for which we have data, were on slag roofs and there is no suggestion from our data that Killdeer select gravel for nesting; it seems unlikely that Killdeer would nest on a roof with a smooth surface, but such roofs are relatively rare (Hopkins, pers. obs.), and it would take much more data to find that out.

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**Breeding Age of the Tule White-fronted Goose.**—Based on knowledge of the mid-continent white-front (Barry, T. W., Geese of the Anderson River delta, Northwest Territories, Canada, Ph.D. thesis, Univ. of Alberta, Edmonton, 1966), the Tule White-fronted Goose (*Anser albifrons gambelli*) is thought to reach breeding maturity at 3 years. To the best of our knowledge, this assumption exists even though data supporting breeding age in wild, nearctic white-fronts have not been published. This note documents breeding age in Tule White-fronted Geese.

In 1980, 253 Tule White-fronted Geese were banded and collared during molt in Cook Inlet, Alaska. A second-year male and female collared in a group of 162 birds (92 second-year and 70 after-second-year birds) were observed 18 times between 1980 and 1982, 11 times on the breeding grounds, 4 times on the wintering grounds of central California, and 3 times at staging areas in southern Oregon. These birds were observed together in all 3 areas in 1981, and on the nesting grounds in Cook Inlet in 1982.

The pair did not nest in 1981. But during the spring of 1982, the pairs' behavior suggested that they might nest and on 7 June, their nest was discovered. The clutch of 2 partially-covered eggs was floated and estimated to be about 2 weeks into incubation. The poorly constructed nest in low, flooded vegetation, and small clutch were typical of geese nesting for the first time.

These observations suggest that Tule White-fronted Geese may establish pair bonds by the time they are one-year-old and substantiates the assumption that they can breed at 3 years of age.—BRUCE CAMPBELL AND ENID GOODWIN, *Division of Game, Alaska Department of Fish and Game, Anchorage, Alaska 99502.* Received 8 May 1984; accepted 30 Jan. 1985.

**Foods of Wintering Brant in Eastern North America.**—Brant (*Branta bernicla*) winter along the Atlantic coast from Massachusetts to North Carolina (Kirby and Obrecht 1982). Their populations have undergone dramatic fluctuations (Cottam et al. 1944, Kirby

and Obrecht 1982) which have been attributed to poor breeding success (Barry 1962) and severe weather on the wintering grounds (Nelson 1978). Lincoln (1950) and Cottam and Munro (1954) suggested that Brant were specialized for consuming eelgrass (*Zostera marina*), and that the disappearance of eelgrass from much of the Atlantic coast was responsible for their decline. Ogilvie and Matthews (1969) attributed the decline in Brant to a decline in eelgrass in England. Kirby and Obrecht (1982) suggested that the "specific food preference" hypothesis may not carry great importance. However, few recent data exist on the foods of Brant, especially for different wintering areas at a given point in time. We report on the food habits of Brant wintering in New York, New Jersey, and Virginia in late January when most wintering populations are less likely to be undergoing migrational movements.

*Methods.*—Brant were collected in Nassau Co., New York (n = 40), Accomac Co., Virginia (n = 13), and Cape May Co., New Jersey (n = 41). Birds were shot in bays and estuaries, except 18 birds that were cannon-netted in New York without the use of bait. Trapped birds were included with the other New York samples since their food habits were not different ($P > 0.10$) from birds shot. Esophageal and proventriculus contents were preserved in 80% ethanol. Gizzard contents were not used in the analysis due to differential digestion (Swanson and Bartonek 1970). Contents were identified and their volume measured to the nearest .1 ml in a graduate cylinder. Volumes less than .1 ml were considered as trace amounts. Birds with less than .1 ml total volume were not included in the results. Food items were described as aggregate percents due to biases associated with percent occurrence and aggregate volume techniques (Swanson et al. 1974). Potential differences in diet by sex and wintering areas were described using the Mann-Whitney and Kruskall-Wallis tests (Siegel 1956, Hollander and Wolfe 1973).

*Results and Discussion.*—Two Brant in Virginia, 3 in New Jersey, and 6 in New York (Table 1) were unsuitable for food habits analysis (i.e., contained less than .1 ml). There was no difference ($P > .10$) in the amount of sea lettuce (*Ulva lactuca*) or cordgrass (*Spartina alterniflora*) consumed by male and female Brant in New Jersey. Similarly, there was no difference ($P > .10$) between sexes in the amount of sea lettuce eaten in New Jersey, or cultivated grass and clover in New York. The diets of male and female Brant were similar.

The diet of Brant varied significantly by wintering area (Table 1). Brant in Virginia consumed more ($P < .01$) eelgrass than birds wintering farther to the north. This does not mean to suggest that Brant wintering in other areas of New Jersey do not consume eelgrass. Penkala (1975) found that Brant using Barnegat Bay in New Jersey consumed large amounts of eelgrass. Use of eelgrass in different wintering areas is partially related to its availability. However, Brant examined from New York did not contain eelgrass even though eelgrass may be increasing in abundance in this area (Orth and Moore 1983).

Brant collected in New Jersey contained more ($P < .01$) cordgrass than birds collected in New York or Virginia (Table 1). Possibly as the other foods begin to decline in abundance during January, such as sea lettuce, birds consume cordgrass (Kirby and Obrecht 1980). Sea lettuce was more ($P < .05$) important in the diet of birds from New Jersey and Virginia than in New York Brant. Cottam and Munro (1954) suggested than Brant may have started feeding on sea lettuce after the historical declines in eelgrass abundance.

As evidenced by the preponderance ($P < .01$) of cultivated grass and clover in the crops of Brant from New York, birds in this area fed on land more consistently than birds from New Jersey and Virginia (Table 1). Why Brant field feed, a recently acquired trait, more frequently in New York where submerged aquatic vegetation is increasing in abundance than to the south where submerged vegetation may be declining is unknown (Orth and Moore 1983). Perhaps feeding on upland grasses is related to nutritional quality. Ranwell and Downing (1959) suggested that Brant selected foods on the basis of nutritive quality. Although the Brant diet in New York was dominated by cultivated grass (mainly from lawns and golf courses), the birds also fed in bays as evidenced by the common occurrence of cultivated grass and sea lettuce in the same crop.

Evidence suggests (Cottam and Munro 1954, Penkala 1975, this study) that food habits of Brant have changed since the decline of eelgrass in the early 1930's. Brant have expanded the breadth of their diet by relying more heavily on foods other than eelgrass and by feeding in upland areas. The expansion of dietary breadth may be the result of

TABLE 1. Food items consumed by wintering Brant in eastern North America. Values are in aggregate percent.

| Food item | Wintering area | | |
|---|---|---|---|
| | Virginia (n = 11) | New Jersey (n = 38) | New York (n = 34) |
| Cultivated clover | — | — | 10.59 |
| Cultivated grass | — | — | 65.59 |
| *Enteromorpha* sp. | — | 2.97 | — |
| *Fucus* spp. | — | Tr[a] | — |
| *Spartina alterniflora* | 12.67 | 49.68 | Tr |
| *Ulva lactuca* | 42.66 | 35.57 | 15.83 |
| Unidentified filamentous algae | 0.50 | Tr | — |
| Unidentified red algae | — | 0.67 | 1.40 |
| Unidentified fibrous wrack | 10.13 | 10.18 | 6.54 |
| *Zostera marina* | 34.09 | Tr | — |

[a] Tr = less than .5%.

the interaction of: (1) plasticity in feeding behavior, (2) winter philopatry, and (3) learning. Possibly during the decline of eelgrass certain individuals began to feed heavily on alternate foods and/or to feed in upland areas. These behaviors were transmitted to other individuals by learning. Transmission of these behaviors among individuals and from one generation to the next was probably facilitated by the propensity of Brant to winter in family groups and by the strong philopatry that Brant may show to specific wintering areas. Immature Brant would learn feeding behaviors from their parents and would, in later years, return to the same wintering areas and "teach" similar behavior to their offspring.

Differences in frequencies of field-feeding among Brant wintering in New York, New Jersey, and Virginia may also be explained by "tradition drift" (Wilson 1975) which would result from, in this case, philopatry of Brant that first began field-feeding, to specific wintering locations (e.g., New York). Field-feeding by Brant in New York would be perpetuated and increase in frequency from one generation to the next because Brant exhibiting this behavior would continue to return to New York and transmit this behavior to other individuals which also return to New York. On the other hand, Brant wintering in New Jersey and Virginia may have only recently developed this behavior and therefore, the behavior would occur at a lower frequency. The development of tradition in feeding behavior may also explain why more Brant in New Jersey have not switched from sea lettuce back to the extensive eelgrass beds in Barnegat Bay.

This possible development of changes in Brant feeding behavior and the explanation for these changes, parallel those that have been documented in the Japanese Macaque (*Macaca fuscata*) populations (see Wilson 1975:170–171). Wilson defined tradition as "the creation of specific forms of behavior that are passed from generation to generation by learning" and considered it to be "the ultimate refinement in environmental tracking." Brant may have, through a unique combination of winter philopatry and social organization which has enabled the development of tradition in feeding behavior, been able to adapt to drastic changes in their winter environment. A similar argument probably applies to the recent increase in field-feeding behavior that has been observed in Brant in England (St. Joseph 1979) and the Tundra Swan (*Cygnus columbianus*) and Greater Snow Goose (*Chen caerulescens*) along the Atlantic Coast. Finally, the frequency of field-feeding may be a function of the availability of suitable field sites in relationship to estuarine habitat.

Studies currently being conducted on the energetic status of Brant wintering in different areas along the Atlantic Coast coupled with food habits data will allow us to determine how these observed dietary differences may be affecting survival of Brant

(Vangilder and Smith, unpublished data). In addition, studies aimed at determining whether birds wintering in different areas may be from different nesting regions or are essentially mixing on the wintering ground will help us understand why some wintering birds exhibit different feeding strategies (i.e., field feeding) in certain areas.

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