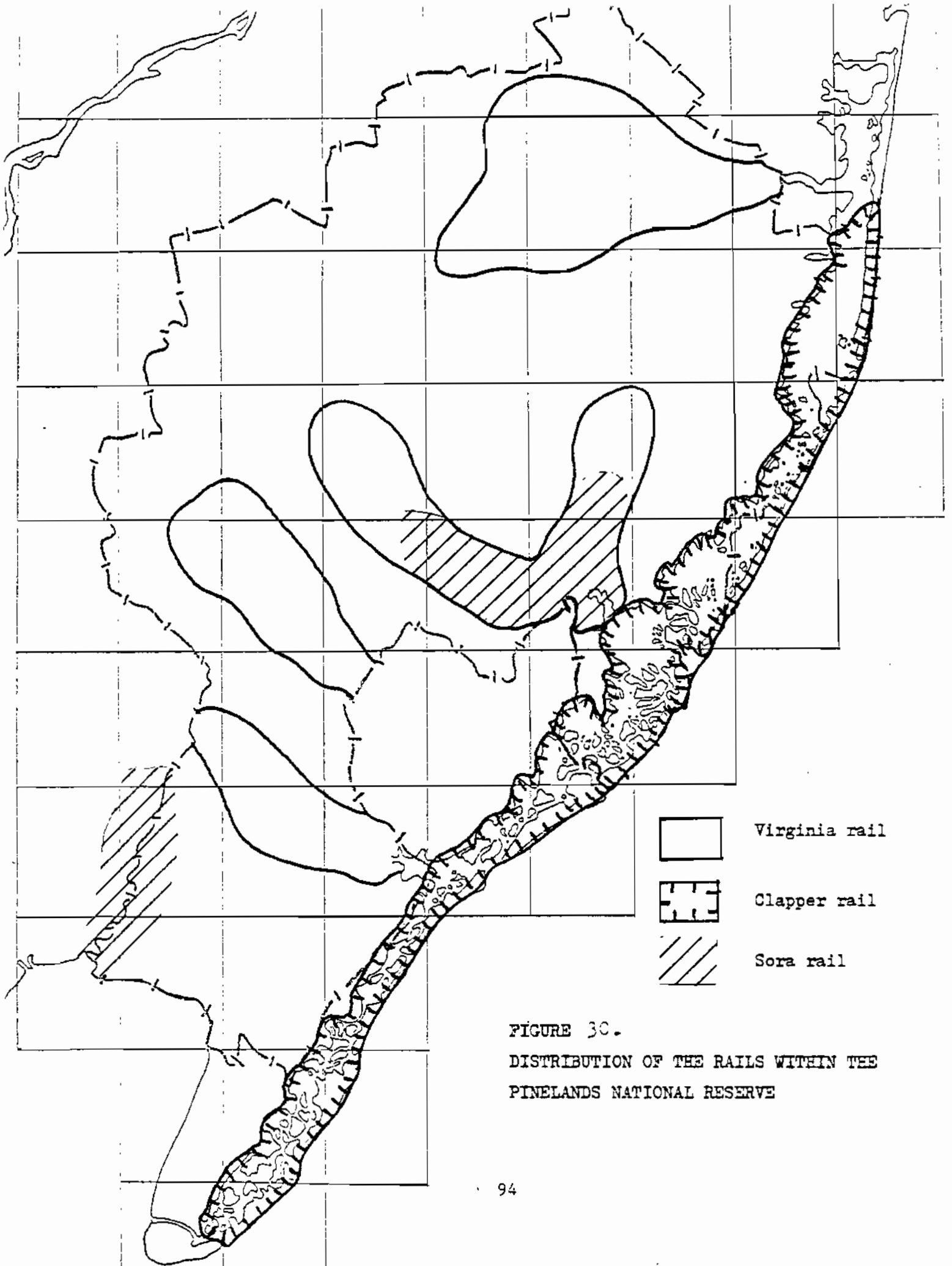


FIGURE 3C.

DISTRIBUTION OF THE RAILS WITHIN THE
PINELANDS NATIONAL RESERVE

brown with black barring on the sides and grey patches on the cheeks. The Virginia rail is about half the size of a clapper rail. It feeds on small aquatic animals and plants. This rail nests in many of the fresh water swamps and marshes. Any development of these wetland areas would eliminate the breeding habitats of the bird.

The sora rail is the smallest of the hunted rails, measuring a little over 20.3 cm. It is a plump, greyish brown bird with a black patch on the cheeks and neck and a short yellow bill. The sora rail nests principally along the marshes of the Mullica, Wading, and Maurice Rivers and their tributaries (Shoemaker, 1975) (Fig. 30). Any disturbances to these rivers or the wetlands that surround them would endanger the sora rail population of the pinelands.

2.7.28

GALLINULES AND COOT

Common Gallinule	(<u>Gallinula chloropus</u>)
American Coot	(<u>Fulica americana</u>)

The common gallinule is a medium-sized wading bird (30 to 36 cm) with short neck, long legs, long toes, and chicken-like bill. Its color is slate-gray with a red face, yellow-tipped bill, and a band of white feathers on the flanks.

The common gallinule is found in fresh water marshes and along the edges of lakes (Fig. 31). It feeds along the edge of open water by wading or swimming.

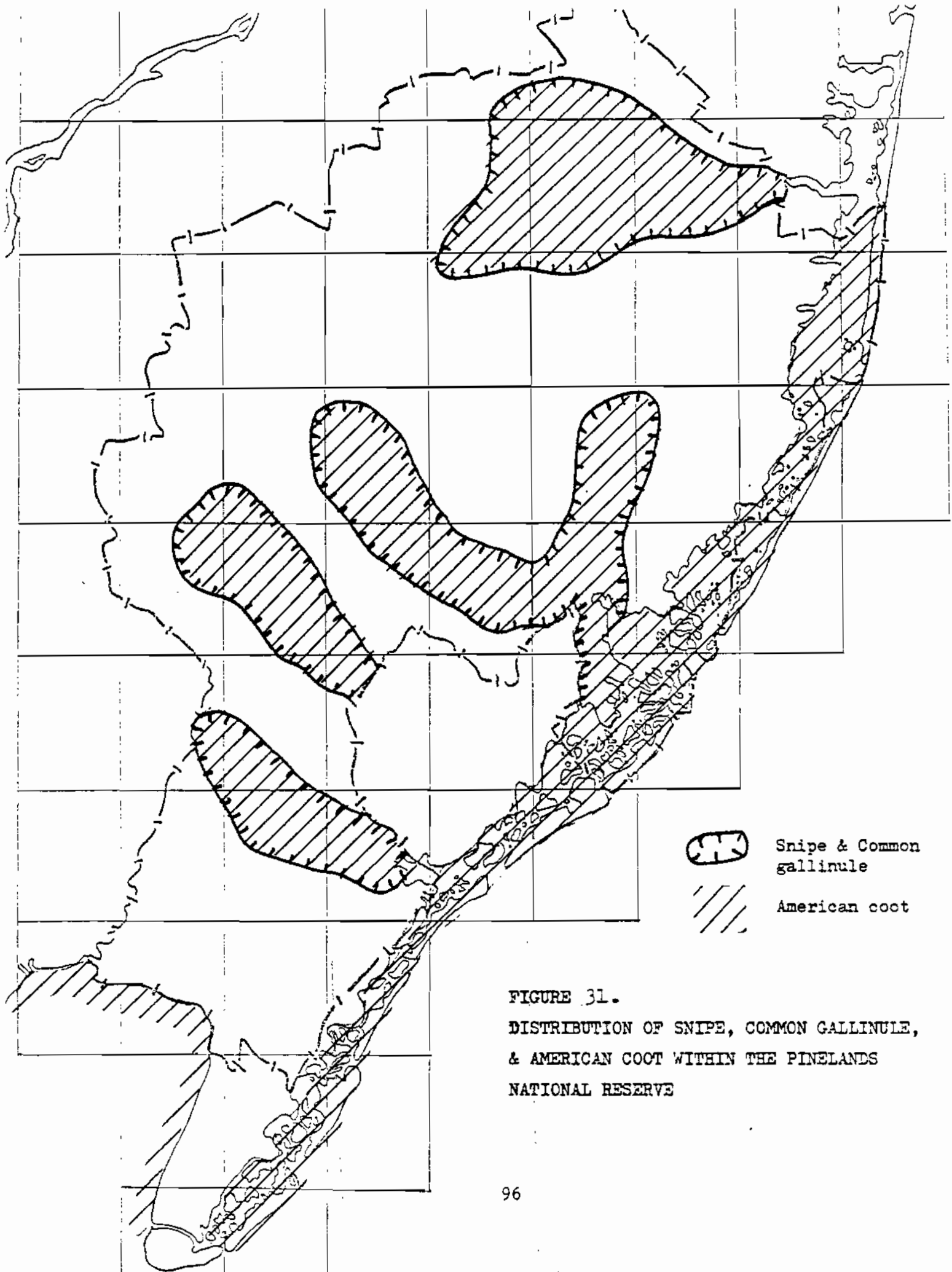


FIGURE 31.
 DISTRIBUTION OF SNIPE, COMMON GALLINULE,
 & AMERICAN COOT WITHIN THE PINELANDS
 NATIONAL RESERVE

The American coot is found on fresh water during nesting and on fresh and salt water in winter when it is often seen in flocks (Fig. 31). It feeds on shore, on the water surface, or by diving. In flight the legs are trailing.

2.7.29

WOODCOCK AND SNIPE

American Woodcock (Philohela minor)

Common Snipe (Capella gallinago)

The American woodcock is a mottled brown, stocky bird slightly larger (25 to 30 cm) than a bobwhite quail. It has a very short neck; short legs; short, rounded wings; and a long, slender bill.

The woodcock lives in moist woodlands, swamps, and leafy thickets. It feeds at night, primarily on earthworms. Nesting woodcock are found scattered throughout the Pinelands. During migration however, the woodcock, depending on the weather, can be found in larger numbers, especially along the coastal corridor (Ferrigno and Widjeskog, 1975) (Fig. 32). These migrating birds provide some of the finest upland game gunning for thousands of gunners throughout the pinelands. Hunters harvest an estimated 21,200 woodcock per year from the area.

The common snipe is about the size and shape of a dowitcher with a brown and white streaked head and body. The snipe is common in marshes, bogs, and along river banks (Fig. 32). The snipe feeds chiefly on small aquatic plants and animals. When the snipe takes to the air it flies in a fast zigzag pattern. The snipe is a sporting upland sandpiper and provides limited recreation through hunting.

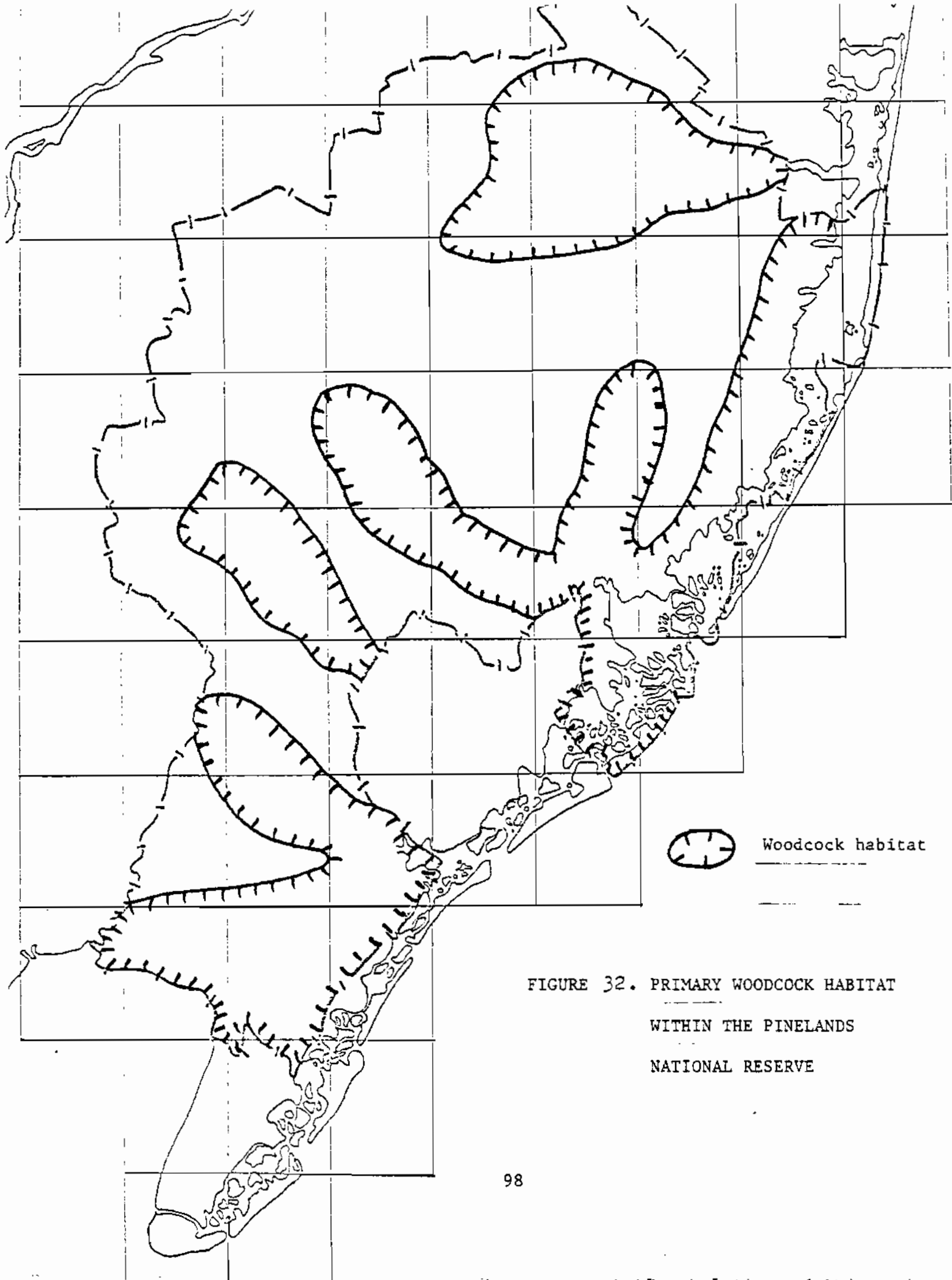


FIGURE 32. PRIMARY WOODCOCK HABITAT
WITHIN THE PINELANDS
NATIONAL RESERVE

Both the common snipe and the American woodcock populations would be affected detrimentally by development in any of the fresh or salt water wetlands or the uplands surrounding them.

2.7.30

CROWS

Common crow (Corvus brachyrhynchos)

Fish crow (Corvus ossifragus)

Crows are large flocking birds with solid black plumage. They like open country and gather in communal roosts which may contain hundreds of birds.

The common crow is a large bird, 43 to 53 cm in length. This familiar bird has a chunky body and heavy bill. The crow's flight is a steady, frequent flapping with only infrequent gliding. The common crow eats a variety of things. It feeds in croplands and may be seen scavenging along roadways. The crow is found everywhere in New Jersey but is most abundant in agricultural land and open country (Fig. 33).

The fish crow is slightly smaller than the common crow (40 to 51 cm) and has a thinner bill. It feeds mainly by scavenging along the shore, but may feed inland with the common crow. The fish crow is seldom found far from tidal waters (Fig. 33).

Both species provide many hours of recreation in the form of bird watching and hunting.

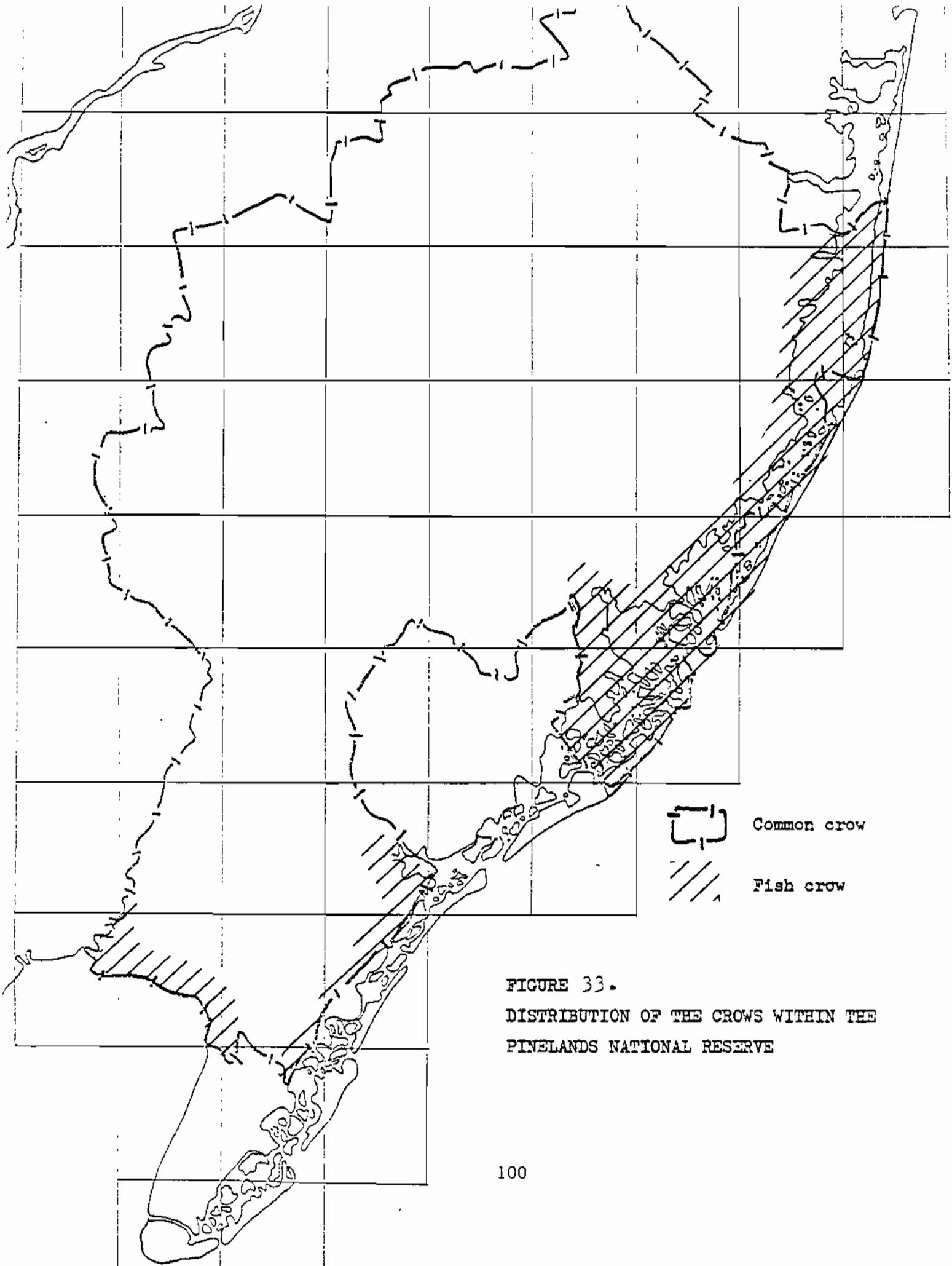


FIGURE 33.
DISTRIBUTION OF THE CROWS WITHIN THE
PINELANDS NATIONAL RESERVE

3.1 Species status

The small mammals of the Pine Barrens consist of 19 species. At least one species, the rice rat, is questionable. This group of animals covers three orders, Insectivora (the shrews and moles), Chiroptera (the bats), and Rodentia (the mice, voles and rats). Less is known about this group of animals than any other group in the region. These small mammals play an important role in the food chain in the area where they occur.

The status of many of the small mammals of the region is undetermined (Table 9). Status code definitions are as follow:

C - Common UC - Uncommon
 UD - Undetermined

Table 9. Status of the Small Mammals of the Pine Barrens

<u>Insectivora</u>	<u>Status in Pinelands</u>
Masked shrew	C
<u>Sorex cinereus</u>	
Shorttail shrew	UC
<u>Blarina brevicauda</u>	
Least Shrew	UD
<u>Cryptotis parva</u>	
Eastern mole	C
<u>Scalopus aquaticus</u>	
Starnose mole	UC
<u>Condylura cristata</u>	

Chiroptera

Little brown myotis UD

Myotis lucifugus

Eastern pipistrel UD

Pipistrellus subflavus

Big brown bat UD

Eptesicus fuscus

Rodentia

Eastern chipmunk C

Tamias striatus

Southern flying squirrel C

Glacomys volans

Rice rat UD

Oryzomys palustris

White-footed mouse C

Peromyscus leucopus

Redbacked vole C

Clethrionomys gapperi

Meadow vole UC

Microtus pennsylvanicus

Pine vole C

Pitymys pinetorum

Southern bog lemming UD

Synaptomys cooperi

Norway rat C

Rattus norvegicus

House mouse	C
<u>Mus musculus</u>	
Meadow jumping mouse	UD
<u>Zapus hudsonius</u>	

3.2 Species comment

Masked Shrews (Sorex cinereus). The masked shrew is 51-64 mm in length and ranges in weight from 3-6g. Body is grayish brown in color. It feeds primarily on insects. It is commonly found under logs or brushy cover (Burt and Grossenheider, 1976). These shrews are common in open lowland sites (Mc Cormick, 1970). Habitats where it would be commonly found would be bogs, hard wood swamps, pitch pine lowlands, and cedar swamps. It can also be found in immature forest areas and agricultural areas. The animal is found in other areas of the state (Applegate, 1974).

Short-tail Shrew (Blarina brevicauda). The shorttail shrew is 76-102 mm in length and weighs between 11-22g. The pelage is lead in color and the tail is short (Burt and Grossenheider, 1976). This animal commonly occurs in forests, grasslands, marshes and brushy areas. It is a good deal less restrictive in terms of habitat than the masked shrew. In the Pinelands the animal could be expected to be found in most upland and lowland habitats. Applegate (1970) lists the shorttail shrew as being common throughout the region.

Least Shrew (Cryptotis parva). The least shrew is 56-64 mm in length and weighs 4-7 grams. Its habitat is open, grass covered areas and marshes. The existence of this shrew in the Pinelands and statewide is in dispute. Conner (1953) suggests that the species occurs in the meadows along the Wading River. Applegate (1974) lists the species as undetermined. Additional work will be needed to document the occurrence and distribution of this animal.

Eastern Mole (Scalopus aquaticus). The eastern mole is 114-165 mm in length and weights range from 67-104 g (Burt and Grossenheider, 1976). The front feet are broad with palms out-turned. The animal prefers open fields and meadows as habitat. The animal is common throughout the region in lowland meadows and bogs and marshes as well as in agricultural areas (McCormick 1970).

Starnose Mole (Condylura cristata). The starnose mole is 114-127 mm in length and 34-78 g in weight (Burt and Grossenheider, 1976). The animal is rare in the region (McCormick 1970). The preferred habitats are lowland areas, cedar swamps, and hardwood swamps.

Little brown myotis (Myotis lucifugus). The little brown bat weighs from 7-9 g (Burt and Grossenheider, 1976). The bat is very common throughout the Pinelands and the state (Applegate 1974). It can be found throughout most habitats in the region and requires hollow trees or buildings as roosting places.

Eastern Pipistrel (Pipistrellus subflavus). This bat ranges in weight from 3.5-6 grams (Burt and Grossenheider, 1976). Its color is yellowish brown. The animal is uncommon (Applegate 1974) in the region, if it occurs at all (McCormick 1970).

Big Brown Bat (Eptesicus fuscus). The big brown bat weighs 11-17 grams. It is a relatively large bat (Burt and Grossenheider, 1976). The animal is uncommon in this region as well as statewide (Applegate 1974).

Eastern Chipmunk (Tamias striatus). The eastern chipmunk measures 127-152 mm in length and weighs 65-127 grams. It is a squirrel-like animal with

facial, side and back stripes (Burt and Grossenheider 1976). The animal is common in upland hardwood forests. The animal is uncommon to rare in the region but is abundant in other areas of the state.

Southern Flying Squirrel (Glaucomys volans). The flying squirrel measures 140-144 mm in body length and weighs 50 to 79 grams (Burt and Grossenheider, 1976). The fur is soft and glossy olive-brown above to white below. Common habitats are deciduous, or mixed deciduous and coniferous forests. Habitats in the Pinelands would include oak-pine and hardwoods. The animal is uncommon (Applegate 1974) in this region. This designation may be a function of the difficulty in observing the animal rather than a low population.

Rice Rat (Oryzomys palustris). The rice rat measures 121-132 mm in body length and weighs 40-80 grams (Burt and Grossenheider, 1976). It feeds on green vegetation and seeds. Its habitat preferences are mostly areas of grasses and sedges. Its occurrence in the Pinelands is doubtful (Applegate 1974, McCormick 1970).

White-footed Mouse (Peromyscus leucopus). The white-footed mouse measures 91-107 mm in length and weighs 14-31 grams. Upper parts are reddish-brown and under parts are white (Burt and Grossenheider, 1976). It feeds on seeds, nuts and insects. Habitat preferences are wooded or brushy areas. The animal is common in forested and field areas in this region (Applegate 1974).

Redbacked Vole (Clethrionomys gapperi). The redback vole measures 93-118 mm in length and weighs 14-40 grams (Burt and Grossenheider 1976). It can be found in coniferous, deciduous, and mixed forests. It feeds on green vegetation, seeds, and a few insects. The species is common throughout the region (Applegate 1974, McCormick 1970) and occurs in many habitats.

Meadow Vole (Microtus pennsylvanicus). The meadow vole is 89-127 mm in length and weighs 28-70 grams (Burt and Grossenheider, 1976). It is dark brown in color. The under parts are silvery to buff in color. The animal feeds on green vegetation, seeds and insects. Preferred habitats are grassy areas near streams or swamps. The animal is common in the region (Applegate 1974) and is found in salt marsh and cranberry bog habitat.

Pine Vole (Pitymys pinetorum). The pine vole is 71-107 mm in length and weighs 22-37 grams (Burt and Grossenheider, 1976). The animal usually can be found on the forest floor and builds burrows through the leaf mold. It eats seeds, bulbs and tubers, and seeds. It can be found in most forested upland habitats in the Pine Barrens. It is common in the region (McCormick 1970).

Southern Bog Lemming (Synaptomys cooperi). The bog lemming ranges from 86-112 mm in length and weighs 14-40 grams. Upper parts are brownish-gray and underparts are gray (Burt and Grossenheider, 1976). This animal feeds primarily on green vegetation. The animal is commonly found in bogs and lowland meadows. Its existence and abundance in the pinelands is in dispute (Applegate 1974) and further work is needed.

Norway Rat (Rattus norvegicus). The Norway rat measures 178-254 mm in length and weighs 200-283 grams. The Norway is an introduced species and not native to the area. They are well established statewide. They are commonly found around human habitation. They feed on anything edible. The Norway rat is common around settled areas and dumps in the pineland region (Applegate, 1974).

House Mouse (Mus musculus). The house mouse is 81-86 mm in body length and weighs 11-22 grams (Burt and Grossenheider, 1976). It feeds on anything

edible and is common in open fields and in and around human habitation. The species is not native to the area but is now well established. The house mouse is common in the Pinelands region (Applegate 1974).

Meadow Jumping Mouse (Zapus hudsonius). The meadow jumping mouse is 76-85 mm in length and weighs 14-22 grams (Burt and Grossenheider 1976). The animal has characteristically very large hind feet. It feeds on seeds, insects and fruit. It prefers low meadows for feeding but is not very restrictive in terms of habitat. The animal is common in the Pinelands region (Conner 1953, Applegate 1974).

Wolgast (1979) reports that four additional species may be found in the area during migration. They are Keen's myotis (Myotis kenni), red bat (Lasiurus borealis), hoary bat (Lasiurus cinereus), and silver-haired bat (Lasionycteris noctivagans). Tables 10, 11 and 12 present the distribution of small mammals in the Pinelands by habitat, watershed, and county, respectively.

As stated earlier, little is known about the small mammals of the pinelands. They are important components of the ecosystem. The general lack of data concerning their range, densities, and requirements in the region prohibits any but general statements concerning habitat critical areas or land use controls and criteria. In general, wetland and lowland habitats appear to be important. General preservation of habitat will benefit these species. Open and diverse habitats also appear to be important.

As a group, the small mammals are in need of a greater deal of additional research effort, with the possible exception of the endangered species.

Other than scientific interest, these species can be of economic importance in terms of the damage to orchards and other agricultural crops by the "mice and rats" and the problem of rabies in the bats. These facts in themselves are reasons for further study.

Table 10. Distribution of Small Mammals by Habitat

	PO	OP	PPL	C	HDW	WATER	BOG	MARSH	NPB	AGR	URB	NF	BP	OF	OCEAN	BAY
Masked shrew	X	X			X		X			X				X		
Short-tailed shrew	X	X	X		X		X							X		
Least shrew							X	X						X		
Eastern mole							X			X	X			X		
Star-nosed mole			X	X	X		X	X		X						
Little brown bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Eastern pipistrel	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Big brown bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
E. chipmunk	X	X	X		X					X	X			X		
Flying squirrel	X	X	X		X					X						
Rice rat								X								
White-footed mouse	X	X			X					X				X		
Red backed vole	X	X	X	X	X											
Meadow vole			X	X	X		X			X						
Pine vole	X	X	X	X	X		X									
Southern bog lemming				X	X		X									
Norway rat										X	X			X		
House mouse										X	X			X		
Meadow jumping mouse			X	X	X		X							X		

Table 11. Distribution of Small Mammals by Watershed

	NBRC	SBRC	CC	MR	DC	LMR	WR	BR	MA	FR	LGE	UGE	TR	AD	SLC	CDC
Masked shrew	X	X	X	X	X	X	X	X	X	X	X	X	X			
Short-tailed shrew	X	X	X	X	X	X	X	X	X	X	X	X	X			
Least shrew	Undetermined															
Eastern mole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Star-nosed mole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Little brown bat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Eastern pipistrel	Undetermined															
Big brown bat	Undetermined															
E. chipmunk	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flying squirrel	X	X	X	X	X	X			X	X	X	X	X	X	X	X
Rice rat	Undetermined															
White-footed mouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Red-backed vole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Meadow vole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pine vole	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Southern bog lemming	Undetermined															
Norway rat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
House mouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Meadow jumping mouse	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 12. Distribution of Small Mammals by County.

	A	B	CA	CM	CU	GL	O
Masked shrew	X	X	X	X	X	X	X
Short-tailed shrew	X	X	X	X	X	X	X
Least shrew	X	X	X	X	X	X	X
Eastern mole	X	X	X	X	X	X	X
Starnosed mole	X	X	X	X	X	X	X
Little brown bat	X	X	X	X	X	X	X
Eastern pipistrel	X	X	X	X	X	X	X
Big brown bat	X	X	X	X	X	X	X
E. chipmunk	X	X	X	X	X	X	X
Flying squirrel	X	X	X	X	X	X	X
Rice rat	X	X	X	X	X	X	X
White-footed mouse	X	X	X	X	X	X	X
Red backed vole	X	X	X	X	X	X	X
Meadow vole	X	X	X	X	X	X	X
Pine vole	X	X	X	X	X	X	X
Southern bog lemming	X	X	X	X	X	X	X
Norway rat	X	X	X	X	X	X	X
House mouse	X	X	X	X	X	X	X
Meadow jumping mouse	X	X	X	X	X	X	X

4.0 Recommendations

It is extremely difficult to identify selected critical habitats for a group of species as diverse as the game species of the Pinelands. Every habitat is critical to some species of wildlife. Using diversity of vegetation as the key to faunal diversity along with other basic principals of wildlife management the following recommendation are proposed to protect wildlife habitats and to continue to provide wildlife oriented recreation in the Pinelands.

1. Construction should be restricted from lowland habitat types (cedar swamp, pitch pine lowlands, inland marshes, bogs, pond and lake shores, bayshore, and intertidal marshes). These habitats are in short supply, environmentally sensitive, and they along with their interface with neighboring habitats, support the greatest diversity of both flora and fauna.

2. Offsite construction which would significantly change the ecological characteristics of these lowland areas should be restricted. Impacts would include increased runoff, siltation, and addition of materials which could change the physical and chemical characteristics of the surface or subsurface water. Also the time period during which construction will take place should be limited as to not disturb wildlife breeding in these areas. Buffer zones should be designated around these environmentally sensitive areas. The size of these buffer zones should be determined by careful investigation of the critical area and the type of development project.

3. The Division of Fish, Game and Wildlife will continue to purchase land surrounding existing Wildlife Management Areas. Also tracts of land determined to be critical to the areas of wildlife (deer yards in cedar swamps) will be considered for purchase.

4. Through extension services, and information and education efforts, the Division will provide information necessary to carry out wildlife management techniques on areas not actively managed by the Division. These techniques will concentrate on enhancing wildlife habitat and protecting sensitive areas.

5. Research projects should be designed to determine the criteria for identifying and locating specific critical areas within the Pinelands. At the present time only general guidelines can be drawn for defining critical habitats and little information exists on the location of specific critical areas. Some of the criteria that should be included in the research are as follows:

- abundance of the habitat
- diversity of the vegetation
- species present and their status
- is the area critical to a species' life cycle
- environmental sensitivity

6. Research should be conducted investigating habitat and wildlife relationships in the Pinelands. Some of the topics that should be covered are:

- a. determining methods of reducing wildlife damage and disease
- b. exploring alternative methods of increasing wildlife oriented recreation
- c. effects of fire on habitat and wildlife
- d. censusing population levels

7. Agricultural and forestry production should be encouraged since they are an integral part of the local economy and they diversify wildlife habitat in a positive manner.

8. Any development that takes place in the Pinelands should be located in the upland areas. Since upland areas of pine-oak and oak-pine associations are the most abundant, least sensitive, and poorest in quality from a wildlife habitat viewpoint, supervised development in these areas would be the most acceptable.

9. Clustered development would be more desirable than scattered development. Clustered housing developments utilize less open space than low density rural development. Low density development piecemeals open space making a much larger area unsuitable for many recreation activities. Clustered development also lends itself to regional sewage facilities, thus discouraging individual septic systems scattered throughout the Pinelands.

10. Intensive recreational development (camping, ball fields, etc.) should also take place in the upland areas. The activities are a strain on the area and should be kept away from environmentally sensitive areas.

11. Passive recreational activities (hunting, trapping, hiking, nature photography, etc.) need not be restricted since they pose little threat to sensitive areas.

12. Development which results in an interspersion of native vegetation and other land uses is desirable. An example of this development would be the clearing of a power line which would result in the creation of old field and edge habitat.

13. Research should be conducted determining which areas of the Pinelands are being underutilized and whether increased access would increase utilization.

14. It is recommended that the human management aspect, especially the information and education dimension be expanded. In specific, programs should be designed for implementation into the school systems at the elementary level in an effort to foster an understanding of the natural system and the results of human impact on it.

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