MANAGEMENT EVOLUTION OF DUSKY CANADA GEESE

Daniel E. Timm
Alaska Department of Fish and Game, Anchorage, Alaska
Robert G. Bromley
Oregon State University, Corvallis, Oregon
Donald E. McKnight
Alaska Department of Fish and Game, Juneau, Alaska
Richard S. Rodgers
U.S. Fish and Wildlife Service, Portland, Oregon

Abstract: The management of dusky Canada geese (*Branta canadensis occidentalis*) has, in less than 30 years, evolved from guesswork based on little information to meaningful actions supported by extensive research findings and a continuum of population data. In this paper we trace the major events leading to present management, describe current management procedures and discuss challenges of the future. Innovative methods of population management must be developed to cope with a new and dynamic situation on the wintering grounds.

Dusky Canada geese (*Branta canadensis occidentalis*) comprise the smallest population of Canada geese presently subjected to hunting; their numbers exceed only those of the endangered Aleutian Canada goose (*B.c. leucopareia*). Hansen (1968) wrote, "the destiny of the dusky Canada goose is controlled by hunting pressure, not only in one state, but in a restricted area in one small river valley." His statement is as true now, 10 years later, as it was then. Although eventually hunting pressure may no longer be the primary factor limiting numerical expansion of this subspecies, its management at present requires intensive population and harvest monitoring.

In less than 30 years management of dusky Canada geese has evolved from guesswork based on little information to meaningful actions based on extensive research findings and a continuum of population data undertaken in a spirit of close cooperation among managing agencies.

We feel it will be useful to summarize management evolution of the subspecies, review current management procedures and discuss the challenges of the future for managers of dusky geese. Other goose managers should profit from this review, and perhaps enlighten us to options for management which we have overlooked. Also, this paper will be a timely contribution to the Pacific Flyway goose management planning process which was recently initiated.

MANAGEMENT HISTORY

As recently as 1940 it was believed that dusky Canada geese wintered along Oregon's coast and only occasionally straggled inland (Gabrielson and Jewett 1940). Little evidence to the contrary existed until 1952 when Federal game agent F. C. Robards first banded dusky geese on their Copper River Delta,

Alaska nesting grounds. His efforts, as well as subsequent banding, have shown the Copper River Delta and Willamette Valley, Oregon to be the nesting and primary wintering areas, respectively, for this subspecies. Also in 1952 the first of annual post-season counts of Canada geese was made in the Willamette Valley.

During the mid-1950's general assessments of production were made on the Copper River Delta, and one attempt was made to reduce nest loss from flooding. However, 50 nesting structures erected in 1953 were used only as roosts in 1954 (S. T. Olson, 1954. Report on banding and production studies for 1954. Fed. Aid Wildl. Rest. Q. Rep., Work Plan C. 14p). Trainer (1959) was the first to conduct an intensive nesting study of dusky geese.

Until 1962, daily bag and possession limits and season length in the Willamette Valley were apparently based on tradition, and on the status of other waterfowl besides Canada geese. From 1951 to 1962 the effective season length (post November 5) and daily bag varied between 41 and 70 days and two and three geese, respectively. Reliable estimates of post-season populations varied between 10,000 and 17,000 geese during this period (Hansen 1968).

Hansen (1962) summarized 10 years of banding data and showed how the manipulation of season length and/or bag limit in the Willamette Valley could be used to alter the population. He demonstrated that significant reduction in adult kill would occur if hunting were curtailed after December 26.

Chapman (1967) and Henny (1967) conducted complimentary studies of population dynamics and hunter harvest of duskys in the Willamette Valley. Their combined work (Chapman et al. 1969) provided the fundamental conceptual basis for harvest management.

In March 1964 the Copper River Delta was uplifted about 1.9 m by the most powerful earthquake ever felt in North America. Two buried forest horizons now exposed in slough banks attest to previous tectonic activity. Carbon-14 dating indicated that the ages of these forests are 750 and 1,700 years (Reimnitz 1972).

In 1965 P. E. K. Shepherd established 15 plots on the Delta to provide baseline data on the nesting characteristics of dusky geese, as they related to plant successional changes caused by the earthquake. Crow (1968, 1972) described the early effects of the 1964 earthquake on vegetation, and Potyondy et al. (1975) described the hydrologic effects.

In 1962 a Copper River Delta Cooperative Management Agreement was signed by the U.S. Forest Service and the Alaska Departments of Fish and Game and Natural Resources. This agreement recognized wildlife and fisheries as the most important resources of the Delta and defined agency responsibilities as they related to the area.

In the late 1950's the need for refuges in the Willamette Valley was recognized. Geese were concentrated on a few privately owned areas and relatively few hunters accounted for most of the harvest. The U.S. Fish and Wildlife Service initiated land purchases for refuges in 1963 and additional major purchases occurred in 1964 and 1965.

The hunting situation has changed with the creation of the 4,295 ha, three-refuge complex. No longer are large flocks of geese located on a few private hunting clubs. Most geese in the Willamette Valley are now concentrated on refuge lands and greater hunting opportunity has probably been provided.

From 1963 to 1969 the post-season population of dusky Canada geese increased substantially from about 14,000 birds to over 23,000. This occurred despite a daily bag limit of three geese (except 1967 and 1968), and seasons that extended as late as January 12. This population increase attested to the effectiveness of the refuge complex.

Until 1972 the management of dusky Canada geese was characterized by a lack of management goals and objectives, and a lack of interagency coordination. When Hansen (1968) stated, "responsibility for action in behalf of the dusky Canada goose stands in lonely isolation," his was a plea for cooperative management.

In 1972 a Dusky Canada Goose Subcommittee of the Pacific Flyway Technical Committee was formed. As its first major action, the subcommittee developed a population management plan which was approved by the Pacific Flyway Council and signed by the heads of appropriate managing agencies (Pacific Flyway Council 1973).

CURRENT MANAGEMENT

Current management of dusky geese exemplifies interagency cooperation. The U.S. Forest Service, U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, Oregon State Game Commission, Oregon State University, the University of Alaska, the Young Adult Conservation Corps and private citizens all have been directly involved in management activities. Coordination with the Province of British Columbia and the Canadian Wildlife Service is achieved at the Pacific Flyway Technical Committee and subcommittee levels.

Since 1973 the U.S. Forest Service (manager of all Copper River Delta uplands) has sponsored annual meetings which concerned land and other resource management of the Copper River Delta. At these meetings and by other means the Forest Service and others are advised of dusky goose population status and of desirable land management practices for these geese and other wildlife on the Delta. Additional protection for the Delta's habitat was secured in 1978 when the Alaska State Legislature designated adjacent intertidal lands as critical habitat.

Population management procedures are designed to maintain a post-season population of 20,000 to 25,000 geese (Pacific Flyway Council 1973). Comprehensive population inventories are conducted post-season, as well as several times during the fall on refuges. In 1974, spring aerial counts on the Copper River Delta were initiated, in response to difficulties encountered in determining the number of dusky geese in the Willamette Valley.

Pre-season banding on the Copper River Delta has been conducted annually since 1952, with the exception of 1961, 1964 and 1969. Band recovery data have been used in harvest and total mortality assessments, and in recovery distribution studies. When regulation restrictions are necessary, those areas where most of the harvest recently occurred (as determined from band recoveries) assume the greatest restrictions (Pacific Flyway Council 1973).

Annual quantitative assessments of goose production on the Copper River Delta have been made since 1971. In late July about 10,000 dusky geese were counted from the air and classified as either young or adults. To compensate for reduced visibility of young, the number of young counted were doubled. Although we had little objective information on which to assume a 50 percent

visibility rate for goslings in 1971, this rate has proven to be surprisingly accurate, as determined by comparisons with ground studies and adjusted age ratios in the harvest.

The ratio of young geese in the Willamette Valley harvest can be adjusted with differential vulnerability rates calculated from band recoveries for 5 years--1971, 1972, 1973, 1976 and 1977 (D. E. Timm 1972, 1973. Rep. Surv. Inven. Act.--Waterfowl, Fed. Aid Wildl. Rest.; R. L. Jarvis and R. S. Rodgers, unpubl. reps. to the Dusky Canada Goose Subcommittee). The average annual component of young in the population as predicted from summer surveys was 22.2 percent, compared to the average adjusted age ratio in the kill of 24.1 percent young.

If the breeding population size is known and if production can be quantified by late July, more precise population management is possible by regulation manipulation. This management precision is impossible for most goose populations.

A summary of population data collected since 1971 and used for management are presented in Table 1. For the years 1971-1976, there was strong correlation between total annual fall flight and same year harvest ($r = 0.97$). Estimates of breeding population size in 1977 and 1978, and the harvest estimate in 1977 were questionable, and are undergoing further analysis.

Table 1. Summary of population data for dusky Canada geese, 1971-78.

Year	Mid-winter	Breeding Pop.[2/]	% Yg.	% Non-Prod. Ad.[3/]	No. Yg. Produced	Fall Flight	Harvest[4/]
1971	20,850	20,065	16.2	79.8	3,880	23,945	5,995
1972	17,950	17,275	10.6	71.7	2,050	19,325	3,450
1973	15,875[1/]	15,280	36.0	64.6	8,595	23,875	4,875
1974	19,000[1/]	18,290	51.4	35.7	19,345	37,635	12,070
1975	26,550[1/]	25,565	17.9	84.5	5,575	31,140	9,010
1976	22,725[1/]	21,870	24.2	54.2	6,890	28,850	6,350[5/]
1977	22,500[5/]	21,650[5/]	44.3	56.9	17,225	38,875	15,100[5/]
1978	23,775[5/]	23,000[5/]	24.0	71.8	7,600	30,600	8,400(est)
1979	22,200(est)						

1/ Calculated from spring breeding grounds survey
2/ Mid-winter less 0.0375 mortality (Chapman et al. 1969)
3/ Percent of total adults in flocks with no young
4/ Fall flight less mid-winter inventory
5/ Preliminary estimates pending further analyses

Since 1971 the daily bag limit in the Willamette Valley has been two Canada geese. The effective season length (post November 5) since 1971 varied between 49 days and 73 days, and was adjusted according to the size of the fall flight. Since 1975 the daily bag limit has been two Canada geese in all of western Oregon.

In response to an increasing population of other Canada goose subspecies, a current objective of refuge management in the Valley is to increase the carrying capacity of refuge lands for geese. Also, the public hunting program

is being modified which will probably result in increased goose kill, but the quality of hunting will be improved (P. C. Sekora, personal communications). The retrieved harvest of all Canada geese on Federal refuges in the Willamette Valley has averaged about 1,100 birds per year during the past three hunting seasons (R.L. Jarvis and R.S. Rodgers, unpubl. reps. to the Dusky Canada Goose Subcommittee; R.L. Jarvis, unpubl. rep. to the subcommittee).

On the Sauvie Island State Management Area, land use practices are designed to enhance duck use and duck hunting. However, in recent years there has been a large increase in the use of the area by all subspecies of Canada geese. The average annual harvest of Canada geese on Sauvie Island during the past three seasons has been over 1,300 birds per year (F. Newton, unpublished data). Dusky Canada geese comprised over 70 percent of this harvest, which was similiar to the subspecies composition of the harvest on refuges in the Willamette Valley.

MANAGEMENT CHALLENGES AND DISCUSSION

Maintenance of waterfowl habitat on the Copper River Delta is paramount to the long-term welfare of dusky Canada geese. Shepherd (1965), Crow (1968, 1972), Potyondy et al. (1975) and Bromley (1976) agreed that plant succession on the Delta would result in development of a shrub-forest community over much of the area. They also believed that nesting habitat lost to shrub encroachment would not be replaced for many years by uplift and sediment deposition on intertidal lands adjacent to the Delta. Bromley (1976) speculated that a "stable" habitat condition, accompanied by reduced nest densities, may develop on the Delta within 20 to 30 years. He felt that with a concomitant increase of mammalian predators, consideration of predator control may be necessary within a decade.

Bromley (1976) found a high rate of homing to nest sites by female geese. However, he also discovered an adaptability of individual geese to use different habitat types for nest construction on a year to year basis. In consideration of the changing habitat on the Delta, he recommended that the population be retained at a higher level (50,000 fall flight and 35,000 post-season) so maximum advantage could be taken of the adaptability of geese in selecting nest sites.

Chapman et al. (1969) also recommended a population increase to 50,000 geese in the fall flight, based on the potential of both the nesting and wintering grounds to support additional birds. R. K. Martinson, Region I Director, U.S. Fish and Wildlife Service, recommended to the Dusky Goose Subcommittee that the population objective be changed to 22,000-28,000 geese post-season (1975, memo. to Dusky Canada Goose Subcommittee). His recommendation was based on the recent expansion of the wintering flock into the lower Columbia River area, particularly on Sauvie Island.

When the present population objective was established in 1973, the post-season population was less than 16,000 dusky geese. The objective of 20,000 to 25,000 geese allowed for up to a 56 percent population increase which was believed to be the carrying capacity of geese in the Willamette Valley, based on potential crop depredations. From 1963 to 1972 the wintering population of all subspecies of Canada geese in traditional dusky goose areas ranged from 20,000 to 28,000 birds (U.S. Fish and Wildlife Service, unpublished data).

Since the management plan was written in 1973, the post-season population of all Canada geese has increased about 100 percent. In 1977 nearly 51,000

Canada geese were present in traditional dusky goose areas. The increase of geese since 1973 primarily reflects increased numbers of lesser Canada geese (*B. c. taverneri* and *B. c. parvipes*) (R. L. Jarvis and R. S. Rodgers, unpubl. reps. to Dusky Canada Goose Subcommittee; R. L. Jarvis unpubl. rep. to the subcommittee). Peak fall counts of Canada geese on Sauvie Island have increased from 5,300 geese in 1971 to 24,000 in 1978 (F. Newton, unpublished data).

The number of crop depredation complaints in the Willamette Valley is currently not considered a serious problem (Clark and Jarvis 1978; J. Annear, personal communications). Most private landowners employ scare devices to solve or moderate their problems (J. Annear, personal communications). However, on Sauvie Island the number of crop depredation complaints is increasing and may soon reach a level that causes political complications (F. Newton, personal communications).

Surveys and banding by the Alaska Department of Fish and Game (D.E. Timm, 1978. Rep. Surv. Inven. Act.--Waterfowl, Fed. Aid. Wildl. Rest. Proj. W-17-10, Job 10. 27 p.) have shown that about 2,000 *B. c. parvipes* from upper Cook Inlet, Alaska are wintering in the Willamette Valley. The Cook Inlet population is apparently expanding rapidly and the potential carrying capacity of the breeding grounds is perhaps 500 to 1,000 nesting pairs. This population of geese reportedly did not exist prior to the 1964 earthquake (King and Lensink 1971).

Banding and color marking of *B. c. taverneri* near Cold Bay, Alaska have shown that at least a portion of the fall-staging Canada geese there are beginning to winter in traditional dusky goose areas. Since 1974, the maximum count of *taverneri* near Cold Bay has been 73,500 birds (D.E. Timm and J.E. Sarvis, unpublished data).

Based on current "short-stopping" of Canada geese, it is clear that the realistic potential size of the wintering Canada goose population in western Oregon is 100,000 birds. At this point it may be premature to change the population objective for dusky Canada geese, without the benefit of additional knowledge about the other two subspecies, particularly *B. c. taverneri*.

Simpson and Jarvis (1979) have shown that during 1976-1978 in western Oregon, a dusky goose was about 2.7 times more likely to be shot than was a *taverneri*. During this period the two subspecies were present in nearly equal numbers. Differences in vulnerability existed for refuge and private lands, and among refuges. Without additional innovative research, present harvest management is inadequate to "control" the numbers of non-dusky Canada geese.

Although it may be impossible to influence agricultural practices throughout the Willamette Valley, crop manipulation could be used on federal refuges and on the Sauvie Island State Game Management Area. Research may show ways to encourage use by dusky geese on public lands and discourage the use of those areas by other subspecies. For example, Simpson and Jarvis (1979) found that the mean size of fields used by dusky geese was significantly smaller than the mean size of fields used by *taverneri*.

Banding of Canada geese on breeding and fall-staging areas in Alaska and Canada would show the current relationships between those areas and wintering areas. Significant numbers of *parvipes* and *taverneri* have not been banded in Alaska since the 1950's, except on the North Slope and Cook Inlet. Early banding of *taverneri* on the Yukon-Kuskokwim Delta (where Cold Bay *taverneri* are suspected to nest) indicated that California was their wintering area

(D.E. Timm, 1974. Rep. Surv. Inven. Act.--Waterfowl, Fed. Aid Wildl. Rest., Proj. W-17-6, Jobs 11, 22. 54p.). However, the number of lesser Canada geese counted during mid-winter inventories in California has never exceeded 18,000 geese, and has averaged 11,000 birds since 1952 (U.S. Fish Wildlife Service, unpublished data).

The growing numbers of non-dusky Canada geese using the Willamette Valley and Sauvie Island have created problems of determining the post-season population of dusky Canada geese. Concurrent with efforts to determine subspecies composition from field counts (R. L. Jarvis and R. S. Rodgers, unpubl. reps. to Dusky Canada Goose Subcommittee), efforts were made on the Copper River Delta nesting grounds to determine the size of the breeding population. Although the technique described by Timm (1978, Rep. Surv. Inven. Act.--Waterfowl, Fed. Aid Wildl. Rest., Proj. W-17-10, Job 10. 27p.) appeared usable, the air to ground visibility index for geese was unknown. The results of these aerial counts indicated that as the number of geese present increased, the proportion of geese seen from the air decreased.

If Canada geese in western Oregon were managed as a total population with little regard for individual subspecies, the dusky goose population would decrease substantially. This decrease would occur because liberalized seasons, designed to contain the increasing total population, would have a greater impact on dusky Canada geese due to their higher vulnerability to the gun. A decline of dusky geese infers that a decline in recreation would also occur because fewer geese would be harvested per unit effort if duskys comprised a small proportion of the total goose population.

The dynamic situation which has developed in western Oregon since 1973 requires the attention and skill of goose managers. Questions which should be answered soon include: 1) should dusky geese be maintained at the present population level; 2) how many Canada geese can the wintering area support; and 3) how can the population level of other subspecies of geese be managed, without adversely impacting dusky goose numbers?

A better opportunity can seldom be found for in-depth research of Canada goose population dynamics. The limited size of the Copper River Delta nesting grounds where over 150 nests/km^2 can sometimes be found, and a restricted wintering area create a "test tube" situation equalled only by that of *B. c. leucopareia*.

Since 1973, 1,879 known-age geese have been neck collared and a large number of these birds are available for study. These geese, plus additional unknown-age adults, are being studied to determine the relationships between spring weather and annual production of young. The percent young in the population is predictable ($r=0.89$) using an index of spring weather (Bromley 1976). However, a better understanding of the contribution of young by adult age classes in given years, incorporated with a weather index, would refine the predictability of percent young in the fall flight.

A better understanding of year-class productivity in Arctic and sub-Arctic nesting geese is still a major hurdle to our knowledge of goose populations, and we feel that this area of goose ecology deserves further attention. Also, the use of individually marked geese to study movements and other habits on the wintering grounds would prove beneficial by helping to discover new population management options.

ACKNOWLEDGMENTS

Present day cooperative management of the dusky Canada goose was made possible through the unrelenting efforts of H.A. Hansen and the late H.M. Wight. To them we extend our sincere appreciation.

R.A. Sellers reviewed an earlier draft of this paper and made useful suggestions for improvement. J. Annear and F. Newton provided unpublished data and information. D. McLean provided typing skills. The efforts of R.L. Jarvis and J.C. Bartonek must be recognized and we are grateful to them for sponsoring this timely and important symposium.

LITERATURE CITED

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

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

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

Clark, S.L. and R.L. Jarvis. 1978. Effects of winter grazing by geese on yield of ryegrass seed. Wildl. Soc. Bull. 6(2):84-87.

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

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

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

Hansen, H.A. 1962. Canada geese of coastal Alaska. Trans. N. Amer. Wildl. Nat. Resour. Conf. 27:301-320.

Hansen, H.A. 1968. Pacific Flyway Canada goose management - Federal and State cooperation. Pages 47-49 In R.L. Hine and C. Schoenfelf, eds. Canada goose management: current continental problems and program, Dembar Educ. Res. Serv., Madison, Wisconsin. 47-49 p.

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

King, J.G. and C.J. Lensink. 1971. An evaluation of Alaskan habitat for migratory birds. U.S. Dept. Int., Bur. Sport Fish Wildl. Washington, D.C. Unpubl. admin. rep. 72 p.

Potyondy, J.P., M.P. Meyer and A.C. Mase, Jr. 1975. Hydrologic response of the Copper River Delta-Controller Bay Area, Alaska to land emergence and uplift. U.S.D.A. Contract 08-DNN-74. Univ. Minnesota, St. Paul. 81 p.

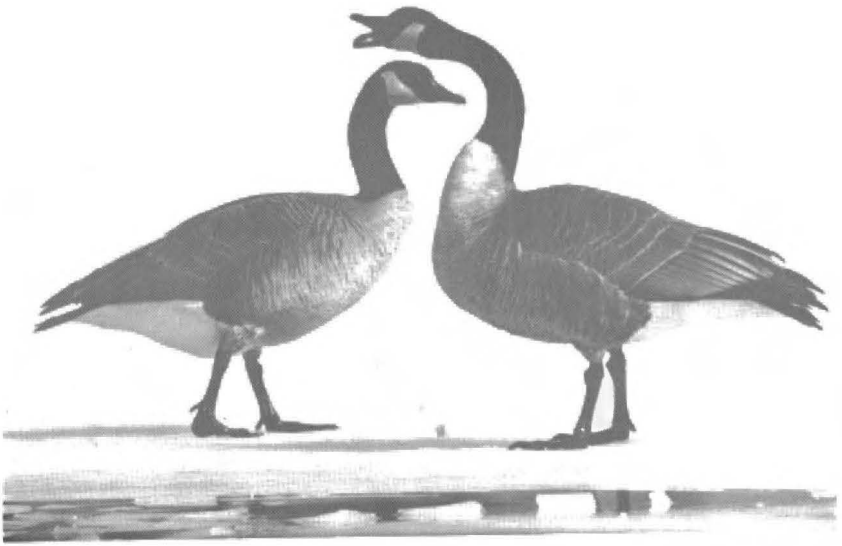
Reimnitz, E. 1972. Effects in the Copper River Delta. In The great Alaska earthquake of 1964: oceanography and coastal engineering. Nat. Acad. Sci. Pub. 1605. 13 p.

Shepherd, P.E.K. 1965. A preliminary evaluation of earthquake damage to waterfowl habitat in Southcentral Alaska. Ann. Conf. West. Assoc. State Game and Fish Comm. 9 p.

Simpson, G.S. and R.L. Jarvis. 1979. Comparative ecology of several subspecies of Canada geese during winter in western Oregon. In R.L. Jarvis and J.C. Bartonek, eds. Management and biology of Pacific Flyway geese. In press.

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. 9 p.

MANAGEMENT AND BIOLOGY OF PACIFIC FLYWAY GEESE



Edited by
ROBERT L. JARVIS and JAMES C. BARTONEK