MANAGEMENT OPTIONS FOR DUSKY CANADA GEESE AND THEIR PREDATORS ON THE COPPER RIVER DELTA, ALASKA

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EXECUTIVE SUMMARY

The dusky Canada goose population has been steadily declining from 25,500 in 1979 to approximately 12,200 in 1986 and is currently well below the Pacific Flyway Council's population objective of 20,000 geese. This decline is the result of poor production on the Copper River Delta in Alaska and hunting on the wintering grounds in western Oregon and southwestern Washington. A series of progressively more restrictive hunting seasons and, or bag limits on the wintering grounds and in GMU 5 and 6 in Alaska since 1983 have significantly reduced harvest but the population has not responded. Restrictions on the wintering grounds, to protect a small segment of a large and expanding total wintering Canada goose population, have led to a dramatic increase in crop depredation complaints and potential legislative action to reimburse farmers for damages. Further decline of the population could result in management actions that would significantly restrict Canada goose hunting in portions of the Pacific Flyway and impair recreational and other resource uses on the Copper River Delta and wintering grounds.

Changes in habitat on the Copper River Delta caused by the 1964 earthquake have resulted in increased predation on goose nests and goslings. Prior to the earthquake nesting success was nearly 90 percent with tidal flooding being the primary cause of nest failure. Mammalian predators such as the brown bear and coyote were infrequent visitors to the Delta and were not documented predators of the dusky goose.

Between 1964-78, average nest success and percent young in the fall population remained high at 75 percent and 28 percent, respectively. Predation by large mammals and avian predators was the primary cause of nest failure. Brown bears and coyotes increased in abundance as habitat became more favorable, and prey species expanded onto the Delta. The canid population increased immediately following the earthquake and, in 1976, a biologist from the University of Alaska speculated that brown bears may have had a "substantial impact" on nesting geese in local areas.

Between 1979-86, average nest success and percent young in the population declined to about 24 percent and 16 percent, respectively. The primary cause for poor production was predation with brown bears and coyotes being responsible for about 70 percent of the total nest destruction, followed by 20 percent by avian predators and 10 percent by unknown predators.

In 1983 and 1984, there were indications that low goose production was not solely due to predation on nests. Nest success was 51.9 percent in 1983 and 75.8 percent in 1984, but young comprised only 15 percent and 18.3 percent respectively, of the late July population, indicating poor survival of goslings between hatching and fledging. Heavy predation on goslings, probably by coyotes, was suspected because environmental

conditions were favorable during the period when geese were brooding.

Brown bear numbers are probably currently at the highest level since the 1800's with an estimated density of one bear per 3.3-4.6 mi^2 or 60-85 bears in GMU 6(C) and 85-120 bears in GMU 6(B). While the current density of coyotes on the Delta is not known, it is considered high. During the winter of 1984-85, 35 coyotes were harvested from GMU 6(B) and 6(C) by one individual with little or no apparent impact on the overall population.

The objective of this document is to identify management options for the dusky Canada goose that will reverse the population decline and build the population back to the population objective of at least 20,000 geese. To assist with the identification and evaluation of management options, a series of population models were developed to determine how the dusky population might respond to various management schemes. These models indicate that average annual production would have to average 15 percent young in the fall population to maintain the population at its current level of 12,000-13,000 birds. Average annual production would have to exceed this level if the population objective of 20,000 is to be attained. The time required to attain the objective is dependant upon how much average production exceeds 15 percent. For example, an average annual production of 22 percent would result in an annual increase in the population of 9-11 percent and the 20,000 population objective would be attained in about 5 years.

The following management options are recommended by the Alaska Department of Fish and Game (ADF&G). These options were identified and discussed at meetings with the U.S. Forest Service, U.S. Fish and Wildlife Service, National Audubon Society, Alaska Chapter of the Wildlife Society, and the National Wildlife Federation, or in writing from the Alaska Wildlife Alliance and Greenpeace. For comparison of impacts and costs of these options, an Options Analysis Table is presented on pages iv-vii.

1. Dusky Goose Transplant. Establish additional breeding populations of dusky Canada geese through transplants. Potential locations are Middleton Island, Katalla area, and Yakutat area.

   This option was not directly opposed by any of the participating agencies or conservation groups. Although the National Audubon Society expressed opposition to the transplant of any species outside its natural range of distribution.

2. Habitat Enhancement. Support existing habitat enhancement programs of the Forest Service and cooperators and recommend the Forest Service continue feasibility and cost studies of

additional enhancement methods. The ADF&G also proposes experimental development of small berms and levees on the coastal tide flats.

This option was not opposed by any of the participating agencies or conservation groups.

3. Nest Avoidance by Predators. Limited testing of the effectiveness of taste aversion conditioning to deter predators from goose nests. Testing could be done as a graduate student project. If this technique proved effective, it could be applied on a limited basis such as the nesting islands being constructed by the Forest Service and Cooperators.

   This option was opposed by the Alaska Wildlife Alliance.

4. Transplant Bears From the Delta to Other Locations. Relocate 15-20 bears from the coastal nesting area to suitable locations in GMU 6(A) to verify that a reduction in brown bears will immediately improve goose production. This action is preliminary to a decision on liberalization of brown bear bag limit and season length in GMU 6(B) and 6(C).

   This option was opposed by the Alaska Wildlife Alliance.

5. Liberalize Hunting and Trapping Regulations for Coyotes in Unit 6(C) and 6(B). While this option will likely do little to reduce the coyote population as long as fur prices remain low, the ADF&G recommends it be implemented on a trial basis. The ADF&G will monitor the coyote harvest and coyote population trends. If coyote numbers are not effectively reduced, additional management actions such as coyote removal by a department sponsored trapper may be recommended.

   This option was opposed by the Alaska Wildlife Alliance.

OPTION ANALYSIS TABLE

Considerations	A No Action	B FWS Assume Lead	C List Dusky as Threatened	D "Recovery" Program	E Revise Pop. Objective	F Further Harvest Restrictions	G Goose Transplants
Goose Production Response							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	VL	M
Coyote Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Brown Bear Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Impact on other wildlife on the Delta	N	N	N	N	N	N	N
Impact on Vegetation	N	N	N	N	N	N	N
Public Acceptance in Alaska	L-M	L	VL	VL	VL	M	S
Cost (x$1000)							
Initial	-0-	-0-	-0-	-0-	-0-	-0-	4.0
Recurrent	-0-	-0-	-0-	-0-	-0-	-0-	4.0

Effectiveness or impact of management option:

N = Negligible
VL = Very Limited
L = Limited
M = Moderate
S = Substantial

OPTION ANALYSIS TABLE
(continued)

Considerations	H Captive Rearing	I Habitat Enhancement	J1 Aversive Conditioning	J2 Baiting	K Exclusion	L1 Liberalize Bear Hunting Regulations	L2 Open Guide Area
Goose Production Response							
Short-term	L	VL	VL-L	VL	VL	VL	VL
Long-term	L	VL	L	L	VL	L	L
Coyote Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Brown Bear Reduction							
Short-term	N	N	N	VL	N	L	L
Long-term	N	N	N	VL	N	L	L
Impact on other wildlife on the Delta	L	L	VL	VL	VL	VL	L
Impact on Vegetation	N	M-S	N	N	VL	N	N
Public Acceptance in Alaska	L-M	S	L	L	VL	L-M	L-M
Cost (x$1000)							
Initial	25.0	*	120	20-45	150-1000	0.1	-0-
Recurrent	25.0	*	100	20-45	10	0.1	-0-

Effectiveness or impact of management option:
N = Negligible
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L = Limited
M = Moderate
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*High costs borne by FS and cooperators.

OPTION ANALYSIS TABLE
(continued)

Considerations	L3 Bear Transplant	L4 Bear Sterilization	L5 Bear Removal by ADF&G	M1 Coyote Hunter/ Trapper Education	M2 Liberalize Coyote Harvest Regulations
Goose Production Response					
Short-term	L	N	M	N-VL	L
Long-term	L-M	VL	L	N	VL
Coyote Reduction					
Short-term	N	N	N	VL	L
Long-term	N	N	N	N	VL
Brown Bear Reduction					
Short-term	M	VL	S	N	N
Long-term	L	VL	M	N	N
Impact on other wildlife on the Delta	L	N	L	VL	VL
Impact on Vegetation	N	N	N	N	N
Public Acceptance in Alaska	M	L	VL	M	L-M
Cost (x$1000)					
Initial	22-30	10-15	10.5-14	0.3	0.2
Recurrent	22	10-15	10.5-14	0.3	0.2

Effectiveness or impact of management option:

N = Negligible
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L = Limited
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OPTION ANALYSIS TABLE
(continued)

Considerations	M3 Permit Aerial Shooting of Coyotes by Public	M4 Bounty for Coyotes	M5 Department Trapper	M6 Approved Poisons
Goose Production Response				
Short-term	L-M	M	M	M
Long-term	L-M	M	M-S	M-S
Coyote Reduction				
Short-term	M-S	M-S	S	S
Long-term	L	L-M	M	M
Brown Bear Reduction				
Short-term	N	N	N	N
Long-term	N	N	N	N
Impact on other wildlife on the Delta	VL	VL	VL	VL
Impact on Vegetation	N	N	N	N
Public Acceptance in Alaska	VL	VL	VL-L	VL
Cost (x$1000)				
Initial	0.3	12-17	49.5-56	20
Recurrent	0.3	6-8.5	35	20

Effectiveness or impact of management option:
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I. Statement of Problem

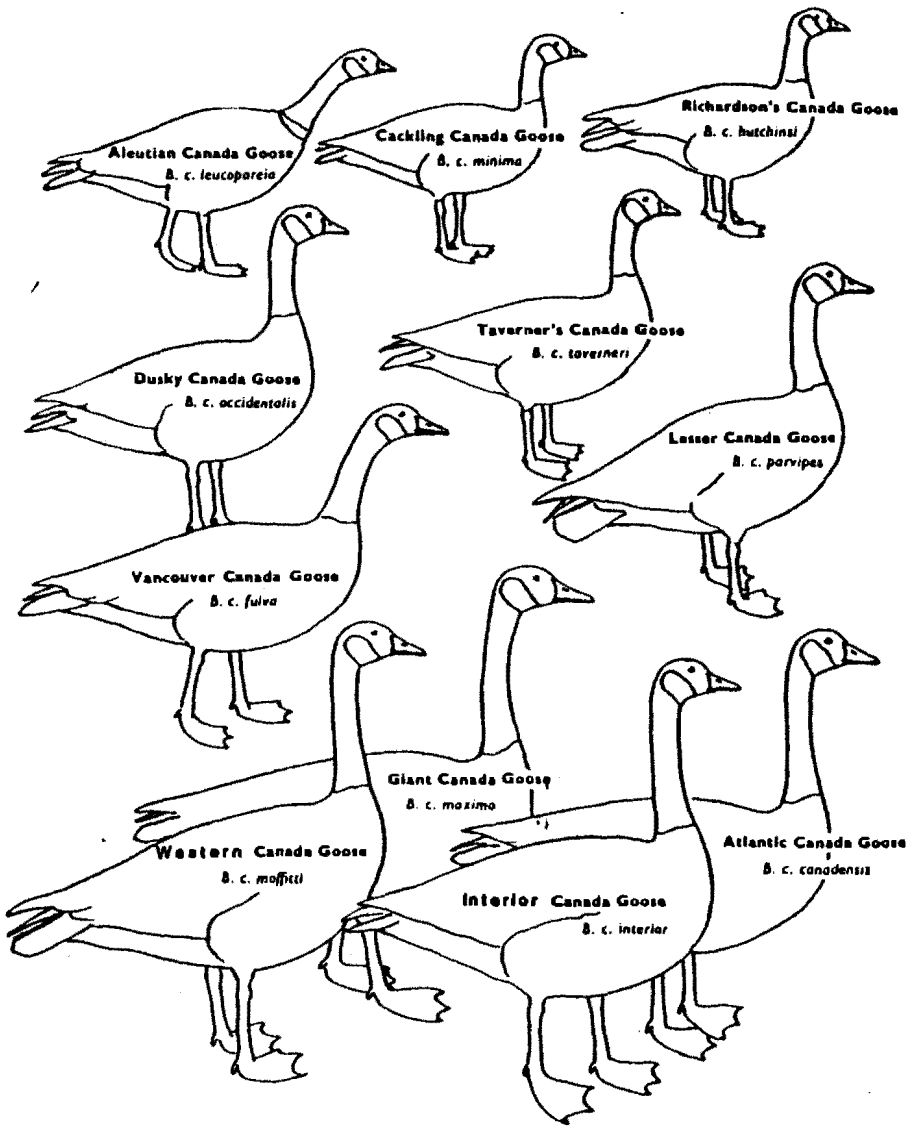
The Dusky Canada goose population has undergone a serious decline since 1979. This decline is the result of poor production on the Copper River Delta (Delta) in Alaska and hunting on the wintering grounds in western Oregon and southwestern Washington. The population has not responded to major reductions in sport harvest since 1983. Changes in habitat on the Delta caused by the 1964 earthquake have resulted in increased predation on nests and goslings by brown bears and canids. Further decline could result in nomination for and possible listing as a threatened species. Designation as a threatened species would greatly reduce state management options and could significantly restrict Canada goose hunting in the Pacific Flyway where the dusky goose occurs. Recreational and other resource uses on the Copper River Delta and elsewhere could also be impaired.

Restricted Canada goose hunting seasons on the wintering grounds, to protect a small segment of a large and expanding total wintering Canada goose population, has led to a dramatic increase in crop depredation complaints and potential legislative action to reimburse farmers for damages. Potential administrative and fiscal burdens from such legislative mandates could seriously impact conservation agency budgets.

II. Background

Depending on the taxonomic authority, there are at least 11 recognized subspecies of Canada geese in North America (Figure 1). These range in size from the 2-5 pound cackling Canada goose to the 14-18 pound giant Canada goose. Six subspecies: Vancouver Canada goose, Taverner's Canada goose, lesser Canada goose, cackling Canada goose, Aleutian Canada goose, and dusky Canada goose nest in Alaska. The dusky Canada goose has been considered a race of the Vancouver Canada goose by some authorities in the past but is currently considered a true subspecies of Canada goose. It is only known to nest on the Copper River Delta, Alaska, and winters primarily in western Oregon and southwestern Washington (Figure 2).

Although the dusky Canada goose was described from a specimen collected in Washington in 1857, dusky geese were considered to be nonmigratory residents of Alaska until the 1940's. In the early 1940's observations of flocks of dusky geese along the Oregon coast during the winter led



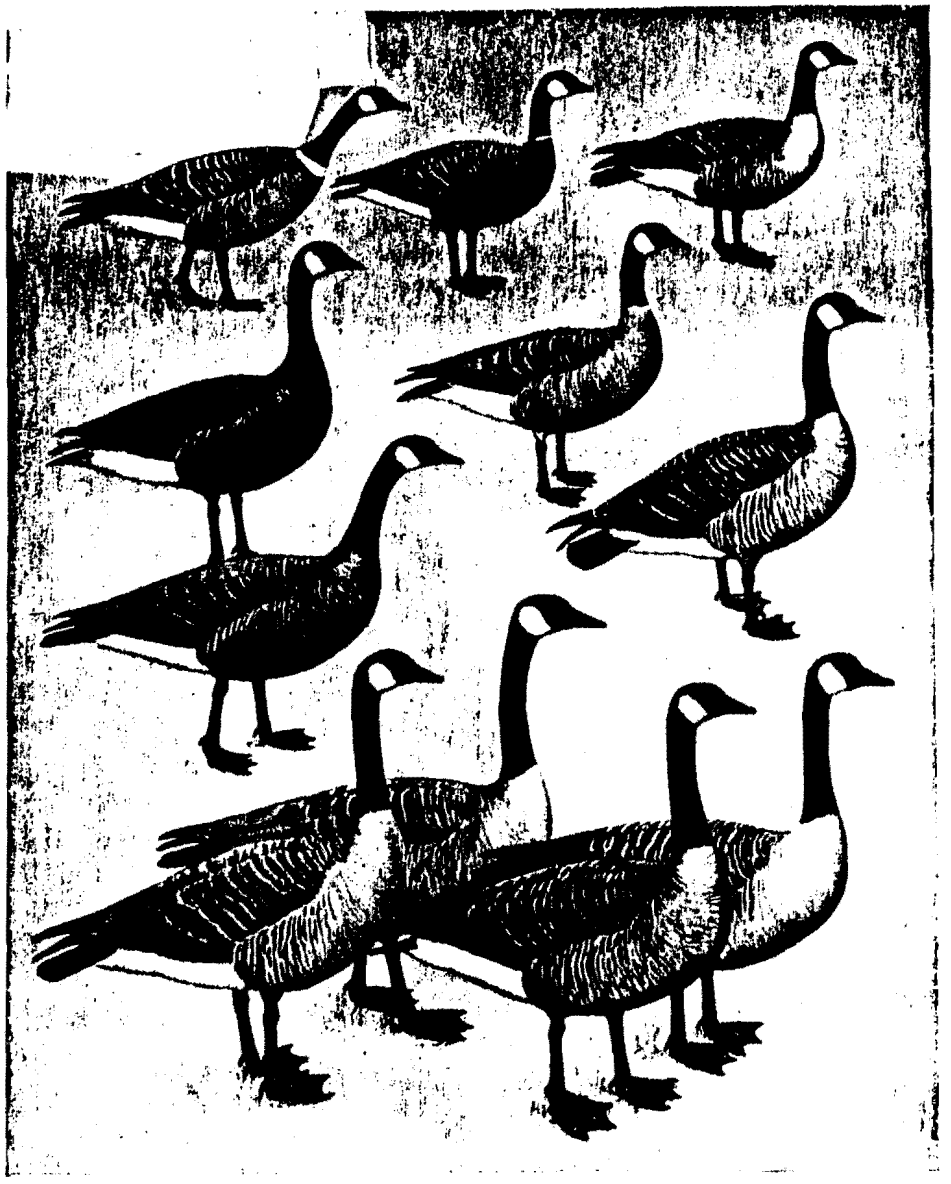


Figure 1. Subspecies of Canada geese.

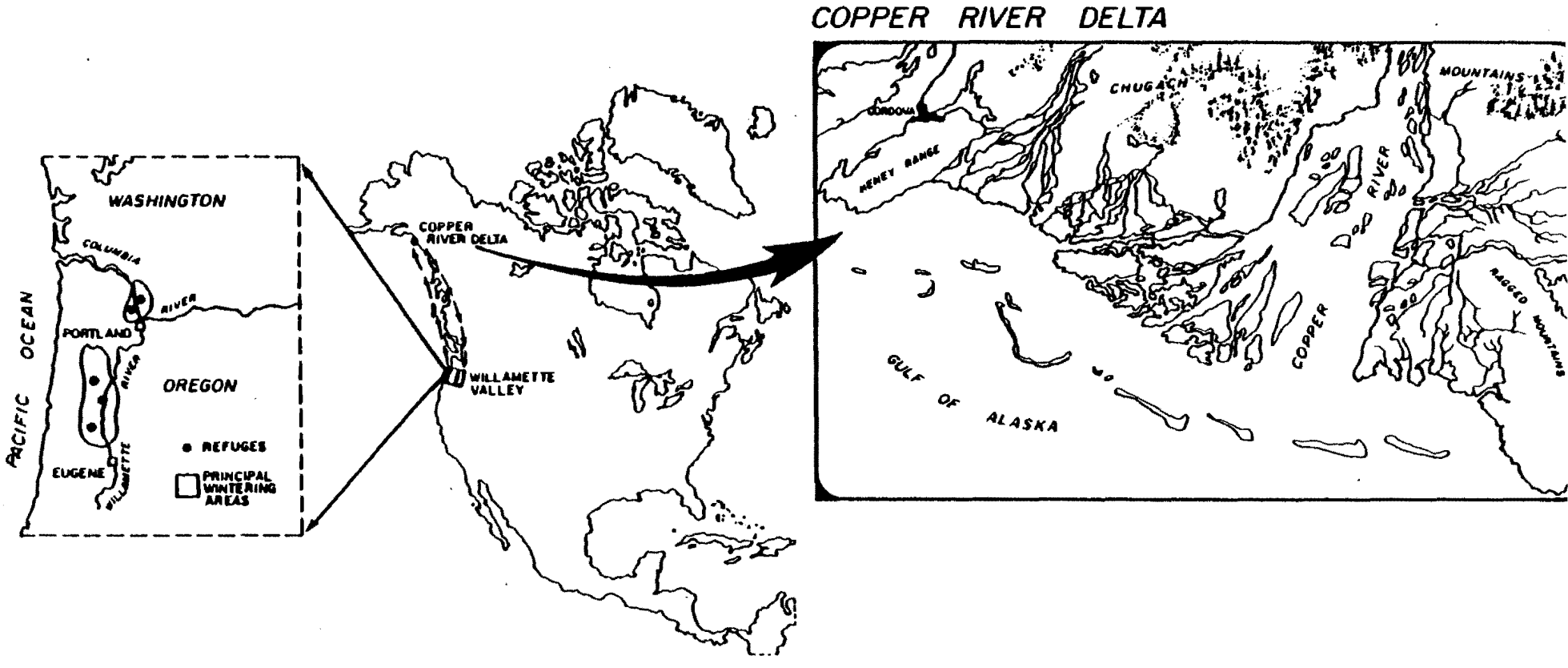


Figure 2. Breeding and wintering range of the dusky Canada goose.

biologists to believe that coastal Oregon was the primary wintering area, but banding studies initiated in Alaska in the late 1940's established the Willamette Valley of Oregon as the major wintering area.

Early banding studies also indicated that a high harvest of dusky geese was occurring on the wintering area. Since the dusky population was known to be numerically small and the numerical margin for error in the allowable harvest of a small population is proportionately less than for a large population, studies designed to provide information for management were initiated in the early 1950's. The population has been closely monitored since that time.

The 1953-1986 post-hunting season population index (mid-winter inventory) for dusky geese has ranged from about 8,000 in 1953 to 28,100 in 1960 (Table 1). Until recently, hunting mortality has been the primary factor controlling the size of the population. Estimated annual population mortality between 1952-1963 was 45.6 percent and nearly 95 percent of this mortality was due to hunting. Harvest of the adult component of the population was within acceptable limits, ranging from 22 - 38 percent. About 70 percent of the harvest occurred in the Willamette Valley in Oregon with the remaining 30 percent evenly distributed between Alaska, British Columbia, and Washington. While a harvest of this magnitude required close monitoring of the population and annual modification of regulations, annual production was generally high. The density of nests on the Delta and nest success rates were high relative to other subspecies of geese (Table 2).

Several events in the early-mid 1960's had a significant influence on the dusky goose population. Large numbers of dusky geese began to use an area of private land east of Corvallis, Oregon and, by 1963, the majority of the geese wintering in the Valley was concentrated in the area. Heavy harvest of these birds led, in part, to the second major event, establishment of the Willamette Valley National Wildlife Refuges (NWR). The third major event was uplifting of the nesting area by about 6 feet during the "Good Friday" earthquake in 1964. This uplift caused drying of the substrate which, in turn, initiated changes in habitat and associated fish and wildlife populations.

Although the influence of these events and their combined influence on the dusky goose population is complicated, changes in the distribution, harvest rates, and subspecies composition of geese on the wintering grounds seem to be correlated with them. Hunting continued to be the major source of mortality to the dusky population, but the population began to increase and had reached over 26,500 post-season by 1975. Nest densities and nest success continued to be high through 1978 (Table 2) and the annual

Table 1. Mid-winter population index for the dusky Canada goose, 1953-1986.

Year	Population Index	Year	Population Index
1953[a]	8,080	1970	---
1954[a]	10,570	1971	19,800
1955[a]	9,960	1972	17,900
1956[a]	11,370	1973	15,800
1957[a]	15,220	1974	18,600
1958[a]	17,450	1975	26,500
1959[a]	10,580	1976	23,000
1960[a]	28,100	1977	24,100
1961[a]	19,200	1978	24,000
1962[a]	16,780	1979	25,500
1963[a]	16,800	1980	22,000
1964[a]	15,800	1981	23,000
1965[a]	18,000	1982	17,740
1966[a]	17,100	1983	17,000
1967[a]	20,800	1984	10,100
1968	---	1985[b]	7,500
1969	---	1986	12,200

a/ From: Hansen, H. S. 1968. Pacific Flyway Canada goose management--federal and state cooperation. In, Hine, R. L. and C. Shoenfeld (eds.) Canada goose management; Current continental problems and programs. Dembar Educational Research Services, Madison, Wisconsin. 195pp.

b/ Accuracy of mid-winter population questionable, calculated breeding grounds estimate was 13,150.

Table 2. Dusky Canada goose nest densities, nesting success, and nest fate on the west Copper River Delta as determined by various studies, 1959-86.

Year	Source	No. Nests	Calculated nest density per mi^2	% nests successful	% nests destroyed	% nests abandoned	% young in fall production	% Type of nest destruction					
								Flooded	Brown bear	Canid	Unkn Mammal	Avian	Unkn
1959	Trainer(1959)	1,162[a/]	108	89.2	7.7	3.2	---	88.6	-0-	-0-	-0-	11.4	-0-
1964	ADF&G(1973)	102	---	82.4	9.8	7.8	---						
1965	ADF&G(1973)	221	---	62.9	30.3	6.8	---						
1966	ADF&G(1973)	100	---	97.0	-0-	3.0	---						
1967	ADF&G(1971)	13	111	---	---	---	---						
1968	ADF&G(1973)	38	---	86.8	13.2	-0-	---						
1970	ADF&G(1973)	164	---	88.2	8.6	3.2	---						
1971	ADF&G(1973)	100	---	76.0	24.0	-0-	16.2						
1972	ADF&G(1973)	116	---	81.0	19.0	-0-	10.6						
1973	ADF&G(1973)	---	---	---	---	---	36.0						
1974	Bromley(1976)	81	192	82.7	14.8	2.5	51.4				[c/]		
1975	Bromley(1976)	215	174	31.6	64.6	3.7	17.9				[c/]		
1976	Bromley(1976)	---	---	---	---	---	24.2						
1977	Bromley(unpub.)	229	164	79.0	---	---	44.8						
1978	Bromley(unpub.)	390	195	56.2	---	---	24.8						
1979	Bromley(unpub.)	409	142	18.8	---	---	16.0						
1980	ADF&G(unpub.)	136	168	---	---	---	23.7						
1981	ADF&G(1982)	---	---	---	---	---	17.9						
1982	ADF&G(1983)	158	102	49.2	48.8	1.8	23.7	-0-	28.1	16.9	-0-	33.8	21.8[d/]
1983	ADF&G(1984)	161	93	51.9	37.7	3.7	15.0	-0-	45.6	10.5	8.7	5.6	29.6[d/]
1984	ADF&G(1985)	161	95	75.8	14.9	3.1	18.3	-0-	34.4	24.6	3.4	37.6[e/]	4.0
1985	ADF&G(1986)	168	97	8.9	78.6	3.6	3.7	-0-	48.3	21.3	7.0	19.1[e/]	4.3
1986[b/]	ADF&G(unpub.)	201	116	11.4	67.2	9.0	10.7	-0-	46.7	17.0	20.0	5.2[e/]	11.1

a/ Eggs rather than nests.
b/ Preliminary, pending final analysis.
c/ Percentages not given, but major loss attributed to avian predators.
d/ Suspected to have been primarily mammalian predation but evidence inconclusive.
e/ Avian predation may have been masked and underestimated due to the complete destruction of nests and evidence by large mammals.

winter population mortality index declined from the 1952-63 average of 45.6 percent to a 1971-78 average of 23.9 percent. Spring weather accounted for nearly 80 percent of the variation in goose production between 1971-1975.

The dusky goose population began to exhibit symptoms of a problem in 1979 when downward trends in several production indices (nest density, nest success, and percentage of young in late summer population) were observed (Table 2). By the early 1980's, harvest composition and mid-winter population indices confirmed a problem. The mid-winter population index began a rather steep decline after 1979 and harvest monitoring on the Willamette Valley NWRs indicated a consistently heavy harvest of adult dusky geese. The percentage of adults in the harvest ranged from 46.7-64.1 percent and averaged about 56 percent; the winter mortality index average increased to 31 percent. These changes occurred despite a daily bag limit reduction from 3 to 2 geese in Oregon.

In 1979, the correlation between spring weather conditions and percent young in the fall population began to deteriorate. By 1986 spring weather was responsible for only 7 percent of the variability in production ($r = 0.2646$)--indicating that some factor(s) other than weather was primarily influencing production.

Initially, managers and biologists were only moderately concerned over the heavy harvest of dusky geese because they felt that increases in the number of geese from other subspecies on the wintering grounds would relieve much of the hunting pressure on duskys. Prior to the early 1970's most of the geese wintering in the Willamette Valley were duskys but during the early to mid 1970's the number of Taverner's Canada goose began to increase. In 1975, Taverner's geese comprised about 25 percent of the wintering goose population and by 1985 they had increased to approximately 80 percent (Figure 3). Unfortunately, the presence of 60,000-65,000 Taverner's geese has not relieved the hunting pressure on dusky geese. Duskys are 2.5 times more vulnerable to hunters than Taverner's and they continue to comprise a disproportionately large part of the sport harvest.

Additional Taverner's geese in the Willamette Valley have caused problems. Canada goose harvest restrictions or closures instituted in 1983 to protect duskys have allowed large numbers of Taverner's geese safe access to, and use of winter wheat and ryegrass fields. This has resulted in a dramatic increase in crop depredation complaints and an unsuccessful attempt in 1985 to pass legislation that would have required the Oregon Department of Fish and Wildlife to reimburse farmers for crop damages. In 1985, the Governor of Oregon appointed a task force to study crop depredation

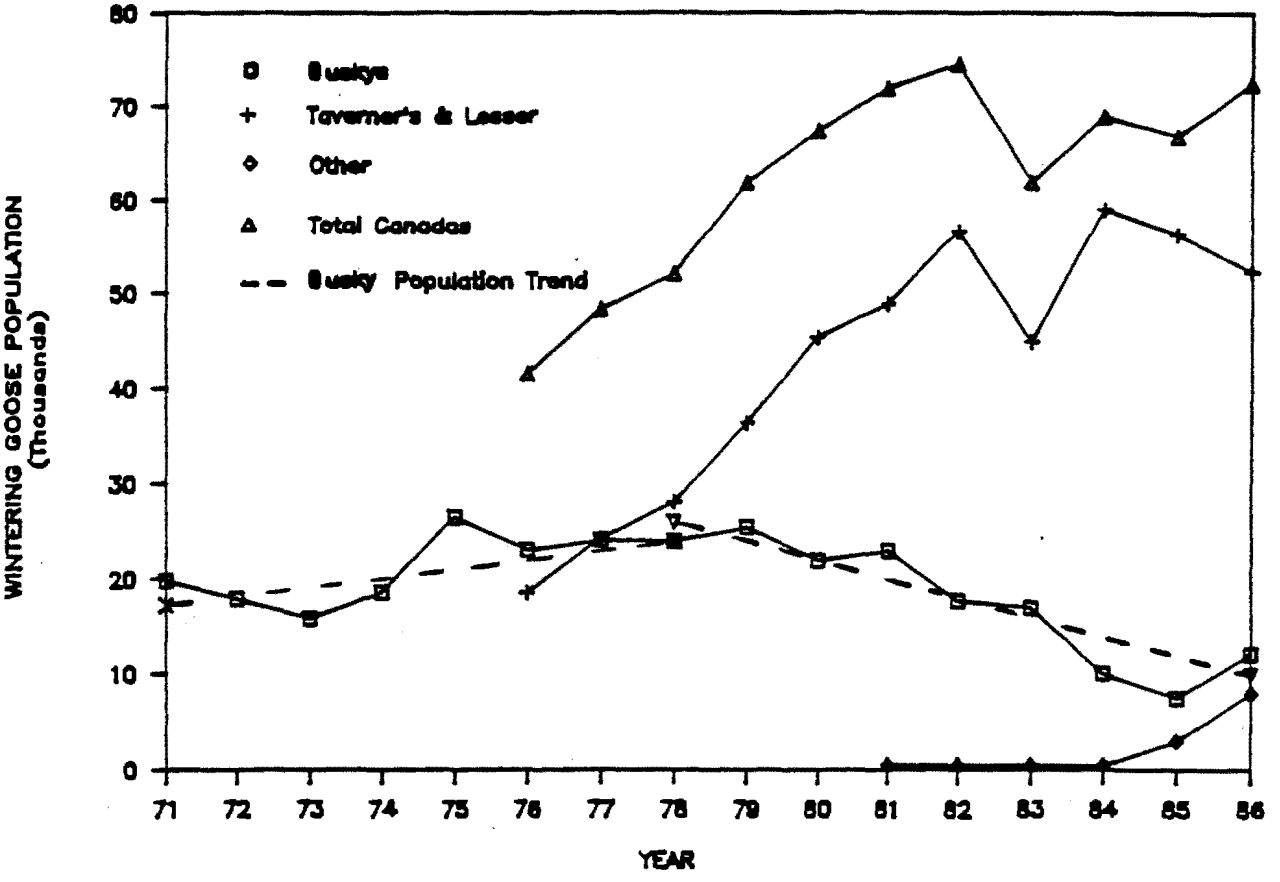


Figure 3. Number and population trend (fit to population data by linear regression) of dusky Canada geese and other subspecies of Canada geese wintering in the Willamette Valley, OR since 1971.

problems, and reintroduction of legislation to compensate those claiming damages from wildlife is possible in the upcoming legislative session.

A decline in production has not been unexpected. As early as 1953, biologists speculated that if conditions became more favorable for predators, or if the predators changed their foraging patterns, nest predation on the Copper River Delta could become a serious limiting factor. Following the earthquake in 1964, researchers predicted that changes in goose nesting habitat would occur. They speculated that production might increase at first as the amount of preferred grass-mixed forb-low shrub habitat increased, but that as plant succession continued toward tall shrub and then forest, the amount of favorable nesting habitat would decrease. These predictions were accurate.

Prior to the earthquake, periodic tidal flooding maintained salt tolerant vegetation on the outer delta and influenced habitat use by nesting geese. Virtually all nesting occurred on elevated slough banks in grass-mixed forb-low shrub (primarily Myrica) vegetation; a cover type that covered less that 15 percent of the delta (Table 3). The absence of tidal flooding after the earthquake promoted development of fresh water marshes and expansion of shrub cover onto much of the preferred goose nesting habitat. Many of these areas now support stands of up to 15 foot tall willow and alder. The geese have responded to the changes by nesting more frequently in meadow and tall shrub cover than in the past (Table 3).

Changes in vegetation on the Delta have influenced the distribution of other wildlife species also. With the drier conditions and the establishment of tall shrub communities came beaver, moose, hare, microtines, and seasonally ptarmigan. Moose and beaver are now common seaward to the high tide line. In recent years a major increase in the number of beaver lodges and caches has been observed on the coastal delta.

Uplifting of the barrier islands off the coast of the delta provided additional nesting habitat for marine birds. In 1976 Egg Island, the largest of the barrier islands, was supporting approximately 10,000 pairs of glaucous-winged gulls. This colony was calculated to be increasing at an annual rate of 4 percent.

Changes in habitat on the Delta have provided new habitat for predators. Prior to the earthquake biologists noted that while brown bears and coyotes occasionally visited the coastal delta, predation on eggs, goslings, and adult geese was rare. Documented high nest success and low nest destruction, primarily by tidal flooding, confirmed these observations. Predation rates have increased dramatically

Table 3. Pre-earthquake and post-earthquake distributions of dusky Canada goose nests with respect to cover type on the coastal portion of the west Copper River Delta, Alaska.

Cover Type	1959		1975[c/]		1982-85[d/]	
	% of Area[a/]	% of Nests[b/]	% of Area	% of Nests	% of Area[e/]	% of Nests
Grass-mixed forb-low shrub	10-15	97	46	76.4	25	44.6
Tall shrub	-0-	-0-	-0-	-0-	21	16.9
Meadow	85-90	3	54	23.6	54	38.3

a/ Calculated from data in Potyondy et al. 1975.

b/ Trainer 1959.

c/ Bromley 1976.

d/ ADF&G unpubl. data.

e/ ADF&G Unpubl. data from preliminary sample of 1.73 mi^2 of nesting study plots in 1982.

in the past 10-15 years. During the mid 1970's a research biologist from the University of Alaska documented nest predation as the largest cause of nest failure. While the type of predation was not quantified, avian (gulls) and mammalian (brown bears and coyotes) predators were implicated. The canid population was reported to be increasing and brown bears were reported to "have had a substantial impact in local areas."

In 1982, the Alaska Department of Fish and Game (ADF&G) began documenting types of nest predation using published characteristics of predation and techniques applicable to the local area. Between 1982-86, mammalian predators were responsible for 45-84 percent of the nest destruction (Table 2). Avian predation may have been higher than the data indicated in 1985 and 1986 since extensive nest destruction by large mammals may have masked avian predation. Typically large mammals totally destroy nests along with the more subtle evidence of avian predation.

In 1983 and 1984, there were indications that low goose production was not solely due to predation on nests. Nest success was 51.9 percent in 1983 and 75.8 percent in 1984, but young comprised only 15 percent and 18.3 percent respectively, of the late July population, indicating poor survival of goslings between hatching and fledging. Heavy predation on goslings was suspected because environmental conditions were favorable during the period when geese were brooding.

III. Predators and Their Population Status

Predatory birds and the mammals on the Copper River Delta currently have a major impact on the dusky Canada goose population. Brown bears and coyotes are the most significant of predators followed by large gulls and jaegers. Birds known to prey on the geese or their eggs include large gulls, jaegers, ravens, and bald eagles. Gulls, ravens, and jaegers eat eggs and young, while bald eagle take adults and larger goslings. Mammalian predators include brown bears, coyotes, mink, and possibly wolves and river otters. Mink eat goslings and flightless adults. Wolves may take adults, goslings, and eggs. River otters are suspected of eating eggs.

Mammalian Predators

Brown Bear--Based on recent brown bear studies, the calculated 1986 population on the Delta was 32.5 ± 15 animals (Table 4) or approximately 1 bear per 3.3 - 4.6 miles^2. This projects to 60-86 bears in GMU 6(C) and 85-120 in GMU 6(B). Brown bear numbers on the Delta are probably at the highest density since the 1800's. In the early 1900's, they

Table 4. Sex and age composition of brown bears observed on the west Copper River Delta, May-June, 1984-86.

Year		Adult	Immature	Yearling Cubs	Cubs of Year	Sub Total
1984						
	Male	4	2	1	0	7
	Female	5	4	1	0	10
	Unknown	3	1	2	3	9
	Totals	12	7	4	3	26
1985						
	Male	4	1	3	0	8
	Female	5	1	2	0	8
	Unknown	4	8	2	3	17
	Totals	13	10	7	3	33
1986						
	Male	7	3	0	0	10
	Female	11	4	0	0	15
	Unknown	3	1	3	2	9
	Totals	21	8	3	2	35[a/]

a/ Population estimate based on capture, recapture techniques = 32.5 ± 15 bears. Since a minimum of 35 bears have been observed, a more appropriate range might be 35-48.

were shot indiscriminately because they were considered a danger to man and his livestock. During the 1950's, bears began to receive more attention from managers. Liberal hunting seasons and guiding operations produced high harvest rates until the late 1960's (Figure 4). At that time, season length was reduced and hunters were restricted to one bear every 4 years.

Bag limit reductions may have had a greater effect on harvest reduction than reduction in season length. Reduced fall season length may have decreased sport harvest while shortened spring seasons did not necessarily reduce harvest (Figures 5 and 6). For purposes of evaluation, fall seasons were determined to end November 30 and spring seasons to begin April 1, unless opened later, because no bears have been harvested between those dates in Unit 6.

In southcentral Alaska, females generally produce 1-3 off-spring every 3-5 years once they have reached age 5 or 6, and are capable of producing cubs in successive years following loss of new cubs as late as July. Cubs stay with sows 2 and sometimes 3 years after birth.

Brown bears are opportunistic omnivores. Spawning eulachon on the Delta in April and May attract some bears. Spawning sockeye and coho salmon attract bears to upland streams in late June through November. The attraction of bears to the Delta seems to be a combination of favorable habitat, spawning eulachon, and an abundance of avian eggs. Salmon and ripening berries in upland habitats appear to draw bears away from goose nesting habitat, but only after peak egg hatching dates.

Coyote--Coyotes are common on and near the Delta. In the early 1900's coyotes were scarce on the Delta, and red fox were common to abundant. By the 1940's the coyote was becoming more abundant on the Delta. Both fox and coyotes were relatively abundant immediately after the 1964 earthquake as microtine populations expanded in newly created habitat. High coyote densities are generally detrimental to fox populations, and in the last decade fox have become scarce on the Delta.

Coyotes are highly adaptive omnivores and their effectiveness as a major predator of nesting and young waterfowl is well documented. Coyote population levels are typically related to fluctuating prey bases and reflect the availability of prey species such as microtines or hares. Microtine populations appeared to peak in 1984 on the Delta, although populations still remain high on the barrier islands. The hare population apparently peaked in 1985. Coyotes breed in February or March giving birth to 4-10 pups in April or May. Dens have been located on the Delta in goose nesting areas.

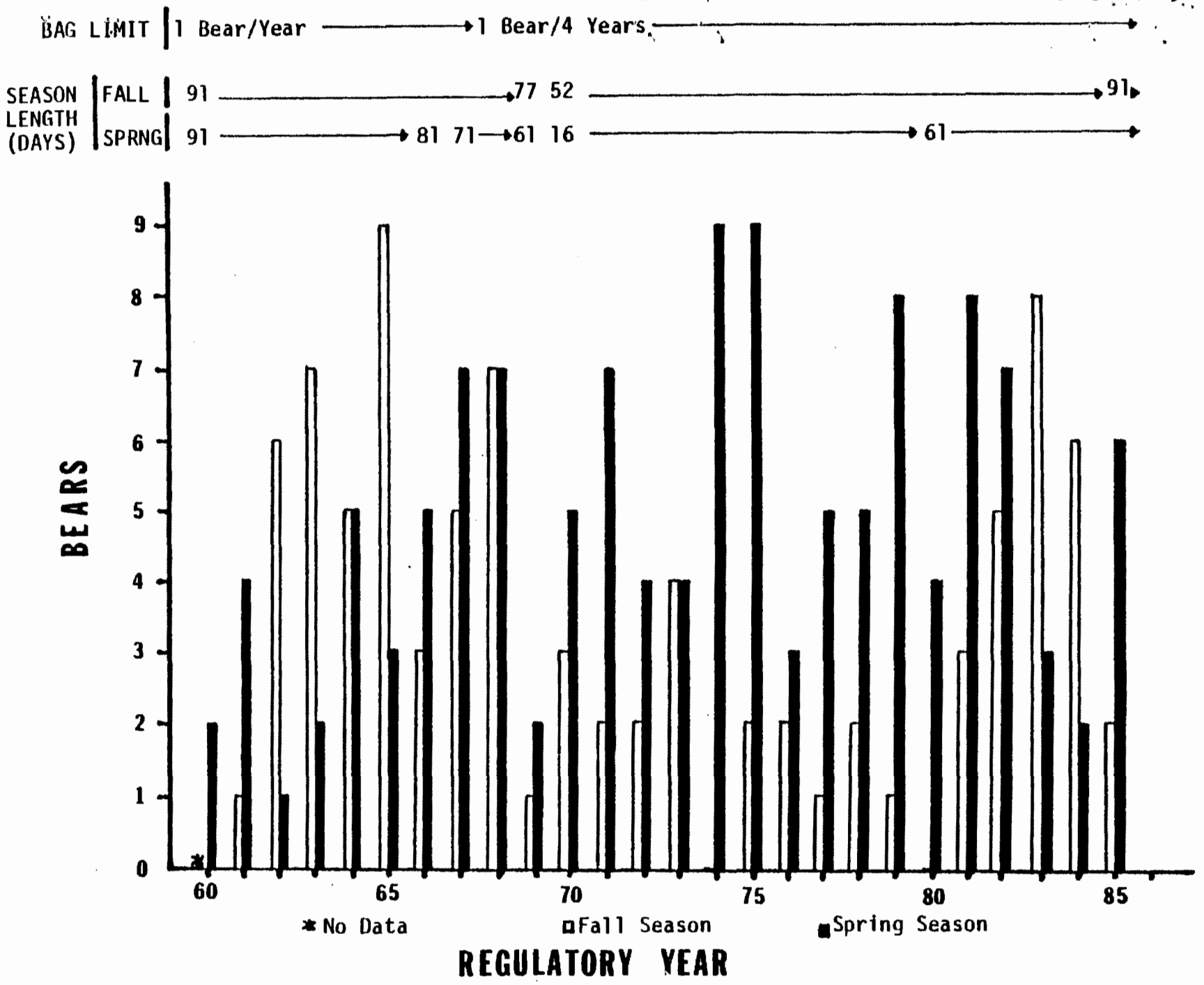


Figure 4. Brown bear sport harvest compared with season lenght and bag limit, Copper River Delta, Alaska 1960-1985.

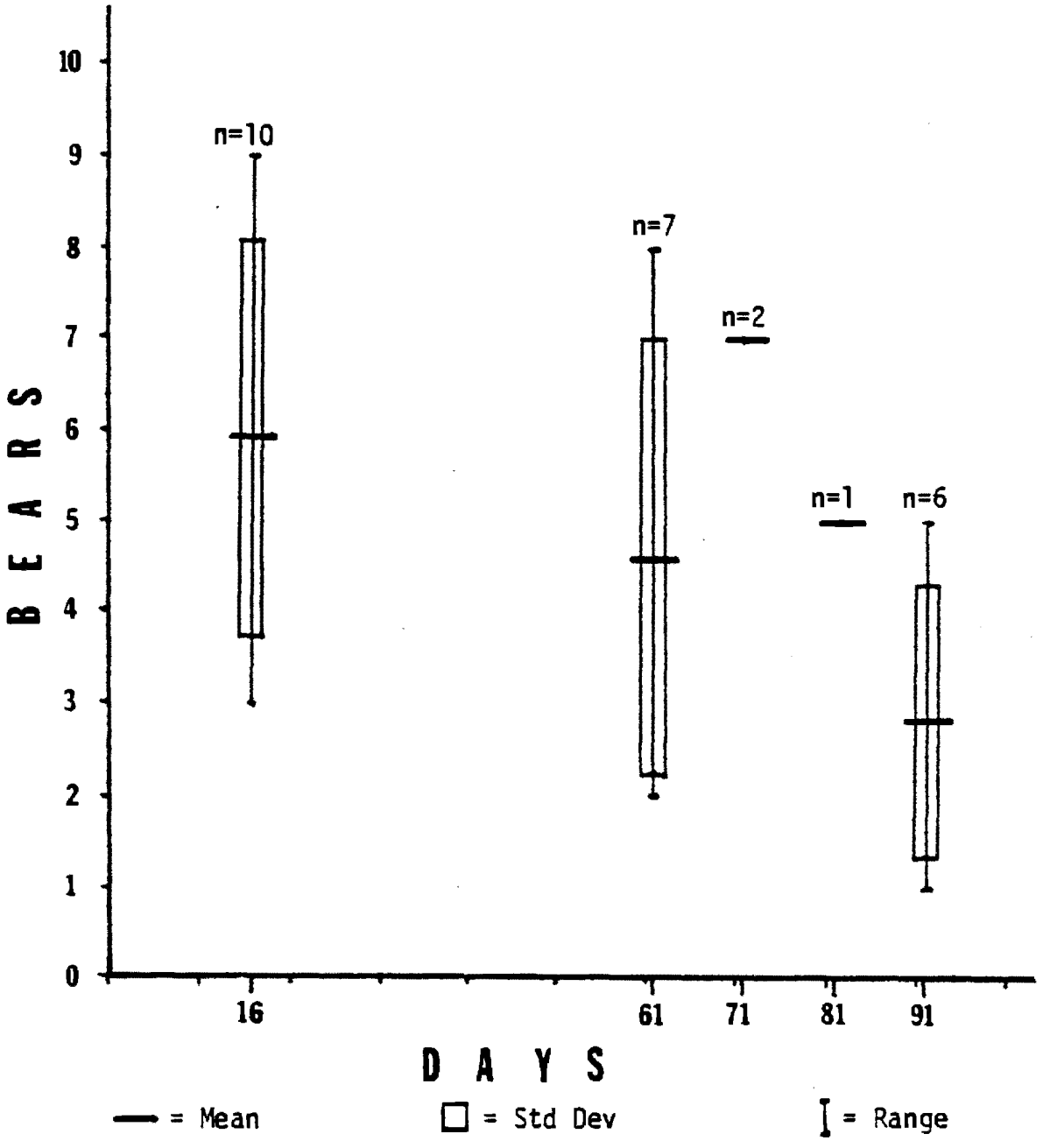


Figure 5. Brown bear sport harvest during spring compared with spring season length, Copper River Delta, Alaska, 1961-1985.

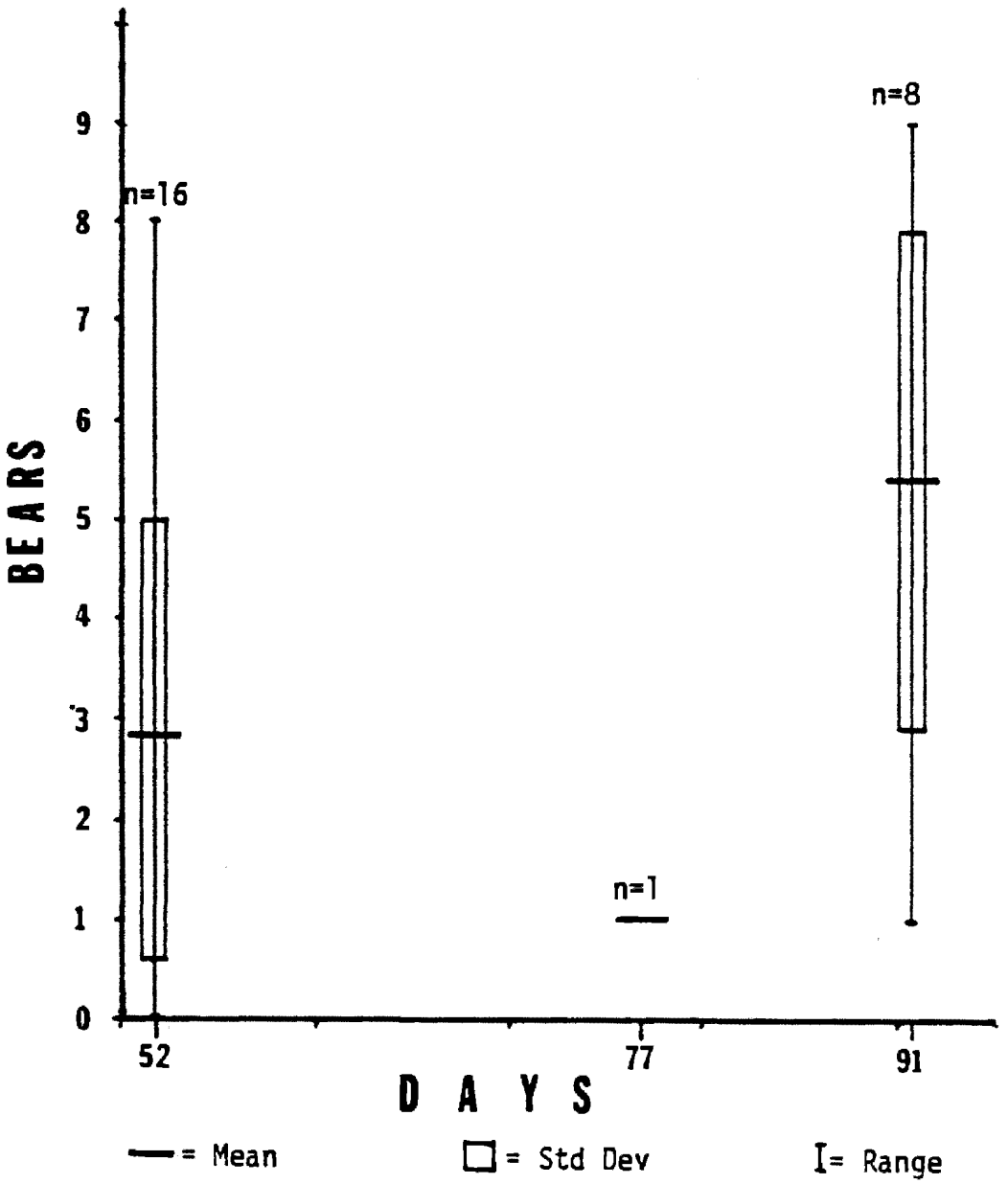


Figure 6. Brown bear sport harvest during fall season compared with fall season length, Copper River Delta, Alaska, 1961-1985.

Accurate harvest data for coyotes is not available for the Delta. During the 1960's aerial gunners and trappers took 30-40 a year. Questionnaires indicated trappers harvested between 1 and 16 coyotes annually between 1970-1977. Trapper interest in coyotes on the Delta was high in the late 1970's during periods of favorable fur prices. In 1984-85, 35 coyotes were harvested from Units 6(B) and 6(C) and the population did not appear to decrease substantially. Less than 15 coyotes were harvested on the Delta during the 1985-86 trapping season. Coyotes have normally been absent from Egg Island during the nesting period; however, since 1984 their presence and impacts on dusky have been documented. The percentage of the July population comprised of young geese on Egg Island has declined from 49-59 percent in 1981-83 to 0-18 percent in 1984-86. Egg Island also appears to be in a cycle high for microtine populations.

Mink--Mink are common to abundant on the Delta. Mink populations are affected by microtine densities, peaking shortly after microtine numbers peak. Evidence at mink dens on the Delta indicate that mink occasionally catch and eat goslings and flightless adults. However, the overall impact of mink on geese is probably minor.

Wolves--Wolves have been uncommon users of the Delta but 2-3 packs and several singles may seasonally travel on the Delta. In recent years there appears to be an increase of wolves using the Delta, probably due to more favorable habitat. Wolves are fully capable of catching adults and goslings and finding and eating eggs; however, they are currently considered to have only minor to no impact on geese.

River Otter--River otters are common on the Delta. In recent years, trappers in the north gulf coast have reduced their efforts in taking otter due to declining fur prices. Harvest of otters in Game Unit 6 has declined from 163 in 1978 to 35 in 1984. Since 1982, otter harvest on the Delta has averaged 4 per year. The harvest of otters on the Delta ranges from 5 to 15 percent of the total Unit 6 harvest. Evidence of otter activity on the Delta has been increasing in recent years and increasing beaver abundance should lead to further increases of otter in the future.

There is no evidence that river otters are major predators on eggs or goslings on the Delta; however, otters are known to prey on eggs and young birds elsewhere in Alaska.

Avian Predators

Gulls--The glaucous-winged gull is an abundant breeder on the coastal barrier islands of the Delta. The estimated number of breeding pairs on the Delta in 1976 was 13,000; Egg Island possessed the largest colony of 10,000. Adults

begin arriving on the Delta in April and lay 2-3 eggs in May. They migrate south beginning in August. Cordova canneries, the garbage dump, and eulachon runs in late April-early June offer alternative food sources for the gulls.

Mew gulls are common nesters on the Delta. They feed primarily on invertebrates, small fish, and fish eggs, but have been reported to eat goose eggs. Mew gulls are much less abundant than glaucous-winged gulls and they probably take fewer eggs.

Jaegers--Parasitic jaegers are common nesters on the Delta. In 1980 there was an estimated 175 pairs of jaegers nesting on the Delta and they appear to be increasing in the area. Jaegers eat eulachon and other small fish, but they are also predacious on eggs, young birds, and small mammals. A 1958 study on the Delta indicated that they were a goose predator of "little concern." However a 1976 study found them to be important predators on dusky Canada goose eggs. Their current impact on gosling survival is unknown.

Ravens--Ravens are uncommon visitors to the Delta during the goose nesting period. A few individual birds have been recorded feeding on goose eggs. Their affect on goose production is minimal.

Birds of Prey--Bald eagles are seasonally abundant on the Delta. Up to 5,000 may be present during spring and fall migration. An estimated 20-30 pairs nest on or near the Delta. Eagles prey primarily on adult geese and large goslings. In comparison to predators such as bears and coyotes, eagles likely have minimal effect on geese.

Goshawks, peregrine falcons, and northern harriers have been observed on or near the Delta during spring and summer. Of these raptors, harriers that nest and feed on the Delta are most likely to take young goslings. Peregrines have been observed chasing adults with no success. Goshawks are apparently rare breeders near the Delta, but they are capable of capturing adult geese as well as goslings.

Short-eared owls and great horned owls occur on the Delta; short-eared owls are uncommon nesters there except during peaks in microtine numbers. Both species are capable of taking goslings and great horned owls take adult geese, but their impact on dusky Canada geese is minor.

IV. Dusky Canada Goose Management

As with all species of migratory waterfowl, primary management authority for the dusky Canada goose lays with the U.S. Fish and Wildlife Service (FWS). The FWS is advised by

flyway councils which represent the states, provinces and, in some cases, other federal agencies involved in local management of waterfowl populations. One of the major responsibilities of the flyway councils is to develop management plans for species, subspecies, or populations in the flyway and implement these plans. Implementation includes recommending seasons and bag limits to the FWS as well as identifying research needs and coordinating range-wide habitat protection. Alaska is a member of the Pacific Flyway Council (PFC) and shares management responsibility for the dusky goose with British Columbia, Oregon (see Appendix 1), and Washington. Habitat on the nesting grounds is managed primarily by the U.S. Forest Service (FS) while winter habitat is a complex of private and publicly owned lands.

Until about 1972, harvest of the dusky goose was regulated on an annual basis based primarily on tradition, production, and status of other waterfowl besides Canada geese. Effective season length (period between arrival of geese in Willamette Valley and end of waterfowl season) and daily bag limit varied between 41 and 70 days and 2 and 3 geese, respectively.

In 1973 the PFC adopted and published a management plan for the dusky Canada goose. The principal objective identified in the plan, which was revised and updated in 1985, is to "maintain a post-hunting season population of at least 20,000 dusky geese (3-year average) as part of an overall wintering population of Canada geese in northwestern Oregon and southwestern Washington of at least 40,000 but no more than 75,000." Additional objectives are to maintain the nesting, migration, and wintering habitats in sufficient quantity and quality to meet and maintain the population objectives, recognizing that ecological changes are altering the nesting habitat, food resources, and extent of predation; manage the wintering habitat to provide optimum food, water, and sanctuary conditions and to provide optimum geographical distribution of geese; and to manage the dusky goose population and other Canada goose populations with which they sometimes mix, to provide optimal hunting and other recreational uses.

The management plan also presents guidelines to be used in recommending changes in hunting regulations. These include progressive adjustments in harvest when the 3-year average for the winter population index drops below 20,000 and closure of the hunting season when the winter population index drops to 10,000 or less. It further recommends that limited hunting not be considered until the winter population index attains at least 13,000 geese.

In response to the dusky goose population decline in the late 1970's and early 1980's, the last two weeks of the

season, the period when harvest of adult geese is greatest, were closed in western Oregon and southwestern Washington in 1983. Harvest remained high and a one month reduction in season length and reduction in the daily bag limit to one dusky on state and federal management areas and one Canada goose of any subspecies outside those areas was instituted in 1984. The Canada goose season was also delayed 2 weeks along the Gulf of Alaska to allow duskys to leave the area. Even with these restrictions, the dusky harvest was high enough to prompt an emergency closure of the already shortened season in Oregon.

In 1985, the Canada goose season was delayed 3 weeks along the Gulf of Alaska and was closed in western Oregon and southwestern Washington except for Sauvie Island in Oregon and Ridgefield NWR in Washington. An experimental season was held on these areas to determine whether hunters could distinguish between dusky and other subspecies of Canada geese. The season, which was based on a total harvest quota of not more than 200 duskys, was successful in Oregon and ran the full allowable 93 days without attaining or surpassing the quota (Appendix 2). The hunt was not so successful in Washington and was closed after 2 weeks because the harvest quota was surpassed (Appendix 3).

The experimental season in Oregon demonstrated that controlled goose hunts could be used in the Willamette Valley to reduce depredation problems without an excessive harvest of dusky Canada geese. Results of the experimental season combined with delination of parts of the Willamette Valley that are not used by duskys (based on over 14,000 observations of collared birds during the winter of 1985-86) has led to plans for expansion of the controlled goose hunt in Oregon and refinement of the experimental season in Washington in 1986. The Canada goose season was again delayed 3 weeks along the Gulf of Alaska in 1986.

V. Population Objectives

The objective of the following management options is to reverse the dusky Canada goose population decline and build the population back to at least 20,000 geese. Some of the options include actions that are outside the authority of the ADF&G and the Board of Game. Implementation of these options would be through the cooperation of other agencies. The objective of management options addressing predation on the nesting grounds is <u>not</u> elimination of any species of predator from the delta. Rather, the objective is to reduce predation and allow recovery of the goose population. Periodic or continuous low level predator population management may be necessary to maintain a dusky population of at least 20,000 birds after the population objective is

attained. The need for such maintenance action is not known at this time. Long term nonlethal methods of reducing predation will be considered, but these are typically expensive and would require major funding.

The following models demonstrate how the dusky population might respond to various management schemes. All of the models start with a 1986 post nesting population of 13,350 geese comprised of about 10,500 (79%) adult geese, 1,430 (11%) subadult geese and 1,420 (11%) young of the year. Age composition of the 1986 population is based on 1984-86 production and 1952-1965 band recovery data. Based on survival rates for captive geese, the 12 year age class was considered the last productive age class and, for modeling purposes, older classes were eliminated from the population. All models assume continuation of a low level annual harvest of 500 geese, total annual mortality (including hunting) of 10 percent for birds older than one year, 25 percent for fledged young of the year, and 13 percent combined age class mortality. It is also assumed that hunting mortality of 500 birds annually is compensatory to natural mortality, i.e. if no harvest occurred, at least 500 birds would still be lost to natural causes. Mortality rates are in part based on those for other subspecies or populations of Canada geese that are not hunted or only lightly hunted. These include the Aleutian Canada goose, which has an average annual adult mortality rate of 22 percent, the Vancouver Canada goose, which has an average annual adult mortality rate of 16 percent, and a non-migratory population of giant Canada geese that had an average annual adult mortality rate of 10 percent and young mortality rate of 25 percent (Dennis Raveling, per. comm.). Because of a low correlation (R = .2646) between spring weather and percent young in the fall population, the influence of spring weather on production has not been incorporated into the models. In reality, very late springs would result in poorer production and influence population trends to some extent.

The linear relationship between nesting success and percent young in the July population was defined so that the nesting success necessary to maintain the various production levels used in the models could be projected. This was done by fitting 1974-86 nesting effort (calculated nest density X nest success) and percent young data to a regression curve (Figure 7). The linear relationship of these data is strong ($r = 0.94$).

Model 1 (Figure 8) assumes an average annual production rate of 16 percent. This is the 1979-86 average and represents production during a period when predation was increasing. The population in this model increases at a low, nonlinear rate of 0.6 - 3.6 percent annually until 1993 when older, larger age classes become unproductive. After 1997 the

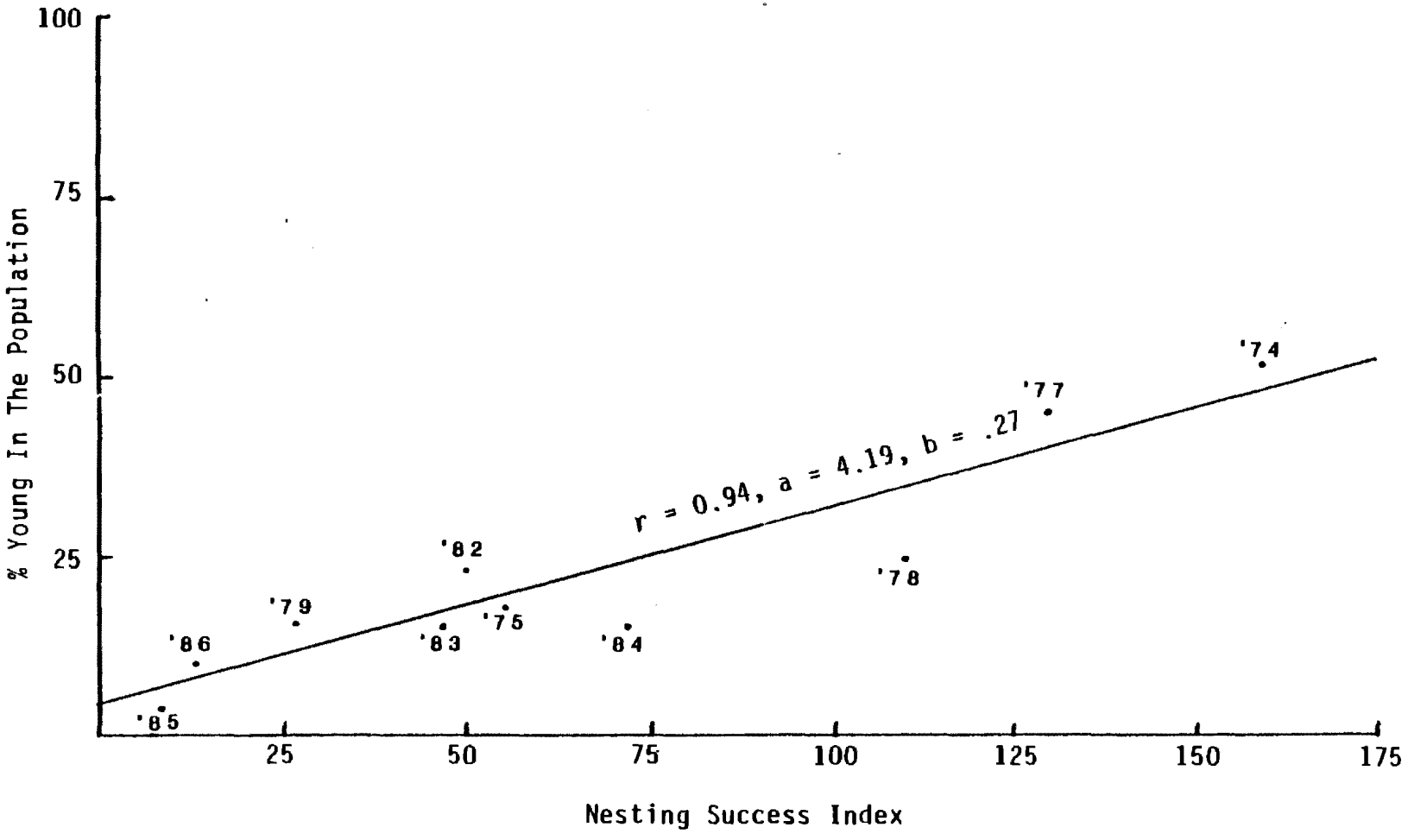
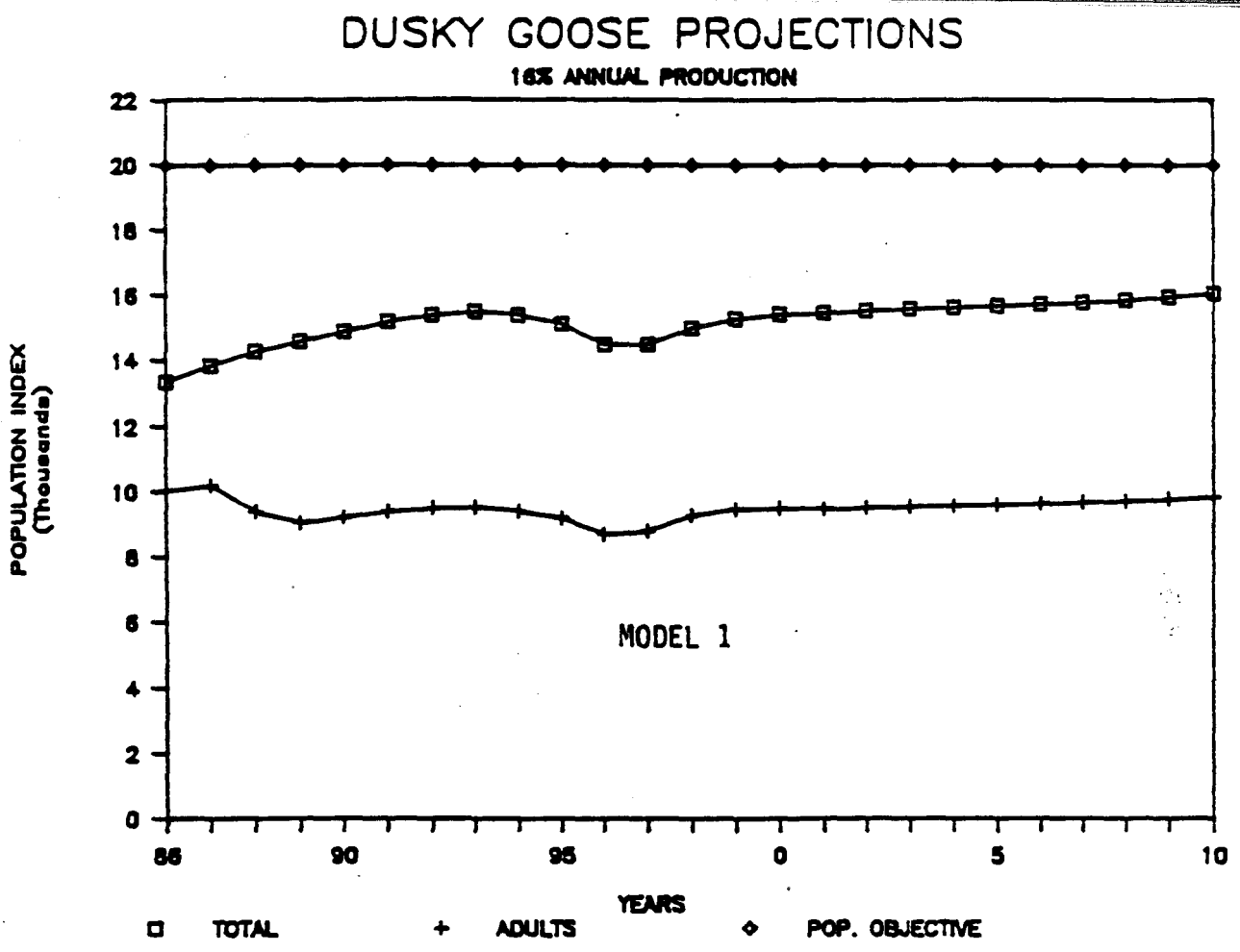


Figure 7. A linear regression of nesting success index (calculated nest density X nest success) on the percent young in the fall population of geese on the Copper River Delta, 1974-1986.



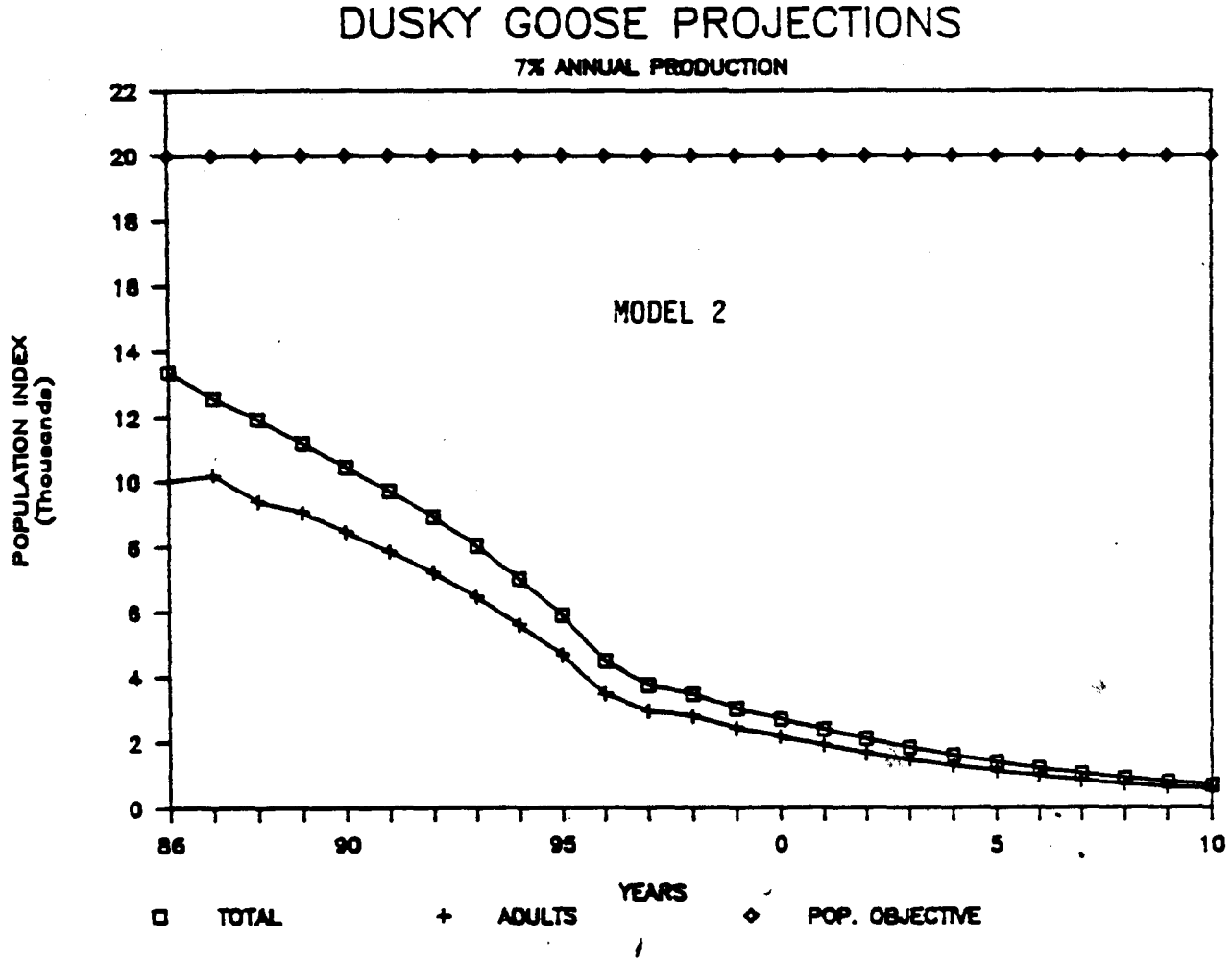


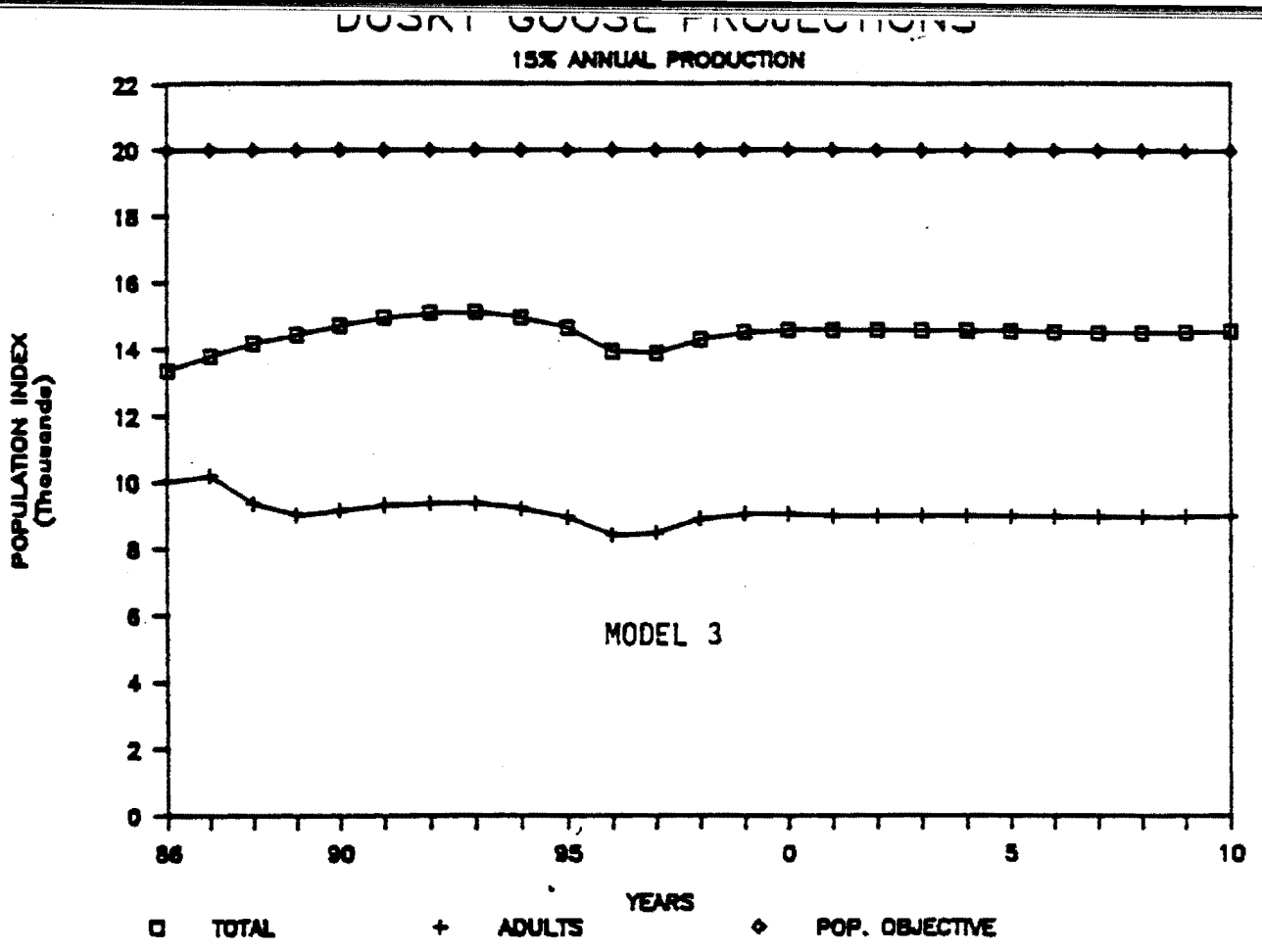
Figure 8. Dusky Canada goose population models assuming average annual production rates of 16 percent and 7 percent.

population increases at 0.3 - 0.5 percent annually and should be considered stable at about 15,000 since unknown variables such as weather, which could easily off set the 1-2 percent annual increase, have not been incorporated. Based on the relationship between nesting success and production (Figure 7), a nesting success index of 43.7 would be required to maintain 16 percent production. Assuming a 1982-86 average nest density of 100.6, a calculated average annual nest success of at least 44 percent would be necessary to accomplish the population growth depicted in this model. Further reductions in harvest would not necessarily stimulate population growth because natural mortality, which is responsible for over 3/4 of the annual population loss, would be compensatory. The difficulty in reducing total mortality below 13 percent (the combined age class mortality rate in the model) is illustrated by the Aleutian Canada goose. This subspecies, which is listed as endangered and is not hunted, still encounters about 22 percent annual mortality.

Model 2 (Figure 8) is based on the same assumptions as Model 1 except that annual production is 7.2 percent. This rate represents average production in 1985 and 1986 when predation was severe. In this scenario the average age of the population would grow progressively older due to low production. Production would not off-set losses to old age and the population would decline at a nonlinear rate of 5 - 24 percent until 1996. After 1996 the age class composition would become more favorable, i.e. a more even distribution of age classes, but the population would still decline due to low production. In the absence of hunting, the population would still decline, although at a progressively slower rate. At lower population levels the harvest of 500 birds would progressively be additive, not compensatory, and exceed natural mortality. However, hunting mortality could probably not be totally eliminated. For example, about one quarter of the annual mortality for the Aleutian Canada goose, for which there is no legal hunting season, is by hunting.

Model 3 (Figure 9) is based on the same assumptions as Model 1 except that average annual production is 15.7 percent. Based on the relationship between nesting effort and production (Figure 7), the current population level, and nest density (1982-86 $\bar{x}$ = 100.6), nest success would have to average at least 43 percent to maintain 13.4 percent annual production. This scenario depicts the minimum average annual production and nest success necessary to maintain the current population under an assumed combined age class mortality of 13 percent annually.

Model 4 (Figure 9) uses the same assumptions as Model 1 except a 1971-78 average annual production of 28.2 percent



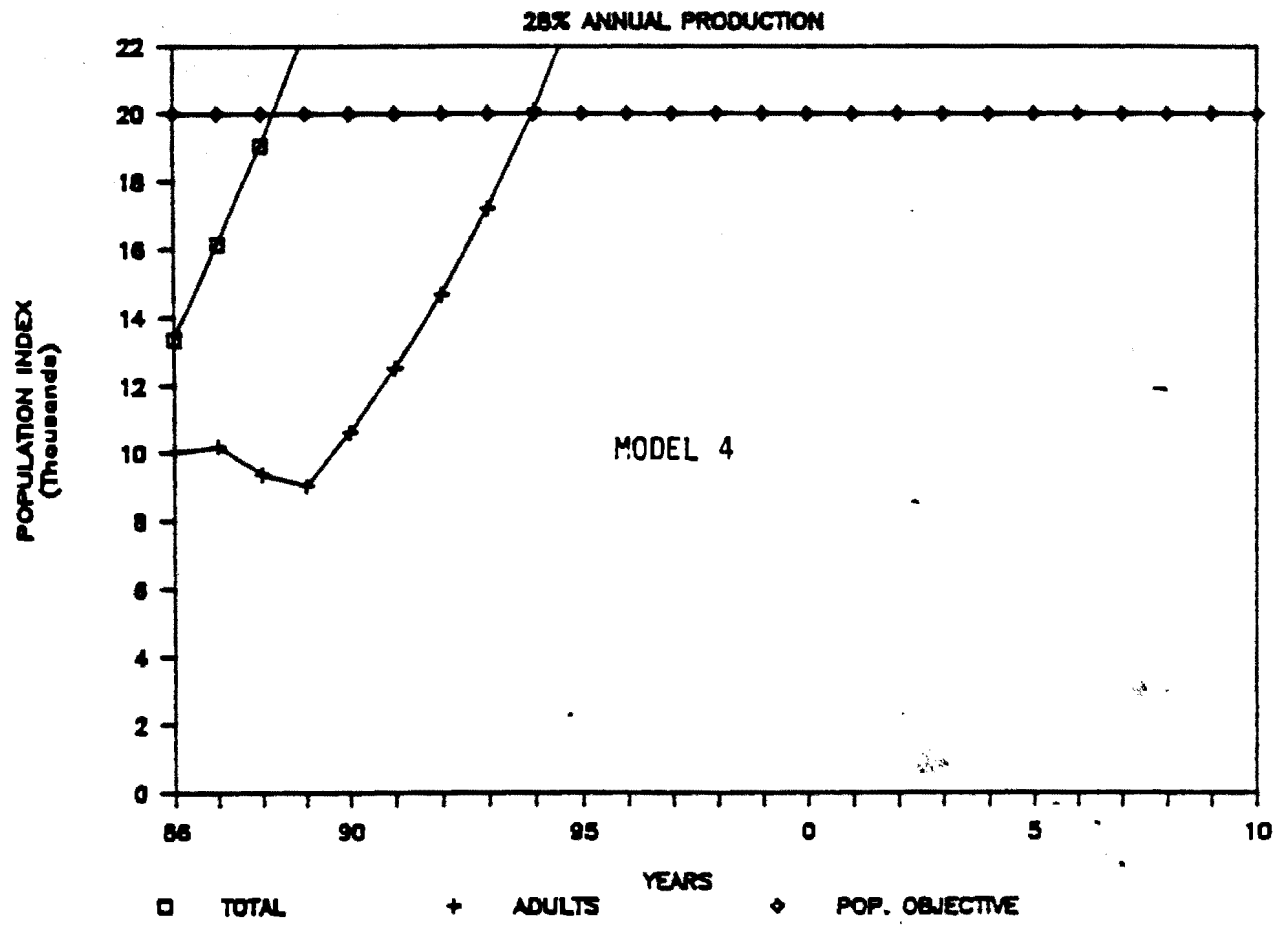


Figure 9. Dusky Canada goose population models assuming average annual production rates of 15.7 percent and 28 percent.

is assumed. At the current population level and average nest density, average nest success of at least 89 percent would be necessary to achieve 28.2 percent annual production. The level of required nest success would progressively decline as the population and nest density increased. This model indicates that, with high production similar to that during the period when the population was at a record high, it would take 3 years to attain the population objective of 20,000 geese. Given current habitat conditions, predator population levels and predator activity on the delta, an average annual production rate of 28 percent and nest success of 89 percent is not realistic.

Model 5 (Figure 10) is based on the same assumptions as Model 1 but average annual production and nest success has been raised to 22 percent and 66 percent, respectively, by management actions on the Delta. The population would increase at an annual rate of 9 - 11 percent and attain 20,000 in about 5 years.

Regardless of the option(s) selected, complete evaluation of the results of management actions will be made by the ADF&G, Pacific Flyway Technical Committee, FS, and FWS three years after implementation.

VI. Management Options

The following management options were identified and discussed at meetings with the U.S. Forest Service (FS), the U.S. Fish and Wildlife Service (FWS), the National Audubon Society, Alaska Chapter of the Wildlife Society, and the National Wildlife Federation, or in writing from the Alaska Wildlife Alliance and Greenpeace (Appendix 4). Other groups were invited to participate but did not. As of January 1, 1987, 31 letters were received from Wildlife Alliance members (2 AK and 29 non-residents), all of which expressed very similar views.

General recommendations of the agencies and groups participating in the review of the options paper were: the FS and the FWS indicated an intent to cooperate with the Alaska Department of Fish and Game (ADF&G) to solve the declining dusky population problem. The Audubon Society recommended that management options involving practices normally considered illegal and/or highly controversial not be considered until after a thorough public review. Options which are either unproven, impractical, or excessively expensive should not be considered unless they are determined to be otherwise. The Audubon Society also stressed that management activities involving the dusky population or nesting habitat would have to be consistent with laws and policies of the FWS or the FS and that involvement and cooperation of all appropriate agencies and groups should

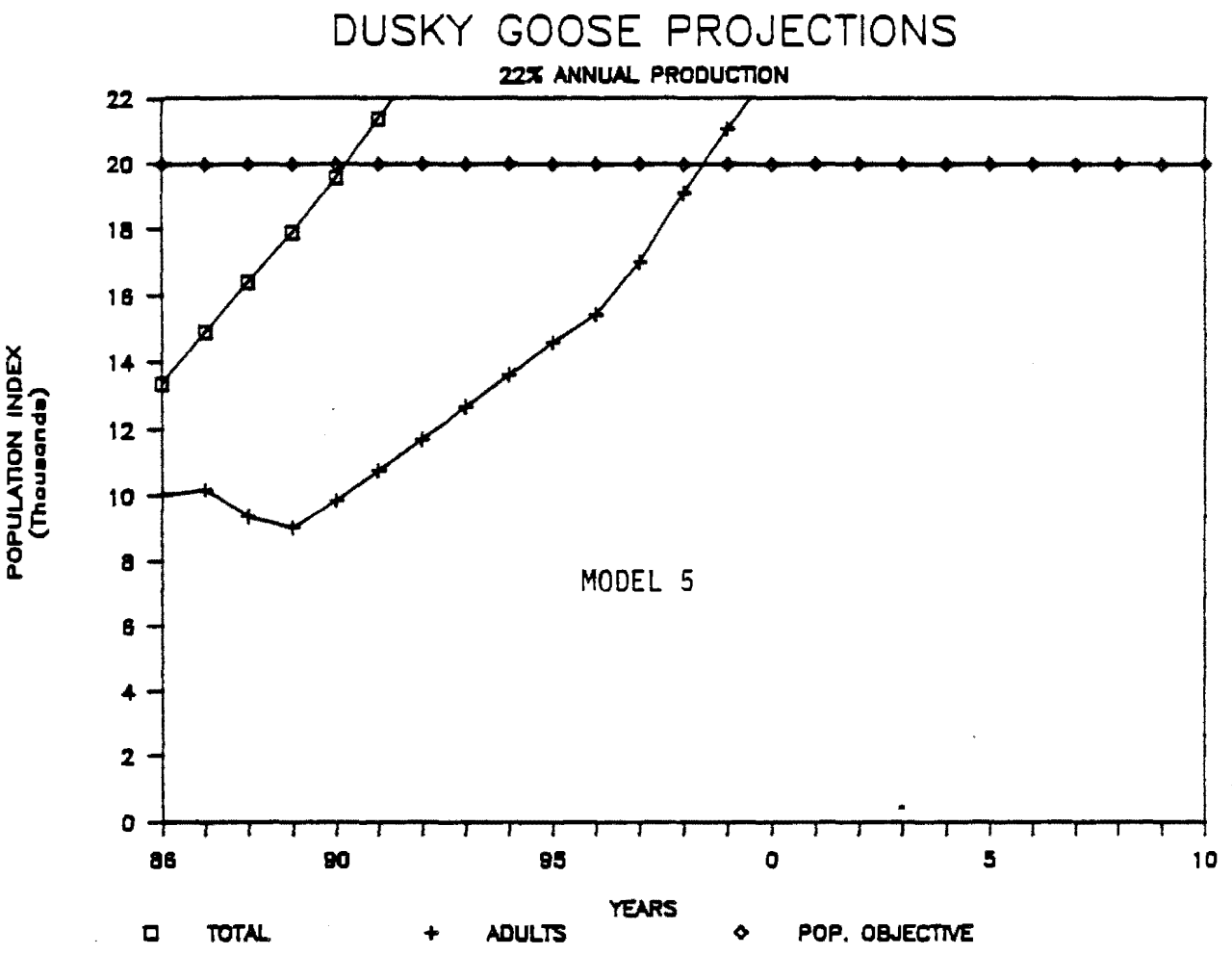


Figure 10. Dusky Canada goose population model assuming an average annaul production of 22 percent.

continue. The National Audubon Society also recommended that any management action involving expenditure of public funds be prioritized according to public priorities and applied only when there is a reasonable chance for success. The Wildlife Society and National Wildlife Federation both indicated general support of any actions necessary to increase the dusky population. Both groups as well as the National Audubon Society and Alaska Wildlife Alliance felt that management actions should be progressive, i.e. try management techniques that are generally acceptable to the public and within the existing framework of laws and policies before initiating more extreme management options. Specific comments on the management options are presented in the following discussion of options.

A. No Additional Action in Alaska by ADF&G

No management actions to improve production would be taken by the ADF&G. Surveys and monitoring programs identified in the Dusky Goose Management Plan and banding would continue. None of the federal agencies or conservation groups supported this option; however, the Audubon Society and Alaska Wildlife Alliance felt that the FWS should assume the lead in management of the dusky in Alaska.

Under this option, no additional expenditure of public funds would occur in Alaska. Implementation of this option would result in an increase in expenditure of public funds on the wintering grounds by state and federal management activities to ensure adequate wintering habitat, proper use of this habitat, and, possibly, financial reimbursement for crop damages.

If this option was selected and mortality continued to surpass recruitment, the population would continue to decline and listing of the dusky as threatened has a high probability.

B. U.S. Fish and Wildlife Service Assume Lead Management Responsibility for the Dusky Canada Goose

The National Audubon Society and Alaska Wildlife Alliance identified and recommended this management option. This option would result in a reduction in the expenditure of state funds but would place an additional financial burden on the FWS.

A common misconception is that the FWS has sole management authority over all migratory waterfowl. In actuality, while the FWS is responsible for overseeing management of waterfowl, the FWS and states have dual management authority. In the early 1960's the State of Alaska assumed the lead for management of the dusky

goose in partnership with the State of Oregon. This partnership was expanded in 1972 with establishment of the Dusky/Taverner's Canada Goose Subcommittee of the Pacific Flyway Council Technical Committee which added the State of Washington and Province of British Columbia as cooperators in management of the dusky. Since the early 1960's the FWS has had little involvement with dusky management in Alaska. Assumption of sole management by the FWS would not only remove 25 years of management expertise, but would place the FWS in a position where they would have to address predation on the nesting grounds by resident wildlife species--a management issue that is more properly addressed by the ADF&G. A final argument against transfer of lead management is equity. It would not be professionally ethical for the State of Alaska, which was to a large degree responsible for management of the dusky during the 1970's when the population was at record highs, to defer management to the FWS now that a serious problem exists. Close cooperation with the FWS is, however, warranted and on-going.

C. List the Dusky as a Threatened Species

The Alaska Wildlife Alliance recommended that this management action be taken in conjunction with elimination of all hunting. While the National Audubon Society did not recommend listing of the dusky per se, they did recommend that the FWS assume full management responsibility and that they organize a dusky recovery team and develop a recovery plan--actions which typically occur after listing under the Endangered Species Act. Listing of the dusky Canada goose would not increase expenditure of state funds but would increase expenditure of federal funds.

One of the primary reasons behind development of this document is to stop the decline of a population before special status classification is necessary. At the current population of approximately 13,000-13,500 geese, nomination for, or listing of the dusky, is not warranted. Other populations of geese such as the tule white-fronted goose, which numbers approximately 5,000, the Aleutian Canada goose, which numbers approximately 4,500, and dusky geese which numbered well below 10,000 in the early 1950's, are (and were) viable and capable of increasing rapidly under favorable conditions. Listing the dusky as a threatened species would not solve the problem of declining numbers or negative impacts of changing habitat and predation. These issues would still have to be addressed.

While the Dusky/Taverner's Subcommittee has discussed population threshold levels for listing, none have been established. The Audubon Society recommended establishment of this threshold population level. Using a recently published mathematical formula:

$$N_e = L \times N_o \times \bar{l}$$

where

N_e = the effective population size necessary to ensure genetic variability

N_o = the actual population size

L = the generation length

$\bar{l}$ = the probability that a newborn survives to the average age of reproduction

and assuming a conservative effective population (N_e) of 1000 that would allow adequate genetic diversity for evolution (a minimum N_e of 50-500 is recommended by Franklin, 1980); an average generation length (L) of 5.6 years (annual survival rate for Vancouver Canada goose which receive little hunting pressure); and survival rate for young ($\bar{l}$) of 0.3918 (computed from Raveling 1981 and Raveling pers. comm.), a minimum population or threshold population ($N_e + N_o$) for the dusky Canada goose is 1456 birds. This would be the calculated endangered level. To ensure an adequate number of geese in the population to offset mortality from unanticipated catastrophic events such as disease or severe weather, this number should be at least doubled, resulting in a theoretical population threshold for listing as a threatened species of about 2,900 geese--far below the current population index of 12,200. In reality, listing of the dusky as threatened would be based on the "best opinion" of dusky and other goose experts and would probably occur before the calculated threshold was reached.

D. Organize a "Recovery Team" and Develop a "Recovery Plan"

The National Audubon Society recommended this option along with a recommendation to address the dusky problem on a flyway-wide basis. These recommendations are combined for discussion under one management option since they pertain to functions of the Flyway Council.

This option would cost little to implement, but would duplicate efforts. The Dusky/Taverner's Canada Goose

Subcommittee of the Pacific Flyway Council (the "recovery team") currently serves as the entity responsible for overseeing management of the dusky in accordance with an adopted management plan ("recovery plan"). The subcommittee meets semi-annually and is receptive to public input. The management plan includes provisions for revisions to ensure achievement of the population goals or modification of the population goals. Allocation of funds at both the state and federal level are based on the plan and recommendations of the subcommittee. The subcommittee is fully aware of, and endorses this option paper.

E. Revise Population Objective

The minimum 20,000 geese post-season objective was established when productivity was high and hunting seasons merely had to be adjusted to compensate for weather-induced production changes. Because even a complete elimination of hunting would not reverse the declining trend, a downward revision of the population objective would, in a sense, be moot without corrective action in Alaska. An objective of 15,000 or 10,000 would be easier to maintain because less drastic action on the breeding grounds would be required. Lowering the objective would permanently lock in very restricted seasons throughout the birds' range and would do nothing to solve the serious agricultural depredation problems in Oregon. This option will, however, be thoroughly discussed at the next flyway subcommittee meeting. A decision to change or maintain the present objective will to a large degree depend upon the actions taken in Alaska to increase production, and the ability to sustain those actions long-term.

A few taxonomists classify the dusky and Vancouver Canada goose as one subspecies. A thorough serological/morphometric study may demonstrate a basis for a single subspecies. Until a study is made, the ADF&G will continue to manage each subspecies as a separate entity.

F. Harvest Restrictions

The option of complete hunting closure of duskys was endorsed by the Audubon Society, the Alaska Wildlife Alliance, and Greenpeace. It would result in no additional expenditure of state funds in Alaska, but would probably result in the additional expenditure of funds on the wintering grounds. This option would essentially mean a closed season for Canada geese throughout the range of the Dusky. A current small harvest of duskys on the wintering grounds is allowed as part of a management tool to condition all Canada

geese to avoid agricultural areas and respond to hazing. In the absence of this tool, expenses associated with crop depredation to the State of Oregon and the federal government would increase, and significant hunting opportunity would be lost.

Further harvest restrictions, except as provided in the management plan when the population is 10,000 or less geese, would provide little or no benefit to the dusky Canada goose. As discussed in Models 1 and 2 in the Population Objectives section, current mortality from hunting is minimal at about 3.5 percent annually and is assumed to be compensatory to natural mortality at the present population level. While additional harvest restrictions might provide slight additional biological benefits to the geese, most of the benefit would be of a perceived nature by some sectors of the public.

G. Goose Transplants

The Alaska Wildlife Alliance and Audubon Society supported this option, however, the Audubon Society expressed opposition to transplanting the dusky outside it's historical range. All other agencies and groups participating in the review of options were generally neutral, although expense and questionable results were identified by the FWS.

This option would result in the expenditure of additional state funds. Potential transplant sites are on Middleton Island, Katalla area, and the Yakutat area. Establishment of a viable population of duskys at any of these locations would require that several hundred young birds be transplanted annually for at least 3 years. Annual costs would range up to $4,000 depending on distance, number of geese relocated, and assistance from other agencies.

Transplants have been widely and successfully used to establish or reestablish goose populations. Giant Canada geese and Aleutian Canada geese have been reintroduced into portions of their former range by transplants, and nonmigratory populations of both Great Basin and dusky Canada geese have been established by transplants in the Pacific Northwest and mountain states.

H. Captive Rearing of Geese

This option was not opposed by any of the agencies or groups, although both the Audubon Society and the FWS expressed concern about costs and low probability of success.

Captive rearing of the dusky Canada goose would be an additional cost to the state. To raise 500 goslings annually, rearing facilities, equipment, and personnel would be required at an estimated cost of $25,000 annually.

Captive rearing of Aleutian and giant Canada geese for release in the wild has been used to augment wild populations. Of the techniques used to assist recovery of the Aleutian Canada goose, captive rearing was one of the least successful. Survival rates for captive reared geese released on the Aleutian Islands was low. Large scale captive rearing of geese is not a desirable option from the state's perspective. However, captive rearing, on a limited scale and short-term basis, to produce young for transplants, may be considered.

I. Habitat Enhancement

Habitat enhancement such as development of additional nesting habitat on the coastal Copper River Delta, brush removal and control, and construction of nesting structures was supported by all agencies and conservation groups.

The FS is responsible for habitat management on most of the Copper River Delta. The cost of this option to the State of Alaska would depend upon the extent of cooperative funding of habitat enhancement projects.

Artificial nesting structures have been successfully used to improve waterfowl production in other areas. Ducks Unlimited in cooperation with the FS and the State of Oregon are currently testing several types of nesting structures. Based on the results of these tests, additional structures may be built on the delta.

Uplifting of the Delta by the 1964 earthquake exposed tidal flats seaward of the old hightide line. These areas are slowly evolving toward the grass-forb-low shrub habitat type that was common on the coastal delta before the earthquake and preferred by geese for nesting. Development of this habitat could be enhanced by constructing low levees and berms. However, predators currently use the area and nest predation would probably be high.

Brush removal and control to reduce preferred habitat for mammalian predators and to provide additional low shrub covered levees for nesting is currently being considered by the FS. After a thorough analysis of costs and feasibility, brush may be removed and controlled on test areas by burning or mechanical means.

J. Nest Avoidance by Predators

This option was opposed by the Alaska Wildlife Alliance while all other agencies and groups were generally neutral or expressed no opinion. The FS indicated that this option may require NEPA analysis and District Ranger approval.

1. Aversive Conditioning--Bears and canids have been successfully conditioned to avoid refuse dumps, bee yards, and campgrounds in other areas. Food items were laced with offensive/emetic chemicals and fed to predators. The predator thereafter avoided the bait or prey, at least temporarily. Lithium chloride, emetine hydrochloride, and ANTU (alpha-napthyl-thiourea) have been used with varying degrees of success.

   This option would involve treating eggs in live and/or "dummy" nests with an aversive agent. Hypothetically, predators that fed on treated eggs would at least temporarily refrain from eating additional eggs. The aversive agent would have to be available to predators throughout the nesting season and in sufficient quantity to reinforce aversion of goose nests. Sustained and widespread treatment may develop a long-term avoidance behavior by individual predators.

   Implementation of this option on the entire west Copper River Delta would be expensive. Estimated initial costs are $120,000 with reoccurring annual costs of $100,000. Aversive conditioning on a small scale to test effectiveness would be less expensive, depending upon the size of the test.

   Advantages of this option are continued availability of predators to hunters, trappers, and photographers plus the support of some segments of the public that oppose lethal control measures. Disadvantages include the continual need for reinforcement of aversive conditioning, relatively high cost, the possibility that predators would learn to avoid treated eggs rather than all eggs, and the lack of knowledge on large scale conditioning on large areas; aversive conditioning has been used successfully only at confined food sources such as dumps in the past. A final disadvantage is the lack of information on the effectiveness of aversive agents on brown bears.

2. Baiting Predators to Other Areas--Establish feeding stations for bears and canids away from major nesting areas on the Delta. Based on one

year of information, it appears that feeding stations in interior Alaska have provided grizzly bears with an alternative to moose calves and calf survival has increased.

This option would involve placing and maintaining through the nesting period, large quantities of meat or other baits in areas that would intercept bears traveling to the Delta. Presumably, bears would remain near feeding stations and spend less time in search of nests and eggs. Annual station maintenance may develop feeding patterns away from the Delta in future generations of bears.

This option would cost an estimated $20,000-$45,000 annually.

Primary advantages of bait stations are their nonlethal nature and the support of some of those segments of the public opposed to lethal control methods. Disadvantages include the potential ineffectiveness of feeding stations to hold bears away from nesting areas. Some bears (sows with cubs of the year) would be reluctant to visit areas of high bear density and others may be reluctant to break annual feeding patterns. Therefore not all bears would be affected by bait stations. A second possible disadvantage is development of undesirable concentrations of bears. These concentrations may create bear/human conflicts or attract hunters, however current regulations make it illegal to hunt or take brown bears over bait. Some bears may also develop a dependency on artificial food sources and become a problem at areas where garbage or human related foods are available. Other disadvantages are the unavailability of an attractive, abundant, and inexpensive food source, the offensive smell and appearance of bait stations, and high annual cost.

K. Exclusion

This option was not identified or discussed during meetings with agencies or groups. Enclosing concentrated food sources in a sturdy electric fence has successfully excluded black bears and polar bears. Heavy duty fencing augmented with electrical shocks may be capable of excluding brown bears and coyotes during the nesting period. Enclosures would be opened during the remainder of the year.

The costs of this option would depend upon the size of the area to be fenced. The effectiveness of fencing to exclude mammalian predators should be tested before

large scale application. Estimated costs of fencing to test effectiveness are:

12 km^2 = $500,000 - $1,000,000
8 km^2 = $400,000 - $ 600,000
3 km^2 = $150,000 - $ 220,000

In addition, annual maintenance costs would be approximately $10,000.

The advantage of this option is it's nonlethal approach to managing predators. Disadvantages are: the lack of knowledge on how brown bears will react to fences, electric or otherwise; construction and maintenance difficulties; potential disruption of the use of the Delta by moose; visual aesthetics; costs; and the unknown effect on geese and other wildlife of voltage sufficient to deter bears. Also, avian predators would not be excluded so predation losses would still occur and goslings would become vulnerable upon leaving fenced areas.

L. Reduction of Brown Bears

A reduction in bear numbers on the Delta during the nesting period would improve nest success. Moose calf survival rates would possibly increase under reduced bear densities and human/bear conflicts, currently 3-5/year, should also decline with population reductions. However, reduced bear densities on the Delta would reduce bear hunter success and photographer/viewing opportunities.

There are several ways that bear numbers could be reduced. These are:

1. Liberalizing bag limit and season length for brown bear hunting in Units 6(B) and 6(C).

   This option was supported by the Alaska Chapter of The Wildlife Society and Alaska Chapter of the Wildlife Federation. Both the FS and the FWS supported this option if the ADF&G felt such action was necessary. The Alaska Wildlife Alliance opposed liberalization of the harvest and all other groups expressed no specific support or opposition.

   Costs of this option would be minimal with an estimated annual expenditure of $100.

   This Board of Game action might initially increase bear harvest a limited amount. Brown bear hunters would enjoy greater hunting opportunity, but

hunter interest would probably wane with reduced hunter success. Because adult female bears are vulnerable to hunters only once every 3-4 years, liberalized seasons should be in place for at least 5 years to effectively reduce the number of problem bears (females with cubs and immature bears) on the Delta.

2. Convert Unit 6(C) to an open guiding area for brown bear hunting.

   This option was not identified until after meetings with federal agencies and conservation groups, therefore, their opinions are unknown.

   Costs of this option to the state would be minimal to none.

   Currently Units 6(B) and 6(C) are joint-use areas assigned to 12 professional guides. Few guides having use of Unit 6(C), take their hunters there preferring more remote locations in their guide areas.

   Opening of Unit 6(C) to guides by the Guide Licensing and Control Board would likely increase hunting effort and hunting success on brown bears initially, but effort would decline as the bear population declined. Local non-guided hunters may resent competition from more guides and guided hunters.

3. Transplanting bears from the Delta to other locations.

   Support and opposition to this management option by agency and conservation group was similar to option L.1.

   Costs of this option to the state would vary considerably depending on the number of bears moved, distance of moves, aircraft availability, and extent of interagency cooperation. Estimated costs for short distance/short-term relocation is $22,000-$30,000 annually.

   Bears would be moved from the Delta in the spring prior to or during goose nesting. Most bears would probably return to their former home range in a short time period--a few days to several weeks. Others would not return and others, primarily cubs and young bears, may be killed along the way. Only bears in the nesting area would be targeted for transplanting.

Advantages of this option are an immediate reduction in bear numbers on the Delta and its potentially nonlethal nature. Disadvantages are the short-term of it's effectiveness, potential for animal mortality, danger to personnel, potential for additional human/bear conflicts, and limited number of suitable transplant sites.

4. Sterilization.

Support and opposition to this option was similar to option L.1.

Estimated annual costs of this option are $10,000-$15,000, depending on techniques and number of animals sterilized.

This management action would involve surgical sterilization of female bears on the Delta over a 3 year period. Research results indicate that female bears with cubs and immature bears are the major predators of goose nests on the Delta. A reduced number of family groups and immature bears would reduce bear density and nest predation. This reduction would persist until fertile females immigrated onto the Delta.

Advantages of this option are continued availability of bears for viewing and nonlethal nature of the management action. Disadvantages are: the need for restriction or elimination of bear hunting to protect non-productive females; delayed reduction in nest predation; potential loss of bears during capture or surgery; and public opposition.

5. Removal of bears by staff.

The Alaska Chapter of The Wildlife Society supported this option because it allowed targeting and removal of only problem bears by experienced personnel. The FS indicated that a NEPA analysis and Forest Supervisor approval would be required. The National Audubon Society, Greenpeace, and the Alaska Wildlife Alliance all oppose this option.

Estimated costs to the state are $10,555-$14,000 annually.

Bears in the nesting area would be removed in the spring for a 3 year period by shooting. All animals would be salvaged. Only bears, by sex and age, that would provide desired nesting success

would be removed, leaving a viable population for recovery.

The advantage of this option is immediate reduction in bear numbers on the nesting grounds. Major disadvantages are public opposition to predator control and the reduction in bears available for public use and enjoyment.

M. Reduction of Coyote Numbers

A moderate to substantial reduction of the coyote population using the Delta during the spring and summer would increase nesting success and gosling survival. Combined with brown bear reduction, reduction of coyotes would substantially improve gosling production. Other waterfowl would also experience improved nest success. Hypothetically, fox may temporarily reestablish on the Delta and other prey species such as deer, hare, and grouse would temporarily benefit.

The high fecundity rate of coyotes allows a substantial reduction in numbers with little or no chance of extirpation. There are no records of coyote extirpation, even after years of extensive attempts to eliminate them in parts of the western United States. In these areas 40-70 percent annual population reductions have been necessary to affect a population reduction. When control measures are terminated, population recovery is generally rapid.

Reduced coyote numbers will lower the opportunity for hunters and trappers to take coyotes. Coyote viewing and listening opportunities would also be reduced. A number of options for coyote reduction are possible:

1. Hunter/Trapper education.

Expressed opposition to this option was received only from the Alaska Wildlife Alliance.

Estimated annual costs are $300.

The ADF&G would provide information to the public on techniques of calling, locating, and trapping coyotes. Although, coyotes are difficult to trap and hunt, hunter and trapper success may improve slightly with education programs. Higher fur prices would likely be more effective in increasing effort and success. Providing education to the hunter/trapper does little to increase interest in a low price fur.

This option may result in a higher trapping/ hunting effort of other predatory furbearers. Increased trapping efforts may discourage the more effective trappers. Coyotes may be "educated" quicker, thus neutralizing increased effort. Public sentiment in Alaska would generally be favorable to this option.

2. Liberalize hunting and trapping regulations for coyotes in Units 6(C) and 6(B).

Opposition to this option was expressed only by the Alaska Wildlife Alliance.

Estimated annual costs of this option are $200.

The current hunting season for coyotes is September 1 - April 30 with a bag limit of 2 per year. Hunting with artificial light is prohibited. The current trapping season is November 10 - March 31 with no bag limit. This option would involve liberalization of these regulations by the Board

of Game to allow no closed season, no bag limit and to allow the use of artificial light to take coyotes. Use of calls and artificial light would increase harvest, but would probably not affect the population. Greatest effort and success would occur along the road system.

Advantages of this option are generally favorable public sentiment in Alaska and additional opportunity for hunting. Disadvantages are an increased probability of illegal take of other species and reduced vulnerability of coyotes to artificial light and calls. The latter would ultimately result in a decline in the public's effectiveness to take coyotes and could possibly impede future efforts by the ADF&G to control coyotes should such efforts be necessary.

3. Allow public aerial shooting by permit for coyotes in Unit 6(B) and 6(C).

The Audubon Society, Greenpeace, and the Alaska Wildlife Alliance opposed this option.

Estimated annual costs of this option are $300.

Aerial shooting was last allowed on the Delta in 1971 and reportedly limited coyote numbers. Board of Game authorization of seasonal aerial shooting would allow the ADF&G to issue permits to the public. Permits would allow shooting only in

Units 6(B) and 6(C) during the winter and spring months (January - April).

4. Authorize a bounty for coyotes killed in Units 6(B) and 6(C).

   This option was opposed by virtually all of the conservation groups and agencies participating in the review of management options. Reasons for opposition range from high potential for misuse of the bounty system to philosophical opposition.

   Annual costs would be dependant upon the bounty offered and ability of the public to catch coyotes. An estimate, based on a $200/coyote bounty, is $12,000-$17,000, for the first year and probably 50 percent less in subsequent years.

   A bounty would have to be authorized by the Alaska Legislature. Bounties would be paid for freshly killed, fully intact coyotes. A substantial bounty (e.g. $200/coyote) offered for Units 6(B) and 6(C) coyotes would encourage trappers and hunters to expend additional effort harvesting coyotes. The bounty period may coincide with pelt primeness to offer successful trappers best fur prices for their efforts.

   The advantage of this option is an immediate, moderate to substantial reduction of coyote numbers in Units 6(B) and 6(C). Disadvantages are the probable take of coyotes outside of the legal area boundaries, substantial pressure on ground trappers from airborne trappers, and negative sentiment from some segments of the public.

5. Removal by departmental trapper using all means including aerial gunning but excluding poisons.

   This option was opposed by The National Audubon Society, Greenpeace, and The Alaska Wildlife Alliance. It was supported by the Alaska Chapter of The Wildlife Society because it would allow efficient removal of animals, by experienced personnel, from only target areas. The FS indicated that a NEPA analysis and Forest Supervisor approval would be required.

   Estimated costs are $49,500-56,000 the first year and $35,000 in subsequent years.

   A professional trapper would be hired by the ADF&G to remove coyotes from the Delta. All available

means of reducing coyotes would be utilized with the exception of poisons.

Advantages of this option are: efficient removal of coyotes by a professional, properly equipped trapper; immediate and substantial reduction of coyotes on the Delta; ability to efficiently maintain low concentrations of coyotes; ADF&G control of coyote removal; and ability to target specific areas. Disadvantages are some negative public sentiment, reduced success of public hunters and trappers, and relatively high costs.

6. Use of approved poisons (coyote getters).

This option received the same opposition and comments as option M.5. In addition, the FWS cautioned that, based on the experience in the Aleutian Islands, several years may be required to obtain approval to use poisons.

Annual costs of this option are difficult to estimate but would probably be around $20,000.

M-44 coyote getters would be placed in areas of high density goose nesting. These devices would be used only during winter and spring to avoid non-target species such as brown bears.

Advantages of this option are an efficient and immediate reduction in coyote numbers, use of a tested and effective canicide, and ability to direct removal efforts at specific areas. Disadvantages are the time required to obtain federal approval for use of M-44s, potential danger to non-target species such as humans, stray dogs, or wolves, and public opposition.

VII. Options Analysis Table

The following tables summarizes the effectiveness of all the options presented above. Effectiveness or impact is estimated as negligible (N), very limited (VL), limited (L), moderate (M), and substantial (S). Short-term effects are those projected for 1 to 3 years and long-term are 4+ years. While the final approach to managing predators on the Delta will most likely be a combination of 2 or more options, the best estimate of the effect of a complete effort to meet goose production quotas is considered. When used in combination with other options, individual costs may be reduced and overall effect increased.

OPTION ANALYSIS TABLE

Considerations	A No Action	B FWS Assume Lead	C List Dusky as Threatened	D "Recovery" Program	E Revise Pop. Objective	F Further Harvest Restrictions	G Goose Transplants
Goose Production Response							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	VL	M
Coyote Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Brown Bear Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Impact on other wildlife on the Delta	N	N	N	N	N	N	N
Impact on Vegetation	N	N	N	N	N	N	N
Public Acceptance in Alaska	L-M	L	VL	VL	VL	M	S
Cost (x$1000)							
Initial	-0-	-0-	-0-	-0-	-0-	-0-	4.0
Recurrent	-0-	-0-	-0-	-0-	-0-	-0-	4.0

Effectiveness or impact of management option:

N = Negligible
VL = Very Limited
L = Limited
M = Moderate
S = Substantial

OPTION ANALYSIS TABLE
(continued)

Considerations	H Captive Rearing	I Habitat Enhancement	J1 Aversive Conditioning	J2 Baiting	K Exclusion	L1 Liberalize Bear Hunting Regulations	L2 Open Guide Area
Goose Production Response							
Short-term	L	VL	VL-L	VL	VL	VL	VL
Long-term	L	VL	L	L	VL	L	L
Coyote Reduction							
Short-term	N	N	N	N	N	N	N
Long-term	N	N	N	N	N	N	N
Brown Bear Reduction							
Short-term	N	N	N	VL	N	L	L
Long-term	N	N	N	VL	N	L	L
Impact on other wildlife on the Delta	L	L	VL	VL	VL	VL	L
Impact on Vegetation	N	M-S	N	N	VL	N	N
Public Acceptance in Alaska	L-M	S	L	L	VL	L-M	L-M
Cost (x$1000)							
Initial	25.0	*	120	20-45	150-1000	0.1	-0-
Recurrent	25.0	*	100	20-45	10	0.1	-0-

Effectiveness or impact of management option:
N = Negligible
VL = Very Limited
L = Limited
M = Moderate
S = Substantial

*High costs borne by FS and cooperators.

OPTION ANALYSIS TABLE
(continued)

Considerations	L3 Bear Transplant	L4 Bear Sterilization	L5 Bear Removal by ADF&G	M1 Coyote Hunter/ Trapper Education	M2 Liberalize Coyote Harvest Regulations
Goose Production Response					
Short-term	L	N	M	N-VL	L
Long-term	L-M	VL	L	N	VL
Coyote Reduction					
Short-term	N	N	N	VL	L
Long-term	N	N	N	N	VL
Brown Bear Reduction					
Short-term	M	VL	S	N	N
Long-term	L	VL	M	N	N
Impact on other wildlife on the Delta	L	N	L	VL	VL
Impact on Vegetation	N	N	N	N	N
Public Acceptance in Alaska	M	L	VL	M	L-M
Cost (x$1000)					
Initial	22-30	10-15	10.5-14	0.3	0.2
Recurrent	22	10-15	10.5-14	0.3	0.2

Effectiveness or impact of management option:
N = Negligible
VL = Very Limited
L = Limited
M = Moderate
S = Substantial

OPTION ANALYSIS TABLE
(continued)

Considerations	M3 Permit Aerial Shooting of Coyotes by Public	M4 Bounty for Coyotes	M5 Department Trapper	M6 Approved Poisons
Goose Production Response				
Short-term	L-M	M	M	M
Long-term	L-M	M	M-S	M-S
Coyote Reduction				
Short-term	M-S	M-S	S	S
Long-term	L	L-M	M	M
Brown Bear Reduction				
Short-term	N	N	N	N
Long-term	N	N	N	N
Impact on other wildlife on the Delta	VL	VL	VL	VL
Impact on Vegetation	N	N	N	N
Public Acceptance in Alaska	VL	VL	VL-L	VL
Cost (x$1000)				
Initial	0.3	12-17	49.5-56	20
Recurrent	0.3	6-8.5	35	20

Effectiveness or impact of management option:

N = Negligible
VL = Very Limited
L = Limited
M = Moderate
S = Substantial

VIII. Recommended Management Options

The ADF&G recommends 5 management options be implemented and defers recommendation on 3 additional options pending additional information. The 3 deferred options are Captive Rearing (H), liberalization of the brown bear season and bag limit (L.1.), and removal of coyotes by a government trapper (M.5.). Some of the recommended options are recommended with the reservation that they initially be implemented as tests and that further use be dependent upon their demonstrated feasibility and effectiveness in improving dusky Canada goose production. Implementation of recommended options will be dependent upon availability of funds and necessary approvals by the Board of Game.

The ADF&G recommends that current dusky Canada goose harvest restrictions continue until the population objective is achieved or the PFC determines that the population has increased sufficiently to allow liberalization of the harvest. Any harvest liberalization should be conservative and population response closely monitored.

The ADF&G will continue to keep the public informed on the status of the dusky Canada goose and results of management actions. This will be done through annual reports to the Board of Game, the annual report of waterfowl program survey-inventory activities, annual reports to the Pacific Flyway Technical Committee, newsletters, Copper River Delta Conference sponsored by the FS, technical publications, and newspaper and magazine articles. If there is enough public interest an annual review and public meeting would also be sponsored.

Recommended management options are:

G. Goose Transplants

Establishment of additional breeding populations of duskys would augment production on the Delta and lessen the affect on the population of poor production on the Delta.

Captive rearing (Option H), on a limited and short-term basis, to produce young for transplants may be considered if natural production of young is insufficient to provide transplant stock.

I. Habitat Enhancement

The ADF&G supports efforts by the FS and cooperators to enhance habitat on the Delta and recommends the FS continue feasibility and cost studies of additional enhancement methods. The ADF&G also proposes experimental development of small berms and levees on

the tide flats seaward of the pre-earth tide line (cut-bank) in association with brush removal along the adjacent coastal cut-bank. This would provide elevated nest sites protected from tidal flooding in habitat similar to that on the Delta prior to the earthquake. Removal of brush from the adjacent cut-bank would reduce cover for mammalian predators near the development and presumably lower the incidence of nest loss from predators.

J. Nest Avoidance by Predators

The ADF&G recommends this option on a limited test basis. A test of the effectiveness of taste aversion to deter predation on goose nests would be preliminary to limited application of the technique in areas of habitat enhancement. Testing could be done as a graduate student project. Potential use of taste aversion, should it prove to be effective, is on nesting islands and the new marsh development recommended in Option I. Application of the technique is too expensive for use delta-wide.

L.3. Transplant bears from the Delta to other locations

This option is recommended as a test to verify that a reduction in brown bear numbers will immediately improve goose production. Fifteen to 20 bears would be relocated from the coastal west Copper River Delta to suitable locations in GMU 6(A) in May 1987.

Goose production and other factors that influence production will be monitored. If production improves, the ADF&G will recommend liberalization of brown bear bag limit and season length in GMU 6(B) and 6(C) (Management Option L.1.) in 1988.

M.2. Liberalize hunting and trapping regulations for coyotes in Unit 6(C) and 6(B).

While this option will likely do little to reduce the coyote population as long as fur prices remain low, the ADF&G recommends it be implemented on a trial bases. The ADF&G will monitor the coyote harvest and coyote population trends. If coyote numbers are not effectively reduced, additional management actions, such as coyote removal by a departmental trapper (M.5.), may be recommended.

IV. Management Options Not Recommended.

The ADF&G does not recommend the following management Options.

A. No Further Action in Alaska by ADF&G.

This option does nothing to reverse the dusky Canada goose population decline and build the population back to the objective of at least 20,000 geese.

B. Transfer Management Lead for the Dusky Canada Goose in Alaska to the FWS

This option does nothing to reverse the dusky Canada Goose population decline and build the population back to the objective of at least 20,000 geese.

C. List the Dusky as a Threatened Species

The purpose of this document and resulting actions is to correct the problem before listing as a threatened species is necessary. This option does nothing to reverse the dusky population decline and build the population back to at least 20,000 geese.

D. Organize a "Recovery Team" and Develop a "Recovery Plan"

In concept, this option is already in place in the form of the Dusky/Taverner's Canada Goose Subcommittee of the Pacific Flyway Council and an adopted management plan for the dusky. Organizing additional teams and plans would primarily be a duplication of effort. Public review and involvement in management of the dusky that would be provided by this option has been provided in the recommended options (Section VIII).

E. Revise Population Objective and/or Reclassify Subspecies

Revision of the population objective would do nothing to reverse the declining population. However, such a revision is a possible future task pending response of the population to management techniques and a review of dusky goose management by the Pacific Flyway Council/ Technical Committee. Current band recovery and winter distribution information supports division of the Vancouver and dusky Canada goose subspecies. Until a thorough serological/morphometric study is done, reclassification is not warranted.

F. Harvest Restrictions

Complete closure of hunting seasons for the dusky goose would essentially mean no or greatly reduced seasons for Canada geese wherever the dusky occurred, and would do little or nothing to stop the population decline and build the population back to at least 20,000 geese.

Current mortality from hunting is only 3.5 percent annually and is assumed to be compensatory to natural mortality at the present population level. This option would result in a perceived benefit to the dusky by some sectors of the public at a significant increase in the expenditure of public funds on the wintering grounds.

H. Captive Rearing of Geese

Captive rearing of geese on a large scale is not an effective method of augmenting the dusky population. Survival rates for captive reared geese that are released into the wild are typically very low. Captive rearing on a limited basis and scale to produce young for transplants may be a viable option.

J.2. Baiting Predators to Other Areas

This option is expensive and its effectiveness unproven. The availability of sufficient quantities of attractive, inexpensive bait is questionable. Some predators may develop a dependency on artificial food sources, creating predator/human conflicts.

K. Exclusion

This option is expensive and unproven. The reaction of brown bears to fences, electric or otherwise, is not known. Fences would disrupt the use of the Delta by wildlife, including flightless geese and family groups, and impact visual aesthetics.

L.2. Convert Unit 6(C) to an Open Guiding Area for Brown Bear Hunting

While brown bear harvest might increase initially, the long-term effectiveness of this option would likely be minimal and would not justify opposition by guides and local nonguided hunters.

L.4. Brown Bear Sterilization

This option is unproven, would require restriction or elimination of brown bear hunting to protect non-productive females, would provide only a delayed and limited reduction in nest predation, has a high potential for loss of bears during capture or surgery, and would likely meet considerable public opposition.

L.5. Removal of Bears by Staff

While this option would give the ADF&G precise control over how and where bears were removed from the Delta,

it would meet major public opposition. Bear numbers can probably be reduced by less controversial means.

M.1. Hunter/Trapper Education

This method of reducing canid populations has not achieved population reduction goals in other parts of Alaska. Low fur prices and the poor quality of coastal coyote furs would further reduce the effectiveness of hunter/trapper education as a management tool. This option would take an inordinate amount of staff time to produce few results.

M.3. Allow Public Aerial Shooting by Permit for Coyotes in Unit 6(B) and 6(C).

This option would probably not adequately reduce the coyote population for the same reason identified in options M.1. and M.2.--low fur prices and poor fur quality. It would increase the probability of coyotes being taken outside of the legal area boundaries, and would be met with considerable public opposition.

M.4. Authorize a Bounty for Coyotes Killed in Units 6(B) and 6(C).

This option would be difficult to apply because of high probability of coyotes being taken in areas other than Units 6(B) and 6(C). It would also receive substantial negative public sentiment.

M.6. Use of Approved Poisons

While this option would result in efficient and immediate reduction in coyote numbers, implementation could take several years, there would be a potential danger to non-target species, and considerable negative public sentiment would be generated.

Selected Bibliography

Bromley, R. G. H. 1976. Nesting and habitat studies of the dusky Canada goose (Branta canadensis occidentalis) on the Copper River Delta, Alaska. M.S. Thesis. Univ. Alaska, Fairbanks. 81pp.

_____ 1985. The energetics of migration and reproduction of dusky Canada geese (Branta canadensis occidentalis). PhD. Dissert. Oregon State Univ. 116pp.

Campbell, B. H. 1982. Dusky Canada goose status Report (abstract only). Alaska Migratory Bird Conference, Anchorage. p. 18.

_____ 1984. Status of the dusky Canada goose on the Copper River Delta. Proceedings of the Tenth Copper River Delta Conference. U.S. Forest Service. Cordova, Alaska. pp. 33-37.

_____ 1984. Annual report of survey-inventory activities, Part V. Waterfowl. Vol. XIV. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest Prog. Rep. Proj. W-22-2, Job 11.0. Juneau. 29pp.

_____ 1985. Annual report of survey-inventory activities, Part XIII. Waterfowl. Vol. XV. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-22-3, Job 11.0. Juneau. 31pp.

_____ 1985. Brown bear activity and impacts on nesting geese on the west Copper River Delta--1984 progress report. Alaska Dept. Fish and Game. Anchorage. 39pp.

_____ 1985. Brown bear activity and impacts on nesting geese on the west Copper River Delta--1985 progress report. Alaska Dept. Fish and Game. Anchorage. 49pp.

_____ 1986. Annual report of survey-inventory activities, Part XIV. Waterfowl. VOl. XVI. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-22-4, Job 11.0. Juneau 36pp.

_____ and D. E. Timm. 1983. Annual report of survey-inventory activities. Part V. Waterfowl. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-22-1, Job 11.0 Juneau. 45pp.

Cline, D. and C. Lenhart. 1985. The dusky Canada goose. In Eno, A. S. and R. L. DiSilvestro, eds. Audubon Wildlife Report 1985. National Audubon Society, New York, N.Y. 433-436pp.

Cornely, J. E. and R. L. Jarvis. 1984. Status of Canada geese wintering in western Oregon and southwestern Washington. Rep. to Dusky Canada Goose Subcommittee, Pac. Flyway Waterfowl Tech. Committee. 7pp.

_____ and _____ 1985. Status of Canada geese wintering in western Oregon and southwestern Washington. Rep. to Dusky Canada Goose Subcommittee, Pac. Flyway Waterfowl Tech. Committee. 7pp.

_____ and _____ 1986. Status of Canada geese wintering in western Oregon and southwestern Washington. Rep to Dusky Canada Goose Subcommittee, Pac. Flyway Waterfowl Tech. Committee. 6pp.

_____, B. H. Campbell, and R. L. Jarvis. 1985. Productivity, mortality, and population status of dusky Canada geese. Trans. N. Amer. Wildl. and Natu. Resour. Conf. 50. 540-548pp.

Chapman, J. A. 1967. Population characteristics, hunter kill, and productivity of dusky Canada geese. M.S. Thesis, Oregon St. Univ., Corvallis, 82pp.

_____ 1970. Weights and measurements of dusky Canada geese wintering in Oregon. Murrelet,51:34-37.

_____, C. J. Henny, and H. M. Wight. 1969. The status, population dynamics and harvest of the dusky Canada goose. Wildl. Monogr. 18. 48p.

Chattin, J. E. 1964. Pacific Flyway. in Linduska, J. P., ed. Waterfowl Tomorrow. U.S. Fish and Wildlife Service. pp. 233-252.

Clark, S. L. and R. L. Jarvis. 1978. Effects of winter grazing by geese on yield of ryegrass seed. Wildl. Soc. Bull. 6:84-87.

Crow, J. H. 1968. Plant ecology of the Copper River Delta, Alaska. Ph.D. Dissert. Washington State Univ. Pullman. 120pp.

_____. 1972. Earthquake-initiated changes in the nesting habitat of dusky Canada goose. In the great Alaska earthquake of 1964: biology. Natl. Acad. Sci. Publ. 1609. 7p.

Dawson, W. L. 1897. Nesting of the larger White-checked goose (Branta Canadensis occidentalis) in Okanogan Co., Wash. Auk, 14:87-88.

Delacour, J. 1951. Preliminary note on the taxonomy of Canada Geese, Branta canadensis. Amer. Mus. Novit., 1537:1-10.

Dixon, J. 1908. Field notes form Alaska. Condor, 10(4): 139-143.

Dusky Canada Goose Subcommittee. 1985. Management Plan-Dusky Canada goose. Pacific Waterfowl Flyway Council. 23pp.

Gabirelson, I. N. and S. G. Jewett. 1940. Birds of Oregon. Oregon State Coll., Corvallis. 650p.

Gladson, J. 1975. Dusky Canada Geese. Oregon Wildlife:10-11. (Jan)

Grinnell, J. 1910. Birds of the 1908 Alexander Alaska expedition. Univ. California Publ. Zool., 5:361-428.

Hansen, H. A. 1961. Loss of waterfowl production to tide floods. J. Wildl. Manage. 25:242-248.

_____. 1962. Canada geese of coastal Alaska. Trans. N. Amer. Wildl. Conf. 27:301-329.

_____. 1968. Pacific Flyway Canada goose management--federal and state cooperation. In Hine, R. L. and C. Schoenfield, eds. Canada goose management; Current continental problems and programs. Dembar Ed. Research Services, Madison Ws. pp.43-49.

Hatler, D. F. 1973. An analysis of use by waterfowl, of the tide flats in southern Clayoquote Sound, British Columbia. Canadian Wildl. Ser. Rep. 134pp.

Havel, L. H. 1984. Formation of feeding flocks during winter by dusky and Taverner's Canada geese in Oregon. M.S. Thesis. Oregon State Univ. Corvallis. 81pp.

Hawkings, J. S. 1982. Migration and habitat relationships of geese on the eastern Copper River Delta, Alaska. M.S. Thesis. Univ. Alaska, Fairbanks. 113pp.

Henny, C. J. 1967. Population characteristics of the dusky Canada goose as determined from banding data. M.S. Thesis. Oregon State Univ., Corvallis. 98p.

Jarvis, R. L. and R. S. Rodgers. 1976. The dusky Canada goose - a new Minority? Rep. to Dusky Canada Goose Subcommittee, Pac. Flyway Tech. Committee. 18pp.

_____ and R. S. Rodgers. 1977. The dusky Canada goose - a new minority! Rep. to Dusky Canada Goose Subcommittee, Pac. Flyway Tech. Committee. 14pp.

_____. 1978. The dusky Canada goose: an entrenched minority! Rep. to Dusky Canada Goose Subcommittee, Pac. Flyway Tech. Committee. 14pp.

_____. 1980. Status of dusky and Taverner's Canada geese in the Willamette Valley. Rep. to dusky Canada goose Subcommittee, Pac. Flyway Tech. Committee. 9pp.

_____. and P. Sekora. 1981. Status of Canada geese Wintering in Oregon - Southwestern Washington. Rep. to Dusky Canada Goose Subcommittee. Pac. Flyway Tech. Committee. 8pp.

_____. 1982. Status of Canada geese Wintering in Western Oregon - Southwestern Washington. Rep. to Dusky Canada Goose Subcommittee of the Pac. Flyway Tech. Committee. 9pp.

_____, and J. Cornely. 1983. Status of Canada geese wintering in western Oregon-Southwestern Washington: Report to the Dusky Canada Goose subcommittee of the Pacific Flyway Technical Committee. 7pp.

Jewett, S. C. 1932. The white-checked geese in Oregon. Condor 34:136.

Johnson, D. H., D. E. Timm and P. F. Springer. 1979. Morphological characteristics of Canada geese in the Pacific Flyway. In R. L. Jarvis and J. C. Bartonek, (Eds.). Management and biology of Pacific Flyway geese. OSU Book Store, Corvallis. pp56-87.

Klein, D. R., R. W. Ingebo, F. C. Robards, H. King and J. Walker. 1955. Copper River Delta Banding and Production studies. U.S. Fish and Wildlife Service. Fed. Aid Wildl. Rest. Quarterly Prog. Rep. Proj. W-3-4-10, Work Plan C. Juneau. pp30-33.

Leach, B. 1982. Waterfowl on a Pacific estuary. British Columbia Provincial Mus., Spec. Publ., 5:1-211.

McKnight, D. E. 1971. Report of survey and Inventory Activities. Part III - Waterfowl and small game. Vol. II. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-3, Jobs 10 and 11. Juneau. 52pp.

Mickelson, P. G. and H. M. Wight. 1974. The dusky Canada goose. Naturalist 25:24-27.

Olson, S. T. 1953. Copper River Delta banding operations. U.S. Fish and Wildlife Service. Fed. Aid Wildl. Rest. Quarterly Prog. Rep. Proj. W-3-R-8, Work Plan C. Juneau. pp34-40.

_____. 1954. Migratory waterfowl studies: Copper River Delta, banding and production studies. U.S. Fish and Wildlife Service Fed. Aid Wildl. Rest. Quarterly REp. Proj. W-3-R-9, work plan C. Appendix B. Juneau. 9pp.

_____. 1966. Waterfowl Report. Vol. VII. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-6-R-6, work Plan H and W-13-R-1, Work Plan C. Juneau. 28pp.

_____, B. L. Hilliker, and R. J. Somerville. 1967. Waterfowl Report. Vol. VIII. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-13-R-1 and 2, Work Plan C. Juneau. 27pp.

_____, B. L. Hilliker and J. H. Crow. 1968. Waterfowl Report. Vol. IX. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-13-R-2 and 3, Work Plan C. Juneau. 39pp.

Simpson, G. S. 1979. Comparative ecology of several subspecies of Canada geese during winter in Western Oregon. M.S. Thesis. Oregon State Univ., Corvallis. ___pp.

_____ and R. L. Jarvis. 1979. Comparative ecology of several subspecies of Canada geese during winter in Oregon. In R. L. Jarvis and J. C. Bartonek (Eds.). Management and biology of Pacific Flyway geese. OSU Book Stores. Corvallis. pp.223-241.

Swarth, H. S. 1913. A study of a collection of geese of the Branta canadensis group from the San Joaquine Valley, California. Univ. Calif. Publ. Zool, 12:1-24.

Taverner, P. A. 1931. A study of Branta canadensis (Linnaeus). The Canada Goose. pages 28-40, Ann. Rept. Nat. Mus. Canada, 1929.

Timm, D. E. 1972. Report of survey-inventory activities, waterfowl hunter mail questionnaire survey. Vol. III. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Proj. W-17-4, Job 10.0. Juneau. 17pp.

_____ and P. Havens. 1973. Report of Survey and inventory activities - Waterfowl. Vol. IV. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-5, Jobs 10 and 22. Juneau. 64pp.

_____. 1974. Report of survey-inventory activities, waterfowl. Vol. V. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-6, Jobs 11 and 22. Juneau. 54pp.

_____. 1975. Report of survey-inventory activities, waterfowl. Vol. VI. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-7, Jobs 11.0, 11.1, 11.2, 11.3 and 22. Juneau. 53pp.

_____ and R. G. Bromley. 1976. Driving Canada geese by helicopter. Wildl. Soc. Bul 4:180-181.

_____. 1976. Report of survey and inventory activities - waterfowl. Vol. VII. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-8, Jobs 11.0, 11.1, 11.2 and 11.3. Juneau. 61pp.

_____. 1977. Report of survey-inventory activities. Vol. VIII. Waterfowl. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-17-9, Job 11,0-11.3 and 22.0. Juneau. 37pp.

_____. 1978. Annual report of survey-inventory activities. Vol. IX. Waterfowl. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-17-10, Job 10.0. Juneau. 27pp.

_____ and D. Sellers. 1979. Annual Report of Survey and inventory activities - Waterfowl. Vol. X. Alaska Dept. Fish and Game. Fed. Aid Wildl. Rest. Prog. Rep. Proj. W-17-11, Job 10. Juneau. 29pp.

_____. 1980. Annual report of survey-inventory activities. Vol. XO. Waterfowl. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Rep. Proj. W-19-1, Job 10.0. Juneau. 35pp.

_____. 1982. Annual report for survey-inventory activities. Vol. XII. Waterfowl. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Prog. Rep. Proj. W-19-2, Job 11.0. Juneau. 48pp.

_____, R. G. Bromley, D. McKnight, and R. S. Rodgers. 1979. Management and biology of Pacific Flyway geese. OSU Book Stored, Inc. Corvallis. pp 322-330.

Trainer, C. E. 1959. The 1959 western Canada goose (Branta canadensis occidentalis) study on the Copper River Delta, Alaska. In Ann. waterfowl rep., Alaska. U.S Fish Wildl. Serv., Juneau. 9pp.

_____. 1967. Appraisal of Canada goose nesting densities on the Copper River Delta, Alaska. Unpubl. Manuscript. 9pp.

Weeden, R., P. LeRoux and B. Hilliker. 1969. Waterfowl Report. Vol. X. Alaska Dept. fish and Game. Fed Aid in Wildl. Rest. Prog. Rep. Proj. W-13-R-3 and W-17-1, Work Plan C. Juneau. 19pp.

Yocom, C. F. 1963. July bird life in the Copper River Delta country, Alaska - 1962. The Murrelet 44:28-34.

Yparraguirre, D. R. 1982. Annual survival and wintering distribution of Aleutian Canada geese, 1976-1981. M. S. Thesis. Humboldt State University, Eureka, CA. 73pp.

APPENDIX 1

Letter of Support

from

Oregon Department of Fish and Wildlife

VICTOR ATIYEH
GOVERNOR

Department of Fish and Wildlife
OFFICE OF THE DIRECTOR
506 SW MILL STREET, P.O. BOX 59, PORTLAND, OREGON 97207

August 28, 1986

Don W. Collinsworth, Commissioner
Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99502

Dear Don:

This letter will relay some concerns from the Oregon perspective regarding current problems with low production of dusky Canada geese on the Copper River Delta.

As you undoubtedly know, Oregon's wintering Canada goose situation has changed drastically over the last 15 years or so. Prior to that time, most of the geese wintering in the Willamette Valley were duskys. Beginning about 15 years ago, taverner Canada geese began wintering in the Willamette Valley and lower Columbia River in steadily increasing numbers. What we have now are record wintering numbers of geese consisting of taverners, duskys, lessers, Moffiti, cacklers and a few Vancouvers.

With the increases in total wintering numbers have come substantial increases in agricultural damage. At the same time, beginning in the early '80's we have been increasingly restricting hunting opportunity because of concern over declining numbers of dusky geese. Farmers view this combination of increasing goose numbers and progressive restriction of goose hunting with alarm.

The subject of agricultural damage has entered the political arena with introduction of a bill into the last session of the Legislature that would have required our Department to pay damage claims. The bill did not pass, but it did result in the appointment of a Game Damage Task Force charged with examining agency policies concerning handling of wildlife damage. I will be surprised if game damage is not again a hot issue in the legislative session which begins in January. We are doing everything we can to reduce agricultural conflicts by hunting where possible and by planting additional crops on appropriate state and federal areas to give the geese a place to feed when winter and spring hazing begins on private lands. We, and the Fish and Wildlife Service have been threatened with lawsuits with increasing frequency by landowners wishing to be paid for crop damages caused by geese.

We began restricting hunting in response to declining numbers of dusky geese in 1983 with a reduction in season length. In 1984 the season length was restricted further and the bag limit reduced from two to one per day. In 1985 the season was closed for Canada goose hunting throughout northwestern Oregon except for a tightly controlled experimental season on Sauvie Island intended to redirect hunting pressure to taverner geese through an education program, permit and check stations requirements, and a quota on dusky geese to insure harvest did not exceed 160 duskys in Oregon. I've included a report on the success of that effort.

We are continuing a very restrictive hunting program this year under even tighter controls to continue educating hunters in the identification of goose racial differences and to try to alleviate some of the agricultural damage problems. This has been an extremely expensive and manpower-intensive undertaking, but appears to be about the only approach we can take until dusky numbers increase. We expect we will always be hunting under a season structure designed to achieve a differential harvest to prevent overharvest of duskys, even when their numbers do again reach management objectives. But for now, management of goose hunting is a very tricky business.

That brings me to the reason for writing. We are very concerned about the very poor dusky goose production on the Copper River Delta in recent years as we're sure you are, too. From what we understand, lack of suitable nesting sites is not the problem at current goose population levels; rather that predation on eggs, nesting adults and broods is currently the limiting factor. Last year we contributed $100,000 of state duck stamp funds toward a Ducks Unlimited project to establish island nesting habitat for geese on the Delta, removed, as much as possible, from the brushy travel corridors commonly used by brown bears and coyotes. We will have to wait to see how effective this effort will be since the predators may simply learn to home in on these structures, thus negating our efforts.

It would appear that the single most effective step we could take, in combination with continuing restrictions on hunting, would be to reduce the level of predation on the nesting grounds. We know you are considering the possibility of predator control on the Delta and would like to encourage this effort as vigorously as possible. Every other step that we can think of to resolve the problem is already underway.

We had a parallel situation on a waterfowl management area in eastern Oregon several years ago. Three years of nest success documentation revealed extremely low waterfowl production levels, with major losses attributed to predation by gulls and ravens.

We undertook to correct this through a combination of changes in grazing practices, management efforts and predator control. Using dummy nests with treated eggs, we reduced populations of egg predators (although we have not eliminated them by any means, nor do we want to) and we have seen an immediate response in improved nesting success beginning with the first year of treatment and continuing to this day. Gulls and ravens are still evident on the area, but nest success has risen steadily from the 20-40 percent range prior to treatment. In 1983, the first year of treatment, nest success increased 68 percent. In 1984 another 24 percent improvement was seen. Brood counts since then have indicated continued improved nest success to present.

We realize that the issue of predator control is a potentially hot one, but what we advocate is a shift in balance between predators and dusky geese on their only known nesting area, not a total elimination of predators.

Anything you folks can do to help us with the problem on this end will be greatly appreciated. If we can provide additional information that will be helpful to you, please don't hesitate to call on us.

Best regards,

John R. Donaldson, PhD
Director

kdp

APPENDIX 2

1985-86 Oregon-Washington

"Non-dusky" Canada Goose Season,

Special Report

1985-86 OREGON-WASHINGTON "NON-DUSKY" CANADA GOOSE SEASON
Special Report
Ken Durbin - Staff Biologist

Steadily declining populations of dusky Canada geese prompted flyway managers to begin restricting goose hunting on wintering areas in 1981. Harvest restrictions were increasingly tightened until the 1985 season when record low dusky production on the Cooper River Delta, Alaska, prompted closure of the Canada goose season in northwestern Oregon, and Clark, Cowlitz and Wahkiakum counties of southwestern Washington.

In July of 1985 Pacific Flyway managers wrestled with ways to allow hunting for abundant taverner geese while providing needed protection for dusky and cackling Canada geese.

An "experimental" hunting scheme was developed which called for departures from the past in order to test hunter ability to learn identification of Canada goose racial differences and apply this knowledge in the field. The special season was approved by the Pacific Flyway Council and later allowed by the federal regulatory framework for 1985-86 waterfowl seasons. Details of the Oregon season follow:

OREGON SEASON

Rationale:

Although dusky Canada geese have declined precipitously in recent years, total numbers of Canada geese have continued to increase in northwestern Oregon and southwestern Washington due largely to increases of taverner geese. This increase has resulted in severe damages to agricultural crops and ways were needed to reduce this problem. When dusky geese again reach levels where limited dusky goose hunting can be allowed, a strategy must in place whereby differential harvest of Canada geese can be achieved.

In 1984 a season was conducted in which hunters on five management areas in Oregon and Washington could take two or three geese, depending on area, provided not more than one was a dusky. Harvest of dusky geese remained unacceptably high. Because hunters were always allowed one dusky goose in the bag, this was not a good test of hunter ability to select for taverner geese. Many hunters simply took one dusky goose as regulations allowed.

The 1985-86 season was different in that purposeful taking of dusky geese would result in the early closure of goose hunting and, hunters were told, could also jeopardize future goose hunting through total restriction of harvest of Canada geese.

The season was also intended to provide a harassment factor to help prevent damage on private lands.

Objective:

To evaluate the ability of hunters to learn to identify subspecies of Canada geese and select for unrestricted species.

Goals:

1. To measure the objective in four hunt areas which provide varying Canada geese populations (duskys v. taverner v. habitat types). The areas were as follows.

   a. Ridgefield National Wildlife Refuge
   b. Adjacent Washington private lands
   c. Sauvie Island Wildlife Area
   d. Sauvie Island private lands

2. To measure ability of various hunter types to identify taverner/other geese.

3. To measure the willingness of hunters to select for goose subspecies and comply with regulations designed to achieve a differential goose harvest.

4. To provide incentives for hunters to selectively harvest geese.

5. To identify methods of selectively harvesting geese for application in future goose seasons.

Procedures:

1. All of northwest Oregon and part of southwest Washington was closed to Canada goose hunting except for four designated areas.

2. These areas were open to hunting with a bag limit of three Canada geese per day.

3. Hunters were instructed to avoid shooting dusky Canada geese, even though they were legally allowed to do so.

4. Hunting of Canada geese on hunt areas was contingent on attendance at an identification training session. Only hunters who attended the orientation session were issued a permit to harvest geese. Both permits and I.D. sessions were free.

5. Harvest was directed at taverner and other subspecies of geese.

6. Quotas for dusky geese harvest were set for each of the four areas as follows. Numbers were based roughly on proportion of harvest in each area the year previous.

   a. Ridgefield NWR - 20
   b. Adjacent Washington Private Lands - 20
   c. Sauvie Island Wildlife Area - 100
   d. Sauvie Island Private Lands - 60

   Dusky harvest was not intended to exceed 200. When the quota was reached for any of the four areas, that area closed for Canada goose hunting independent of the others.

7. Hunters were required to check in and out daily at designated check stations.* Records of harvest by subspecies were kept for each area.

8. Intensive field observations by state and federal enforcement personnel were made on hunting areas to insure compliance.

9. Hunters were informed that the season would close immediately if dusky goose quotas were met and that the success of the effort would determine whether future Canada goose hunting could be allowed in dusky goose wintering areas. They were told that if they demonstrated an ability and willingness to select the right geese, managers had an option to consider for future years, but that if they didn't, managers would have no choice but to regulate on the basis of the most depressed population.

In Oregon, a season was adopted as follows:

Sauvie Island Special Permit Goose Season

Open Area: Sauvie Island Wildlife Area (excluding North Unit and Columbia River Beaches), and private lands of Sauvie Island.

Open Season: October 12, 1985 through January 12, 1986

Shooting Time: Goose hunting prohibited before 9 a.m. and after 4 p.m.

Shooting days:

Sauvie Island Wildlife Area —
October 12, 14, 16, 18, 20, 22, 24, 26, 28, 30
November 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29
December 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 26, 28, 30
January 1, 3, 5, 7, 9, 11, 12

Private Lands — Saturdays, Sundays and Wednesdays

Daily Bag Limit: 3 geese of which only one may be a dusky goose until dusky goose quota for individual area is reached.

Possession Limit: 6 geese of which only two may be dusky geese until dusky goose quota for individual area is reached.

(a) A maximum harvest of 100 dusky Canada geese will be permitted on Oregon Department of Fish and Wildlife controlled lands on Sauvie Island at which time the season will close.

(b) A maximum harvest of 60 dusky Canada geese will be permitted on privately owned lands on Sauvie Island at which time the season will close.

Dusky Canada Goose: Any dark breasted Canada goose with a bill length between 40 and 50 millimeters.

SPECIAL REGULATIONS

Hunting Certification: Only persons attending and satisfactorily completing an identification class provided by the Oregon Department of Fish and Wildlife and/or U.S. Fish and Wildlife Service may be certified to hunt Canada geese. Classes will be announced and publicized to provide potential hunters an opportunity for attendance.

A certification card authorizing participation in the Sauvie Island Special Goose Season must be in possession while hunting geese.

Check-in and Check-out: All hunters must check in and check out at Department check stations as follows:

Sauvie Island Wildlife Area: Hunters must check in and out at Eastside or Westside check stations. Oak Island hunters who take geese must check out at the Eastside check station. Hunters must check out by 6 p.m. daily.

Private Lands: All hunters must check in and out at Sauvie Island Bridge. Hunters must check out by 6 p.m. daily.

Goose Tagging: All Canada geese must be inspected and tagged by Oregon Department of Fish and Wildlife personnel at designated check stations.

* See appendix B for exception in Washington.

In Washington, the season was structured somewhat differently (see appendix B) but objectives and general provisions were as in Oregon.

Goose season orientation/identification seminars were scheduled in both Oregon and Washington. Altogether, five sessions were conducted in Oregon and five more in Washington. All classes were open to hunters from both states. Class format and instruction was the same in both states, and permits issued on completion of the class were reciprocal. Oregon permits were honored in Washington and vice verse. About 2,000 goose hunters were certified in the ten sessions.

Shown below are examples of the permits issued in Oregon, and a goose bill measurement card issued to hunters at check stations to help them with subspecies identification of birds in the hand.

OREGON Fish & Wildlife

Oregon Dept. of Fish & Wildlife

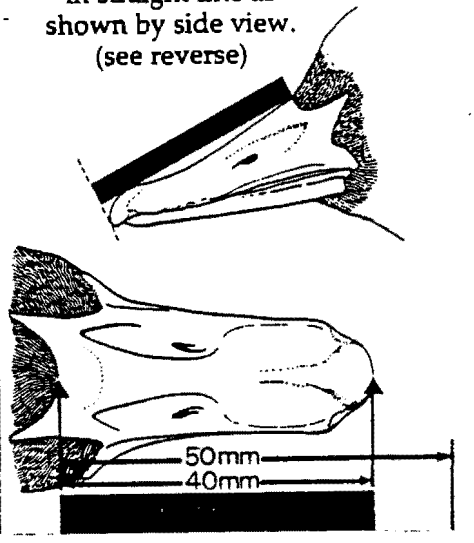
has completed a class in Canada goose identification and is hereby authorized to participate in the Sauvie Island Special Permit Goose Season.

001607 John R. Lowell

Director

Dusky Goose Bill Gauge

Take bill measurement in straight line as shown by side view. (see reverse)



Results:

A detailed analysis of the Sauvie Island hunt can be found in appendix A.

Sauvie Island Private Lands

In general, private land hunters on Sauvie Island were successful in meeting objectives. In all, 482 hunters participated in the private-land hunt, taking 1,388 geese. A total of 54 geese classified as duskys under the legal definition were taken, for a four percent dusky harvest rate. Since the quota of 60 dusky geese was not met, the season went to its scheduled conclusion.

Several factors probably contributed to the success of the program on private lands. Most clubs on Sauvie Island have been in existence for a long time and many members have hunted there for years. Club members tend to be experienced and conscientious hunters. Most clubs are also members of the Oregon Landowners and Waterfowlers Association. The Association was very supportive of the special season and its president worked hard to attain the backing of member clubs and nonmember clubs as well. As a group, these clubs were determined to make the season work. Some clubs imposed penalities of their own against hunters who took dusky geese, including fines and loss of goose hunting priviledges.

Additionally, the habitat on most of the private clubs favors use by taverner geese and hunters on these lands generally had more opportunity to bag taverners and a smaller likelihood of shooting duskys than those using the public shooting area.

Sauvie Island Management Area

Results were somewhat less favorable on the public management area, but still exceeded the expectations of many critics. Hunters were generally very cooperative and tried to avoid shooting duskys. No records were kept of goose hunter numbers as opposed to those just hunting ducks. The 100 - dusky quota for the public area was met and the season closed on December 9. At that time 440 geese had been taken of which 103 met the legal dusky definition, for a 23 percent dusky harvest rate.

Several factors contributed to a higher dusky take on the public area. Habitat on the area favors heavier use by duskys than by taverners. The public area has a higher proportion of casual hunters lacking experience and identification skills. And there was probably less peer pressure than occurred in the private club situation. With no dusky season limit per individual, eight hunters with poor attitudes accounted for 25 of the 100-bird public area quota.

Washington:

Results of the season in Washington are discussed in a report by Area Wildlife Biologist Patrick Miller (see appendix B).

Harvest:

In total, Oregon and Washington Special Season goose harvest totaled 2,067 of which 204 were dusky geese. This means 10 percent of the geese taken were duskys, a substantial reduction from previous years when dusky harvest has run closer to 50 percent of total geese in the special hunt areas. Given some instruction and incentive, hunters effectively demonstrated they could reduce harvest on dusky geese.

The table below shows breakdown of harvest by area:

Oregon	Total Geese	Dusky Geese	Dusky Harvest Rate
Public	440	103	23%
Private	1,388	54	4%
	1,828	157	9%
Washington			
Ridgefield	122	26	21%
Private	115	21	18%
	237	47	20%
Total Geese	2,067	204	10%

Appendix A

Sauvie Island Special Goose Season

Prepared by
Raymond L. Johnson
Manager, Sauvie Island Wildlife Area
Oregon Department of Fish and Wildlife

Private Land

Hunters

Four hundred eighty-two (482) individual goose hunters participated during the 41 day Canada goose season. Total hunter days were 3,701 for an average of 7.7 days per hunter.

Only one hunter harvested more than one dusky and he took 2 duskys during the early part of the season, Nov. 3 and 7; he reported no duskys the remainder of the season.

Most hunters were kept in check by fellow hunters, who considered it a sin to kill a dusky. The highest number of hunters on a single day occurred 11-30-85 when 153 goose hunters checked in.

Hunting Clubs

A total of 51 individual hunting areas were obtained from the checkout sheets.

24 hunting areas harvested 0 duskys
15 hunting areas harvested 1 dusky
8 hunting areas harvested 2 duskys
3 hunting areas harvested 3 duskys
2 hunting areas harvested 4 duskys
1 hunting area harvested 6 duskys

Of the 24 hunting areas that harvested no duskys, only five clubs had three or more hunters which hunted almost everyday, the remaining 19 clubs had one or two hunters that only hunted occasionally.

The one club that harvested six duskys had a high number of one time guest hunters. The harvest could indicate the guest hunters wanted a goose to take home regardless of species.

Harvest

Fifty-four duskys with bill length between 40 and 50mm (includes one dusky found crippled and turned in at check station), seven sub-duskys (bill lengths less then 40mm), 930 taverner's, 237 lessers, 82 great basin, 3 cacklers, 68 snow geese, 5 white-fronts and 2 Vancouvers were taken during 41 hunt days.

Fifteen duskys were harvested on that portion of the Island south of Reeder Road.

The highest number of duskys were taken on 11-30-85, when 8 birds were recorded at the check station. The average dusky take per hunt day was 1.3 and the total goose take per day average was 33.9.

The highest number of geese taken on any one hunt day was 99 birds, which occurred on 11-16-85.

Law Enforcement

Many hours of field observation by law enforcement personnel was conducted during the season. No violations or citations were issued in conjunction with the special goose season on Sauvie Island except for the killing of cackler Canada geese.

One day-long road block was also held, stopping and searching all vehicles, no wildlife violations were encountered.

Public Land

Hunters

No total numbers of goose hunters were kept on the public shooting grounds, except during the 18 day duck season closure, when 267 goose hunters were recorded at two check stations.

Most hunters using the public hunting area wanted the special goose season to work but, a handful (8 hunters) appeared to have no regard for shooting dusky geese. These eight hunters killed about 25 of the duskys taken on the public hunting area. If this same type of season is available next year, maybe hunters could be limited to no more then two geese before their certificate is taken away.

Two hunters were so distraught about killing a dusky, they tore up their certification card and did not hunt geese the remainder of the season.

Harvest

The dusky quota on public land was reached on Dec. 9, 1985 after 30 days of goose hunting. One hundred three (103) duskys were taken by public hunters; 13 great basin, 226 taverner's, 25 lesser, 5 cacklers and 68 snow geese were also harvested, bringing the total to 440 geese.

Fifty-four (54) duskys were harvested during the duck season closure.

Increased goose harvest started to occur in mid-November.

Law Enforcement

No citations were issued for violation of Special Goose Season regulations. Hunters did report geese shot before 9 a.m. on three occasions but, no citations were issued.

Four citations were issued for killing cackling Canada Geese.

Table 4

1985 -1986

SAUVIE ISLAND GOOSE SEASON HARVEST

	Dusky	Tav	Lesser	Grt. Basin	Cacklers	Snows	WF	Vanc.
Private								
Ad M	22 (1)	196	96	26	2	9	1	2
Ad F	18 (2)	252	45	13	-	14	-	-
Im M	6 (1)	200	64	15	-	12	1	-
Im F	7 (3)	259	30	11	1	20	2	-
No sex/juv	1	23	2	17	-	13	1	-
	54 (7)	930	237	82	3	68	5	2
Public								
Ad M	39	48	6	5	2	-	-	-
Ad F	32 (4)	72	3	-	2	-	-	-
Im M	18	43	6	2	1	-	-	-
Im F	13 (1)	56	5	5	-	-	-	-
No sex/Ad	1	7	0	1	-	-	-	-
	103 (5)	226	20	13	5	68	-	-
Combined Public and Private Harvest								
Ad M	62 (1)	244	102	31	3	9	1	2
Ad F	46 (5)	324	48	13	2	14	-	-
Im M	28 (1)	243	70	17	1	12	1	-
Im F	23 (5)	315	35	16	1	20	2	-
No sex/age	2	30	5	18	-	13	1	-
	157 (12)	1,156	258	95	7	136	5	2

Nos. in parenthesis indicate duskys less then 40mm not included in dusky quota.

APPENDIX 3

Southwest Washington

Special Goose Season Report

SOUTHWEST WASHINGTON SPECIAL GOOSE SEASON

Prepared by
Patrick J. Miller
Area Wildlife Biologist
Washington Department of Game

An experimental hunting season was conducted in Clark and Cowlitz counties in November, 1985. The goal of the experiment was to determine the feasibility of a selective harvest of Canada geese in response to the declining populations of the dusky Canada goose. Background data on the dusky is well documented in the files and will not be reviewed here.

Season Structure

The goose hunting season, as adopted by the Washington Game commission in August of 1985 was as follows:

Canada Goose Season CLOSED in Cowlitz, Wahkiakum and Clark counties. EXCEPT FOR THE FOLLOWING AREA: All lands south of the Kalama grain elevator in Cowlitz County and west of Interstate 5 in Clark and Cowlitz Counties.

November 17-December 29*
Only on hunting days established for Ridgefield National Wildlife Refuge.
Daily bag limit: 3 geese.
Possession limit: 6 geese.

Hunting by written authorization from Washington Department of Game only.

Daily bay limit: 3 geese.
Possession limit: 6 geese.

Special season for 1985, arranged cooperatively by the Washington Department of Game and U.S. Fish and Wildlife Service. All hunters must have proof of attending the Canada goose identification class while hunting. Geese must be properly tagged by Ridgefield National Wildlife Refuge or the Washington Department of Game Vancouver Regional office on the day of kill. Part or all of the special area may be closed early if dusky harvest limits are exceeded. Contact Washington Department of Game, Vancouver Regional Office, or Ridgefield National Wildlife Refuge for more information.

Similar season structure, with some important exceptions, were implemented in Oregon on Sauvies Island.

Seminars to aid the goose hunter in identifying geese on the wing were held in Oregon and Washington. In Washington, approximately 600 hunters attended the seminars in Vancouver, Longview, and Tacoma. The same information was used in both states' classes to provide uniformity in approach. The material presented was developed at a joint USFWS/ODFW/WDG meeting where the USFWS experts provided expertise on subspecies identification.

All geese were required to be tagged with a lead seal at the Vancouver Game office, Ridgefield NWR hunter check station, or at a temporary check station in Woodland. At the time of sealing, specific data were recorded from each goose to aid in subspecies determination. Field checks were conducted to measure wastage and seal birds in the field.

Results

Harvest

A total of 241 Canada geese were harvested in Clark and Cowlitz counties in November of 1985. The harvest quota was exceeded on the private lands after three days of hunting. The harvest quota on Ridgefield NWR was exceeded after seven days of hunting. See Appendix A for details of the harvested geese. Subspecies breakdown of harvest was as follows:

Private Lands

Total Geese Killed = 115

Subspecies	# Harvested	% of Total
Dusky	21	18.3
P.P. Western	50	43.4
Lesser	12	10.4
Taverner	32	27.8
Other	1	.1
	115	100.0

Ridgefield NWR

Total Geese Killed = 122

Subspecies	# Harvested	% of Total
Dusky	26	21.3
P.P. Western	12	9.8
Lesser	12	9.8
Taverner	66	54.7
Other	6	4.9
	122	100.0

Identification Workshops

Hunters contacted in the field expressed mixed views of the workshops. Some felt the information was not accurate or helpful in hunting situations, while others indicated that their ability to discriminate between subspecies was enhanced by the class. Many comments were made about the lack of a night training class in Longview.

Monitoring

The Washington Game Department conducted emphasis patrols during the open hunting days. Units were assigned to watch each of the known hunt clubs on opening day in an attempt to enumerate the harvest. It was hoped to document wastage and over-limits on geese. Approximately 35 man days were expended on monitoring the short season on the private lands.

Discussion

The short season on geese in southwest Washington indicates the difficulty that sportsmen have in separating races of Canada geese on the wing. Several other factors may have contributed to this short season:

1. The "reserve" effect that probably occurred when Oregon was open for goose hunting and Washington was closed created an environment conducive to a very high harvest when Washington opened; consequently, a high number of duskys were killed on the opening day, expecially on the private lands.

2. The bag limit of three allowed some hunters to kill several duskys on one day. At least six hunters were checked who had killed more than one dusky.

3. The attitude of some hunters was not very good about this season. Many felt the quota was so low to be not worth having a hunting season. This poor attitude probably contributed to the rapid manner in which the dusky quota was reached.

Recommendations

The following recommendations assume that a limited harvest goose season will be desired and attempted in the future.

1. Reduce the bag limit. If the intention of a hunting season is to teach hunters to shoot selectively on geese, then a reduction in bag limit would limit the impact of any one individual's mistakes. Hunters need time in field situations to learn to discriminate between races. A reduction in bag limit to one would lengthen the season and provide more opportunities to learn this difficult task. Lengthening the season would also help with the landowner problems.

2. Curtail shooting hours. This was a suggestion often heard from hunters, especially when they were aware of ODFW's regulations. This would force hunters to wait until optimum conditions exist for identification.

3. Select only one sealing station. I would recommend that all birds be checked through the hunter check station at Ridgefield NWR. This would eliminate confusion over what locations were open to seal birds at what time. It would also eliminate any of the confusion as to agency criteria on dusky identification, and remove the possibility of hunters having birds checked at two locations and different subspecies identification assigned. It would be appropriate for WDG personnel to assist at the Ridgefield check station.

4. Concurrent opening dates in Oregon and Washington. This would prevent the large population build-ups we had this year when Oregon was open and Washington was not. The geese were using Washington locations heavily prior to our opener and this probably contributed to a higher than normal harvest when the season did open.

5. Reallocate the goose quota, if possible. It would appear that a reevalation of the state harvest quota may be in order. Collar sighting data may show a higher proportion of duskys in southwest Washington than previously believed. The quota this year was so low as to not give the hunters much time to perfect their field identification skills.

6. Improve coordination between Washington and Oregon. The differences in season structure and timing were of concern to many hunters, and made it appear tht the two states were not working very closely on the issue. It may be possible that Oregon's reduced bag and shooting hours contributed to their longer season. Coordination of subspecies identification criteria should also be conducted prior to the season.

July 23, 1986

APPENDIX 4

Written Comments on Draft Management

Options Paper

THE ALASKA WILDLIFE ALLIANCE

P.O. BOX 190953
ANCHORAGE, ALASKA 99519
907-277-0897

Appendix 4

October 5, 1986

cc: Lew P.
Greg G.
Tom R.
Bruce C.
Herman G.

Mr. Dan Timm
Regional Supervisor
Division of Game
Alaska Department of Fish and Game
333 Raspberry Road
Anchorage, Alaska 99518

Dear Mr. Timm,

Following are the comments of The Alaska Wildlife Alliance on the "Management Options for Dusky Canada Geese and Their Predators on the Copper River Delta, Alaska".

We agree there is a reduction in the population level of dusky Canada geese when compared to historic levels. But we feel the corrective actions suggested by the draft management paper, i.e. reducing the impacts of "wild" predators, are at best premature at this time.

We believe the first step in any recovery program, especially one which even hints at control of native wild predators as an option, is to list the species to be "recovered" as at least a "threatened" species under the federal Endangered Species Act. With the documented declines of the dusky goose, we believe this is an essential first step and well supported. Although we have yet to receive any word on the recommendations made by the Alaska Department of Fish and Game with respect to species to be listed under the State of Alaska's "threatened and endangered species" statute, we hope that the department has included such a recommendation to the Legislature for the dusky Canada goose.

Listing as a threatened species under the federal Endangered Species Act would bring greater coordination of management and recovery efforts throughout the range of the dusky goose including protection of remaining critical habitat. Just as important, and especially so given our state's own revenue situation, it would increase the likelihood that funding and other resources would be made available to implement a recovery program which does not include predator control. Such coordination of effort and resources would reduce the competition for funds for crop depredation awards in the Pacific northwest versus habitat management in Alaska, both expensive propositions. Through the State and federal listing processes and through associated studies, other habitat transitions or more suitable habitat areas may be identified for transplants or as areas in which the part of the dusky goose population might naturally relocate.

Furthermore, when a species has declined so much as to be designated threatened or endangered, it is much more likely to be viewed all concerned parties as a situation serious enough to require significant protection from further habitat loss and significant reduction of mortality. If a population is on a permanent decline, the sooner it is listed as threatened, the less drastic are the steps needed for its recovery. We believe reduction of mortality must come first from "discretionary" human activities, primarily from what is traditionally considered to be "sport huntin This reduction, to zero if necessary, must take place throughout the range of the affected species. If indeed the population decline is not merely cyclic in nature but most likely otherwise permanent, we feel this is a necessary first step before any reduction of predation by wild predators. Given these conditions and should the subject population continue to decline, the next step would be to manage the habitat for increased survival and reproduction of the subject species. Only when these step have been implemented and the subject population continues to decline should lethal

predator control be considered as a "last-ditch" effort to save the endangered species Finally, in a recovery program which is begun when the problem is identified relatively early in the process rather than when it is a last-ditch effort, the objective should not be to dramatically increase then subject population in a very short period of time. Instead, the object should be to arrest the decline first and provide for a stable and long-term population increase.

We do not support the "objective" of the management options presented, i.e "to reduce, and maintain at a low level, predation on dusky geese on the Copper River Delta..." through what seems to be an intent to shift the burden of recovery to native wild predators through lethal predator control. We support as a necessary first step the listing of the dusky goose as a threatened species and the further reduction of human-caused mortality. The listing process should not wait for further decline. Neither should lethal predator control be considered as an alternative to listing as a threatened species. After further reduction of human-caused mortality and habitat loss, should the dusky goose population continue to decline, habitat enhancement and transplants could be considered.

We do not at this time support even the "nest avoidance" measures or the baiting of predator to other areas through feeding stations and other attractants. Such baiting would be tantamount to lethal predator control.

As has already been stated, we oppose any consideration of predator control measures, including elimination "by appropriate means" (what are "appropriate means"?) and sterilization of brown bears and the promotion of public sport harvest of coyotes through "coyote calling" and the use of artificial light to kill coyotes, prior to the designation of the dusky goose as a threatened or endangered species under the federal Endangered Species Act. We oppose the aerial shooting of coyotes by the publi or ADF&G at any time of year and the establishment of bounties for coyotes on the Copper River Delta. Finally, we oppose the use of poisons in any fashion at any time on the Copper River Delta. The increased killing of coyotes, brown bears and other wild predators, even on a "short-term basis", should only not even be considered excep as a last-ditch effort to save the dusky goose from extinction after all other non-lethal options have been exhausted. We do not accept any lack of funds for alternatives, after the reduction of human-caused mortality, to be reason for the immediate implementation of predator control. We oppose the use of bounties and poisc under any circumstances.

We appreciate the opportunity to provide input to the management plans and will look forward to participating in the management planning and regulatory process.

Sincerely,

Wayne Hall
Director

National Audubon Society

ALASKA REGIONAL OFFICE

308 G STREET, SUITE 217, ANCHORAGE, ALASKA 99501 (907) 276-7034

September 29, 1986

Bruce Campbell
Waterfowl Biologist
Alaska Department of Fish and Game
Division of Game
333 Raspberry Road
Anchorage, Alaska 99502

Dear Bruce:

This is to provide you with a written follow-up to our meeting last Thursday on management of the Dusky Canada Goose (Branta canadensis occidentalis). I commend you for calling the meeting, and for sharing a wealth of information on this most challenging waterfowl management problem. I also greatly appreciate your seeking our advice before taking any actions on behalf of the geese that might prove highly controversial.

I thought that it might prove useful to reiterate in writing the principal recommendations that I provided at Thursday's meeting. These recommendations are as follows:

1. Continue to deal with the problem flyway-wide, consistent with the goals and objectives of an updated species management plan prepared by the Pacific Flyway Council.

2. Organize a "Dusky Recovery Team" to include both agency professionals and representatives of public interest groups should the population continue to decline.

3. Based on the recommendations of the recovery team, have the U.S. Fish and Wildlife Service prepare a "Dusky Recovery Plan" and make it available for public review and comment.

4. Reject management options that involve practices normally considered illegal and/or highly controversial unless, after thorough public review, the recovery team should determine them absolutely necessary to save the subspecies. Such practices include aerial gunning, nightlighting, poisoning and bounties on predators, or spraying brush with herbicides.

5. Likewise, reject management options that are either unproven, impractical, or excessively expensive unless the recovery team determines otherwise. Such practices include goose transplants, captive rearing, and bear sterilization and/or transplants.

6. Provide estimates of both short and long term funding and staffing needs for each management option given further consideration.

7. View management needs of the "dusky" in relation to the needs of all other geese in the Pacific Flyway. Then set priorities for allocation of scarce resources consistent with the public's priorities, and where there is a reasonable chance of achieving the desired results.

8. Establish population levels at which the "dusky" would be considered "threatened" and "endangered" by the resource professionals most knowledgeable on the subspecies.

9. Continue to solicit the involvement, cooperation and support of all appropriate government agencies and concerned public interest groups.

10. Continue to keep all interest groups informed by providing them with periodic updates of the "dusky's" status.

As I mentioned at our meeting Thursday, the 1964 earthquake was a natural event that has apparently precipitated significant ecological changes on the Copper River Delta. Most of these changes appear unfavorable to nesting "duskies". On the other hand, they may well have benefited other wildlife species, including brown bears and coyotes. If the decision is made to alter these natural processes through management activities aimed at helping the geese rebuild their numbers, this should be done consistent with the laws and policies of both the U.S. Forest Service (which has jurisdiction over delta lands in the Chugach National Forest), and U.S. Fish and Wildlife Service (which has jurisdiction over the geese under international treaties). It should also be done consistent with the public's desires.

Continued cooperation between all appropriate state and federal agencies involved in management of the "dusky" will be essential to the success of recovery efforts. The U.S. Fish and Wildlife Service as the federal agency with ultimate responsibility for management of the "dusky" under international treaties and national law should assume the leadership role in this, and provide all concerned parties with the best available scientific information in a timely manner. It was, therefore, disappointing not to see the Service represented at your important meeting last week.

For the immediate future, it appears the most practical things that should be done to help the "dusky" are to:

1) Further reduce or eliminate the sport hunter harvest of the subspecies in the entire Pacific Flyway until the midwinter population goal of 20,000 birds is reached;

2) Continue to experiment with techniques to increase nesting success and gosling survival on the Copper River Delta, including manipulation of goose habitat and predator populations;

3) Intensify research efforts on goose population dynamics, predator-prey relationships, management of nesting habitat, winter movement patterns, and genetic discreetness of the population; and

4) Increase public education efforts in all states frequented by the birds with special emphasis on goose hunters to help them appreciate the need to accurately distinguish the "dusky" from other geese, and to abide by severe restrictions on seasons and bag limits.

Thanks again, Bruce, for providing us the opportunity to comment. Please let us know if you believe we can be of further assistance.

Sincerely,

David R. Cline

David R. Cline
Regional Vice President

cc: Bob Gilmore, U.S. Fish and Wildlife Service
Mike Novey, Chugach National Forest
Tom Rothe, Alaska Department of Fish and Game
Bruce Apple, National Wildlife Federation
Chip Dennerlein
Frosty Anderson, National Audubon Society
Alaska Audubon chapters
Other Alaska conservation organizations

United States Department of Agriculture
Forest Service
Chugach NF
201 E. 9th Ave.
Suite 206
Anchorage, AK 99501

Reply to: 2610

Date: September 24, 1986

Mr. Daniel E. Timm
Regional Supervisor
Division of Game
Alaska Department of
Fish and Game
333 Raspberry Road
Anchorage, Alaska 99518-1599

Dear Dan:

We found the September 17 presentation, "Management Options For Dusky Canada Geese and Their Predators on the Copper River Delta, Alaska", informative and appreciate the close coordination with your agency and the Fish and Wildlife Service. Bruce Campbell's review of population response of dusky geese under models with a variety of management schemes was enlightening. We concur with the suggestion that refinement of models and projection of the results expected under long term implications with various management options has merit.

From the information and ensuing discussion of the various management options, it appears that no one option may provide the panacea. Solutions to the goose/predator/hunter/crop depredation situation throughout the range of the dusky Canada goose will be controversial - particularly with regard to work on the Copper River Delta. You can be sure the Forest Service will continue to work closely with the Alaska Department of Fish and Game and the Fish and Wildlife Service to help find a solution. In that regard, we refer to direction from our Master MOU between the Forest Service and the Alaska Department of Fish and Game and to our own Forest Service Manual.

It is the Forest Service position that National Environmental Policy Act (NEPA) analysis be required with approval by the Forest Service for predator control methods and/or use of toxicants if these management options are pursued on National Forest lands. We wish to work closely with you should such a document be prepared.

We support the liberalization of Alaska Department of Fish and Game brown bear regulations in so far as that avenue would help control the density of this important mammal within the dusky breeding grounds on the west Copper River Delta area of the Copper River Delta management area.

Protection and enhancement of waterfowl habitat is an important management option within Forest Service jurisdiction. We continue to review habitat improvement treatments for the delta. At the September 17 dusky/predator management option meeting, we identified the need to focus management actions on the key area of goose nesting activity on the Delta.

We believe nest habitat improvement and brush removal have the potential for increasing nest success among dusky Canada geese over the long term. Evaluation and large scale application will take some time. We will continue our monitoring program to evaluate and refine our artificial goose nest island installation program and will undertake an analysis and feasibility study to assess site specific, selective shrub control this year.

Analysis of recent air photos may help us determine whether areas where geese nest and where tall shrubs have been cut by beaver have higher levels of nest success than unaltered tall vegetative growths on nearby goose nesting grounds. Perhaps openness favoring low shrubs and grass/forb habitats along high ditch banks bordering sedge meadows would offer less desirable cover for foraging mammalian predators. Such a comparison lends itself to testing and will require close coordination among cooperators. We will initiate the investigation this year.

Related to this are means which may favor increasing buffer prey species through special habitat treatments - tall shrub growths seem to have negatively influenced nesting colonies of terns and mew gulls. Similarly, perhaps treatments may be devised to encourage increasing populations of voles. Special habitat treatments represent potential long term solutions to the current dilemma.

From a short term management perspective, we favor options which can be focused on means to reduce or shift territories of brown Bear and or coyotes away from key goose nesting concentrations. It is likely that combining options may bring about the most rapid response in terms of dusky population growth.

We appreciate the opportunity for comment and look forward to hear responses resulting from your September 25 meeting with 12 special interest groups.

Sincerely,

for DALTON Du LAC
Forest Supervisor

cc: Phil Janik, FS FW Staff Director
Dick Pospahala, FWS
Mike Novy, FS FWTF Staff Officer
Kurt Nelson, Cordova District Ranger
John Henley, FS FSL Project Leader

GREENPEACE U.S.A.

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Mr. Bruce Campbell
Alaska Department of Fish and Game
Division of Game
333 Raspberry Road
Anchorage, AK 99502

October 16, 1986

Dear Bruce:

Thank you so much for putting together the information packet and presentation on the Dusky Canada Goose problem. Your treatment of this subject was exceptionally thorough and I appreciate your taking the time and effort to include the environmental community on decisions affecting future management.

Following are comments on the proposed management options:

We must keep in mind that the Dusky Canada Goose's viability is affected by factors throughout its range and therefore management must be approached with a comprehensive look at factors affecting both mortality and productivity throughout the Pacific Flyway.

Mortality:

According to your presentation, the greatest source of mortality, 95%, is hunting pressure, predominantly in Oregon. I would therefore suggest that primary efforts at maintaining a viable Dusky Canada Goose population be directed at reducing this impact. I was encouraged to read that experimental programs aimed at maintaining quotas on Dusky Canada Geese harvests and educating hunters to distinguish Dusky Canda Geese from the other available stocks were underway and proving in large part to be successful. I would suggest that, overall, the approach of curtailing the effects of hunting pressure would provide the most effective, economically feasible, and ecologically sound approach to maintaining viable Dusky Canda Geese stocks. Please include this as one of your management options.

Productivity:

Since the Dusky Canda Goose nests exclusively within Alaska on the Copper River Delta, ADFG management options concentrated on possible techniques that could be employed in that area. As I already mentioned, I do not believe that this is the most effec-

tive point in the Dusky Canada Goose's life cycle to implement management.

The information packet and presentation emphasized the factor of increased predator populations and predation in conjunction with habitat changes caused by the 1964 earthquake. Needless to say, these changes are not completely reversible. The Dusky Canada Goose uses remarkably discrete nesting and wintering areas thus making it tempting to impose management techniques which would maintain the status quo for resident populations in these areas. However, as habitat largely defines which species an area will support, the changing habitat on the Copper River Delta is bound to continue to result in changing the resident wildlife populations and changing the balance of resident populations. In the long run, it would prove very economically and ecologically unsound to try and reverse these effects of the 1964 earthquake either through extensive habitat manipulation or through predator control.

Population Objectives and Predator Control:

I was discouraged to see the large emphasis on predator control in the management options. I would have expected the heading "Population Objectives" on page 13 of the draft to be followed by a discussion of maintaining population objectives for the Dusky Canada Goose and to include all possible methods of approaching this problem. Instead it reads," The objective of the management options presented in this document is to reduce, and maintain at a low level, predation on dusky geese on the Copper River Delta until the population returns to 20,000 geese." As I mentioned in my opening comments, a sound management program must look at all factors affecting geese throughout its range, not just selected factors within Alaska. Based on the current information provided, predator control is unwarranted and unacceptable.

The predation figures available in the information packet and as discussed at our meeting show that avian predation is underrated in the figures and in fact may be the largest predation factor, yet this type of predation is not addressed in the management options.

Controlling predation by bears and coyotes is addressed in three of the management options. Habitat changes on the Delta which appear to be benefiting bear and coyote populations should not be treated solely as a negative change of events. These populations indeed may prove to become popular for wildlife observation in the future, maintaining recreational opportunities. In any case, management which allows for reduction of these species should not be implemented until ADFG has a better understanding of the nature of these populations and ADFG sets clear management objectives for sustaining appropriate levels of these residents of the Delta.

The other question which I expected to see addressed under the heading Population Objectives was whether the Pacific Flyway

Management Council should consider reevaluating their population goals for the Dusky Canada Goose in recognition that the habitat and resident species composition of the nesting grounds has undergone an extreme, natural change. I understand that this would be a controversial topic, but it may prove more realisitic to change the management objectives to match the Delta's changed habitat status rather than try to fight the changes brought on by the earthquake through the expensive and ecologically questionable means of habitat manipulation and predator control.

Thanks again for all the effort you put into making it possible for Greenpeace and other members of the environmental communtiy to comment on this topic. Please let me know how things progress and whether I can be of any further assistance.

Sincerely,

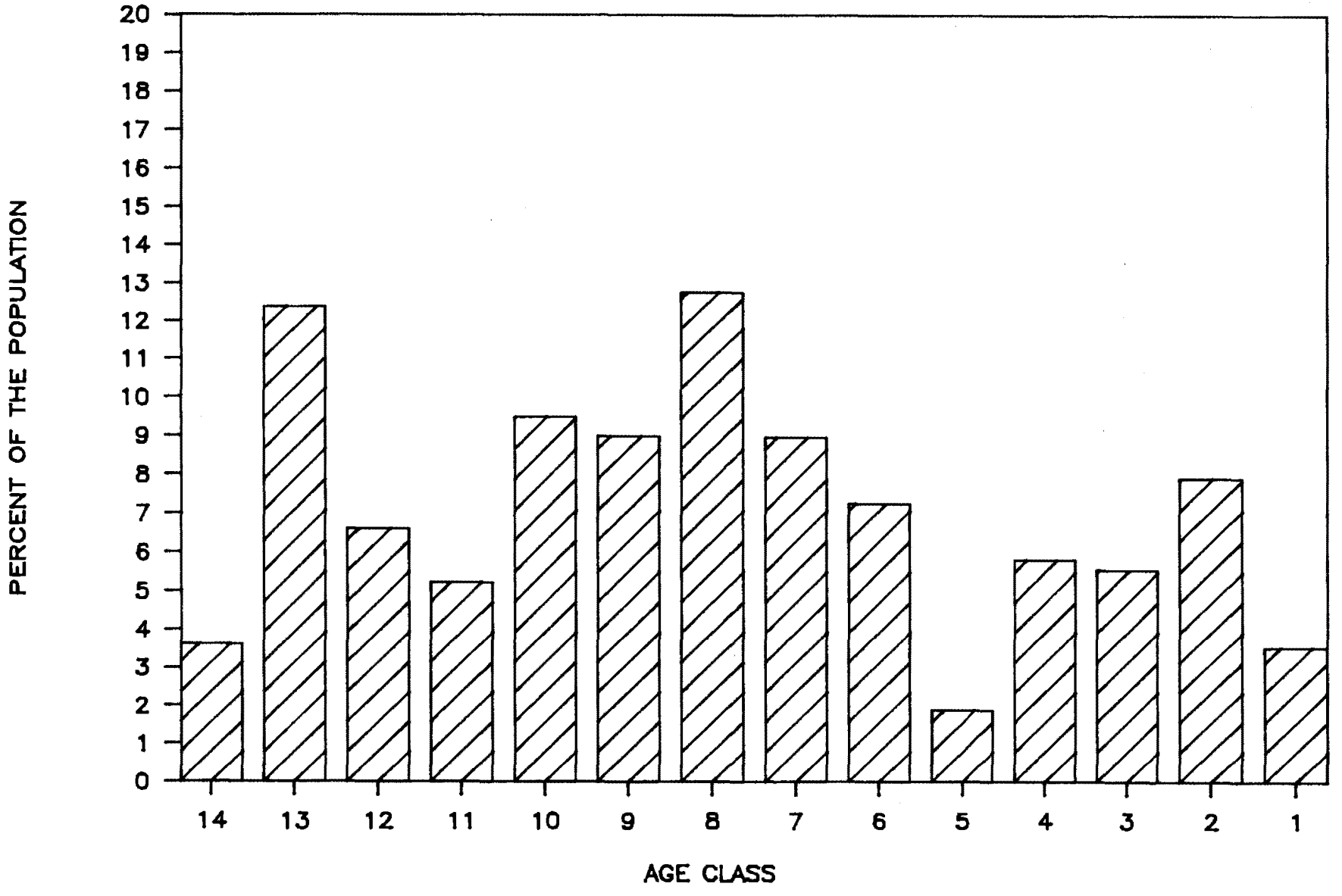
Sue D. Libenson

Sue D. Libenson
Resource Specialist

Dusky Canada Goose nest density, hatching success, and production on the Copper River Delta, Alaska, 1959-89.

YEAR	NEST/MI	NEST N	SUCCESS %	PRODUCTION % Young
59	105	222	89.2	--
64		102	82.4	--
65		221	62.9	--
66		100	97	--
67	111			--
68		38	86.8	--
69				--
70		164	88.2	--
71		100	76	16.2
72		116	81	10.6
73				36.0
74		81	82.7	51.4
75	179	215	31.6	17.9
76	156	168		24.2
77	175	229	79	44.8
78	183	390	56.2	24.8
79	133	409	18.8	16.0
80	108			23.7
81				17.9
82	102	158	49.2	23.7
83	91	162	51.9	15.0
84	95	161	75.8	18.3
85	97	168	8.9	3.7
86	119	201	11.4	10.7
87	116	196	23.7	9.5
88	116	111	17.3	22.5
89	98	94	4.3	8.6

APPROX. AGE COMPOSITION OF DUSKY POP.



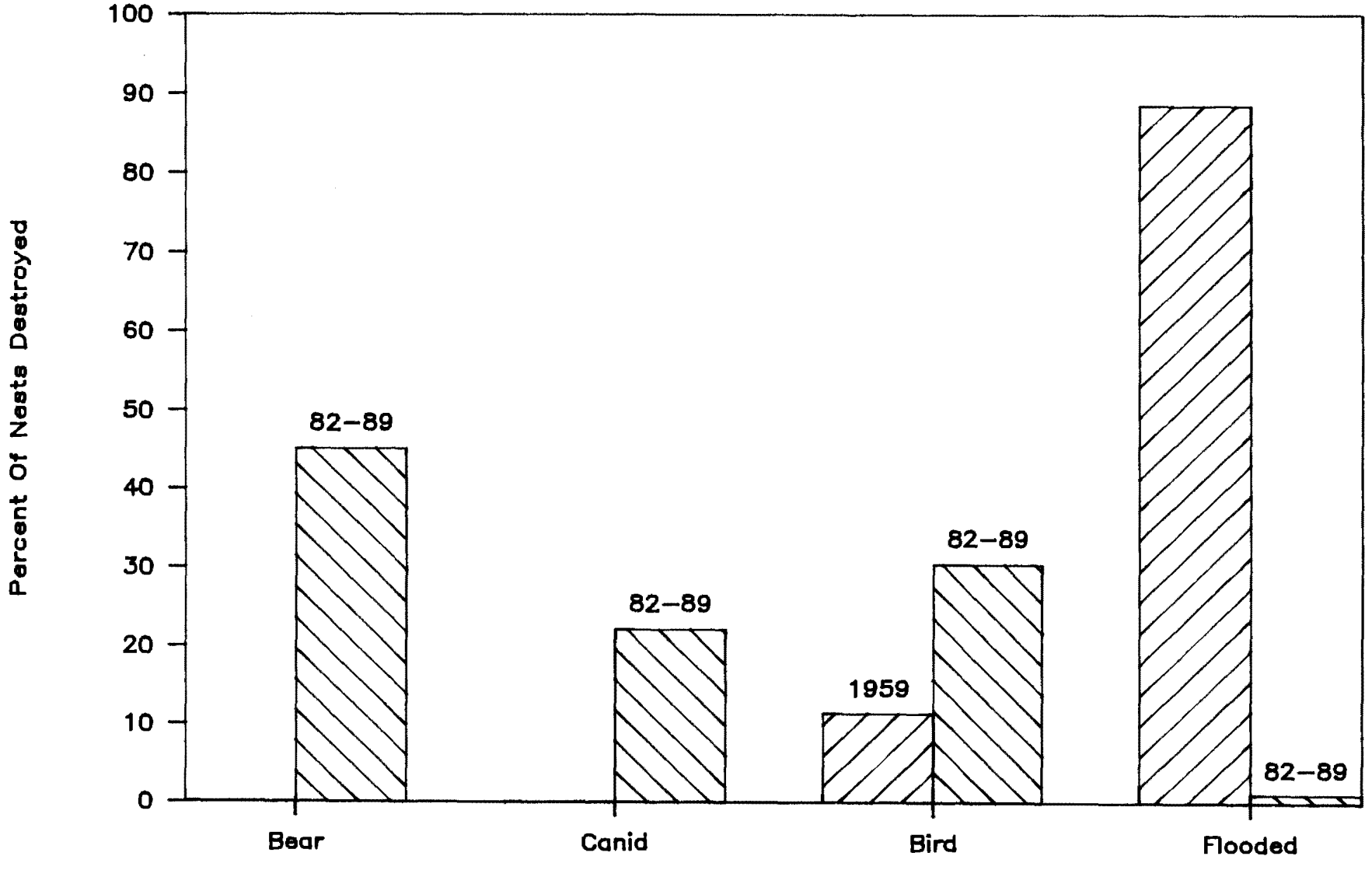
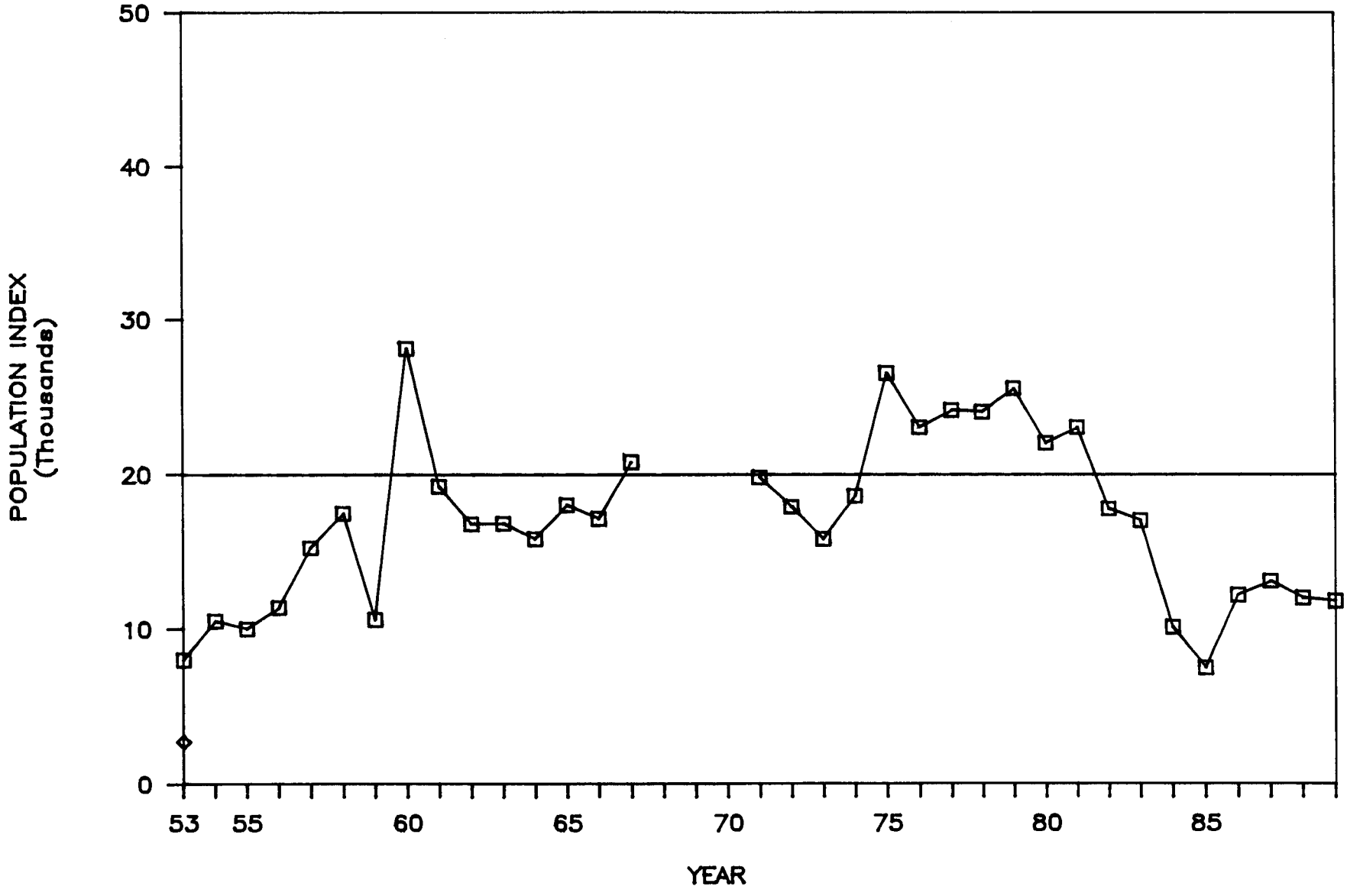

COMPOSITION OF NEST DESTRUCTION
Percent Of Nests Destroyed
100
90
80
70
60
50
40
30
20
10
0
82–89
82–89
1959
82–89
82–89
Bear
Canid
Bird
Flooded

Table 3. Fate of dusky Canada goose nests on the west Copper River Delta study area, 1959, 1974-75, and 1982-89.

Year	No. nests	% Successful	% Abandoned	% Fate unknown	% Destroyed	Type destruction: % Mammal	% Avian	% Flooded	% Unknown
1959[a]	1,162[b]	79.6	1.8	2.0	6.0	0	11.4	88.6	0
1974[c]	81	82.7	2.5	ND[d]	14.8	ND[d]	--[e]	0	ND[d]
1975[c]	215	31.6	3.7	ND[d]	64.6	ND[d]	--[e]	0	ND[d]
1982	158	49.2	1.8	ND[d]	49.0	45.0	33.8	0	21.8
1983	162	51.9	3.7	8.0	35.2	64.8	5.6	0	29.6
1984	161	75.8	3.1	6.2	14.9	62.4	37.6	0	4.0
1985	258	7.0	1.9	10.9	81.0	78.8	18.4	0	2.8
1986	201	11.4	9.0	12.5	67.2	83.7	5.2	0	11.1
1987	213	23.9	14.1	1.0	61.0	45.6	47.3	7.0	0.2
1988	110	17.3	3.6	17.3	61.8	53.3	40.0	6.7	0.1
1989	94	4.3	3.2	14.8	76.6	54.1	45.8	0.0	0.1

a Trainer 1959
b Eggs rather than nests
c Bromley 1976
d Not reported.
e Percentages not given, but majority of losses attributed to avian predators.

DUSKY CANADA GOOSE POPULATION INDEX



COMPOSITION OF WINTERING POPULATION