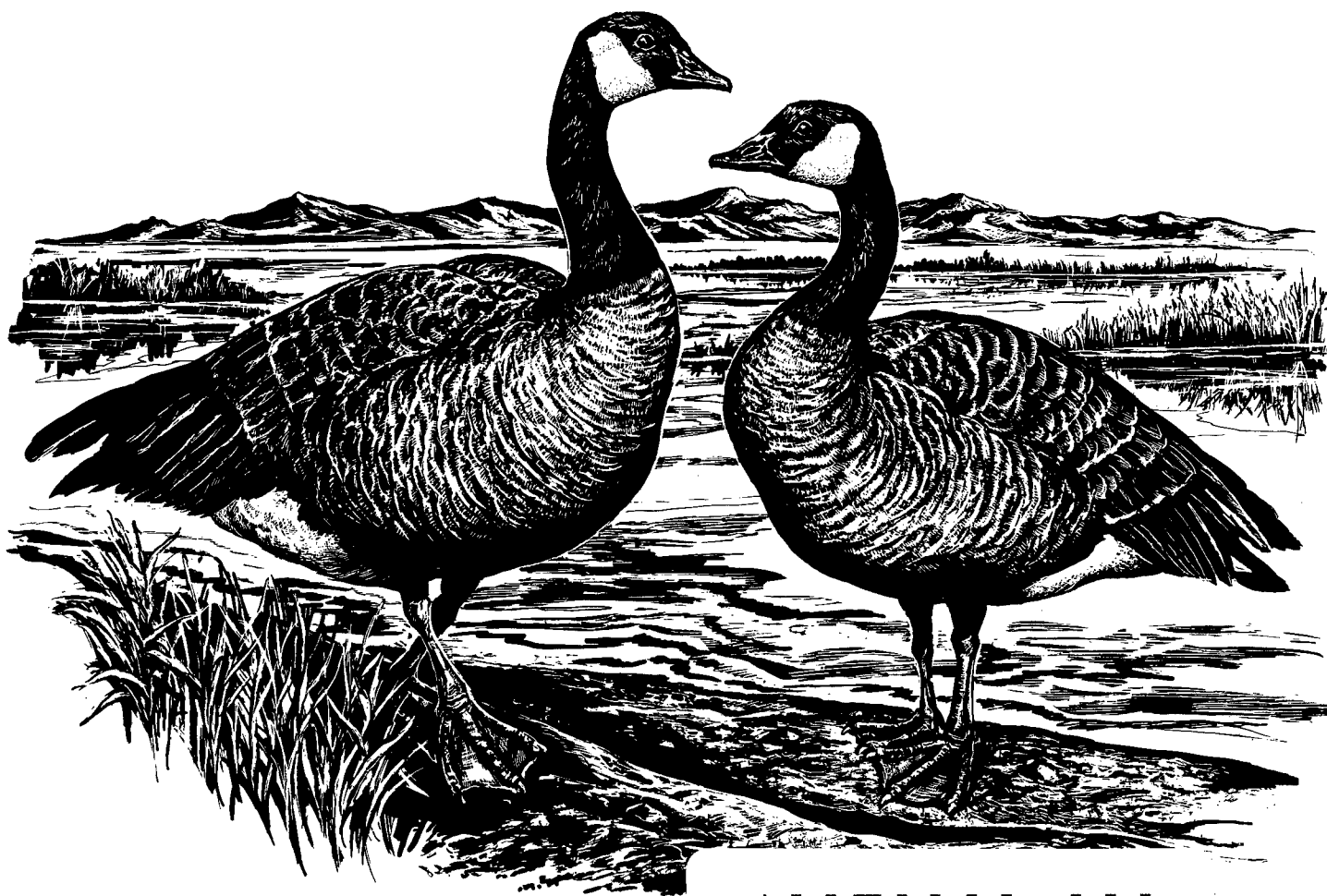


Dusky Canada Goose: An Annotated Bibliography



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Dusky Canada Goose: An Annotated Bibliography

By Bruce H. Campbell
John E. Cornely

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Dusky Canada Goose: An Annotated Bibliography

by

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Abstract. This bibliography contains 151 references pertaining to the dusky Canada goose (*Branta canadensis occidentalis*). References are through early 1991 and include published material as well as important unpublished agency and administrative reports. Entries are listed alphabetically by author and summarized by subject.

Key words: Alaska, banding, British Columbia, dusky Canada goose, genetics, harvest, hunting, management, migration, mortality, nesting, Oregon, Pacific coast, Pacific Flyway, predation, production, transplants, Washington, wintering.

This bibliography was produced to aid those working with the dusky Canada goose (*Branta canadensis occidentalis*). We searched both the published literature and unpublished agency and administrative reports. Unpublished documents, which are generally available from agencies or authors, were included because they contain much information important to the management of the subspecies. General ornithological texts, checklists, and reference books were not included unless we believed information presented in them was significantly pertinent to the dusky Canada goose. For example,

checklists that define seasonal range, migration routes, or pertain to taxonomy of the dusky Canada goose were included, whereas major reference books that present a standard summarization of natural history and range were omitted. Popular magazine accounts were not included. We have cited several papers presented at the International Canada Goose Symposium in April 1991, because of their contribution to our knowledge of dusky Canada geese. These papers will be published in the transactions of the symposium.

References were located and verified to determine their authenticity and availability. Annota-

tions came from the original author's abstract, either verbatim or a condensation, or from one of us. A subject index follows the bibliography.

The taxonomic status of the dusky Canada goose has been the subject of considerable discussion and confusion. As a result, a careful examination of the history of taxonomy and usage of scientific and common names of Canada geese in western North America is a necessary introduction to this bibliography.

In 1857, a Canada goose was collected at Port Townsend, Washington Territory (now Washington State), that Baird (1858) subsequently described as *Bernicla leucopareia*. Baird noted, however, that the specimen was larger and darker than *B. leucopareia* from the Aleutian Islands. He suggested that if the Port Townsend bird proved to be a different species it could be appropriately called *B. occidentalis*. This specimen is the type specimen for the dusky Canada goose and is in the collection at the U.S. National Museum of Natural History (U.S. Nat. Mus. No. 5994).

Baird et al. (1884) considered *B. occidentalis* a separate species that ranged from Sitka, Alaska, south to California. Unfortunately, they used two different common names (the western goose and larger white-cheeked goose) in reference to *B. occidentalis*. Based on the type specimen, their early descriptions emphasized the presence of a white collar on the neck and a black line on the throat separating the white cheek patches as being distinguishing characteristics. Grinnell (1910) and Swarth (1911) pointed out that geese from southeastern Alaska usually did not exhibit these characteristics.

Swarth (1911) concluded that Canada geese were one species (*Branta canadensis*) with four subspecies (*canadensis*, *occidentalis*, *hutchinsii*, and *minima*). He further concluded that *B. c. occidentalis* did not occur in California at any time of the year, but rather, is a well-defined subspecies occupying the northwest coast region, and its distinguishing characteristics are extremely dark coloration, smaller size than *B. c. canadensis*, and a proportionally longer tarsus. Brooks (1914), in response to Swarth's study, reported that Canada geese breeding in coastal British Columbia were as large as *canadensis* and as dark as *occidentalis*. Brooks (1914, 1926) proposed that there were three species of Canada geese (*canadensis*, *hutchinsii*,

minima) and that *occidentalis* was a subspecies of *canadensis*. Figgins (1920) criticized Swarth's study and held that *occidentalis* should not be considered even a subspecies. Swarth (1920) and Brooks (1926) rebutted Figgins' arguments.

Taverner (1931) listed three species of Canada geese (*canadensis*, *minima*, and *hutchinsii*) and included three subspecies under *B. canadensis* (*canadensis*, *occidentalis*, and *leucopareia*). Taverner used the common name western Canada goose in reference to *occidentalis* and reported these geese as breeding on the Queen Charlotte Islands, British Columbia, and exhibiting little migrational movement. The common name western Canada goose (also called Great Basin Canada goose) is currently used in reference to *B. c. moffitti*. Jewett (1932) reported, based on specimens from the Oregon coast and the Willamette Valley, Oregon, that *B. c. occidentalis* wanders south to Oregon in late fall. Moffitt (1937) concurred with Swarth (1911) that most previous reports of *occidentalis* in California were in error, but reported that *occidentalis* was a regular winter visitor to the northwestern coast of California. Moffitt (1937, 1939) maintained the use of the common name white-cheeked goose for *occidentalis*.

Aldrich (1946) used white-cheeked goose to refer to all Canada geese and called *B. c. occidentalis* the Pacific Canada goose. Hellmayr and Conover (1948) called *occidentalis* a subspecies of *Branta leucopareia* and gave it the common name West Coast goose.

Delacour (1951) named a new subspecies, *Branta canadensis fulva*. He included in *fulva* the large, dark geese that nest from Vancouver Island, British Columbia, north to Glacier Bay, Alaska. Also he reported that the breeding range of *B. c. occidentalis* was around Prince William Sound, Alaska, and perhaps farther north and south. Therefore, he split *occidentalis* into *occidentalis* and *fulva*. Dickinson (1953) disputed the validity of *fulva* and concurred with Hellmayr and Conover (1948), who concluded that variation in size of Canada geese along the Pacific Coast formed a cline.

The common name dusky Canada goose was first used by Delacour (1954) to refer to *B. c. occidentalis*. We have followed Delacour's classification in our work with Canada geese in Alaska and the Pacific Northwest, but the debate continues. Palmer

(1976), Olgilvie (1978), and Owen (1980) prefer to leave dusky Canada geese and Vancouver Canada geese (*fulva*) in the subspecies *occidentalis*. Lebeda and Ratti (1983) maintain that *fulva* is a valid subspecies. Genetic studies that may help clarify the classification of Canada geese are currently underway.

Regardless of taxonomic status, there is obviously a discrete population of Canada geese breeding on the Copper River Delta, Alaska. To ensure maximum diversity of the waterfowl resource, this

population should be given special consideration when management decisions affecting Pacific Flyway Canada geese are made.

Acknowledgments

We thank J. Cox, U.S. Fish and Wildlife Service, for reviewing this bibliography and S. West for typing and revising the manuscript.

Bibliography

1. ALASKA DEPARTMENT OF HIGHWAYS. 1973. Copper River Highway: Final Environmental Impact Study. Alaska Department of Highways, Juneau. 480 pp.
Summarizes the natural history of the dusky Canada goose and identifies potential effects of highway extension on the population.
2. ALDRICH, J. W. 1946. Speciation in the white-cheeked geese. *Wilson Bulletin* 58:94-103.
Supports splitting Canada geese into two species, *Branta canadensis* and *B. hutchinsii*. Proposes two new subspecies, *B. h. asiatic* or Asiatic cackling goose for birds inhabiting the Bering Island, and *B. c. moffitti* or basin Canada goose for birds inhabiting the Great Plains and Great Basin. Agrees with others that *B. c. occidentalis* included all Canada geese along British Columbia coast, Vancouver Island (B.C.), and southeastern Alaska.
3. BAILEY, A. M. 1927. Notes on the birds of southeastern Alaska. *Auk* 44:1-23, 184-205, 351-367.
Describes observations of geese in 1919. States that a large goose designated as *Branta canadensis occidentalis* is a year-round resident of southeastern Alaska.
4. BAIRD, S. F. 1858. Birds. Pages 765-766 in Reports of explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean. A. O. T. Nicholson, Washington, D.C. Vol. 9.
Contains the original description of the dusky Canada goose from a specimen collected at Port Townsend, Washington Territory, in 1857. The specimen is placed under *Bernicla leucopareia*, but Baird notes "that the possibilities are very great that the present species is really distinct from *leucopareia*." Suggests that if the specimen were a different species it would be appropriate to call it *B. occidentalis*.
5. BAIRD, S. F., T. M. BREWER, AND R. RIDGEWAY. 1884. The waterbirds of North America. Vol. 1., *Memoirs of the Museum of Comparative Zoology of Harvard College* 12:1-537.
Provides information about the type specimen of *Branta canadensis occidentalis* collected in 1857 at Port Townsend, Washington Territory, and three additional specimens, collected on Puget Sound, Washington; Sitka, Alaska, in May 1866; and at San Francisco, California, in April 1861.
6. BAKER, A. J. 1991. Identification of Canada goose stocks using analysis of mitochondrial DNA. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.
By using a set of 21 restriction enzymes, subspecies of Canada geese, including dusky Canada geese, were distinguished by their composite mitochondrial DNA genotypes.
7. BARTONEK, J. C., J. G. KING, AND H. K. NELSON. 1971. Problems confronting migratory birds in Alaska. *Transactions of the North American Wildlife and Natural Resources Conference* 36:345-361.
Identifies petroleum development, proposed river basin projects, and coal field development as potential problems confronting the dusky Canada goose.
8. 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, University of Alaska, Fairbanks. 81 pp.
Describes nesting and habitat studies of dusky Canada geese conducted in 1974 and 1975 on the Copper River Delta, Alaska. Relates some of the effects of the 1964 earthquake on vegetation and habitat, and subsequently on nesting, reproduction, and production. Discusses reproduction success as a result of spring weather conditions, age of nesting adults in relation to clutch size, and nest predation. Includes discussion of the implications of present and future trends in plant succession.
9. BROMLEY, R. G. H. 1985. The energetics of migration and reproduction of dusky Canada geese (*Branta canadensis occidentalis*). Ph.D.

dissertation, Oregon State University, Corvallis. 116 pp.

Adult female dusky Canada geese were studied on the Copper River Delta, Alaska, and in the Willamette Valley, Oregon, during April through July, 1977 to 1979. Tissue composition analysis was performed on 162 geese to determine the chronology of use of protein and energy reserves in relation to migration, prelaying, egg laying, and incubation periods, and the role of food items in meeting energy requirements during these four periods.

Endogenous lipids were used during migration, egg laying, and incubation. Endogenous protein was important during egg laying and incubation. Food supplied about half of the energy requirements calculated for the migration period, all needs during prelaying, over three-fourths during egg laying, and about one-third of energy requirements during incubation. Food was most important for supplementing high protein needs of laying geese and both protein and energy needs of geese during the last third of the incubation period when endogenous reserves were depleted.

10. BROOKS, A. 1914. The races of *Branta canadensis*. Condor 16:123-124.

Criticizes the breeding range of *Branta canadensis occidentalis* as presented in the third edition (1910) A. O. U. Check-list as being impossible. Comments favorably on Swarth's (1913) study of Canada geese from the San Joaquin Valley, California.

11. BROOKS, A. 1917. Birds of the Chilliwach District, B.C. Auk 34:28-50.

Refers to the dark "honkers" that are common in the Chilliwach Valley, B.C., during winter and early spring as the "breeding bird of the coast strip to the northward."

12. BROOKS, A. 1923. Notes on the birds of Porcher Island, B.C. Auk 40:217-224.

Reports Canada geese of the subspecies *Branta canadensis occidentalis* residing on Porcher Island, B.C.

13. BROOKS, A. 1926. Notes on the geese of the *Branta canadensis* group. Ibis 12:339-346.

Supports Swarth's (1913) contention that *occidentalis* is a subspecies of *Branta canadensis*, but contrary to Swarth, contended that *hutchinsii* and *minima* were species of *Branta* rather than subspecies of *B. canadensis*.

14. BUTLER, W. I., AND W. D. ELDRIDGE. 1988. Development of an aerial breeding pair survey for geese nesting in the Copper River Delta. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, Alaska. 31 pp.

Reports methods and results of a spring survey initiated on the breeding grounds in 1986. Between 1986 and 1987 breeding pairs and total goose indices both declined 11%. Highest densities of geese were on offshore islands. Visibility ratio between helicopter and fixed-wing observations for pairs and singles was 1:42. Presents recommendations to improve the survey.

15. BUTLER, W. I., AND W. D. ELDRIDGE. 1989. Development of an aerial breeding pair survey for geese nesting in the Copper River Delta. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, Alaska. 23 pp.

A 1987 spring survey showed a 7% increase in the breeding pair index while the total goose index decreased a fraction of a percent. Presents relative abundance maps of geese on the Delta.

16. BUTLER, W. I., AND W. D. ELDRIDGE. 1991. Development of an aerial breeding pair survey for dusky Canada geese (*Branta canadensis occidentalis*) on the Copper River Delta, Alaska. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, Alaska. 30 pp.

The 1990 breeding pair index decreased 5% and the total goose index declined 27%. The combined helicopter to fixed-wing visibility ratio for 1987-89 was 1:33. Compares aerial survey data to other surveys and presents spring goose distribution maps.

17. CAMPBELL, B. H. 1984. Status of the dusky Canada goose on the Copper River Delta. Pages

33-37 in Proceedings of the Tenth Copper River Delta Conference. U.S. Forest Service, Cordova, Alaska.

Summarizes changes on the nesting grounds between 1974-75 and 1982. Shrub cover had increased dramatically by 1982, and more nests were found in meadows and tall shrub habitats. Nest densities had declined up to 60%, and nest success was 48% in 1982 as compared to an average 76% in the 1970's. Predation was the major cause of nest failure. Includes recommendations for management on wintering grounds.

18. CAMPBELL, B. H. 1984. Annual report of survey-inventory activities, Part V. Waterfowl. Vol. XIV. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Progress Report Project W-22-2, Job 11.0, Juneau, 29 pp.

Summarizes information collected on the nesting grounds in 1983. Nest success was 52%, and mean clutch size was 5.5 eggs. Predation was the primary cause of nest failure, with about two-thirds of the nest destruction attributed to mammalian predators. Estimates the portion of the molting population composed of young birds at 15-18%, and predicts a fall flight of 19,300 geese.

19. CAMPBELL, B. H. 1988. Habitat availability, utilization, and nesting success of dusky Canada geese on the Copper River Delta, Alaska. Unpublished report. Alaska Department of Fish and Game, Anchorage. 45 pp.

See No. 20.

20. CAMPBELL, B. H. 1990. Factors affecting the nesting success of dusky Canada geese, *Branta canadensis occidentalis*, on the Copper River Delta, Alaska. Canadian Field-Naturalist 104:567-574.

Habitat availability, use, and nest fate were sampled between 1982 and 1986 to determine how changes in habitat have affected the nesting ecology of the dusky Canada goose. Geese have adjusted to the invasion of shrub communities, but nest predation has increased. Predation, primarily by brown bears, canids, and

predaceous sea birds, was related to spring phenology, but the portion of nests destroyed by the major predators was not. No association between habitat type and level of nest destruction or predation preference was observed.

21. CAMPBELL, B. H. 1990. Waterfowl program annual progress report. Unpublished report. Alaska Department of Fish and Game, Anchorage. 41 pp.

Summarizes information collected on the nesting grounds in 1990. Nest success was 44.3%, and average clutch size was 5.3 eggs. Most nest losses were to avian predators. Production was estimated at 23.5%. Seven hundred twelve geese were banded. Four hundred eighty-seven were also collared and marked with plastic tarsus bands. Three hundred thirty-four geese were observed on Middleton Island, of which 241 (72.2%) were goslings.

22. CAMPBELL, B. H. 1991. Longevity records for the dusky Canada goose (*Branta canadensis occidentalis*). Northwestern Naturalist 72:34-35.

Extends longevity record for the dusky Canada goose to >19 years.

23. CAMPBELL, B. H. 1991. Activities of brown bears on the Copper River Delta, Alaska and their impacts on nesting Canada geese. Northwestern Naturalist 72:92-99.

Between 1982 and 1987 over half of the dusky Canada goose nests destroyed by predators were destroyed by brown bears. Radiotelemetry showed that from 1984 to 1987 immature bears and females with young were active on the nesting grounds when geese were nesting. Bears generally moved into the area about the same time geese began nesting and remained until mid- to late summer, when they moved to inland salmon spawning streams.

24. CAMPBELL, B. H., AND H. J. GRIESE. 1987. Management options for dusky Canada geese and their predators on the Copper River Delta, Alaska. Unpublished report. Alaska Department of Fish and Game, Anchorage. 91 pp.

Discusses ecology of the dusky Canada goose and identifies and recommends several management options for the goose, nesting grounds habitat, and predators that would increase goose production.

25. CAMPBELL, B. H., AND T. C. ROTHE. 1985. Annual report of survey-inventory activities. Part XIII. Waterfowl. Vol. XV. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-22-3, Job 11.0, Juneau. 31 pp.

Summarizes information collected on the nesting grounds in 1984. Nest success was 75.8% and average clutch size was 5.6 eggs. Most nest losses were to mammalian predators. Production was 20%. In support of research on the wintering grounds, 496 geese were collared. A 3-year study of brown bears as predators on goose nests was initiated.

26. CAMPBELL, B. H., AND T. C. ROTHE. 1986. Annual report of survey-inventory activities. Part XVI. Waterfowl. Vol. XVI. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-22-4, Job 11.0, Juneau. 36 pp.

Summarizes information collected on the nesting grounds in 1985. Nest success was 8.9%, and average clutch size was 4.4 eggs. Nest predation, primarily by large mammalian predators, was the cause of low nest success. Production was 3.7%. One thousand nine hundred fifty-eight geese were collared.

First-year results of the brown bear study indicated that primarily immature bears and females with offspring were active on the nesting grounds. Most of the bears moved inland onto salmon spawning streams in July.

27. CAMPBELL, B. H., T. C. ROTHE, AND D. H. ROSENBERG. 1987. Annual report of survey-inventory activities. Part XIII. Waterfowl. Vol. XVII. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Progress Report Project W-22-5, Job 11.0, Juneau. 55 pp.

Summarizes information collected on the nesting grounds in 1986. Nest success was 11.4%,

and mean clutch size was 4.9 eggs. Nest predation, primarily by large mammalian predators, was the cause of most of the nest losses. Production was 10.7%. Four hundred seventy-seven geese were collared.

Results of the second year of the brown bear study further indicated that primarily immature bears and females with offspring were active on the nesting grounds. Bears moved inland onto salmon spawning streams in July and began entering winter dens in November and December. They emerged from dens in late April and moved onto the nesting grounds in mid-May.

28. CAMPBELL, B. H., AND D. E. TIMM. 1983. Annual report of survey-inventory activities. Part V. Waterfowl. Vol. XIII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-22-1, Job 11.0, Juneau. 45 pp.

Summarizes information collected on the nesting grounds in 1981 and 1982. Nest success was not measured in 1981 but was 49.3% in 1982. Clutches averaged 4.9 eggs in 1981 and 4.8 eggs in 1982. Nest predation was the primary cause of nest failure. Production was 17.9% in 1981 and 23.7% in 1982.

29. CAMPBELL, B. H., T. C. ROTHE, AND D. H. ROSENBERG. 1988. Annual report of survey-inventory activities. Part XIII. Waterfowl. Vol. XVIII. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Progress Report Project W-22-6, Job 11.0, Juneau. 75 pp.

Summarizes information collected on the nesting grounds in 1987. Nest success was 23.7%, and average clutch size was 5.4 eggs. Nest predation was the primary cause of nest losses. Production was 9.5%. Five hundred forty-four geese were collared. One hundred six geese were transplanted to Middleton Island in the Gulf of Alaska in an attempt to establish a breeding population.

Results of an experimental reduction in brown bear numbers on the nesting grounds indicated that nest predation is compensatory. In the absence of brown bears, coyote, and avian pre-

dation increased and nest success remained poor.

30. CAMPBELL, B. H., AND T. C. ROTHE. 1989. Annual report of survey-inventory activities. Part XIII. Waterfowl. Vol. XIX. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Progress Report Project W-23-1, Study 11.0, Juneau. 42 pp.

Summarizes information collected on the nesting grounds in 1988. Nest success was 17.3%, and average clutch size was 5.5 eggs. Predation was the primary cause of nest failure. Production was estimated at 22.5%. Eight hundred one geese were banded, and 506 were also collared. Eighty-seven geese were transplanted to Middleton Island.

31. CAMPBELL, B. H., AND T. C. ROTHE. 1990. Annual report of survey-inventory activities. Part XIII. Waterfowl. Vol. XX. Alaska Department of Fish and Game, Federal Aid to Wildlife Restoration Progress Report Project W-23-2, Study 11.0, Juneau. 41 pp.

Summarizes information collected on the nesting grounds in 1989. Nest success was 4.3%, and average clutch size was 5.3 eggs. Predation was the primary cause of nest failure. Production was estimated at 3.7%. One thousand eighty-seven geese were banded, and 492 were also collared. A survey of Middleton Island produced little evidence of transplanted geese. However, production for geese naturally pioneering the island was an estimated 56%. Bald eagles and glaucous-winged gulls present a potentially serious predation problem on the island.

32. CAMPBELL, B. H., AND E. F. BECKER. 1991. Neck collar retention in dusky Canada geese. *Journal of Field Ornithology* 62:521-527.

Collar retention rates for adult geese, obtained from examination of recaptured birds, varied between sexes. Females retained collars at an average annual rate of 0.875, whereas male retention rates declined over time and were influenced by age at collaring and the year collared. Concludes that collar losses were sub-

stantial and should be considered in population modeling.

33. CHAPMAN, J. A. 1967. Population characteristics, hunter kill, and productivity of dusky Canada geese. M.S. thesis, Oregon State University, Corvallis. 82 pp.

Between 1964 and 1967 over 50% of the dusky Canada goose harvest in the Willamette Valley, Oregon, occurred in the vicinity of Corvallis. Immature geese made up a disproportionately high percent of this harvest. Peak harvest of immature geese occurred early in the season, whereas peak harvest of adults occurred late in the season. Although varying annually for immatures, more adult males than females were consistently harvested. The Oregon pre-season dusky Canada goose population during the period of this study was 18,000-23,000 geese. Discusses population trends, possible influence of Willamette Valley refuges, and harvest management strategies.

34. CHAPMAN, J. A. 1970. Weights and measurements of dusky Canada geese wintering in Oregon. *Murrelet* 51:34-37.

Summarizes weights and measurements of 1,034 dusky Canada geese wintering in the Willamette Valley of Oregon during the 1965-66 and 1966-67 waterfowl seasons. All sex and age classes gained significant weight through early January. Exposed culmen length averaged 45.5 mm and 44.2 mm for adult males and females, respectively. Tarsus length averaged 93.3 mm and 85.9 mm for adult males and females, respectively. Summarizes average weights, middle toe and claw lengths, tail lengths, and flattened wing lengths. Presents similar measurements for immature geese.

35. CHAPMAN, J. A., C. J. HENNY, AND H. M. WIGHT. 1969. The status, population dynamics and harvest of the dusky Canada goose. *Wildlife Monographs* 18:1-48.

About two thirds of the annual dusky Canada goose harvest occurred on the wintering grounds in Oregon between 1952 and 1965.

- Immature geese were more than twice as vulnerable to hunting as adults and were considerably more vulnerable early in the season. Immature geese had an average first-year mortality rate of 57% between 1952 and 1965, whereas the adult mortality rate was 33–35%. An estimated 50–66% of the 2-year-old females must nest to maintain a stable population at this mortality rate. It was concluded that the population should be managed for a fall flight of 34,750–50,000 birds.
36. CHESTER, D., AND K. GIEZENTANNER. 1990. Dusky Canada goose monitoring report, 1990, Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Cordova, Alaska. 15 pp.
- Of 327 islands sampled for goose use in 1990, 68% were available for use. Thirty-nine nesting attempts were made with 28 being successful. Eight nests were destroyed by predators, one was abandoned, one was flooded, and one was unsuccessful for unknown reasons. Twelve nesting attempts were on floating fiberglass islands, 24 on sandbag islands, 2 on floating innertubes, and 1 on a platform, and none on dishes. Based on availability, geese preferred floating fiberglass islands with 60–79% overhead cover.
37. CLARK, S. L. 1976. Effects of winter grazing by geese on ryegrass seed yield. M.S. thesis, Oregon State University, Corvallis. 18 pp.
- The effects of grazing by Canada geese (*Branta canadensis*) on ryegrass (*Lolium* spp.) seed yield were studied from October 1974 to July 1975 in the Willamette Valley, Oregon. Enclosures were used to compare grazed and ungrazed plots, and an index to grazing intensity was obtained from the numbers of geese on each study field. Grazing by geese significantly increased yield in two study fields; there were no significant effects on yield in the remaining eight fields grazed by geese.
38. CLARK, S. L., AND R. L. JARVIS. 1978. Effects of winter grazing by geese on yield of ryegrass seed. *Wildlife Society Bulletin* 6:84–87.
- See No. 37.
39. CLINE, D., AND C. LENHART. 1985. The dusky Canada goose. Pages 433–436 in R. L. Di Silvestro, editor. *Audubon Wildlife Report 1985*. National Audubon Society, N. Y.
- Describes the dusky Canada goose, its significance, history, current population trend, management, and prognosis. Recommends closing goose season in portions of western Oregon, southwestern Washington, and the Copper River Delta, Alaska, and banning egg and gosling collecting.
40. COOKE, W. W. 1906. Distribution and migration of North American ducks, geese, and swans. *U.S. Biological Survey Bulletin* 26:1–90.
- Early account of the subspecies *Branta canadensis occidentalis* states that this form is confined to the Pacific slope and breeds from the Klamath lakes in southern Oregon and northern California and Lake Tahoe in California, north to Sitka and Mitkof Island, Alaska. It winters from Washington south to San Diego County, California. It appears south of its breeding range in early November and starts north so early in the spring that after the middle of March few are left in the southern part of the winter range.
41. CORNELLY, J. E. 1985. Status of Canada geese wintering in western Oregon and southwestern Washington. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Ore. 6 pp.
- Reports that nesting success for dusky Canada geese was 75.8%, the highest since 1977, but that recruitment was estimated at only 18.3% young in the population. The total number of geese wintering in the area during 1984–85 was 65,000, down 5.7% from the previous year. About 12% of this population was dusky Canada geese, but over 46% of the harvest was dusky Canada geese. Describes measures to reduce the harvest of dusky Canada geese.
42. CORNELLY, J. E., B. H. CAMPBELL, AND R. L. JARVIS. 1985. Productivity, mortality, and population status of dusky Canada geese. *Transactions of the North American Wildlife and Natural Resources Conference* 50:540–548.
- Reviews the history of the dusky Canada goose and summarizes recent (1979–84) population

changes and management. Includes discussion of nesting success, nest predation and nesting habitat on the Copper River Delta since the area was uplifted in 1964. Also discusses complications in management of the dusky Canada goose on the winter grounds, including the shrinking proportion of dusky Canada geese in the Canada goose population and high percentage of adults in the harvest.

Discusses the management and research priorities for 1985 including establishing additional breeding populations in areas other than the Copper River Delta.

43. CORNELLY, J. E., AND M. R. HILLS. 1986. Status of Canada geese wintering in western Oregon and southwestern Washington. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 5 pp.

The total number of geese wintering in western Oregon and southwestern Washington during 1985-86 was 72,500. About 12,190 of these were dusky Canada geese. Severe harvest restrictions resulted in fewer dusky Canada geese being harvested, but age ratios in harvested dusky Canada geese were indicative of continued poor production. Observations of marked geese suggest dusky Canada geese are much more sedentary than Taverner's Canada or cackling geese.

44. CORNELLY, J. E., AND R. L. JARVIS. 1984. Status of Canada geese wintering in western Oregon and southwestern Washington. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 7 pp.

Reports that the dusky Canada goose population is at the lowest level in many years. Subspecies composition derived from aerial photography was about 59,000 Taverner's Canada geese (*Branta canadensis taverneri*) and about 10,000 dusky Canada geese. The dusky Canada goose population declined 40.6%, and the Taverner's Canada goose population increased by 30.9% compared to 1983. Discusses the disproportionate ratio of the population composition to harvest composition.

45. CORNELLY, J. E., M. B. NAUGHTON, M. R. HILLS, AND K. M. RAFTERY. 1991. Distribution of wintering dusky and cackling Canada geese in western Oregon and western Washington, 1985-89. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.

Summarizes the dusky and cackling Canada goose distributions in Washington and Oregon based on observations during the winters of 1985-86 through 1988-89. Presents maps illustrating the results of these observations. Dusky Canada geese were observed regularly from Willapa Bay near the mouth of the Columbia River in southwestern Washington, east and south along the Columbia River to the mouth of the Willamette River, and south through the Willamette Valley to Eugene, Oregon. The distribution was clumped, delineating several core areas, most of which were associated with state waterfowl management areas or federal refuges. The distribution of cackling Canada geese largely coincided with the distribution of dusky Canada geese.

46. CROW, J. H. Circa 1966. Some effects of the March 27, 1964 earthquake on the ecology of the Copper River Delta, Alaska. Unpublished report. Alaska Department of Fish and Game, Fairbanks. 18 pp.

Summarizes some of the ecological work done on the Copper River Delta relating to the nesting habitat of dusky Canada geese during 1965 and 1966. Defines immediate post-earthquake composition of the mixed forb-grass community on levees used extensively by nesting geese. Species characteristic of the forb-grass community are migrating laterally, both down slough banks and into pond basins, since the earthquake. Predicts that an increase in area available for nesting will be transient, and an ultimate decrease in nesting habitat will occur.

47. CROW, J. H. 1968. Plant ecology of the Copper River Delta, Alaska. Ph.D. dissertation, Washington State University, Pullman. 120 pp.

Reports on a study of the Copper River Delta, Alaska, undertaken soon after the Good Friday earthquake, 27 March 1964.

Describes four major belts of vegetation characterized by the *Hedysarum-Deschampsia* community, the *Myrica-Poa* community, the *Salix-Festuca* community, and the *Alnus-* and *Picea*-dominated communities, the last two found in the highest vegetation belt. Describes communities associated with the *Hedysarum-Deschampsia* belt. Emphasis was placed on the *Hedysarum-Deschampsia* belt because of its importance to the dusky Canada goose (*Branta canadensis occidentalis*) as a nesting area.

Evidence gathered from nearby tidal flats strongly suggests that their potential for supporting *Hedysarum-Deschampsia* or better-drained communities is limited.

48. CROW, J. H. 1972. Earthquake-initiated changes in the nesting habitat of dusky Canada goose. Pages 130-136 in *The great Alaska earthquake of 1964: biology*. National Academy of Science Publication 1609.

The dusky Canada goose nests in a restricted area, part of the Copper River Delta occupied by a plant community characterized by *Hedysarum alpinum americanum* and *Deschampsia beringensis*. This vegetation flourishes in the mildly saline soil at the tops of channel banks, where it was inundated by diluted seawater during occasional storm tides before the earthquake. The pre-earthquake channel-bank vegetation and the interchannel areas are no longer reached by the tides because of uplift during the earthquake, and the soil is being desalinized. Drier conditions and the removal of salt permit invasion of the *Hedysarum-Deschampsia* belt by plants characteristic of other belts, hence the favored nesting habitat of the dusky Canada goose is deteriorating. Presumably, the *Hedysarum-Deschampsia* community will eventually reestablish itself at a lower level on the tidal flats, but the area available is expected to be much smaller than the area occupied at present. The dusky Canada goose will find progressively more restricted nesting grounds over the years, leading to a reduction in its numbers unless it can adapt to other kinds of vegetation.

49. CUMMING, R. A. 1932. Birds of the Vancouver district, British Columbia. *Murrelet* 13:4-5.

Lists the dusky Canada goose as a winter migrant in the Vancouver, British Columbia, area.

50. DAWSON, W. L. 1897. Nesting of the larger white-cheeked goose (*Branta canadensis occidentalis*) in Okanogan County, Wash. *Auk* 14:87-88.

Report of the subspecies *Branta canadensis occidentalis* nesting on the Columbia River in eastern Washington.

51. DAWSON, W. L. 1909. *The birds of Washington*. Occidental Publication Co., Seattle, Wash. 997 pp.

Reports that the white-cheeked goose (*Branta canadensis occidentalis*) is found only in the northwest coast district of Washington, and is not a common winter resident. The goose is "not strongly established and it may be only a question of time before its ultimate disappearance."

52. DELACOUR, J. 1951. Preliminary note on the taxonomy of Canada geese, *Branta canadensis*. *American Museum Novitates* 1537:1-10.

Recognized 12 subspecies of Canada geese, and considered the dusky Canada goose a separate subspecies from the Vancouver Canada goose.

53. DELACOUR, J. 1954. *The waterfowl of the world*. Vol. 1. Country Life Ltd., London. 281 pp.

Recognized the dusky Canada goose (*Branta canadensis occidentalis*) and Vancouver Canada goose (*B. c. fulva*) as separate subspecies of Canada geese and apparently was the first author to use dusky Canada goose as the common name for *B. c. occidentalis*. Listed range of dusky Canada goose as from Copper River Delta to eastern Alaska Peninsula including Cook Inlet.

54. DICKINSON, J. C., JR. 1953. Report on the McCabe collection of British Columbia birds. *Bulletin of the Museum of Comparative Zoology of Harvard College* 109:123-209.

Questions the validity of *Branta canadensis fulva* as a race separate from *B. c. occidentalis* based on the examination of 14 specimens from coastal British Columbia.

55. DIXON, J. 1908. Field notes from Alaska. *Condor* 10:139-143.

Reports that, in 1908, goslings were "everywhere" in the canoe pass area of Hinchinbrook Island, Prince William Sound.

56. DUNN, E. H., AND C. D. MACINNES. 1987. Geographic variation in clutch size and body size of Canada geese. *Journal of Field Ornithology* 58:355-371.

Information about dusky Canada geese is included as part of the analysis. Concludes that female body size and clutch size decreased with increasing latitude, but that body size was affected more than clutch size. Weather variables, however, accounted for as much variation in clutch and body size as did latitude, longitude, and altitude.

57. FIGGINS, J. D. 1920. The status of the subspecific races of *Branta canadensis*. *Auk* 37:94-102.

Criticizes Swarth (1911) and states that *Branta canadensis occidentalis* should not be considered a subspecies.

58. GABRIELSON, I. N., AND F. C. LINCOLN. 1959. *Birds of Alaska*. The Stackpole Co., Harrisburg, Pa. 922 pp.

Brief description of *Branta canadensis occidentalis* and its range. Reports that Gabrielson saw numerous geese, including pairs, on the Copper River Flats on 10 June 1940, and that he found a nest containing eight eggs. In the same area on 27 September 1941, he saw about 20 geese and reported that large flocks have been seen on Yakutat Bay in the spring.

59. GIEZENTANNER, K. 1987. 1986 progress report on the use of artificial nesting islands by dusky Canada geese, Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Cordova, Alaska. 10 pp.

Ten (8%) of 121 artificial nest structures were used by dusky Canada geese. Seven of the 10 nests were on sandbag islands, whereas 1 was on a fiberglass floating island and 2 on barrel islands. Three (43%) of the sand bag island nests were successful, as was one barrel island nest. No floating island nests were successful. Brown bears and avian predators seemed to be major predators on island nests. Discusses factors that may have influenced nesting success on artificial islands.

60. GIEZENTANNER, K. I. 1991. Artificial nest islands for dusky Canada goose nesting on the Copper River Delta, Alaska. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.

Over 600 artificial nesting islands of 6 types were installed in an attempt to provide safe, dry nesting habitat. Geese that nested on artificial islands had higher nest success than geese nesting in adjacent natural habitats, but only about 10% of the artificial islands were used. Floating fiberglass islands were used at a higher rate than the other types of islands. Floating fiberglass islands and sandbag islands required the least maintenance.

61. GIEZENTANNER, K. I., T. LEVKOVITZ, AND D. CHESTER. 1989. Dusky Canada goose monitoring report 1989, Copper River Delta Alaska. Unpublished report. U.S. Forest Service, Cordova, Alaska. 16 pp.

Reports that 266 (43%) of 620 artificial islands installed on the Copper River Delta for nesting sites for geese were sampled, and that 193 were usable (i.e., not flooded or damaged). Thirty nesting attempts were documented; 17 successful, 6 destroyed, 3 abandoned, and 4 with unknown fate.

62. GRINNELL, J. 1910. *Birds of the 1908 Alexander Alaska expedition*. University of California Publications in Zoology 5:361-428.

Reported a few geese at the head of Cordova Bay, at Graveyard Point on Montague Island, and on Chenaga Island. Small flocks were noted on Hinchinbrook Island, and many

pairs and some small flocks were seen on Hawkins Island. Grinnell reported that Joseph Dixon found a nest with six eggs on 18 June 1908, near Canoe Passage on Hawkins Island. The nest was at the head of a tidal slough at the edge of the forest near the base of a hemlock tree. The nest was lined with moss and down and would have hatched in 2-3 days.

63. GUIGUET, C. J. 1958. The birds of British Columbia. Vol. 6. Waterfowl. British Columbia Provincial Museum Handbook 15:1-84.

Reported the range of the western Canada goose (*Branta canadensis occidentalis*) as along the Pacific coast from Alaska to Washington. In the winter a few birds "straggle down the Washington and Oregon coasts, but this bird is largely resident along the British Columbia coast and islands." Suggested that birds were largely nonmigratory.

64. GULLION, G. W. 1951. Birds of the southern Willamette Valley, Oregon. Condor 53:129-149.

Reported at least two races of Canada geese wintering at Fern Ridge Reservoir in the late 1940's. From mid-October through late March about 500 light-breasted birds were present. In late November large dark-breasted geese moved into the area and by mid-January totaled 1,000.

65. HANSEN, H. A. 1960. Annual waterfowl report, Alaska—1960. Unpublished report. U.S. Bureau of Sport Fisheries and Wildlife, Juneau, Alaska. 28 pp.

Reports distribution and timing of band recoveries from dusky Canada geese banded on the Copper River Delta. Distribution was Copper River Delta, 6.7%; Vancouver, B.C., 10.8%; Puget Sound, 1.4%; mouth of Columbia River, 11.9%; Willamette Valley, 63.4%; and other 5.8%. Geese left the Copper River Delta by 15 October and the majority had arrived in the Willamette Valley by mid-November.

66. HANSEN, H. A. 1961. Loss of waterfowl production to tide floods. Journal of Wildlife Management 25:242-248.

Describes mechanics of tidal flooding and assessment of nest mortality due to flooding on the Copper River Delta. Annual tidal rhythms and heights are such that all nests are exposed to at least one high cycle of tides. Most goose nests are built on high ground, which comprises no more than 10-15% of the delta, to escape encroaching tides. Forty-seven (53%) of 89 nests sampled had been flooded at least once. One hundred ninety-four (87.4%) of another sample of 222 nests hatched at least 1 egg each with flooding being the primary cause of nest failure. Losses from flooding were because of lowered hatchability of eggs rather than total destruction of nests.

67. HANSEN, H. A. 1962. Canada geese of coastal Alaska. Transactions of the North American Wildlife and Natural Resources Conference 27:301-329.

Reports that dusky Canada geese and Vancouver Canada geese are different populations based on band recovery data. Describes breeding range for dusky Canada geese as extending along the coast of Alaska from Bering Glacier to Cook Inlet, with the greatest concentration on the Copper River Delta. Also describes the migration of dusky Canada geese from the nesting grounds in Alaska to the lower Columbia River and the Willamette Valley of Oregon.

Fall populations of dusky Canada geese between 1952 and 1962 ranged from 10,000 to 20,000 birds. Annual mortality of first-year juveniles averaged 57%, whereas mortality after the first year averaged 35%. Age structure of the harvest on the wintering grounds changed during the hunting season; 91% of the juvenile harvest occurred before 27 December and 52% of the adult harvest occurred after 27 December.

68. HANSEN, H. A. 1968. Pacific Flyway Canada goose management—federal and state cooperation. Pages 43-49 in R. L. Hine and C. Schoenfeld, editors. Canada goose management; current continental problems and programs. Dembar Educational Research Services, Inc., Madison, Wis.

Reports on seven subspecies of Canada geese that winter in the Pacific Flyway. Focuses on

three subspecies—the Aleutian Canada goose, the western Canada goose, and the dusky Canada goose—requiring special management measures. Describes the conditions the subspecies face and the management procedures initiated for each.

69. HANSEN, H. A., AND H. K. NELSON. 1964. Honkers large and small. Pages 109–124 in J. P. Linduska, editor. *Waterfowl tomorrow*. U.S. Fish and Wildlife Service, Washington, D.C.

Presents a brief description of the dusky Canada goose and its range.

70. HATLER, D. F. 1973. An analysis of use by waterfowl of the tide flats in southern Clayoquot Sound, British Columbia. Unpublished report. Canadian Wildlife Service, Ottawa. 134 pp.

Suggests that the dusky Canada goose is the most common goose in Clayoquot Sound during fall migration. Presents a history of waterfowl and human use of the sound. The number of geese using the sound has apparently declined because of human disturbance. Areas of use, activity patterns, and influence of various types of disturbance on migrating geese in Clayoquot Sound are presented. Recommendations for rectifying the problem and increasing goose use during fall migration are made.

71. HAVEL, L. H. 1984. Formation of feeding flocks during winter by dusky and Taverner's Canada geese in Oregon. M.S. thesis, Oregon State University, Corvallis. 81 pp.

Describes the behavioral and environmental variables influencing the formation of flocks of dusky Canada geese (*Branta canadensis occidentalis*) and of Taverner's Canada geese (*B. c. taverneri*) studied on Sauvie Island, Oregon, during winter (October–April) 1981–82. Contrasts the ratio of the subspecies (dusky and Taverner's Canada geese) in skeins and in feeding flocks.

Found that during waterfowl hunting season, skeins composed of at least 90% Taverner's Canada geese contained more geese, started approach and landing behaviors at higher elevations, circled more times before landing,

and took a longer time to land than skeins composed of at least 91% dusky Canada geese. Skeins of Taverner's Canada geese approached larger fields located farther from roost lakes than skeins of dusky Canada geese. Out of landing skeins composed of mixed subspecies, a dusky Canada goose was the first bird to land more frequently than expected and a Taverner's Canada goose was the last bird to land more frequently than expected. Taverner's Canada geese frequently use fields on privately owned land, whereas dusky Canada geese were more often associated with fields on a state wildlife management area.

Hypothesizes that the observed differences between dusky and Taverner's Canada geese contribute to differential hunting vulnerability of these subspecies and to the inhibition of pair formation between individuals of different subspecies where these subspecies winter sympatrically.

72. HAVEL, L. H., AND R. L. JARVIS. 1988. Formation of feeding flocks during winter by dusky and Taverner's Canada geese in Oregon. Pages 91–101 in M. W. Weller, editor. *Waterfowl in winter*. University of Minnesota Press, Minneapolis. 624 pp.

See No. 71.

73. HAWKINGS, J. S. 1982. Migration and habitat relationships of geese on the eastern Copper River Delta, Alaska. M.S. thesis, University of Alaska, Fairbanks. 113 pp.

Migration and staging of geese were studied on the eastern Copper River Delta, Alaska, from 1978 to 1979. Spring migration occurred from mid-April to mid-May, and fall migration from mid-August to at least mid-October. *Branta canadensis taverneri* and *B. c. occidentalis* were the most abundant taxa in both seasons. Saltmarsh was the most important spring and fall habitat. Freshwater meadows, which were saltmarsh before the 2.5 m uplift during the 1964 Alaska earthquake, are now characterized by tall vegetation, including shrubs, and were used intensively only by *B. c. occidentalis* during September. *Branta c.*

occidentalis ate many plants in fall, especially *Equisetum arvense*, *Triglochin palustris*, and *Carex lyngbyaei*. Foods were predominantly leaves in August and seeds and roots in September. Migration seemed correlated with fair weather and associated headwinds and crosswinds in spring, and with the most favorable southwest winds in fall.

74. HELLMAYR, C. E., AND B. CONOVER. 1948. Catalogue of birds of the Americas and the adjacent islands in the Field Museum of Natural History. Field Museum of Natural History Publications Zoological Series 8 (part 1[2]):1-434.

Lists specimens in the Field Museum and Conover collections both housed in the Field Museum. Specimens of the dusky Canada goose are listed from Alaska (Craig, 2), and British Columbia (Graham Island, 4; Queen Charlotte Islands, 8; Vancouver Island, 2; Swanson's Bay, 1). These specimens were placed under *Branta leucopareia occidentalis*.

75. HENNY, C. J. 1967. Population characteristics of the dusky Canada goose as determined from banding data. M.S. thesis, Oregon State University, Corvallis. 98 pp.

Gives the population characteristics of the dusky Canada goose based on banding data. Describes the migration route, wintering areas, and migration timing. Distribution of harvest between 1964 and 1967 was Oregon, 65%; British Columbia, 16%; Washington, 11%; and Alaska, 8%. Reported that an average 45.3% of the population was harvested annually between 1952 and 1965. Population mortality rates were increasing in 1965, with over 60% of the immature geese harvested annually. Estimated that over 50% of subadult females must nest and 85-90% of all nests must be successful to maintain population. Discusses the advantages and disadvantages of possible restrictive hunting regulations to stabilize population mortality.

76. HENNY, C. J. 1967. Estimating band-reporting rates from banding and crippling loss data. *Journal of Wildlife Management* 31:533-538.

Describes a new method for estimating band-reporting rates (proportion of bands recovered by hunters that are reported to the Bird Banding Laboratory). This method is dependent upon components obtained from banding data (direct recovery rate, annual mortality rate, and annual natural mortality rate) and crippling loss information. These data are to a large degree already available for waterfowl. The results obtained in my example, involving data from dusky Canada goose (*Branta canadensis occidentalis*), are in close agreement with band-reporting rates determined for other subspecies of geese in 1966 by Martinson and McCann, who used a mail questionnaire survey. The band-reporting rate for the subspecies studied has declined significantly from 49.1% for the period 1953-60 to 33.2% in 1962 and 1963.

77. JARVIS, R. L. 1978. The dusky Canada goose: an entrenched minority! Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 14 pp.

During the winter of 1977-78, 30% of the wintering goose population used Sauvie Island, 30% Ankeny National Wildlife Refuge, 20% Baskett Slough National Wildlife Refuge, and 20% Finley National Wildlife Refuge. At Finley National Wildlife Refuge and Baskett Slough National Wildlife Refuge dusky Canada geese predominated, but the majority of the geese at Sauvie Island and Ankeny National Wildlife Refuge were Taverner's Canada geese. Dusky Canada geese arrived earlier in the fall than Taverner's Canada geese. The best estimate of mid-winter goose numbers was 26,000 dusky Canada and 34,000 Taverner's Canada geese. The Taverner's Canada goose estimate was an increase of 42% from the winter of 1976-77. Reported that dusky Canada geese were from 2.5 to 5 times more likely to be harvested than Taverner's Canada geese.

78. JARVIS, R. L. 1980. Status of dusky and Taverner's Canada geese in the Willamette Valley. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 9 pp.

The mid-winter estimate for Canada geese in the Willamette Valley for 1980 was 67,500, of which 22,000 were dusky Canada geese and 45,500 were Taverner's Canada geese. Since 1976, the Taverner's Canada goose numbers have increased by an average rate of 25.2% per year, whereas dusky Canada geese have declined an average of 0.8%. Over that same period 0.85 immature dusky Canada geese were harvested on Willamette Valley refuges for each adult, but 1.05 immature Taverner's Canada geese were harvested for every adult. During the last 5 years harvest of geese has declined at Baskett Slough National Wildlife Refuge and increased at Finley National Wildlife Refuge. The proportion of Taverner's Canada geese in the harvest has increased, and the proportion of dusky Canada geese has decreased. However, the harvest rate of Taverner's Canada geese has not increased as much as the rate of increase of the Taverner's Canada goose population. Reported on a test of the use of aerial photography to estimate subspecies composition of wintering goose flocks.

79. JARVIS, R. L. 1982. Status of Canada geese wintering in western Oregon-southwestern Washington. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 9 pp.

The dusky Canada goose population declined 22.8% in the last year to an estimated 17,750 geese. At the same time Taverner's Canada geese increased to 56,700, 15.7% more than the year before. Total Canada geese peaked at 74,600 in February. The large number of geese counted in November (72,700) was unusual and probably reflected an early migration. The harvest rate on dusky Canada geese was apparently high; the harvest estimate was 9,250 or 34.3% of the estimated fall flight. Over the past 10 years, the harvest rate for dusky Canada geese averaged 25%.

80. JARVIS, R. L. 1989. Estimated mid-winter population of dusky Canada geese, 1988-89. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 4 pp.

The 1988-89 mid-winter population of dusky Canada geese was estimated at 11,800 birds or 20.1% of the estimated 58,600 wintering Canada geese in western Oregon and southwestern Washington. Whereas the number of dusky Canada geese apparently was similar to 1987-88, the overall number of geese wintering in the Willamette Valley was down by nearly 12,000 birds, which suggests that Taverner's Canada goose numbers may also be declining.

81. JARVIS, R. L., AND R. G. BROMLEY. 1991. Managing racially mixed flocks of Canada geese. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.

Uses the complex case history of Pacific Northwest Canada goose management to illustrate some of the hazards of managing for single populations and provides some suggestions for multi-population management. Seven different races of Canada geese winter in northwestern Oregon and southwestern Washington. Presently 75,000-90,000 Canada geese are winter residents in the area where 20 years ago the management goal was 20,000-25,000 geese. The constituent races have very different population trends; one has declined 50%, two are recovering from substantial declines, one has stabilized after a substantial increase, one is increasing rapidly, and the trends of the remaining two are unknown. The status of dusky Canada geese, because of their prominence in the evolution of goose conservation and because they winter only in this area, drives the management and research efforts. A comprehensive management plan is needed that deals with this mixed flock of Canada geese and the interactions between and among the various races that make up the flock.

82. JARVIS, R. L., AND J. CORNELLY. 1983. Status of Canada geese wintering in western Oregon-southwestern Washington: Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 7 pp.

The dusky Canada goose population was the lowest since before 1971 and continuing to decline. The total number of geese in the area peaked at about 62,000, a 17% decrease from 1981 to 1982. An estimated 17,000 dusky Canada geese and 45,000 Taverner's Canada geese were present during the mid-winter period; age ratios of both suggested poor production in 1982. Harvest for dusky Canada geese was about average as a proportion of the fall flight but exceeded production. Suggestions on how to increase hunting pressure on the Taverner's Canada goose population were made.

83. JARVIS, R. L., AND J. E. CORNELLY. 1988. Recent changes in wintering populations of Canada geese in western Oregon and southwestern Washington. Pages 517-528 in M. W. Weller, editor. *Waterfowl in winter*. University of Minnesota Press, Minneapolis.

Despite management priority, numbers of dusky Canada geese (*Branta canadensis occidentalis*) declined from 20,000 to 25,000 in the 1970's, to 10,000 in 1984. Beginning in the early 1970's Taverner's Canada geese (*B. c. taverneri*) increased from a few thousand to 55,000-60,000 in the mid-1980's and now compose 85% of the combined wintering flock of about 70,000 geese. Recruitment of dusky Canada geese declined from an average of 28% juveniles in the fall population before 1979 to about 19% since 1979. Recruitment of Taverner's Canada geese is unknown, but juveniles constituted a larger proportion of the harvest of Taverner's Canada geese. Managers face a difficult task restoring the number of dusky Canada geese to former levels because of low recruitment and high vulnerability to hunting. The large, thriving population of Taverner's Canada geese compounds the difficulties of protecting the small, unprosperous population of dusky Canada geese.

84. JARVIS, R. L., AND R. S. RODGERS. 1976. The dusky Canada goose—a new minority? Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 18 pp.

This report was the first of a series of annual reports on the status of dusky Canada geese on the wintering grounds. The conclusions were that the subspecies composition of Canada geese wintering in the Willamette Valley and lower Columbia River was changing, the proportion of Taverner's Canada geese was increasing, and dusky Canada geese were more vulnerable to hunting than Taverner's Canada geese. The proportion of adult dusky Canada geese harvested increased as the season progressed and was particularly large when the season extended into January. Further conclusions were that there was relatively little information available on Taverner's Canada geese and that improved methods of determining harvest statistics are desirable.

85. JARVIS, R. L., AND R. S. RODGERS. 1977. The dusky Canada goose—a new minority! Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 14 pp.

This is the second in a series of annual reports. Results of field observations indicated equal numbers of dusky Canada geese and Taverner's Canada geese at about 24,000 birds during 1976-77. This was 40% more Taverner's Canada geese than in 1975-76. The mid-winter population estimate for dusky Canada geese was 24,000. Dusky Canada goose harvest was about 5,000 birds. Suggested that the Taverner's Canada goose population may continue to increase to the point that, in 4 or 5 years, dusky Canada geese would compose only 25% of the population. Identifies the need for innovative harvest regulations to increase the harvest of Taverner's Canada geese while affording some protection to dusky Canada geese. Recommends the use of aerial photography for determination of subspecies composition of goose flocks.

86. JARVIS, R. L., AND P. SEKORA. 1981. Status of Canada geese wintering in Oregon-southwestern Washington. Report to Dusky Canada Goose Subcommittee, Pacific Flyway Study Committee, Corvallis, Oreg. 8 pp.

The number of Canada geese peaked at an estimated 72,000 geese in early December. In early January the mid-winter estimate was about 63,300. This decrease has occurred consistently in recent years, presumably because of dispersal of geese from concentrations on refuges. Dispersed geese are much more difficult to locate and to count. About 32% of the winter goose population was dusky Canada geese and about 68% was Taverner's Canada geese. Total goose harvest was slightly higher than the previous year, but the proportion of dusky Canada geese in the harvest decreased. Age ratios in the harvest were 0.91 young dusky Canada geese to one adult compared to 1.67 young Taverner's Canada geese to one adult.

87. JEWETT, S. G. 1932. The white-cheeked geese in Oregon. *Condor* 34:136.

Documents occurrence of the subspecies *Branta canadensis occidentalis* on the Oregon coast. States that the dusky Canada goose "wanders south from Alaska during late fall at least to the coast of Oregon and into the Willamette Valley."

88. JEWETT, S. G., W. P. TAYLOR, W. T. SHAW, AND J. W. ALDRICH. 1953. *Birds of Washington State*. University of Washington Press, Seattle. 767 pp.

Lists *Branta canadensis occidentalis* as a migrant and winter visitor along the coastline. In addition to the type specimen, the following specimens are listed: two from Camp Simiahmoo and specimens from Puget Sound, Camp Lopez (22 January 1860), and Protection Island. Reports that several small flocks of "very dark" but large geese were seen on Skagit Flats on 18 January 1934 and a lone goose, believed to be *occidentalis*, was observed at Copalis on 6 December 1941.

89. JOHNSON, D. H., D. E. TIMM, AND P. F. SPRINGER. 1979. Morphological characteristics of Canada geese in the Pacific Flyway. Pages 56-87 in R. L. Jarvis and J. C. Bartonek, editors. *Management and biology of Pacific Flyway geese*. Oregon State University Book Store, Corvallis.

Considers the 6 subspecies of Canada geese that breed in Alaska and presents general descriptions of each subspecies based on morphological measurements taken on a sample of 1,345 geese. Concludes that combinations of morphological characteristics can more reliably distinguish subspecies than can single characteristics. Discriminant functions are developed for this purpose. Presents discriminant function analysis of measurements for dusky Canada and Vancouver Canada geese.

90. KAFKA, D. M. 1988. 1988 dusky Canada goose monitoring report, Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Cordova, Alaska. 13 pp.

A total of 480 artificial nest islands were available to nesting dusky Canada geese in 1988. Fifty-five nesting attempts on these islands were documented, 22 on sandbag islands, 23 on fiberglass floaters, 3 on barrel islands, 5 on inner tube floaters, and 2 on platform islands. No nesting attempts were recorded on dish structures. Forty (73%) attempts were successful, 6 (11%) nests were being incubated, and 9 (16%) nests were destroyed by predation. Of those nine, two were destroyed by birds, one by coyotes, five by bears, and one by an undetermined predator. Sandbag islands and fiberglass floaters were the preferred structure type for nesting; they also received the greatest amount of use from 1984 to 1988 (19%).

91. KLEIN, D. R., R. INGEBO, AND D. LITTLE. 1956. Migratory waterfowl studies—Copper River Delta, banding and production studies. Pages 3-6 in R. F. Scott, supervisor. *Alaska Game Commission Quarterly Report*. U.S. Fish and Wildlife Service Federal Aid to Wildlife Restoration Program Report 11(1), Juneau, Alaska.

Summarizes production surveys and banding studies in 1956. Four hundred five molting geese were captured and banded. Although spring was late, production was apparently good. There was little evidence of renesting or nest losses to storm tides. Also, possibly because of local spring ice conditions, an apparent shift was noted in the distribution of nesting geese away from Alaganik and King Salmon sloughs

toward Story and Government sloughs. Average brood size was 5.5 goslings ($N = 27$). Of the nesting platforms constructed in the Pete Dahl Slough area in 1954, three were used by geese and seven by gulls.

92. KLEIN, D. R., R. W. INGEBO, F. C. ROBARDS, H. KING, AND J. WALKER. 1955. Pages 30-33 in U. C. Nelson, Federal Aid Leader. Copper River Delta banding and production studies. Alaska Game Commission Quarterly Report. U.S. Fish and Wildlife Service Federal Aid to Wildlife Restoration Program Report 10(1), Juneau, Alaska.

Summarizes production surveys and banding studies in 1955. Four hundred thirteen molting geese were captured and banded. Nesting was estimated to be 2 weeks later than usual because of poor spring conditions. Evidence of renesting was common. Some nest mortality apparently resulted from flooding by severe storm tides in June. Brown bears, gulls, and jaegers were seen on the flats, but no evidence of predation was observed. Broods averaged 4.2 goslings ($N = 104$).

93. LEACH, B. 1982. Waterfowl on a Pacific estuary. British Columbia Provincial Museum Special Publication 5:1-211.

The dusky Canada goose may have occurred more frequently on the lower Fraser River in the past, but it is seldom reported there today. The decline in use of the Fraser Valley by migrating geese is attributed to habitat loss and hunting pressure.

94. LEBEDA, C. S., AND J. T. RATTI. 1983. Reproductive biology of Vancouver Canada geese on Admiralty Island, Alaska. *Journal of Wildlife Management* 47:297-306.

Recognized *Branta canadensis fulva* as a subspecies of Canada goose.

95. LOWE, R. W. 1987. Coastal Canada geese: a preliminary report. *Oregon Birds* 13:143-146. In 1987, wintering flocks of dusky Canada geese were observed at Pacific City (60), Nestucca Bay (400-500), Brookings (60) on the Oregon coast,

and at the mouth of Smith River (100) on the northern California coast. Pastures associated with dairy farms seemed to be important winter habitat.

96. MACOUN, J., AND J. M. MACOUN. 1909. Catalogue of Canadian birds. Canada Department of Mines, Geological Survey Branch, Ottawa. 761 pp.

States that the Canada goose is "not common in Alaska but breeds in the interior [of Canada] and throughout British Columbia." The white-cheeked goose (*Branta canadensis occidentalis*) was reported found in Alaska only as a straggler, and it ranges along the Pacific coast region from Sitka, Alaska, to California.

97. MCKNIGHT, D. E. 1971. Report of survey and inventory activities. Part III—Waterfowl and small game. Vol. II. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-3, Jobs 10 and 11, Juneau. 52 pp.

Summarizes information collected on the nesting grounds in 1970. Of 164 dusky Canada goose nests sampled, 88.2% were successful, 3.2% were abandoned, and 8.6% were destroyed. Average clutch size for 146 nests was 5.4 eggs. Two hundred ninety-six eggs were measured, and averaged 81.68 by 55.76 mm.

98. MICKELSON, P. G., J. S. HAWKINGS, D. R. HERTER, AND S. M. MURPHY. 1980. Habitat use by birds and other wildlife on the eastern Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Anchorage. 189 pp.

Describes habitat preference, distribution, abundance, and phenology of nesting and migrating birds on the East Copper River Delta (ECRD) during 1978-79. The ECRD seemed to be an important fall staging area for dusky Canada geese. From early August to mid-October, staging geese first used the saltgrass meadows for feeding and loafing but later moved to wet meadows. The ECRD was lightly used by geese during spring migration.

99. MOFFIT, J. 1937. The white-cheeked goose in California. *Condor* 39:149-159.

- First documentation of the subspecies *Branta canadensis occidentalis* in California. Reports observations of *occidentalis* along the northern coast of California and of habitats used by these birds during winter.
100. MOFFIT, J. 1939. Notes on the distribution of whistling swan and Canada goose in California. *Condor* 41:93-97.
Used common name white-cheeked goose for *Branta canadensis occidentalis*.
101. MORGAN, R. P., II, S. T. SULKIN, AND C. J. HENNY. 1977. Serum proteins of Canada goose (*Branta canadensis*). *Condor* 79:276-278.
Serum proteins from nine subspecies of Canada geese were analyzed through electrophoresis. Variation was minimal within a subspecies, although all the subspecies were closely related. The Aleutian Canada goose seemed to be the most distinct subspecies, whereas giant and western Canada geese were the most similar. Results suggest that electrophoresis techniques are sensitive enough to identify some subspecies; however, baseline data from breeding ranges of all subspecies are needed.
102. NELSON, U. C. 1952. Copper River Delta banding operations—July 15-25, 1952. Pages 10-12 in U. C. Nelson, Federal Aid Leader. Alaska Game Commission Quarterly Report. U.S. Fish and Wildlife Service. Federal Aid to Wildlife Restoration Program Report Project 7(1), Juneau.
Summarizes production surveys and banding studies in 1952. One hundred forty-eight molting geese were captured and banded. Estimated 4,000 geese nesting on the delta plus 2,000 nonbreeders. Nests were found primarily on the highest points of slough banks from the coast to 10 miles inland. Nesting sites were in the driftwood line in vegetation dominated by wild iris, shooting star, and salt grass. Average brood size was 5.4 goslings ($N = 9$). Glaucous-winged gulls, short-billed gulls, bald eagles, short-eared owls, unidentified hawks, and brown bears were observed on the nesting grounds, but with no evidence of predation.
103. OLGILVIE, M. A. 1978. Wild geese. Buteo Books, Vermillion, S.Dak. 350 pp.
Considers the dusky Canada goose and Vancouver Canada goose the same subspecies (*Branta canadensis occidentalis*).
104. OLSON, S. T. 1954. Copper River Delta banding operations. Pages 34-42 in U. C. Nelson, Federal Aid Leader. Alaska Game Commission Quarterly Report. U.S. Fish and Wildlife Service. Federal Aid to Wildlife Restoration Program Report 8(1), Juneau.
Summarizes production surveys and banding studies in 1953. Four hundred eighty-two molting geese were captured and banded. Peak of hatch was reported to have been between June 20 and 25. Average brood size was 4.3 ($N = 31$). No evidence of nest destruction by predators was observed. Bear tracks were observed, and it was hypothesized that bears foraging along high slough banks could "go from nest to nest and in a very short period clean out the bulk of the nesting in an area during the height of nesting." Coyote tracks were observed, primarily inland near the heads of glacial streams. Glaucous-winged gulls were common, but the contents of 29 stomachs indicated little predation on waterfowl. Goshawks were occasionally seen. A jaeger was observed harassing adult geese. An experimental attempt to sex geese by the profile of the head was unsuccessful. Also, as an experiment to reduce nest losses to high tides, 50 nesting platforms were constructed from sod along Pete Dahl Slough.
105. OLSON, S. T. 1954. Migratory waterfowl studies: Copper River Delta, banding and production studies. Appendix B in U. C. Nelson, Federal Aid Leader. Alaska Game Commission Quarterly Report. U.S. Fish and Wildlife Service. Federal Aid to Wildlife Restoration Progress Report 9(1):1-73, Juneau.
Summarizes production surveys and banding studies in 1954. In July, 752 geese were banded. The sex ratio for adult geese was 1:1, but juveniles had a ratio favoring males (112:100). Nesting was reported to be 1 week late, with peak of hatch in late June. Average brood size ranged from 4.4 ($N = 21$) for class I

- broods to 6.3 ($N = 6$) for class II broods. Evidence of brown bears was common on the flats; however, no evidence of predation was observed. Coyotes were present inland of the flats, and some predation by them may have been possible. Glaucous-winged gulls were reported to be common, but the examination of five stomachs showed no evidence of predation. Sod platforms built in 1953 had withstood the elements well. They had been used as roosts by geese, but there was no evidence of nesting. The remains of geese were found on or near four platforms, suggesting that birds roosting on the structures were vulnerable to predation by coyotes or eagles.
106. OSGOOD, W. H. 1901. Natural history of the Queen Charlotte Islands, British Columbia. *North American Fauna* 21:51-81.
First record of the subspecies *Branta canadensis occidentalis* on Queen Charlotte Island, Canada. Speculated that dusky Canada geese nested on the island.
107. OWEN, M. 1980. Wild geese of the world. B. T. Batsford, Ltd., London. 248 pp.
Considers the dusky Canada goose and Vancouver goose the same subspecies of Canada goose (*Branta canadensis occidentalis*).
108. PACIFIC FLYWAY COUNCIL. 1973. Guidelines for management of the dusky Canada goose. Portland, Oreg. 12 pp.
Establishes a dusky Canada goose subcommittee of Pacific Flyway Technical Committee and a management plan for the dusky Canada goose. Geese will be managed on a sustained yield basis. Management practices will be designed to achieve maximum postseason populations that are compatible with public tolerance of goose depredations on the wintering grounds, available food, and carrying capacity of the breeding grounds. The postseason population objective of 20,000-25,000 dusky Canada geese, as determined from mid-winter inventories in Oregon and Washington, was established.
109. PACIFIC FLYWAY COUNCIL. 1985. Dusky Canada goose management plan. Portland, Oreg. 23 pp.
Describes the management plan for the dusky Canada goose, establishing four management objectives. The first is to achieve and maintain a wintering population of 20,000 dusky Canada geese (3-year average) as part of an overall wintering Canada goose population in northwestern Oregon and southwestern Washington of at least 40,000, but no more than 75,000. The second is to maintain nesting, migration, and wintering habitats in sufficient quantity and quality to meet and maintain the population objective. The third is to manage the wintering habitat to provide optimum food, water, and sanctuary conditions for dusky Canada geese and to provide optimum geographical distribution of geese. The fourth is to manage the dusky Canada goose and other Canada goose populations to provide optimal hunting and other recreational uses. Recommends management procedures and research to attain management objectives.
110. PALMER, R. S. 1976. Handbook of North American birds. Vol. 2. Yale University Press, New Haven, Conn. 521 pp.
Summarizes natural history, physical characters, distribution, and migration of this coastal goose of British Columbia and Alaska. Considers the dusky Canada goose and Vancouver Canada goose the same subspecies (*Branta canadensis occidentalis*).
111. POLLARD, R. 1984. A report on the field evaluation of dusky Canada goose artificial nest islands on the Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Cordova, Alaska. 23 pp.
Described design, installation, and use of three types of experimental artificial nesting islands on the Copper River Delta. Reports that 8 of 39 islands were used by dusky Canada geese the first year after installation, 5 for nesting and 3 for resting. All five nests were successful.

112. POTYONDY, J. P. 1975. An analysis of 1964 earthquake effects upon vegetation and hydrology of the Copper River Delta, Alaska. University of Minnesota, St. Paul. 84 pp.
See No. 113.
113. 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. University of Minnesota, St. Paul. 81 pp.
Reports on the effects of the 27 March 1964 earthquake on the vegetation and hydrology of the Copper River Delta, Alaska. Includes drainage network map, emphasizing hydrologic characteristics, and a vegetation map, for an area of almost 60 square miles. Describes the effect of tectonic uplift on brackish water ponds and its subsequent effect on aquatic vegetation. Compares pre- and postearthquake conditions.
114. REIMNITZ, E. 1972. Effects on the Copper River Delta. Pages 290-302 in *The great Alaska earthquake of 1964: oceanography and coastal engineering*. National Academy of Science Publication 1605.
The Copper River Delta was uplifted an average of 2 m by the 1964 earthquake. Based on carbon dating of submerged forests, the delta has probably been uplifted by strong earthquakes 700 and 1,000 years B.P. Subsidence after these uplifts was apparently slow and not due to catastrophic events.
115. RILEY, L., AND W. RILEY. 1979. Guide to the National Wildlife Refuges. Anchor Press, Garden City, N.Y. 653 pp.
Notes that William L. Finley, Ankeny, and Baskett Slough National Wildlife Refuges in the Willamette Valley, Oregon, were established in 1964 and 1965 to help safeguard the dusky Canada goose. Canada geese are common in refuge fields during winter.
116. SCHEIERL, R., AND M. MEYER. 1976. Evaluation and inventory of waterfowl habitats of the Copper River Delta, Alaska, by remote sensing. University of Minnesota, St. Paul. 46 pp.
Describes a 35-mm photography system used on the Copper River Delta, Alaska, to establish baseline data for monitoring waterfowl habitat and related vegetation and hydrologic changes, especially those resulting from the Alaska earthquake of 1964. The photography system was deemed to be practical as a field-level resource monitoring tool from the standpoint of resource data collection capabilities, modest cost of operation, and operational feasibility under normal (often adverse) field and weather conditions.
117. SELLERS, D. 1980. Copper River Delta waterfowl update. Page 6 in *Proceedings of the Eighth Copper River Delta Conference*. U.S. Forest Service, Cordova, Alaska.
Reports a dusky Canada goose nest success of 7% in 1980. Predation was the primary reason for poor nest success, with most of the nest losses attributed to brown bears. The calculated nest density was 134 nests per square mile, and average clutch size was 5.4 eggs.
118. SHAEFFER, S. E., AND R. L. JARVIS. 1991. Estimation of neckband retention rates from observations of double-banded dusky Canada geese. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.
Annual neckband retention rates were estimated using recaptures of marked dusky Canada geese that were also banded with matching coded tarsus bands. Discusses the feasibility of this technique to estimate neckband retention rates.
119. SHEPHERD, P. E. K. 1961. Mortality studies of western Canada geese-Copper River Delta. Alaska Wildlife Investigations. Annual Report of Progress, 1960-1961 segment, Vol. 2. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Report Project W-6-R-2, Job 3-A, Juneau. 77 pp.
Summarizes information collected on the nesting grounds in 1960. A substantial increase in

the number of geese on the Copper River Delta was reported, but no supportive data were given. Discusses capture techniques used to catch 619 dusky Canada geese for banding.

120. SHEPHERD, P. E. K. 1962. Production, harvest, distribution, and migration of waterfowl in Alaska. Alaska Wildlife Investigations. Annual Report of Progress, 1961-62 segment. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Report Project W-6-R-3, Job 3-C, Juneau. 112 pp.

Summarizes information collected on the nesting grounds in 1961. Reports that goose production was good, with a noticeable increase over the 1957, 1958, and 1959 populations. No data were presented to support the report.

121. SHEPHERD, P. E. K. 1965. A preliminary evaluation of earthquake damage to waterfowl habitat in south central Alaska. 45th Annual Conference of the Western Association of State Game and Fish Commissioners 9 pp.

After uplifting of the Copper River Delta by 6 feet during the March 1964 earthquake, many sloughs and ponds began drying up. Large expanses of intertidal mudflats were also exposed and are now flooded by only the highest tides. Nest losses to flooding have been reduced, but access to nesting grounds for mammalian predators has improved. Coyotes and other mammals have become increasingly abundant on the nesting grounds, and nest predation has increased. Nest success has declined from 89% in 1959 to 82% in 1964 and 58% in 1965. Conversely, nest predation has increased from 1.3% in 1959 to 10% in 1964 and 30% in 1965.

122. SHEPHERD, P. E. K. 1965. Waterfowl report. Vol. VI. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-6-R-5 and 6, Work Plan H, Jobs 1, 2, and 3, Juneau. 16 pp.

Investigations of the immediate effects of the Good Friday earthquake on the Copper River Delta suggested that the vertical land uplift of 6 feet may cause changes in the aquatic and terrestrial plant ecology. Reported changes in

flight and feeding patterns of waterfowl are suspected to be in response to tidal changes resulting from the earthquake. The delayed spring rather than the earthquake was responsible for lowered production.

123. SHEPHERD, P. E. K. 1966. Waterfowl report. Vol. VII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-6-R-6, work Plan H and W-13-R-1, Work Plan C, Juneau. 28 pp.

Summarizes information collected on the nesting grounds in 1965. Presents initial postearthquake habitat information. Of 221 nests, 139 were successful, 15 abandoned, and 67 destroyed. Mammalian predators were responsible for most of the nest losses with no losses attributed to flooding. Microtine population had increased considerably since 1964 and may be attracting mammalian predators. Speculated on the future need for predator control. Average clutch size was 5.8 eggs ($N = 140$).

124. SHEPHERD, P. E. K., B. L. HILLIKER, AND J. H. CROW. 1968. Waterfowl report. Vol. IX. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-13-R-2 and 3, Work Plan C, Juneau. 39 pp.

Summarizes information collected on the nesting grounds in 1967. Reports third-year results of studies to determine the effect of land uplift on the production of waterfowl. No dusky Canada goose nest success or clutch size data collected. Production, based on a July aerial survey, was 35%.

125. SHEPHERD, P. E. K., B. L. HILLIKER, AND R. J. SOMERVILLE. 1967. Waterfowl report. Vol. VIII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-13-R-1 and 2, Work Plan C, Juneau. 27 pp.

Summarizes information collected on the nesting grounds in 1966. Reports second-year results of studies to determine the effect of land uplifting on the production of waterfowl and to inventory, catalogue, and map habitat. Dusky Canada goose nesting success was 97.0%

($N = 100$), with 3% abandoned and very little nest destruction.

126. SHIELDS, G. F. 1991. Phylogenies of North American geese: The mitochondrial DNA record. Paper presented at the International Canada Goose Symposium, Milwaukee, Wis., 23-25 April.

Research using restriction enzymes as molecular probes to study mitochondrial DNA (mtDNA) indicates that Canada geese of North America are composed of two major groups which last shared a common ancestor about one million years ago. One group, primarily continental in its breeding distribution, includes all large-bodied subspecies (*canadensis*, *interior*, *maxima*, *moffitti*, *fulva*, *occidentalis*, and *parvipes*). The other group includes small-bodied subspecies (*hutchinsii*, *taverneri*, *minima*, and *leucopareia*) which breed in coastal Alaska and Arctic Canada.

Although the separation between the groups dates back one million years, radiation within each group is much more recent. The northwestern, large-bodied Canada geese (*parvipes*, *occidentalis*, *fulva*, and *moffitti*) seem to have radiated within the last 100,000 years.

127. SIMPSON, S. G. 1979. Comparative ecology of several subspecies of Canada geese during winter in western Oregon. M.S. thesis, Oregon State University, Corvallis. 34 pp.

Describes the distribution, harvest, and foraging ecology of Canada geese (*Branta canadensis*) from October through April, 1975-76 to 1977-78, in the Willamette Valley, Oregon. Reports that the relative abundance of Taverner's Canada geese increased from 25% in 1975-76 to 50% in 1977-78 and the distribution of subspecies was not uniform throughout the study area. Dusky Canada geese comprised 70-80% of the harvest on refuges and were 2.6-2.8 times as vulnerable as Taverner's Canada geese. Mean flock sizes and mean sizes of groups arriving in fields were not different between subspecies, although Taverner's Canada geese occurred in larger groups more frequently than dusky Canada

geese. Taverner's Canada geese used larger fields than dusky Canada geese.

128. SIMPSON, S. G., AND R. L. JARVIS. 1979. Comparative ecology of several subspecies of Canada geese during winter in western Oregon. Pages 223-241 in R. L. Jarvis and J. C. Bartonek, editors. Management and biology of Pacific Flyway geese. Oregon State University Book Stores, Corvallis.

See No. 127.

129. SWARTH, H. S. 1911. Birds and mammals of the 1909 Alexander, Alaska expedition. University of California Publications in Zoology 7:9-172.

Reports on observations of Canada geese in southeastern Alaska during the spring and summer of 1909 and on a specimen collected at Thomas Bay on 14 August 1909.

130. SWARTH, H. S. 1913. A study of a collection of geese of the *Branta canadensis* group from the San Joaquin Valley, California. University of California Publications in Zoology 12:1-24.

Concluded that *Branta canadensis occidentalis* did not occur in the San Joaquin Valley, California. Swarth presented an excellent discussion of the taxonomic status of western races of *B. canadensis* at that time. Before this publication, numerous authors referred to the subspecies *occidentalis* as occurring in California. Supports the recognition of *occidentalis*, *canadensis*, *hutchinsi*, and *minima* as subspecies of *B. canadensis*. Concluded that *B. c. occidentalis* is a well-defined subspecies occupying the humid, northwest coast region, where it is practically resident, performing only limited migrations.

131. SWARTH, H. S. 1920. The subspecies of *Branta canadensis*. Auk 37:268-272.

Defends division of Canada geese into four subspecies, *Branta canadensis canadensis*, *occidentalis*, *hutchinsii*, and *minima*.

132. TAVERNER, P. A. 1931. A study of *Branta canadensis* (Linnaeus) the Canada goose. Pages 28-

40 in Annual Report of the Natural Museum of Canada. 1929.

Concludes that *occidentalis* is a subspecies of *Branta canadensis*. Other subspecies are *B. c. canadensis* and *B. c. leucopareia*. Considers *B. minima* and *B. hutchinsii* as full species. All specimens listed under *B. c. occidentalis* are juveniles collected in late August or early September in the Queen Charlotte Islands, British Columbia. These birds are probably *B. c. fulva*, and therefore, the description includes both dusky Canada geese and Vancouver Canada geese. Dropped the use of the common name white-cheeked goose in favor of western Canada goose as expressed in its subspecific title.

Concludes that the genetic differences between races of Canada geese may be far wider than is evident from a superficial examination of specimens. Suggests that the differences are better observed in the habit, stance, action, and voice of live birds. Reports that experienced sportsmen have less difficulty recognizing the various forms of Canada geese in the field than the systematist has in the laboratory with preserved specimens.

133. THILENIUS, J. Circa 1978. Problem analysis: ecology of coastal wetlands, Copper River Delta, Alaska. Unpublished report. U.S. Forest Service, Juneau, Alaska. 104 pp.

Review and critique of literature on the Copper River Delta with emphasis on physical and botanical features.

134. THILENIUS, J. 1990. Plant succession on earthquake uplifted coastal wetlands, Copper River Delta, Alaska. *Northwest Science* 64:259-262.

Describes primary successional pattern, primarily the establishment of sedge, on intertidal areas exposed by uplifting and secondary succession, primarily establishment of shrubs, on supertidal wetlands.

135. TIMM, D. E. 1972. Report of survey and inventory activities—waterfowl. Vol. III. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-4, Job 10.0, Juneau. 17 pp.

Summarizes information collected on nesting grounds in 1971. Estimated nest density was 30-50% below previous years. Seventy-six percent ($N = 100$) of the nests were successful, and 24% were destroyed by predators. Average clutch size was 3.6 eggs ($N = 113$). Young production was estimated at 16.2%. Measurements of 296 eggs were reported and compared to measurements of Vancouver Canada goose and Prince William Sound Canada goose eggs.

136. TIMM, D. E. 1974. Report of survey-inventory activities—waterfowl. Vol. V. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-5, Jobs 10 and 22, Juneau. 64 pp.

Summarizes information collected on the nesting grounds in 1973. No formal nesting studies were conducted, but random sampling of 48 nests indicated an average clutch size of 4.9 eggs. Production was estimated at 22%. Average tail feather length for 65 geese was reported at 153 mm ($N = 15$) for adults and 136 mm ($N = 50$) for immatures.

137. TIMM, D. E. 1975. Report of survey-inventory activities—waterfowl. Vol. VI. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-7, Jobs 11.0, 11.1, 11.2, 11.3, and 22, Juneau. 53 pp.

Summarizes information collected on the nesting grounds in 1974. Average clutch size (sample size not reported) was 5.6 eggs. Nest success was not reported, but production was estimated at 35%.

138. TIMM, D. E. 1976. Report of survey and inventory activities—waterfowl. Vol. VII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-8, Jobs 11.0, 11.1, 11.2, and 11.3, Juneau. 61 pp.

Summarizes information collected on the nesting grounds in 1975. Nest fates and average clutch size were not reported. An estimated 17.9% of the July population was composed of young geese. Includes maps depicting

the distribution of nesting dusky Canada geese on the west Copper River Delta in 1975 and 1976.

139. TIMM, D. E. 1977. Report of survey and inventory activities—waterfowl. Vol. VIII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-9, Job 11.0-11.3, and 22.0, Juneau. 37 pp.
Summarizes information collected on the nesting grounds in 1976. No nest success was reported, but average clutch size was 4.8 eggs ($N = 168$). Twenty-four percent of the July population was composed of young.
140. TIMM, D. E. 1978. Report of survey and inventory activities—waterfowl. Vol. IX. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-10, Job 10.0, Juneau. 27 pp.
Summarizes information collected on the nesting grounds in 1977. No nest success was reported, but production was reported to be excellent. Average clutch size for an unreported sample size was 5.4 eggs. Production was estimated to be 44.3%. Reports distribution of band returns from 1973 to 1977.
141. TIMM, D. E. 1980. Annual report of survey and inventory activities—waterfowl. Vol. XI. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-19-1, Job 10.0, Juneau. 35 pp.
Summarizes information collected on the nesting grounds in 1979. Nest success (sample size not reported) was reported to be 7%. Nest losses were primarily the results of predation. An estimated 16% young were observed in the July population. Also reported the results of air-to-ground comparisons using photography tests preliminary to conducting a breeding grounds population survey.
142. TIMM, D. E. 1982. Annual report of survey-inventory activities—waterfowl. Vol. XII. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-19-2, Job 11.0, Juneau. 48 pp.
Summarizes information collected on nesting grounds in 1980. While the final fate of 231 nests was not reported, midway through incubation 25% had been destroyed, 9% had been abandoned, and 65% were still active. Nest predation was reported as substantial. Clutch size averaged 5.4 eggs ($N = 152$). An estimated 23.7% of the July population was composed of young birds.
143. TIMM, D. E., AND R. G. BROMLEY. 1976. Driving Canada geese by helicopter. *Wildlife Society Bulletin* 4:180-181.
Describes use of helicopters to capture flocks of flightless geese and compares costs to other methods of capturing molting geese.
144. TIMM, D. E., AND P. HAVENS. 1973. Report of survey and inventory activities—waterfowl. Vol. IV. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-5, Jobs 10 and 22, Juneau. 64 pp.
Summarizes information collected on the nesting grounds in 1972. Reported that 73.3% of dusky Canada goose nests ($N = 135$) were in the forb-grass community, followed by 19.3% in sedge, 6.7% in sedge-grass, and 0.7% on mud banks. Eighty-one percent of the nests ($N = 116$) hatched young, and 19.0% were destroyed. Average clutch size was 4.4 eggs ($N = 57$). Estimated 10.6% of the July population were young. Reported average culmen tarsus, and culmen + tarsus measurements of 100 geese.
145. TIMM, D. E., AND D. SELLERS. 1979. Annual report of survey and inventory activities. Waterfowl. Vol. X. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-17-11, Job 10, Juneau. 29 pp.
Summarizes information collected on the nesting grounds in 1978. No nesting data were reported. Production was estimated to be 24.8%. Reports band recovery rates and distribution.
146. TIMM, D. E., R. G. BROMLEY, D. MCKNIGHT, AND R. S. RODGERS. 1979. Management evolu-

tion of dusky Canada geese. Pages 322-330 in R. L. Jarvis and J. C. Bartonek, editors. Management and biology of Pacific Flyway geese. Oregon State University Book Stores, Corvallis.

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. Traces the major events leading to present management, describes current management procedures, and discusses challenges of the future. Innovative methods of population management must be developed to cope with a new and dynamic situation on the wintering grounds.

147. TRAINER, C. E. 1959. The 1959 western Canada goose (*Branta canadensis occidentalis*) study on the Copper River Delta, Alaska. In Annual waterfowl report, Alaska. U.S. Fish and Wildlife Service, Juneau, Alaska. 9 pp.

Identifies dunegrass, herb, alder-willow, and alder-dunegrass as the four major cover types on the Copper River Delta. There were an estimated 108 dusky Canada goose nests per square mile, with 97% located in mixed-forb-low-shrub habitat. Average clutch size was 5.6 eggs. Eighty-nine percent of the nests were successful, with tidal flooding being the primary cause of nest failure. Only 8 of 1,162 eggs (0.7%) were identified as destroyed by predators, all avian.

148. TRAINER, C. E. 1967. Appraisal of Canada goose nesting densities on the Copper River Delta, Alaska. Unpublished report. U.S. Fish and Wildlife Service, Juneau, Alaska. 9 pp.

An estimated 12,781 young dusky Canada geese were hatched on the Copper River Delta in 1959. This estimate was based on estimates of suitable habitat and average number of young produced per nest, and adjusted for varying density of nests.

149. TRAUGER, D. L., AND J. C. BARTONEK. 1977. Leech parasitism of waterfowl in North America. *Wildfowl* 28:143-152.

Reports that Robert G. Bromley removed leeches from under the nictitating membranes of three dusky Canada geese that were captured along with 500 other geese on Alaganik Slough in the Copper River Delta between 23 July and 2 August 1974. Another 40 females trapped on nests in early June were not infested.

150. WEEDEN, R., P. LEROUX, AND B. HILLIKER. 1969. Waterfowl report. Vol. X. Alaska Department of Fish and Game. Federal Aid to Wildlife Restoration Progress Report Project W-13-R-3 and W-17-1, Work Plan C, Juneau. 19 pp.

Presents a table summarizing the age and sex of 433 geese banded in 1968.

151. YOCOM, C. F. 1963. July bird life in the Copper River Delta country, Alaska—1962. *Murrelet* 44:28-34.

Briefly describes nesting habitat on the Copper River Delta. Mentions noticeable trails left in sedge-grass by flocks of molting geese in July. Presents weight, culmen, and tarsus length for five molting adult females and five juveniles.

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168. Mourning Dove Nesting: Seasonal Patterns and Effects of September Hunting, by Paul H. Geissler, David D. Dolton, Rebecca Field, Richard A. Coon, H. Franklin Percival, Don W. Hayne, Lawrence D. Soileau, Ronnie R. George, James H. Dunks, and S. Dwight Bunnell. 1987. 33 pp.
169. Saltcedar Control for Wildlife Habitat Improvement in the Southwestern United States, by Theodore A. Kerpez and Norman S. Smith. 1987. 16 pp.
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186. DUCKDATA: A Bibliographic Data Base for North American Waterfowl (Anatidae) and Their Wetland Habitats, by Ken Reinecke and Don Delnicki. 1992. 8 pp.

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