
 CENSUSES OF BLACK BRANT AT YAQUINA ESTUARY, LINCOLN COUNTY, OREGON

Range D. Bayer, P. O. Box 1467, Newport, Oregon 97365

Copyright © 1996 by Range D. Bayer. Without charge, permission is freely given to anyone to use any means to copy part or all of this article as long as this article is credited as the source.

CITATION: Bayer, R. D. 1996. Censuses of Black Brant at Yaquina Estuary, Lincoln County, Oregon. Journal of Oregon Ornithology 6:723-780.

ABSTRACT.--Black Brant (*Branta bernicla nigricans*) had two different seasonal patterns of occurrence at Yaquina Estuary. At embayment areas with eelgrass (*Zostera marina*), Brant typically arrived between October 22 and November 4, Brant numbers progressively climbed in November, Brant abundance in December-January was relatively constant, and Brant numbers often fluctuated greatly during spring migration in February-April. At a site near the estuary mouth where there was little eelgrass, Brant customarily only appeared during spring migration.

About 300-500 Brant wintered at the Yaquina in the 1980's, and usually fewer than 700 Brant were counted during spring migration.

A. Introduction-----	724
B. Study Areas-----	724
C. Methods-----	726
D. Shortcomings of Observations-----	727
E. Results and Discussion: Censusing Techniques-----	728
F. Results and Discussion: Brant Foraging Behavior and Diet-----	730
G. Results and Discussion: Nocturnal Brant Behavior-----	732
H. Results and Discussion: Brant Distribution-----	733
I. Results and Discussion: Fall Arrival-----	735
J. Results and Discussion: Brant Abundance in November-January-----	736
K. Results and Discussion: Are Brant Wintering or Passing Through? -----	736
L. Results and Discussion: Onset of Spring Migration-----	738
M. Results and Discussion: Brant Fluctuations during February-May-----	738
N. Results and Discussion: Brant Rarity in June-Early October-----	739
O. Results and Discussion: Change in Brant Abundance? -----	739
P. Results and Discussion: Disturbance-----	743
Q. Results and Discussion: Other-----	745
R. Figures and Tables-----	746
S. Acknowledgments-----	776
T. Literature Cited-----	777

LIST OF FIGURES AND TABLES

Fig. 1. Yaquina Estuary areas censused for Black Brant-----	746
Fig. 2. Number of Brant at embayments during November--February for five winters with censuses each month-----	747
Fig. 3. Number of Brant at embayments during December-January for nine winters with several censuses each month-----	750
Table 1. Arrival dates of Brant at Yaquina Estuary-----	751
Table 2. Days with five censuses within minutes of each other at embayments-----	752
Table 3. Comparison of December through January USFWS aerial censuses within three days of ground censuses of Brant at Yaquina Estuary-----	752
Table 4. Records of Brant at Yaquina Estuary after sunset in 1974-----	753

Table 5. Percentage of embayment censuses with Brant present at Sally's Bend, South Bay, or Idaho Flats during November-January----- 754

Table 6. Incidental counts of Brant during November-January at Yaquina Estuary prior to the summer of 1980----- 755

Table 7. Number of Brant reported during Oregon coastal Christmas Bird Counts----- 756

Table 8. Maximum monthly counts of Brant at Yaquina Estuary during 1980-1985----- 758

Table 9. Maximum monthly counts of Brant at embayments or West Bridge during 1980-1995----- 759

Table 10. Summary of total number of Brant at embayments during the first and last halves of November-February----- 760

Table 11. Number of Brant censused at Sally's Bend, South Bay, Idaho Flats, and West Bridge----- 762

Table 12. Number of Brant at West Bridge----- 773

A. INTRODUCTION

Yaquina Estuary is one of only three sites in Oregon that is regularly used for wintering by Black Brant (*Branta bernicla nigricans*).

Bernard J. Bretherton in Woodcock (1902:17) indicated that Brant were very common at Yaquina Bay and that they were often called "China Goose." Other published papers about Brant at the Yaquina are about mortality (Gerow 1939), possible hybrids (Hoffman and Elliott 1974), seasonality and abundance (Bayer 1983, 1995:425; Dau 1992, Wetzel 1996), presence during Christmas Bird Counts (CBC) (Bayer and Krabbe 1984), and foraging at herring spawns or effects on eelgrass (*Zostera marina*) (Bayer 1979, 1980). There are also several other references to Brant elsewhere along the Oregon Coast (e.g., Gabrielson and Jewett 1940:128-129, Giesler 1952, Leopold and Smith 1953:97-98, Batterson 1954, 1968; Einarsen 1955, 1965; Hansen and Nelson 1957:240, 245; Smith 1961, Oregon State Game Commission 1972:115, 143; Carney et al. 1975:106, Munson 1976, Hodder 1986, Ball et al. 1989, Gilligan et al. 1994:41-42).

The purpose of this paper is to give information about Brant that has not been previously published and to also list my censuses, so that the reader can analyze them as he or she wishes.

B. STUDY AREAS

Approx. Center of Site: 44 37' N, 124 01' W
 Oregon Natural Heritage Program Hexagon: 27,176
 Location: portions of Township 11S, Range 11W
 Area Studied: ?
 Habitat(s) Studied: Estuary
 Elevation: intertidal
 Minimum Distance to Coastline: 0 mi (0 km).

B-1. TIDAL CONDITIONS

Yaquina Estuary is located along the Oregon central coast and has an intertidal and submerged area of 3,910 acres (15.8 sq. km) (Oregon State Land Board 1973).

All tidal heights in this paper are relative to Mean Lower Low Water (MLLW) (0.0 ft). Mean Higher High Water is +8.4 ft (+2.6 m), Mean High Water (MHW) is +7.6 ft (+2.3 m), Mean Tide Level is +4.6 ft (+1.4 m), and Mean Low Water (MLW) is +1.5 ft (+0.5 m) (Oregon State Land Board 1973).

General characteristics about Yaquina Estuary are also in Shirzad et al. (1988:4.18), and other notes about macrophyton and tides at the Yaquina are in Bayer (1996).

B-2. ESTUARINE STUDY AREAS

There are eight major study areas that are intertidal mud or sandflats or subtidal channels.

The relative amount of area above or below MLW for a Yaquina study area can be determined by comparing the map of Yaquina Estuary in Oregon State Land Board (1973) (which shows the tideland between MLW and MHW) and nautical charts (e.g., NOAA Chart 6055 for Yaquina Bay) (which shows the tideland between MLLW and MHW).

Idaho Flats, Sallys Bend, and King Slough are names of study areas often currently used by local residents, and I have assigned the other names for convenience.

The study areas:

- 1) WEST BRIDGE ("w" in Fig. 1) is the area west of the Highway 101 Bridge to the "jaws" of the jetties; it has some sandflats on the south shore with patches of *Z. marina* (Gaumer et al. 1974, Bayer 1979, Wetzel 1996) and an intertidal rock shelf that is sometimes covered with sand on the north shore.
- 2) EAST BRIDGE ("e" in Fig. 1) is the area east of the Highway 101 Bridge to Idaho Flats and North Shore. It has some intertidal sandflats adjoining the channel, the South Beach (Newport) Marina was started in 1977 on the south shore, and the Newport Bayfront and docks are on the north shore, so there is extensive human activity along both shores. It had no eelgrass (Gaumer et al. 1974:30, Wetzel 1996).
- 3) IDAHO FLATS ("i" in Fig. 1) is the embayment on the south side of the channel between the Hatfield Marine Science Center (HMSC) and the tip of Idaho Point; I also included the southern half of the channel between Idaho Flats and North Shore. It is mostly mudflats higher than MLW but has a strip of *Z. marina* along the channel with a wider patch of *Z. marina* about a third of the way along the channel from the HMSC to Idaho Point where an intertidal creek empties into the channel (also see Gaumer et al. 1974:30, Wetzel 1996).
- 4) NORTH SHORE ("n" in Fig. 1) includes the north half of the channel between it and Idaho Flats. The north shore has much rock riprap with some sandflats, and no or little *Z. marina* (Gaumer et al. 1974:30, Wetzel 1996). North Shore was originally lumped together with Idaho Flats during censuses, but I never saw Brant at North Shore, and most locals consider Idaho Flats to only be the embayment, so I have split off North Shore in this paper.
- 5) SALLYS BEND ("s" in Fig. 1) is the embayment on the north side of the channel between the Liquefied Natural Gas (LNG) tank and Coquille Point; I also include the northern half of the channel between it and South Bay. Much of Sallys Bend is an intertidal mudflat less than MLW, and it has the most extensive *Z. marina* meadows of any area in Yaquina Estuary (Gaumer et al. 1974:30, Wetzel 1996).
- 6) SOUTH BAY ("o" in Fig. 1) is the embayment at the mouth of King Slough and south of Sallys Bend; I also included the southern half of the channel between it and Sallys Bend. It has some *Z. marina* on the mudflats adjacent to the channel (Gaumer et al. 1974:30, Wetzel 1996). A small marina is on the east side of Idaho Point. Most of South Bay is mudflats higher than MLW.
- 7) KING SLOUGH ("k" in Fig. 1) is the slough south of South Bay and is a mudflat almost entirely above MLW with little or no *Z. marina* (Gaumer et al. 1974:30, Wetzel 1996).
- 8) UPPER ESTUARY ("u" in Fig. 1) includes the channel and intertidal areas from South Bay upstream nearly to Toledo. Mudflats fringe the channel, but *Z. marina* is patchy and usually only grows in strips adjacent to the channel (Gaumer et al. 1974:30).

B-3. UPLAND SITE

Hidden Valley is a minor study area and is the only large farming area adjacent to Yaquina Estuary. It is a valley that is south of

Highway 20 and is between Sallys Bend and Toledo (Fig. 1). At one time, it was an estuarine marsh, but tide gates at Boone and Nute Sloughs (Fig. 1) that drain Hidden Valley prevent brackish water from entering. Today, it is mainly pastures with intermittent houses, especially around its north side.

C. METHODS

C-1. METHODS FOR DETERMINING BRANT ARRIVAL DATES

Beginning in late October, I often surveyed embayment areas for Brant arrivals, especially in 1979-1990 (Table 1). However, I may have missed some arrivals, so I also include arrival dates of other observers in Table 1.

C-2. OBSERVATION POINTS

I used six observation points (1-6 in Fig. 1) for West Bridge and embayments. I almost always observed West Bridge at "1" and most often surveyed Idaho Flats and North Shore from "4" and Sallys Bend and South Bay from "5" (Fig. 1). I walked about 250 ft (76 m) between "4" and "5."

Brant were within 0.4 mi (0.6 km) of the observation point at West Bridge and within 0.9 mi (1.4 km) (but rarely greater than 0.6 mi [1.0 km]) of whichever observation point I used for embayments.

C-3. OPTICAL EQUIPMENT FOR OBSERVATIONS

I used wide-angle 7 X 35 binoculars and a Bushnell Spacemaster II telescope with a 20X wide-angle eyepiece from land adjacent to the intertidal areas to look for Brant arrivals.

Except during December 1988-January 1989, when I often used a Celestron C-90 (1000 mm) telescope with a 31X (32 mm) eyepiece to count Brant at embayments, censuses were with the 20X scope. I preferred using the 20X scope because it was smaller and lighter and had a wider field of view; however, the counts may have been more accurate if I had used a telescope with a higher magnification (section E-3). Each scope was positioned about 2-8 ft (1-2 m) above MHW, which is about 10-16 ft (3-5 m) above MLLW.

C-4. METHODS FOR COUNTING BRANT

I often censused Brant while I was also doing censuses of other waterbirds. I counted Brant individually (usually with a hand clicker), when wind speeds were 20 mph or less and when wave conditions, glare, rain, or fog did not obscure birds. I did not count Brant while they were flying.

Each census was a single sweep of each study area; when there were multiple censuses during a day, each census (i.e., each single sweep) is given in Tables 11 and 12.

Each census of all three embayment areas took a total of about 5-15 minutes, each census of West Bridge lasted about 5 minutes, and it required approximately 20 minutes to move between the census site at West Bridge to the census site for the embayments.

I usually recorded the time when I started a census at West Bridge or embayments, but when I originally compiled these censuses, I just noted whether they were near a low or a high tide. At the time of finishing this paper, I do not have time to go back through my original notes to find the times of each census because they are scattered amongst several notebooks for different census projects.

Counts were usually made within three hours of the time of predicted low tide at the HMSC; most counts were for low tides less than MLW.

D. SHORTCOMINGS OF OBSERVATIONS

D-1. INTRODUCTION

In any ornithological undertaking there are shortcomings, and this is no exception. Here, only the most relevant shortcomings are examined.

D-2. SHORTCOMING: LIMITED INITIAL PURPOSE

My original purpose was to try to monitor Brant numbers with the equipment and time I had available in conjunction with other research projects. As I write this paper, it is apparent that if I had devoted more attention and time only to studying Brant that the results would be more complete and that there may have been less variance amongst counts.

D-3. SHORTCOMING: ERRORS IN DETERMINING ARRIVAL DATES

The first Brant to arrive can be easily overlooked because there may be so few (i.e., only 2-4), but there are often 10-100 by November 1 (Table 1). Ideally, one should begin looking daily for arrivals on about October 20 by carefully searching the embayment areas with a 20X telescope. However, this was not always possible because of poor visibility, large waves, or time constraints. Thus, arrival dates in Table 1 may sometimes be a day or more after they actually arrived.

D-4. SHORTCOMING: METHODS OF COUNTING BRANT

When I started counting Brant, I thought I could do an accurate count by using a 20X telescope during a single sweep of a study area. In 1989-1990, I discovered variation among counts made within minutes of each other. In hindsight, I should have done multiple censuses each day and perhaps used the 31X telescope that I acquired in 1988 more often (see section E).

D-5. SHORTCOMING: NUMBER OF CENSUSES

It seems that there can never be enough censuses. Although 596 censuses of embayments are in Table 11 and 573 censuses of West Bridge are in Table 12, it would have been helpful to have more censuses in each semimonthly period during November-January to better determine the variance in overwintering Brant numbers. Further, more counts during spring migration (especially February-April) would have been useful in detecting ephemeral, peak concentrations.

D-6. SHORTCOMING: NOT MEASURING HUMAN DISTURBANCE

Although it may not be aesthetically pleasing to count and observe the activities of people; it would have been very helpful if I had done so during each census because Brant are vulnerable to human disturbance (section P).

Ideally, it would have been useful to measure the kinds, frequency, and amounts of disturbance; however, I did not have time to do so. It is far less time consuming to census Brant (which can take 5 min) than to spend hours trying to determine the frequency and source of disturbance because disturbance can be infrequent, even though it may significantly influence the distribution and foraging of Brant (section P).

D-7. SHORTCOMING: LACK OF RECORDS SPECIFIC TO INDIVIDUAL HABITATS

Although keeping records separately of the number of Brant present at eelgrass or non-eelgrass areas would have been useful, doing so would have taken more time than I had available.

D-8. SHORTCOMING: LACK OF KNOWLEDGE ABOUT OCEAN ROOSTING

It is unclear if Yaquina Brant sometimes fly to the ocean to roost at night (section G) or in response to human disturbance (section P-2). Such knowledge is important in planning when to best census Brant or in interpreting variation among censuses that may result from some Brant being out on the ocean.

E. RESULTS AND DISCUSSION: CENSUSING TECHNIQUES**E-1. INTRODUCTION**

Brant are one of the easiest waterbirds to count accurately along the Oregon coast. They are easy to identify, they are large and thus visible from a long distance, and they do not dive out of sight during censuses.

Nevertheless, Wetzel (1996:716) estimated a 10% precision error in counting Brant at the Yaquina because of the movement of Brant or reduced visibility. Elsewhere, Wilson and Atkinson (1995) noted that errors in counting Brant varies with the methods used to count them.

E-2. TYPES OF ERRORS IN COUNTING BRANT

FLOCK MOVEMENTS.--Errors can arise if Brant are moving between areas during a census, so that they are either missed or counted twice. This is particularly a problem during migration or if Brant are disturbed.

I do not think this was a significant problem during my censuses because I could see all embayments from observation point "4" or "5", and I did not count flying Brant. If they started flying, I would wait for them to land and then start the census over again.

MOVEMENTS WITHIN A FLOCK.--A second, much more common type of error occurs while counting Brant in a tight flock, so that some may be blocked from view while others may move around and be recounted. This can happen after Brant have been disturbed, so that they walk or swim past each other so closely that it can be hard to separate counted from uncounted birds. Further, Brant lower their heads while foraging and thus can be blocked from view by others in a flock.

This problem can be aggravated by the position of the observer relative to the Brant. If Brant are distant and the observer is only slightly higher than them, then the shallow angle of view can easily result in Brant at the rear of the flock being blocked from the observer's view.

Ideally, one should be patient and wait until Brant disperse, so that the chance of missing or recounting some is reduced. However, this was often not an option because I was also trying to census other birds as well in a short time span. Thus, my counts were affected by this type of error. For example, when I did five counts within a short period of time so that movements between areas was not a problem, I found that minimum and maximum counts differed by 43-57 Brant and that the ratio of minimum to maximum counts was 86-88% (Table 2).

E-3. CENSUS METHODS: MAGNIFICATION AND QUALITY OF TELESCOPE

Especially when Brant are in a tight flock, a higher magnification of telescope may be useful in accurately censusing Brant. For example, Wilson and Atkinson (1995:92) indicate that they counted 1.692 times as many Brant

with a Questar with 50x or 130x eyepieces than with a 20x telescope. However, they appear to have been looking over longer distances than I, and they were also counting many more Brant (i.e., regularly 1,000-12,000), so their potential error of trying to count Brant in tight flocks would be greater. Thus, their correction factor is applicable under their censusing conditions, but may not be elsewhere.

Unfortunately, I did not test the 31X vs 20X telescopes to determine a correction factor between them and to estimate how many Brant I may have missed with the 20X scope. Perhaps, my counts would have been more accurate and less variable with a more powerful telescope.

However, the accuracy of counting is but one factor in determining which scope to use. Because I was also often counting other waterbirds and moving between areas, mobility was important, so I preferred using the more portable 20X scope that also had a much greater field of view than the more unwieldy Celestron.

E-4. CENSUS METHODS: DOING MULTIPLE COUNTS DURING A DAY

Another way of dealing with errors in counting Brant in flocks is to do multiple counts and then use the maximum or average count as being representative of that day. One problem with doing so is that it may take more time than the observer has, especially because disturbance (section P) may result in Brant flying and being so agitated that time and patience is needed before they disperse enough that they can be accurately counted. Further, the maximum count may be inaccurate because it may include some Brant that have been censused more than once.

E-5. CENSUS METHODS: SEASONAL TIMING

WINTERING.--If the purpose of censusing is to count overwintering Brant, then it seems obvious that counts need to be during the time when they are wintering and not migrating. Nonetheless, some early Pacific Flyway counts were done in February, when some Brant may have been migrating, but, nonetheless, were used as an indicator of wintering numbers (Denson and Murrell 1962:258; sections K and O-5). More recently, Pacific Flyway counts are usually done in January (section O-5).

As pointed out in Bayer (1983), the best time to census overwintering Brant numbers at Yaquina Estuary is probably during the 1-15 January period. One advantage to counting then is that the variance between censuses is usually less than during December or late January (Table 10, Fig. 3). If variation among censuses is reduced, then fewer censuses are needed to determine statistical differences in Brant numbers among years. The second advantage to censusing in early January is that this is before spring migrants start arriving (section L), so that censuses may better represent overwintering numbers.

MIGRATING OR SUMMERING.--Many more censuses are required to detect or enumerate migrating or summering than wintering Brant because there is great variation in the number or even the presence of Brant during spring migration (February-May) (Fig. 2, Table 10) and summering Brant (June-September) can also be hard to detect (Tables 11 and 12).

E-6. AERIAL VS GROUND CENSUSES

Brant can be disturbed by aircraft (section P-2), but aerial counts are the only practical way to cover large geographical areas. If Brant flocks are small (e.g., 500 or less birds), some researchers have considered aerial counts to be more accurate than ground counts (Leopold and Smith 1953:96), but other researchers (Denson and Bentley 1962:20, Einarsen 1965:67, 110; Henry 1980:24-25) indicate that ground counts are more accurate. Discussions of the accuracy of aerial censuses and their

use as indices of abundance rather than as exact measures of population numbers are in Stott and Olson (1972), Caughley (1974), Caughley et al. (1976), Page et al. (1982), Gaston and Smith (1984), Broome (1985), Haramis et al. (1985), Pollock and Kendall (1987), and Samuel et al. (1987).

Because aerial counts involve visually estimating the number of birds while the observer is flying, aerial counts are prone to counting errors as are ground counts. A more accurate technique may be to count goose numbers from aerial photographs (e.g., McLandress 1979).

At Yaquina Estuary, aerial censuses of wintering Brant were often much less than my ground counts, with one aerial observer (JC) only seeing 0-33% of the number of wintering Brant that I found (Table 3). Such low aerial counts may be one reason why Yaquina Estuary has been overlooked as a wintering area (section K-2).

Although aerial counts can miss Brant, they are the only way that the entire Oregon coast can be surveyed, and it is not practical to census some estuaries from the ground. Taking and analyzing aerial photographs of Brant in Oregon does not appear to be currently feasible.

E-7. CENSUS METHODS: TIME OF DAY

It is not clear if Brant sometimes fly from the Yaquina to roost at night on the ocean (section G). If they do, then variation between early morning or late afternoon and mid-day counts may be because some Yaquina Brant had left to roost on the ocean. However, it was my impression that Yaquina Brant did not go to the ocean (section G).

E-8. CENSUS METHODS: CONCLUSION

Census methodology depends upon the purpose of the research, the resources and time available, and the allowable error. There are trade-offs, so even though one could improve the accuracy of Brant counts, doing so could be at the expense of being able to census other areas or conducting other activities.

If it is not feasible to do counts that are 100% accurate, then it is important to acknowledge and accept the potential error, and to not overanalyze census data.

F. RESULTS AND DISCUSSION: BRANT FORAGING BEHAVIOR AND DIET

F-1. BRANT FORAGING BEHAVIOR

LOW TIDES.--Brant were usually at intertidal portions of embayments (especially Sallys Bend and Idaho Flats, Table 5), where they fed on vegetation, especially eelgrass, whose shoots were mostly rooted below MLW (Bayer 1979, 1996:785).

Brant were often in a few flocks at low tide, but after a Bald Eagle (*Haliaeetus leucocephalus*) passed by (section P-3), they were almost always in one large flock.

HIGH TIDES.--Both Wetzel (1996) and I observed some Yaquina Brant forage by stealing vegetation brought to the surface by American Coots (*Fulica americana*) that dove into *Z. marina* beds. Elsewhere, Brant sometimes associated with diving ducks, including scaup (*Aythya marila* or *A. affinis*), Redhead (*A. americana*), scoters (*Melanitta*), or goldeneyes (*Bucephala* spp.) to feed on vegetation that the divers brought to the surface (Cottam et al. 1944:47-48, Einarsen 1955, 1965:31).

At high tides, I also saw Brant pick up pieces of vegetation that had broken off and were floating. Although I saw Brant by the salt marsh along the west shore of Idaho Flats near the HMSC, I did not determine if they were feeding on salt marsh vegetation.

Wetzel (1996:717) noted that Yaquina Brant scattered at high tide and did not forage much.

F-2. DIET

ESTUARINE.--Many observers have emphasized the importance of *Z. marina* in the diet of Brant (e.g., Moffitt and Cottam 1941, Cottam et al. 1944, Yocom and Keller 1961, Einarsen 1965:28-29, Palmer 1976:271, Ward and Stehn 1989:42).

At Yaquina Estuary, Wetzel (1996) and I considered *Z. marina* to be very important for Brant at embayments; however, both of us also noted Brant feeding on algae at West Bridge, which mainly occurred during spring migration (Table 9). At Coos Bay, where a few Brant erratically overwinter (Table 7), Hodder (1986) found that Brant during spring migration often forage on sea lettuce (*Ulva* spp.). *Ulva* and other green macroalgae may not be very important for wintering Brant at the Yaquina because macroalgal coverage is greatest in summer and little was present in December (Bayer 1996:784). The growth of *Z. marina* and macroalgae at the Yaquina is examined in Bayer (1979, 1996).

Z. japonica is a smaller species of eelgrass that grows higher in the intertidal than *Z. marina* so it would be available to Brant for longer periods of time (Bayer 1996:781-783) than *Z. marina*. But I do not remember seeing Brant in areas (e.g., along the shores of north Sallys Bend or south Idaho Flats) where *Z. japonica* was present during my 1980-1985 Brant observations. However, during the 30 December 1995 Yaquina Bay CBC, I was surprised to see Brant along the north shore of Sallys Bend, where there were beds of *Z. japonica* (Bayer 1996), but I did not observe if Brant were actually feeding on *Z. japonica* or not. During the 1995/1996 winter, Dave Pitkin (U. S. Fish and Wildlife Service [USFWS] biologist, pers. comm.) sometimes saw Brant feeding on *Z. japonica* at Idaho Flats. Elsewhere, Brant and other waterfowl in British Columbia have been observed to forage on *Z. japonica* (Baldwin and Lovvorn 1994a,b).

Brant also sometimes feed on herring eggs (*Clupea harengus*) attached to *Z. marina* (Moffitt and Cottam 1941:18, Einarsen 1965:29, 74-75; Palmer 1976:271, Bayer 1980). At Yaquina Estuary, herring spawn erratically from as early as December 26 to about mid-April (Bayer 1980:193), and I found an average of 80 or less Brant at herring spawn sites in 1979 (Bayer 1980).

OPEN COAST.--Brant have foraged on surfgrass (*Phyllospadix* spp.) (Moffitt 1941:227, Moffitt and Cottam 1941:16-18, Cottam et al. 1944:45).

UPLAND FIELDS.--I only know of four reports of Brant being in terrestrial areas in Lincoln County: twice near Yaquina Estuary (section H-1), and Kathy Merrifield saw a single Brant together with Canada Geese (*Branta canadensis*) and Gr. White-fronted Geese (*Anser albifrons*) at Bayview Pasture nearly adjacent to north Alsea Bay on 17 and 24 March 1996.

Elsewhere in Oregon, Einarsen (1955) wrote that as many as 1,000 Brant foraged on grass in dairy pastures near Netarts and Tillamook Bays (Tillamook Co.), when *Z. marina* beds had been excessively grazed by Brant; however, he did not mention this or his 1955 paper in Einarsen (1965). Presumably for the Tillamook and Netarts Bay areas, Batterson (1954:5, 1968:4) indicated that "flocks of thousands [of Brant] gather on the grass lands and graze across the meadows like a herd of sheep" during spring when *Z. marina* became scarce. In contrast, Roy Lowe has not seen any Brant in fields along the Oregon Coast during his aerial surveys of waterfowl that began in 1985 and that primarily are during winter, so perhaps the Brant that Einarsen and Batterson reported as feeding in farm fields were a result of a *Z. marina* die-off in the early 1950's (Leopold and Smith 1953:100). Vagrants also occur far inland (Gilligan et al. 1994:42).

Away from Oregon, Black Brant have sometimes been reported to feed in fields, pastures, golf courses, and farm crops (Moffitt 1941:226-230, Moffitt and Cottam 1941:16-18, Leopold and Smith 1953:100); however, such feeding may have been because of a *Z. marina* die-off mentioned in those papers. Other subspecies of Brant sometimes feed extensively in fields or pastures (e.g., Reiger 1982, Stone and Knock 1982, Summers et al. 1993, Vickery et al. 1995, Lane and Hassall 1996).

G. RESULTS AND DISCUSSION: NOCTURNAL BRANT BEHAVIOR

G-1. NOCTURNAL BEHAVIOR OTHER THAN AT YAQUINA ESTUARY

In general, waterfowl behavior at night has been little studied (e.g., Jorde and Owen 1988, Henson and Cooper 1994), and it could be inferred that Brant are just daytime feeders. For example, Einarsen (1965:32-33, 70-71) only mentions Brant as foraging during the day, but he does not say if he looked for night feeding. Further, during part or all of the night, Brant left Humboldt Bay and roosted on the ocean (Denson and Bentley 1962:24, Henry 1980:56-57, 91), Brant also left some Washington bays to spend the night in the Strait of Georgia (Einarsen 1965:57), and Brant have been reported to depart Netarts Bay and spend the night on the ocean (John Stahl, fide Roy Lowe, pers. comm.).

In contrast, Ward and Stehn (1989:72-74) used triangulations of radiotagged Brant in Alaska, to determine that many were at Z. marina areas at night and were presumably then feeding, but that a greater percentage were at roosting areas at night than during the day. Ward and Stehn (1989:116) were not able to view Brant at night satisfactorily with 7X-9X night-vision scopes to see Brant behavior.

In England, reports of Brant feeding at night during winter are in Ranwell and Downing (1959:50), Owens (1977:11), and Lane and Hassall (1996). Ranwell and Downing (1959:43, 50) noted that Brant foraged at night in the salt marsh during full moon and also commented that Chapman (1889) observed Brant feeding by moonlight; in contrast, Lane and Hassall (1996) wrote that moon phase and intensity did not affect the amount of salt marsh foraging. Owens (1977:11) found that Brant sometimes fed at night during cloudy weather and that they mostly fed between tides when water lifted their food off the mud; perhaps Brant see food items better at night in water, or they can reduce ingesting mud with their food when it is floating rather than laying on the mud. Lane and Hassall (1996) reported that individual Brant in the same flock varied widely in the occurrence of nocturnal foraging.

A paper that I have not seen (Madsen et al. 1989) may indicate that Brant are active at night at nesting areas east of Greenland (fide Henson and Cooper 1994:1013).

G-2. NOCTURNAL BEHAVIOR AT YAQUINA ESTUARY

INTRODUCTION.--There is conflicting evidence about what Brant do at night at Yaquina Estuary, but Brant may not always go out to the ocean to roost or always remain within the estuary. Brant may do both, depending upon the weather, tidal conditions, daytime foraging success, disturbance, and season. In any case, many more observations are needed to elucidate their nocturnal behavior at the Yaquina.

OCEAN ROOSTING.--On 21 January 1923, Ira Gabrielson (unpubl. field notes) was at Yaquina Estuary and wrote: "Black Brant flew straight down the bay and over the sandspit point on which the town was built, going straight out to sea and returning to the bay in the morning over the same route." This suggests that Yaquina Brant went out to the ocean at night.

However, I did not see any Brant flights from the embayments to the ocean in the late afternoon, but perhaps I did not do enough observations after sunset to see such flights; for example, Pitkin and Lowe (1995:5) saw Canada Geese making flights to the ocean up to an hour or more after sunset. However, at Humboldt Bay, Brant started flying to the ocean several hours before sunset (Henry 1980:57).

On 16 February 1996 when sunrise is at about 0717 PST, Roy Lowe (pers. comm.) saw a flock of 50 Brant at 0733 PST and 19 Brant at 0741 PST fly into Yaquina Estuary from the ocean, but it is not clear if these were spring migrants or Brant returning to Yaquina Estuary after spending the night on the ocean. However, Dave Pitkin (pers. comm.) counted Brant later

that day and did not find an increase in numbers or any banded Brant that he had not seen before, so these Brant may have spent the night on the ocean. At Humboldt Bay, Henry (1980:57) found that many Brant flew from the ocean into the bay an hour or more after sunrise.

During the evening of 21 February 1996, I went around embayments and West Bridge and did not hear any Brant.

NOCTURNAL PRESENCE IN YAQUINA ESTUARY.--Since the bayfront has lots of outdoor lights, Brant may use this light (which dimly illuminates at least part of Idaho Flats) for foraging. I sometimes heard Brant late at night at embayments and West Bridge in March-April 1974, even a week or more away from a full moon and when tide heights were greater than MLW (Table 4).

On 28 March 1996 at Yaquina Bay State Park (just west of "2" in Fig. 1), Dave Pitkin looked for Brant flights coming from the ocean during 0500-0540 PST but did not see any. At 0545, he went up the estuary and found 162 Brant scattered over embayments and channels, which was down slightly from the 176 that he had counted the day before. Either these Brant spent the night in the estuary or they flew in before 0500.

DISCUSSION.--There would be at least two advantages to Brant remaining at embayments at night rather than going out to the ocean. First, Brant could at least sometimes forage with minimal human and no eagle disturbance (section P) at night.

A second advantage to remaining at the protected embayments is that Brant could drown if they roost on the ocean. This has been reported for other geese in Oregon (Springer et al. 1989, Pitkin and Lowe 1995:6) and for Brant in California (Wooten 1954, Einarsen 1965:74). However, Robert Loeffel (unpubl. data) has been doing beached bird walks along 4.5 mi (7.2 km) of beach starting about 1.5 mi (2.4 mi) south of the Yaquina Bay South Jetty from 1978 to the present and has found few if any Brant each year. Further, the beaches just south of the South Jetty and north of the North Jetty are often walked by people, so even if Brant were only beached occasionally, we would probably have heard about these reports, but we have not. Thus, Brant may either not be present on the ocean near the Yaquina and/or rarely drown in the ocean and wash ashore.

H. RESULTS AND DISCUSSION: BRANT DISTRIBUTION

H-1. NONESTUARINE SITES THAT WERE RARELY, IF EVER, USED BY BRANT

As noted in section F-2, Black Brant sometimes feed in farm fields, but perhaps only during periods of *Z. marina* die-offs. The only large fields or pastures adjacent to Yaquina Estuary are at Hidden Valley (Fig. 1). The only report of Brant at Hidden Valley is of 17 on 24 December 1992, but I suspect that the observer was mistaken. No one else has ever reported Brant at Hidden Valley, although it has occasionally been birded, especially during the Yaquina Bay CBC, and Roy Lowe has conducted USFWS aerial winter waterfowl surveys there since 1988.

I have made a few observations of other fields near Yaquina Estuary and have received field notes from birders in the Newport area since 1973. The only other nonestuarine report near the Yaquina that I am aware of is by Laimons Osis of a singleton feeding on the grass along the Yaquina Bay South Jetty road, just a few yards away from the water, on 27 March 1995.

H-2. ESTUARINE SITES WHERE BRANT WERE ABSENT

NORTH SHORE.-- As noted earlier, I originally censused North Shore at the same time as Idaho Flats but have split off North Shore because Brant were not present there and most locals only consider Idaho Flats to be the embayment south of the channel. So the dates and times listed for censuses at Idaho Flats (Table 11) also apply to North Shore.

KING SLOUGH.--I made over 100 observations here throughout the year during 1973-1975, but never saw any Brant in the area that I have included with King Slough ("k" in Fig. 1). To save space, I do not list each observation. However, I did see Brant at the mouth of King Slough, which I included with South Bay ("o" in Fig. 1).

UPPER ESTUARY.--I censused this area (see Fig. 1) over 100 times during November-May of 1973-1985 and also many times throughout the rest of the year without ever finding any Brant here. Similarly, Wetzel (1996) only noted Brant as far upstream as the shore opposite the site of Yaquina (Fig. 1). The Upper Estuary has also often been birded by others, but I have not found any records of anyone seeing Brant in the Upper Estuary. To conserve space, I do not list these observations.

H-3. ESTUARINE SITE THAT BRANT RARELY USED: EAST BRIDGE

The East Bridge area has changed since the construction of the South Beach Marina, which began in August 1977. Prior to the marina, there was a large intertidal sandflat embayment with a small stream that drained some dirt ponds used for salmon-rearing at Oregon Aqua-Foods before it was expanded and some rock ruins near the southeast corner of the bridge.

In spite of observations throughout the year prior to the marina being constructed, I only saw Brant three times at East Bridge. I counted 16-30 Brant on 27 March, 28 March, and 28 April 1974; so, similarly to West Bridge (section H-4), they were only occasionally present in spring. Further, Wetzel (1996) did not find them here during the spring of 1976. Thus, it appears that Brant were not very common here prior to the construction of the marina in 1977, perhaps because many people were clamming or walking the sandflats, and there was little or no Z. marina.

After the construction of the marina, I seldom censused East Bridge during the winter or spring but could see much of the western portion of this area when I censused West Bridge (Table 12) and the eastern portion when I censused Idaho Flats and North Shore (Table 11). I did not see any Brant at East Bridge during these observations.

I suspect that Brant may avoid East Bridge because of the high level of human disturbance (also see section P-2). On the north side of the channel was the Newport bayfront, docks, Coast Guard Station, and a resort; on the south side was the marina and other docks. Boats were often moving to and fro along the channel.

To save space, I do not list East Bridge observations.

H-4. ESTUARINE SITE USED BY BRANT ONLY IN SPRING: WEST BRIDGE

Wetzel (1996) found Brant here during the spring of 1976, with the northwest shore used much more than the southeast shore. Wetzel felt that Brant went to the northwest shore of West Bridge as a refuge from human disturbance at the embayments, although he noted Brant doing some foraging at West Bridge.

I usually only found Brant at West Bridge during February-May, although a few were sometimes present in June-December (Table 9). Like Wetzel, I noted that Brant seemed to prefer the northwest shore and, secondarily, the south shore between the bridge and the first rock "finger" west of the Bridge. My West Bridge censuses are in Table 12.

H-5. ESTUARINE SITES USED BY BRANT IN WINTER AND SPRING: EMBAYMENTS

During the spring of 1976, Wetzel's (1996) map indicates that the embayment areas most heavily used by Brant were the west shore of Idaho Flats near the HMSC and portions of Sallys Bend.

My censuses of embayments that commenced in 1980 are in Table 11. I found that Brant usually arrived in late October or early November, numbers

built up to a plateau in December or January, their abundance sometimes fluctuated greatly during February, and peak spring numbers were usually slightly greater than wintering peaks (Fig. 2 and Table 9). This seasonal pattern at embayments is similar to two coastal areas in Washington studied by Wilson and Atkinson (1995:93), except that the spring peak abundances in Washington were several times greater than wintering numbers.

On average, Brant were at Idaho Flats during 59% of the censuses, at Sallys Bend during 45% of the censuses, and at South Bay during only 17% of the censuses (Table 5). However, it was my impression that Sallys Bend was used much more than Idaho Flats when tide heights were less than MLW, and it would have been useful to closely study Brant distribution at all tide heights to find out how their distribution changes. During high tides, I, like Wetzel, often saw Brant along the west shore of Idaho Flats near the HMSC.

Although Brant were sometimes out in the main Yaquina channel, I thought they only did so when they were disturbed or during high tides.

H-6. CONCLUSIONS: DIFFERENCES BETWEEN AREAS

Both Wetzel's (1996) spring observations and my censuses throughout the year indicate that Brant did not use all of Yaquina Estuary. My results, however, make it clear that Brant were essentially just spring migrants at West Bridge but were winter residents as well as spring migrants at embayments (e.g., Table 9).

In terms of density in March 1981 and 1982, Brant were about 5-10 times denser at West Bridge than at embayments (Bayer 1983:81).

Because of these differences, censusing only one portion of Yaquina Estuary could give a very distorted view of Brant usage.

I. RESULTS AND DISCUSSION: FALL ARRIVAL

I-1. DATE OF FALL ARRIVAL

The timing of Brant arrivals in Oregon seems to be in dispute. Gabrielson and Jewett (1940:129) indicate that the earliest arrival date for Brant was November 25, Einarsen (1965:53) suggested that Brant may not have arrived until December in 1957, and Batterson (1954, 1968) wrote that Brant arrived "around the middle of November." However, John Wampole reported 365 Brant flying over Coos Bay on 19 October 1958 (Contreras 1996). Further, Brant arrival dates I compiled for Yaquina Estuary in late October were reported by Bayer (1983) and Dau (1992). Nevertheless, Gilligan et al. (1994:41) say that Brant typically arrive in mid-November.

The most recent listing of arrival dates at Yaquina Estuary is in Table 1. The earliest arrival date is October 22, and there are 12 years with arrivals in late October, so October arrivals are not rare (Table 1). However, in a few years (e.g., 1980 and 1987), Brant did not arrive until November 3 or 4, even though observers tried to find them earlier. In only four years were arrival dates after November 4 (1942, 1974, 1991, and 1993) (Table 1), but I suspect that observation effort in these years was inadequate to determine if Brant arrived earlier.

Yaquina arrival dates are similar to those at Humboldt Bay, where Brant have also often arrived in late October (Henry 1980:28-30).

Brant arrival dates may not have changed in the past 50 years--I suspect that observation effort is considerably greater today, so that Brant are being detected earlier. For example, prior to the 1970's, there were not as many researchers, no one appeared to be studying Brant intensively, and observers would have probably been limited to unaided eyes or binoculars, although a telescope is preferable in scanning the embayments to tell when Brant arrive. Further, we have a Yaquina arrival date in 1942 of November 14 (Table 1), and Wampole saw them on 19 October 1958 (Contreras 1996).

I-2. BRANT ABUNDANCE WHEN THEY ARRIVE

1-2 Brant sporadically appear at the Yaquina during summer (Table 9), so it could be difficult to distinguish overwintering Brant from fall arrivals. However, 10-100 Brant were recorded in late October in 1976-1977, 1979-1984, and 1996 (Table 1), so October arrival dates are not just a result of seeing 1-2 summering birds. Similarly, Henry (1980:28-30) found 28-200 Brant that had arrived in late October of 1975-1977.

J. RESULTS AND DISCUSSION: BRANT ABUNDANCE IN NOVEMBER-JANUARY**J-1. GENERAL PATTERN OF NOVEMBER-JANUARY ABUNDANCE**

After their arrival, Brant numbers slowly built up at embayments (but not West Bridge) during November and early December (Fig. 2). By about mid-December and through January, the rate of increase in numbers declined, although there were often more Brant in January than December (Fig. 2, Table 9). There was a lot of variation between years in Brant abundance for a given semimonthly period (Table 10), but the December and January semimonthly periods had less variation as measured by Coefficients of Variation (usually less than 10%) or Minimum/Maximum census ratios (usually 80% or more) than the November or February semimonthly periods (Table 10).

J-2. REASONS FOR VARIATION IN NOVEMBER-JANUARY ABUNDANCE

There could be several reasons for the variation in Brant numbers within one November-January period or between different winters. First, variation could simply be a result of my censusing methods. If I had used a more powerful telescope or did 3-5 counts of Brant after patiently waiting for Brant to be relatively dispersed and used the average or maximum count as a measure of the number of Brant present, the variation in numbers of Brant counted would probably have been less (section E).

Second, during the December-January periods of 1985/1986, 1986/1987, and 1989/1990; the number of Brant declined (Fig. 3), perhaps because of poor weather and subsequent dispersal. For example, a series of storms on 6-9 January 1990 may have resulted in a decrease in Brant numbers from about 500 on 30 December 1989, 6 and 7 January, and 1445 PST on 8 January 1990 to 390 on 8 January 1990 at 1555 PST and about 300-400 on 10 and 22 January 1990 (Table 11). Perhaps an example of dispersal is that on 8 January 1996 at about 0730 PST, Dave Pitkin (pers. comm.) saw 20 Brant flying south at Cape Kiwanda about 11 mi (18 km) south of Netarts Bay, and on 15 January 1996, Kathy Merrifield (pers. comm.) saw flocks of 14, 21, and five Brant flying south at about 0930 PST at Yaquina Head, which is about 2.7 mi (4.3 km) north of Yaquina Estuary; these Brant were flying the wrong way to be early spring migrants.

Third, it is possible that some of the variation in the number of Brant at embayments was because some had left and were roosting on the ocean during my censuses (section G). For example, Brant were flying to and from the ocean at Humboldt Bay during most daylight hours (Henry 1980:57), although such flights were often caused by human disturbance causing Brant to leave Humboldt Bay (Henry 1980:52-54).

Finally, some of the variation within a season could be that spring migration commenced earlier in some years than others.

K. RESULTS AND DISCUSSION: ARE BRANT WINTERING OR PASSING THROUGH?**K-1. DEFINITION OF "WINTERING"**

The meaning of "wintering" Brant has often not been very clear (e.g., see Denson and Murrell 1962:258-259). The most informative way of defining "wintering" is to see if banded Brant remain during the winter or if individuals are only present a few days or weeks and there is a continual migration going on during the winter. However, this is very time consuming

and much more difficult than just doing counts of Brant; Dave Pitkin (USFWS biologist) has been doing this during the 1995-1996 winter at the Yaquina.

The common way of defining "wintering" is the presence of Brant during "winter." For Brant in California and Baja California, Denson and Murrell (1962:258, 261) suggest that Brant present in December are wintering, and Henry (1980:iii) and data in Kramer et al. (1979:245) suggest that wintering occurs from about mid-November through mid- to late January. For Brant in Washington, Wilson and Atkinson (1995:93) defined the wintering period as October-February.

K-2. MISPERCEPTION THAT BRANT DO NOT WINTER AT YAQUINA ESTUARY

After looking through some published references, a reader could easily and erroneously conclude that Brant do not overwinter at Yaquina Estuary:

- 1) Gabrielson and Jewett (1940:129) are somewhat ambiguous about wintering Brant in Oregon. They write that Brant were not abundant until December or January and that Yaquina, Netarts, and Tillamook Bays were the favorite Oregon bays for Brant in "late winter." A reader could infer from this that there were few wintering Brant, and their "late winter" could be in February, when Brant may be migrating.
- 2) Leopold and Smith (1953:97-98) indicate that the only places that Brant were found in January 1952 along the Oregon coast were Tillamook and Netarts Bays.
- 3) Batterson (1954, 1968) does not clearly write that Brant wintered at Yaquina Bay.
- 4) Einarsen (1965:53) writes that William Breese did not record any Brant at Yaquina Bay until after Christmas during the 1957-1958 winter, which suggests that none may have wintered at the Yaquina then. Einarsen (1965:87) also writes that only Netarts and Tillamook Bays have Brant populations consistently and that the presence of Brant at other Oregon areas varies from year to year, so he (1965:89) listed Tillamook, Netarts, Yaquina, and Coos Bays as "Waning or Lost Wintering Areas."
- 5) Smith and Jensen (1970:227-228) note that Oregon areas were disused by Brant for wintering.
- 6) Oregon Dept. of Fish and Wildlife (ODFW) "Mid-winter" counts are sometimes very low (e.g., only 382 Brant for all of Oregon in 1969, Oregon State Game Commission 1972:143), so readers could think few or no Brant wintered in Oregon.

However, Yaquina Bay CBC data have been published in *American Birds* since 1973 (e.g., Table 7), and CBC's occur in late December or the first week of January, so they occur when Brant are considered to be wintering. In Bayer and Krabbe (1984:119), we gave the average abundance (330 Brant) and 100% frequency of Brant during 1973-1982 Yaquina Bay CBC's. Further, Phillips (1984:53-54) lists wintering numbers of Brant at Yaquina Estuary that I had sent him, and I published the numbers of wintering (December and early January) Brant at Yaquina Estuary for the 1980 through 1982 winters (Bayer 1983:83-84) and also mailed letters with wintering Brant numbers at the Yaquina to several waterfowl biologists in 1986-1990.

Nevertheless, Ball et al. (1989:432) mistakenly indicate that the only concentration areas for Oregon Brant in winter are Coos and Tillamook Bays.

A hopeful sign is that Gilligan et al. (1994:41) wrote that Brant winter at Netarts, Tillamook, and Yaquina Bays and that small numbers sometimes winter at Coos Bay.

K-3. CENSUS DATA SUGGEST THAT BRANT WINTER AT YAQUINA ESTUARY

Brant have been present at Yaquina Estuary during the "wintering" period every winter beginning with 1973 (Tables 6 and 9). But this is probably not a recent phenomenon as some were present in January 1923, December 1947, and January 1967 and 1968 (Table 6).

I suspect that at least some Brant arrive at Yaquina Estuary in mid-November and winter through at least mid-January. I base this on the steady increase and approximate plateau of numbers in December and January and also the reduced variation in Brant numbers during this time (Figs. 2 and 3, Table 10). However, it is possible that some Brant are arriving while others are leaving, so that Brant numbers remain relatively constant, but with different individuals. Thus, data from banded individuals are necessary to determine if individual Brant overwinter at the Yaquina.

K-4. OTHER OREGON WINTERING SITES

Presence of Brant during a CBC suggests that Brant may have wintered there. CBC's indicate that Brant were only routinely found at the "Tillamook Bay" CBC (which can include Netarts Bay) and Yaquina Bay CBC (section O-4, Table 7). In some years, as many as 106 (but more often less than 20) Brant were found during the Florence, Coos Bay, Coquille Valley, Port Orford, and Gold Beach CBC's (Table 7).

K-5. YAQUINA ESTUARY AS A WINTERING AREA

It is important that biologists recognize that Brant winter at Yaquina Estuary because if the recent trend of low Brant numbers continues (Tables 9 and 11), then Brant may abandon the Yaquina as a wintering site before biologists recognize that there may be a problem.

L. RESULTS AND DISCUSSION: ONSET OF SPRING MIGRATION

At Baja California and Humboldt Bay, spring migration commences from early to mid-January or early February (Denson and Murrell 1962:258, Kramer et al. 1979:245, Henry 1980:25-30).

At the Yaquina, the onset of spring migration is often not clearcut and may vary from year to year. In 1976, Brant were migrating by early February, since estimates from Wetzel's (1996) data indicate that there were 28-160 Brant on February 2 and 7, 1,509 Brant on February 8, and 307 or less during his 11 subsequent February-April censuses; I also saw Brant flying to and from the ocean on February 9 at an unrecorded time.

On 15 January 1981 at unrecorded times, I saw one flock fly from over the ocean into Yaquina Estuary and land and a second flock of about 150 Brant fly from the ocean to Idaho Flats, turn, fly back to the ocean, and then fly northward. On 17 January 1981, I also saw at least two flocks flying to or from the ocean at unrecorded times. But Brant numbers did not significantly fluctuate (which may signal migration) until early February in 1981 or most other years (Fig. 2). However, in a few years (e.g., 1985, 1986, and 1989), large fluctuations occurred in late December or early January (Fig. 3). Again, data about the comings and goings of banded individuals are necessary to determine if these shifts are local movements, dispersal, or migration.

M. RESULTS AND DISCUSSION: BRANT FLUCTUATIONS DURING FEBRUARY-MAY

My observation effort was greater during winter than in spring, so I may have missed peak numbers in spring (Table 11). From February through about mid-April, Brant numbers fluctuated greatly and also reached their overall peak (Fig. 2, Tables 8 and 9). Peak counts were in February or March, but counts in April were also sometimes very high (Table 8); however, in 1985, the peak count was in January (Table 8), but I did few counts of the entire estuary that spring (Table 11).

Wetzel (1996) counted Brant at the Yaquina during February-April 1976; the estimate of 1,509 Brant from his February 8 census is the only count of more than a thousand Brant at the Yaquina that I know of, and my peak count was 914 Brant (Table 8). Thus, Yaquina Estuary is clearly not a major spring staging area because five thousand or more have been found during

spring migration at Humboldt Bay (Henry 1980:26-27, 32) and two coastal areas in Washington (Wilson and Atkinson 1995:93).

At Coos Bay, Wampole estimated a maximum of at least 800 on 4 April 1959 (Contreras 1996:547), and Hodder (1986:57) found an average of 120-496 Brant in March 1982-1984.

Elsewhere along the Pacific Coast, the peak abundance of Brant generally occurred in March or early April in Baja California or California (Denson and Murrell 1962, Kramer et al. 1979:245, Henry 1980:25-27, 32) and in late April in Washington (Wilson and Atkinson 1995:93).

In May, usually 0-20 Brant were present at Yaquina Estuary (Tables 9 and 11). But 200 were reported on 25 May 1965 (Hesse and Hesse 1965), and I counted up to 67 in early May 1982 and 61-206 in early May 1984 (Table 11).

N. RESULTS AND DISCUSSION: BRANT RARITY IN JUNE-EARLY OCTOBER

N-1. YAQUINA ESTUARY AND LINCOLN COUNTY

Our first report of Brant in summer in Lincoln County is of a female that was collected on 28 July 1941 at Yaquina Bay by J. C. Braly (Bayer 1989:38). The first published report of summering Brant is by Smith (1961), who found a pair along the ocean beach at Lincoln City on 10 August 1961.

During 1972-1992, Brant were recorded in Lincoln County during June in 12 years and during July-September in 13 years (Bayer 1995:425). In 1982, 1984, and 1988, when summer observation effort may have been better than usual, Brant were recorded during each month of the year (Bayer 1995:425). My impression was that Brant were more commonly found along the open coast in summer than in Yaquina Estuary, where as many as 13 were found in June 1983, but usually only 1-2 were uncommonly counted during June-September (Table 9). There was no evidence that Brant nested in Lincoln County.

In 1973, a pair of intergrade Black X Atlantic (B. b. hrota) Brant were spotted at Yaquina Estuary in late July (Hoffman and Elliott 1974). Determining intergrades can be difficult because summering Brant are commonly molting and look a lot different than wintering birds.

N-2. ELSEWHERE IN OREGON

The earliest published summering records were by Giesler (1952:38, 55), who found as many as 13 Brant in Coos County during six days from 18 June through 2 July 1951. Batterson (1954, 1968) saw a flock of five along the ocean beach in Clatsop County on 14 August 1954. In 1958 and perhaps also in 1957, a pair raised a brood of young at Coos Bay (Einarsen 1965:36).

Although usually only 1-2 summering Brant are found, they may sometimes be more numerous at Netarts Bay as about 200 Brant were reported on 12 July 1975 (calculated from Munson 1976:156, 165) and in late August 1977 (Contreras 1977:21). However, Munson (1976:163-165) only found Brant during one of his 15 censuses from 28 June-17 August 1975 at Netarts Bay, so they were apparently not very common there that summer.

O. RESULTS AND DISCUSSION: CHANGE IN BRANT ABUNDANCE?

O-1. IMPORTANCE OF COMPARING ABUNDANCES FOR THE SAME SEASON

In the 1970's, a very good observer, Bob Buchanan, who had watched birds at Yaquina Estuary for many years, said that he did not think that there were as many Brant here as there once were. This may be true, but I have not seen any censuses to confirm or disprove it.

If such statements are based only on memories, then they may be mistaken because memories are selective. For example, seeing a huge flock of Brant is much more "memorable" than the date the flock was present or that large flocks were rare. Since the difference between seeing 1,509

and 160 Brant can only be a day (Wetzel 1996:719), a good observer could remember seeing a great number of Brant once during spring migration, but compare it to the numbers that now overwinter or that are usually present during spring migration. This is an unfair comparison; only accurate, accessible censuses can be used to determine population changes.

O-2. IMPORTANCE OF ACCURATE CENSUSES IN MAKING COMPARISONS

If pre-1980 Brant censuses are found, they may be inaccurate because observers did not have good optical equipment or did not correct for limitations in censusing techniques (section E). For example, observers may have used unaided eyes or binoculars with less sharpness or magnification than are available today. If the accuracy of censuses is questionable, it is not possible to accurately determine if there have been changes in Brant abundance.

O-3. CHANGE IN NUMBER OF BRANT DURING FALL MIGRATION (NOVEMBER)?

In November, Brant numbers are greatly increasing as the month progresses (Fig. 2). This variation (e.g., Table 10) makes comparisons of abundance among years tenuous and limited to detecting very large differences. The only pre-1980 November counts are for 1974-1978 (Table 6) and are not grossly dissimilar from more recent censuses (Table 11).

O-4. CHANGE IN NUMBER OF WINTERING BRANT DURING DECEMBER-JANUARY?

INTRODUCTION.--Brant numbers "wintering" along the U. S. Pacific Coast have decreased considerably in the past 50 years (Smith and Jensen 1970:229, Reiger 1982, Ball et al. 1989). Unfortunately, it is not clear if censuses used by these authors were truly for wintering birds (December-January) or were for spring migrants (February). It is essential to be specific about how "wintering" is defined (section K-1).

At the Yaquina, Brant numbers during December through January are much less variable than in November or February-April (Fig. 2, Table 10). Accordingly, statistically significant changes in Brant numbers can be detected with fewer censuses than during periods with greater variability.

Unfortunately, there may not be any relatively accurate censuses of wintering Brant at Yaquina Estuary prior to 1980. What records I could find are in Table 6, and if those data are used without caution, it appears that Brant numbers may have increased since the 1973/1974 through 1975/1976 winters (Tables 6 and 8). But I know the data for the 1970's were incidentally made, so their accuracy is questionable; I suspect that they were underestimates of the number of Brant present.

Potential sources of historical wintering data for the Yaquina are discussed below.

USFWS DATA.--It is not clear what historical December-January data may exist somewhere in USFWS files. The USFWS appears to have conducted some Winter Waterfowl Surveys in early January (Leopold and Smith 1953, Denson and Murrell 1962:258). Also, Hansen and Nelson (1957:245) give Oregon "Winter Inventory" totals for 1949-1956, but it is not always clear when the Pacific Flyway Counts were done (see section O-5). So it is not certain if these counts are estimates of wintering or migrating Brant.

Perhaps these USFWS counts are in the Portland USFWS office or elsewhere as raw data or reports (e.g., Chattin 1960, 1961). Roy Lowe (USFWS biologist at South Beach) does not have them.

If these counts can be found, they need to be analyzed cautiously because they are probably aerial censuses that may have missed Brant (section E-6). For example, Leopold and Smith (1953:97-98) indicate that Brant did not winter at Yaquina Bay in January 1952, which I suspect is an oversight. Further, if counts were done in late January or February, then

they should not be used to indicate wintering numbers or sites because spring migration might have already been underway.

ODFW DATA.--The ODFW and the preceding Oregon State Game Commission appear to have conducted Mid-Winter Inventories of waterfowl during the first week in January from 1946 to at least 1982 (e.g., Oregon State Game Commission 1972:115, 143). Unfortunately, their published results pool Brant counts for all of Oregon and do not give count methods (e.g., Oregon State Game Commission 1972). Perhaps, their censuses for Yaquina Bay still exist, but some of their Brant censuses appear to be very low (e.g., only 382 Brant for all of Oregon in 1969, Oregon State Game Commission 1972:143), so I suspect that their counts sometimes underestimate Brant numbers, possibly because their staff did Brant counts too infrequently to do so accurately or they censused unfamiliar areas.

CBC DATA.--The Yaquina Bay CBC began in 1973, and the results are compiled in Table 7. It is easy to analyze CBC results beyond their accuracy because results are rough estimates of numbers present; CBC results are probably most accurate for determining bird presence and least accurate for measuring bird abundance.

Some problems with CBC data are not apparent from just looking at the published data. For example, participants from different groups can count the same birds over again because Brant move between areas; this is particularly a problem for the Yaquina Bay CBC because one group has Idaho Flats and a different group has Sallys Bend. This problem is not treated consistently in published Yaquina Bay CBC data, since Brant counts for the two groups are added in some years, but the maximum number counted by a single group are given in other years; this is illustrated in Table 7 by the "official" published number being followed in parentheses by the unpublished, maximum number seen by a single group. Because of the problem in re-counting Brant, using the maximum number seen by one group is probably a better estimator of the Brant present, but a reader of the published CBC data would not know this and probably would not be able to access the unpublished data.

The range in Yaquina Bay CBC Brant counts (108-707 Brant) is much less than for the "Tillamook Bay" CBC (6-4100 Brant) (Table 7). A reader could infer from this that the number of Brant at Tillamook Bay is much more variable than at Yaquina Bay. However, Owen Schmidt (the Tillamook CBC compiler) wrote that the northern tip of Netarts Bay is included in their CBC and that 490 Brant were seen by the group that had Netarts Bay during their 1995 CBC. Thus, one source of the variability in the "Tillamook Bay" CBC is that Netarts Bay Brant may be included some years, but not others. I suspect that another source of variability could be that observation effort in counting Brant during the Tillamook CBC varied considerably among years. Finally, some of the largest Tillamook counts may have resulted from the same Brant being recounted by two or more groups as has also sometimes happened during the Yaquina Bay CBC. In conclusion, the published "Tillamook Bay" CBC counts for Brant are less easy to accurately interpret than they appear on a printed page in a respected journal.

O-5. CHANGE IN NUMBER OF BRANT DURING SPRING MIGRATION?

Determining yearly variation during February-May is speculative because there is so much daily variation in numbers (Fig. 2, Tables 10-12). Thus, differences may reflect observation effort and chance in doing counts during peak days rather than reflecting real differences in Brant numbers.

The USFWS has conducted aerial Pacific Flyway counts, but their timing is unclear. They were done in February in the past (Denson and Murrell 1962:258) and now may be "generally in January" (Pacific Flyway worksheet, fide Roy Lowe) and usually in the first two weeks of January (Roy Lowe, pers. comm.), but in published reports their timing is not given (e.g., Ball et al. 1989). Because Brant start migrating in late January or February (section L), biologists may have mistakenly used Pacific Flyway

counts as measures of Brant wintering sites or abundance (Denson and Murrell 1962:258), rather than more accurately as indices of spring migration. Because Pacific Flyway counts are aerial censuses, they may sometimes underestimate Brant numbers (section E-6).

Wetzel (1996) counted Yaquina Brant during February-April 1976 and had a maximum count of about 1,509 Brant on February 8. His count is much greater than what I found, but his 13 other counts of 300 or less Brant are fewer than I sometimes found (Table 8). Because there can be so much variation among censuses during this period (Fig. 2, Tables 11 and 12), his and my counts are not significantly different, except for his high count.

O-6. CHANGE IN NUMBER OF SUMMERING BRANT?

Summering Brant are now reported much more than they have been in the past, but only a few Brant are usually counted (Table 9). This recent increase in reports probably reflects much greater observation effort and better recordkeeping in the past 20 years.

O-7. FACTORS THAT MAY AFFECT BRANT ABUNDANCE

INTRODUCTION.--Several references suggest that Brant numbers have decreased in Oregon (section O-4), but I do not have data that specifically indicate that Brant numbers at Yaquina Estuary have decreased in the past 50 years. Nevertheless, it is relevant to discuss factors that may have affected Yaquina Brant abundance in the following sections.

Z. MARINA.--This species of eelgrass is a significant food item for Brant (section F-2), and Wetzel (1996) found that Brant spent significantly more time at areas with than without eelgrass during the spring of 1976.

Wilson and Atkinson (1995:96-97) indicate that there has been a great decline in wintering Brant numbers at their two coastal areas in Washington, which they suggest resulted from a decrease in *Z. marina*.

Unfortunately, it is not clear if persistent *Z. marina* beds have increased or decreased at Yaquina Estuary. The only published maps of eelgrass beds are in Gaumer et al. (1974:30), ODFW (1978), and Wetzel (1996); perhaps the ODFW surveys that were used in making their maps or the apparently unpublished ODFW 1973/1974 eelgrass survey map photocopied in Wetzel's original report may still exist in ODFW files. The only reports about the growth of Yaquina *Z. marina* are Bayer (1979, 1996), and although I report on zonation and annual/persistent beds, these reports are not useful in setting up baselines for the size and location of eelgrass beds.

However, I suspect that persistent *Z. marina* beds are less extensive today than they were a hundred years or so ago because Phillips (1984:61-62) wrote that sedimentation and turbidity brought about by logging or dredging limit eelgrass growth and that dredging or filling can destroy eelgrass beds. Perhaps sedimentation resulting from human activities is the reason why so much of the mudflats at Idaho Flats and South Bay is now above MLW.

In Wilson and Atkinson's (1995) areas, oystering had a negative impact on eelgrass beds, but that is not a problem at Yaquina Estuary because oyster farming occurs in the Upper Estuary, where there is little *Z. marina* (Gaumer et al. 1974:30-31).

HUMAN DISTURBANCE.--Brant are very susceptible to human disturbance (section P), but it is unclear if the amount and types of human disturbance have changed at the Yaquina. Perhaps the ODFW has data about how hunting and other kinds of disturbance such as the number of clambers and shoreline and boat fishermen (e.g., Gaumer et al. 1974:16, 19, 27-29) have changed.

Z. JAPONICA.--Brant can feed on *Z. japonica* (section F-2), which is a smaller species of eelgrass that has been discovered relatively recently and is thought to have arrived in the Pacific Northwest along with oysters

from the Orient (Bayer 1996:783). It appears to be expanding in extent at the Yaquina (Bayer 1996) and may be beneficial to Brant because it is present higher in the intertidal than *Z. marina*, so *Z. japonica* is available for foraging when *Z. marina* is submerged (Bayer 1996).

 P. RESULTS AND DISCUSSION: DISTURBANCE

P-1. INTRODUCTION

Human activities disturb Brant (e.g., Denson and Murrell 1962, Einarsen 1965:56, 70-98; Smith and Jensen 1970:236, Owens 1977, Kramer et al. 1979, Henry 1980, Ward and Stehn 1989, Dahlgren and Korschgen 1992, Ward et al. 1994, Wetzel 1996).

Since Brant spend 40-90% of their daylight hours foraging (Owens 1977:10, Kramer et al. 1979:249, Henry 1980:49, Ward and Stehn 1989:77-78), disturbance could decrease their foraging efficiency. Disturbance also increases the amount of time spent flying, which is energetically costly (Owens 1977:11-12, Kramer et al. 1979:250, Ward and Stehn 1989:149).

However, I did not make any attempt to measure the frequency of disturbance or the number of people involved in activities that could disturb Brant. My censuses were brief (a few minutes), but much longer observations (perhaps a minimum of an hour each) are required to measure disturbance.

P-2. HUMAN DISTURBANCE

BRANT HUNTERS.--Batterson (1954, 1968) discusses Brant hunting, presumably only in Oregon, and wrote that the best Brant hunting was at Netarts, Tillamook, Yaquina, and Coos Bays. Einarsen (1965:76-98) also wrote about Brant hunting.

Brant and waterfowl hunters affect Brant in two ways: by direct physical injury (death or crippling) (Denson 1964, Kramer et al. 1979, Henry 1980:69-71) or by disturbing Brant while they are feeding so that they may be more stressed and less able to survive. At Humboldt Bay and Baja California (Denson and Bentley 1962:24, Denson and Murrell 1962:260, Kramer et al. 1979:250-253, Henry 1980:53), Brant often reacted to hunting by stopping feeding and flying to the ocean, where they rested. In Oregon, heavy hunting pressure can cause Brant to leave favored sites and fly to the ocean (Einarsen 1965:95, Batterson 1968:5), but I did not observe this at Yaquina Estuary, although I did not watch hunters often, so I could have missed such flights. In California, hunting is thought to be one factor that may have led to Brant abandoning traditional overwintering areas (e.g., Denson 1964:118, Henry 1980:4, 56-62, 90).

During the 1950's, only about three Brant per year were supposedly shot in Lincoln County (Einarsen 1965:105), and during 1962-1970 no Brant were recorded as taken in Lincoln County and an average of less than three per year were reported as shot in Tillamook County (Carney et al. 1975:106). However, more Brant may have been shot and not reported because there would not be any hunting if so few were taken, and Batterson (1954, 1968) wrote that Brant were hunted in these areas. Recently, an average of 95 Brant per year were reportedly harvested in Oregon (ODFW 1996:25).

WATERFOWL HUNTERS.--Because Brant often react to hunting in general and not just Brant hunters, limiting Brant hunting may decrease direct Brant mortality, but Brant foraging efficiency may still be reduced during the general waterfowl hunting season.

The timing of the waterfowl and Brant hunting seasons may be important in determining the significance of disturbance. Hunting during fall migration may exert enough pressure that Brant may abandon portions of a bay for the rest of the winter for foraging (Einarsen 1965:95). If the hunting season occurs when adult Brant are paired (mating begins in January, Einarsen 1965:36), then nesting success can be reduced because of the break-up of established pairs (Einarsen 1965:97-98), and if hunting

occurs during the early spring migration, then breeding adults may be harvested more (section Q-2).

ILLEGAL HUNTING OR SHOOTING.--My impression is that illegal Brant or waterfowl hunting at Yaquina Estuary occurs sometimes, but there are too few law enforcement officers to stop it. I have observed illegal hunting methods such as using motorboats to disturb Brant so that they may fly towards hunters, but proving intent is difficult in court. I have not attempted to obtain records of citations for illegal Brant hunting, but I have heard that citations have been given to hunters for having more than their bag limit at Yaquina Estuary.

Further, a few "hunters" may shoot birds (including nongame birds) without intending or attempting to recover or use them; this has been documented at Morro Bay, California (Einarsen 1965:72-73). At the Yaquina, a hunter once told me he had shot American Coots only to exercise his retriever dogs, I saw hunters shooting ducks without the means to recover those falling in deep water, and I discovered a local resident shooting at Great Blue Herons (*Ardea herodias*) in King Slough for target practice in the 1970's. Such shooting could result in an underreporting of Brant "hunting" mortality or at least in increased disturbance of Brant.

AIRCRAFT.--Aircraft are highly disturbing to Brant (e.g., Denson and Bentley 1962:20, Einarsen 1965:67, Smith and Jensen 1970:231, Owens 1977, Kramer et al. 1979:251, Henry 1980:63, 66; Ward and Stehn 1989:80-121, Ward et al. 1994), but I rarely saw airplanes flying low enough over embayments or helicopters flying near enough to areas used by Brant for aircraft to be a significant disturbance factor during my observations.

However, the Newport Airport is just south of Idaho Flats, so aircraft can potentially be a significant disturbance factor. Exceptionally, there was a short-lived venture (I believe in the 1980's) along the Newport Bayfront (Fig. 1) in which a seaplane was used as a tourist attraction for flights around the area; it took off and landed along the main Yaquina Estuary channel adjacent to Idaho Flats. Such flights were very noisy and would have been very disturbing to Brant.

Since the 1980's when I did most of these censuses, the U. S. Coast Guard routinely flies helicopters to and from the airport, but I do not know if their flights disturb Brant.

OYSTER CULTURE.--Einarsen (1965:71-72) indicate that human activities involved with oyster farming can disturb Brant.

HARASSMENT AT HERRING SPAWNS.--Brant, as well as other birds, feed on herring eggs attached to *Z. marina* (section F-2). Some fishermen object to this as being harmful to herring (Einarsen 1965:74-75), but I did not see people harassing birds at Yaquina herring spawns (Bayer 1980, pers. obs.).

OTHER HUMAN ACTIVITIES.--Although hunting can cause direct mortality, other human activities may also result in indirect mortality or abandonment of wintering areas by disturbing Brant from feeding areas. For example, Einarsen (1965:71, 73-74) mentions that boating significantly disturbs Brant, so that they consequently spend the night out on the ocean.

Wetzel (1996:717-718) noted that clam and shrimp diggers, fishermen, boaters, and people walking on the mudflats disturbed Brant and that Brant went to the north side of the West Bridge area as a "refuge" when all *Z. marina* areas were being used by humans.

During my observations, I also saw that the approach of clambers, boats, people digging for mud shrimp, and fishermen resulted in Brant leaving an area. Clammers may be particularly disturbing because they were most numerous at low tides less than MLW, which is also when persistent *Z. marina* beds became more available to Brant for foraging. Maps of the distribution of clambers and fishermen at Yaquina Bay in 1971 are in Gaumer et al. (1974). In California, Henry (1980:63, 66) also noted that clambers disturbed Brant during low tides, and, at Netarts Bay, Munson (1976:158-159) noted that humans affected the distribution and sometimes

the density of waterbirds other than Brant.

Although I have observed people letting their dogs chase waterbirds at Siuslaw Estuary (Bayer and Lowe 1988:100 "Disturbance--dogs") and north Siletz Bay (unpubl. data), I do not remember seeing this happen at Sallys Bend, although it may have at Idaho Flats.

P-3. DISTURBANCE BY POTENTIAL AVIAN PREDATORS

Elsewhere, Bald Eagles, Golden Eagles (*Aquila chrysaetos*), Gyrfalcons (*Falco rusticolus*), and Peregrine Falcons (*F. peregrinus*) disturbed or preyed on Brant (Einarsen 1965:66-68, Kramer et al. 1979:249, Ward and Stehn 1989:95-101, Ward et al. 1994).

At Yaquina Estuary, Gerow (1939) saw a Bald Eagle capture a Brant, but I only saw Bald Eagles disturb and flush Brant (Bayer 1987). I also observed Brant flush when a Peregrine Falcon flew over embayments, but Peregrine Falcon flights at the Yaquina were much rarer than flights by Bald Eagles. Occasionally, Brant would also flush when a Red-tailed Hawk (*Buteo jamaicensis*) or Northern Harrier (*Circus cyaneus*) flew by, but this may have only happened when an eagle or Peregrine Falcon had flown by recently and the Brant were still unsettled.

Q. RESULTS AND DISCUSSION: OTHER

Q-1. BANDED BRANT

Many Brant have been captured at nesting areas and fitted with colored neck collars or colored tarsal bands. I did not see any collared or banded Brant during the winters of the 1980's, but perhaps if I had then had a more powerful telescope, I would have seen some.

During the past few years, Dave Pitkin (pers. comm.) has often found Brant with colored tarsal bands at the Yaquina.

Q-2. AGE CLASS OF BRANT

Immature Brant can be distinguished from adults by the presence of white-edged greater and middle wing coverts (Denson and Murrell 1962, Kramer et al. 1979, Henry 1980:17, Wilson and Atkinson 1995). Being able to identify immatures is important because their biology may differ from adults; for example, adults appear to start spring migration earlier (Hansen and Nelson 1957, Kramer et al. 1979, Henry 1980:33-35, 92-93).

I did not attempt to determine the age class of Brant, and it may not have been possible to do so with the 20X telescope.

Q-3. ATLANTIC BRANT

Records of Atlantic Brant along the Oregon Coast are rare, especially since Atlantic and Black Brant were combined into one species. But Batterson (1954, 1968) reported that two were at Tillamook Bay on an unknown date, and Gilligan et al. (1994:42) gave several records.

I did not sort through all Brant looking for Atlantic Brant because time and adequate light conditions were not always available to do so. The only Atlantic Brant that I recorded was one with 503 Black Brant at Sallys Bend on 2 February 1982. During summer, lingering Brant are often molting and may look like Atlantic Brant (section N-1).

Q-4. BELLY COLOR OF BRANT

Reed et al. (1989) found gray- and black-bellied Brant from different breeding stocks wintering in the Strait of Georgia and Puget Sound; I did not look for differences in belly color.

 R. FIGURES AND TABLES

FIGURE 1. Yaquina Estuary areas censused for Brant; also see section B-2 for written descriptions of study areas and section C-2 for discussion of observation points. HMSC=Hatfield Marine Science Center, SB Marina=South Beach (Newport) Marina.

Observation points of West Bridge:

- 1=first rock finger (groin) west of Highway 101 Bridge
- 2=cliff on north side of channel, just west of the Highway 101 Bridge

Observation points of embayments:

- 3=north side of Idaho Point, along Idaho Flats
- 4=south of Liquified Natural Gas (LNG) tank (X)
- 5=east of LNG tank
- 6=Coquille Point

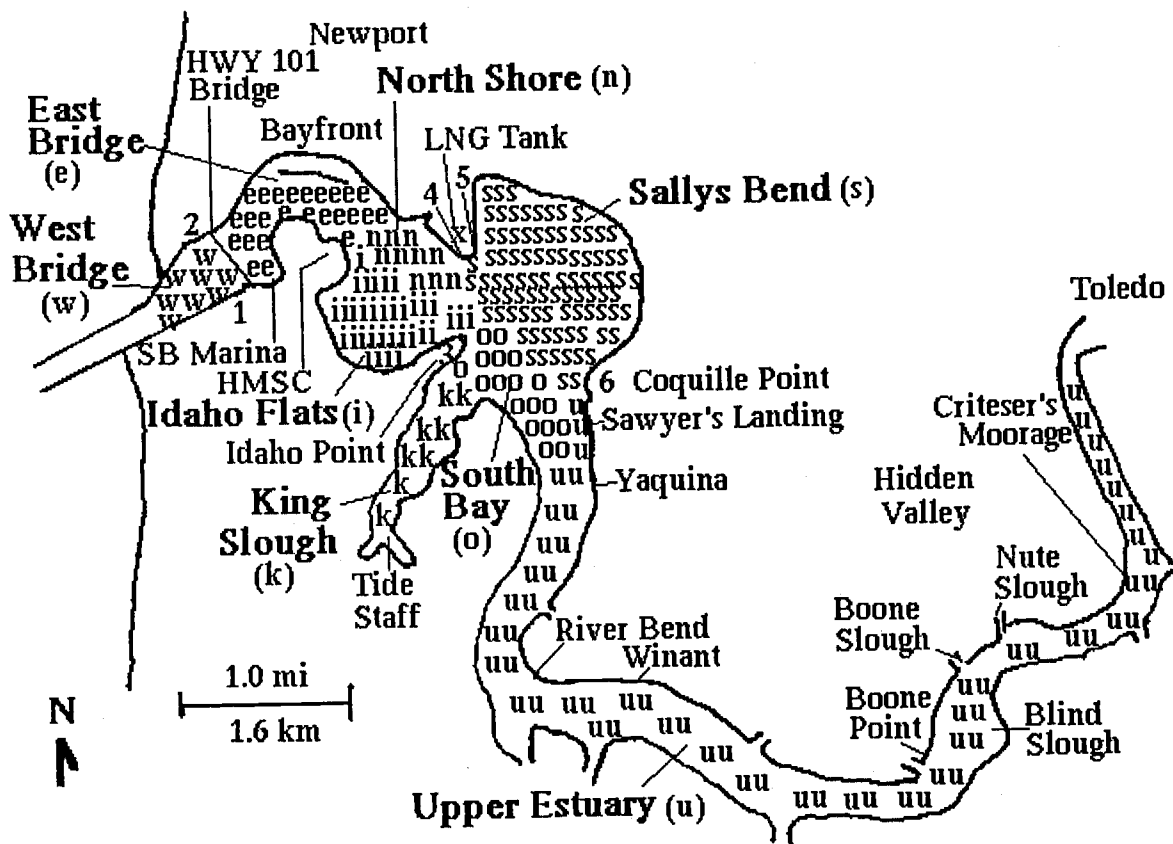
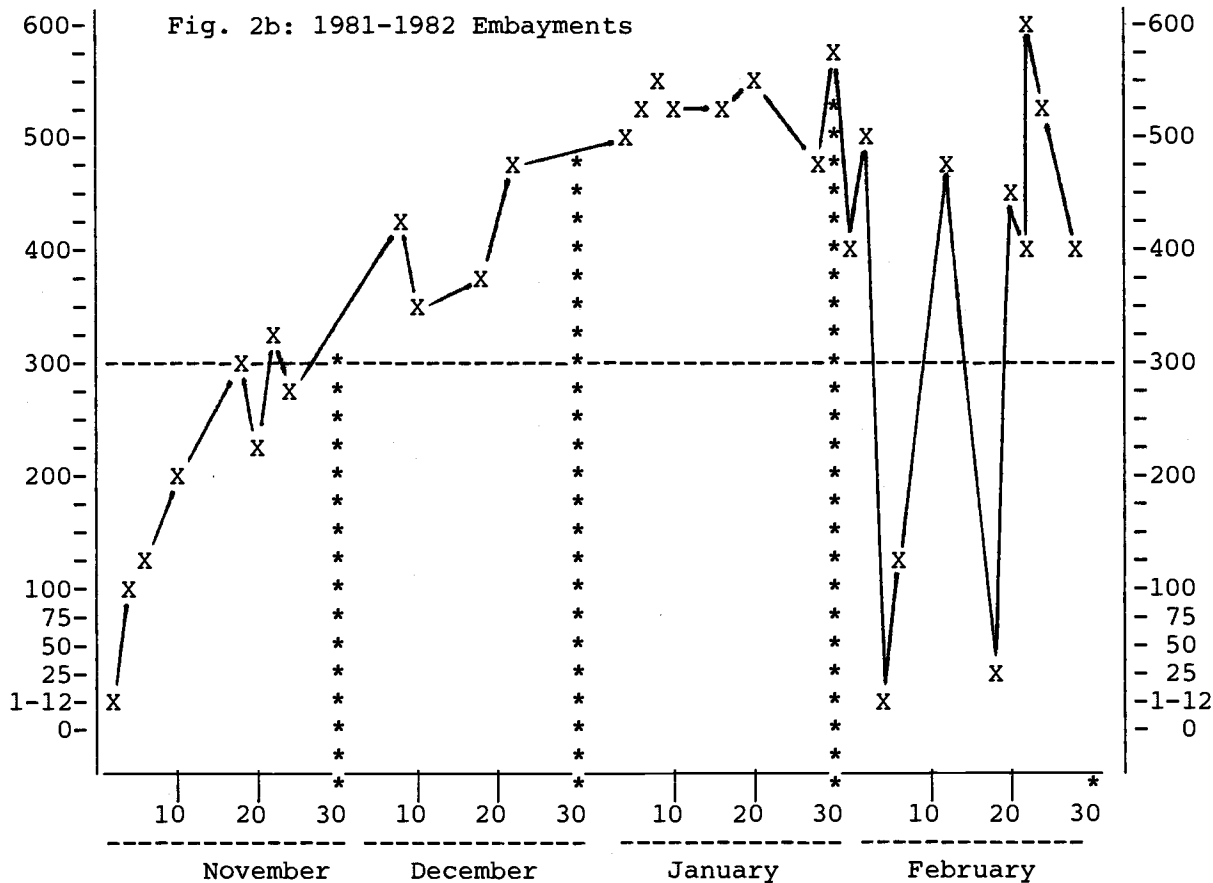
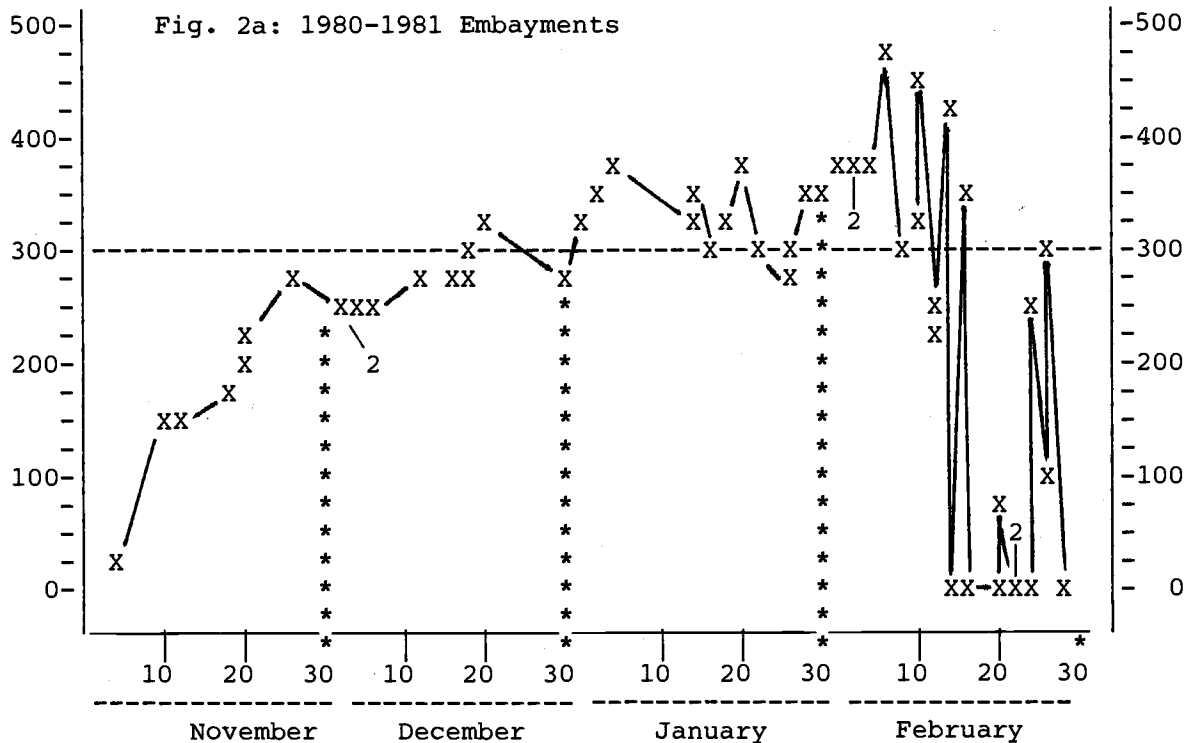
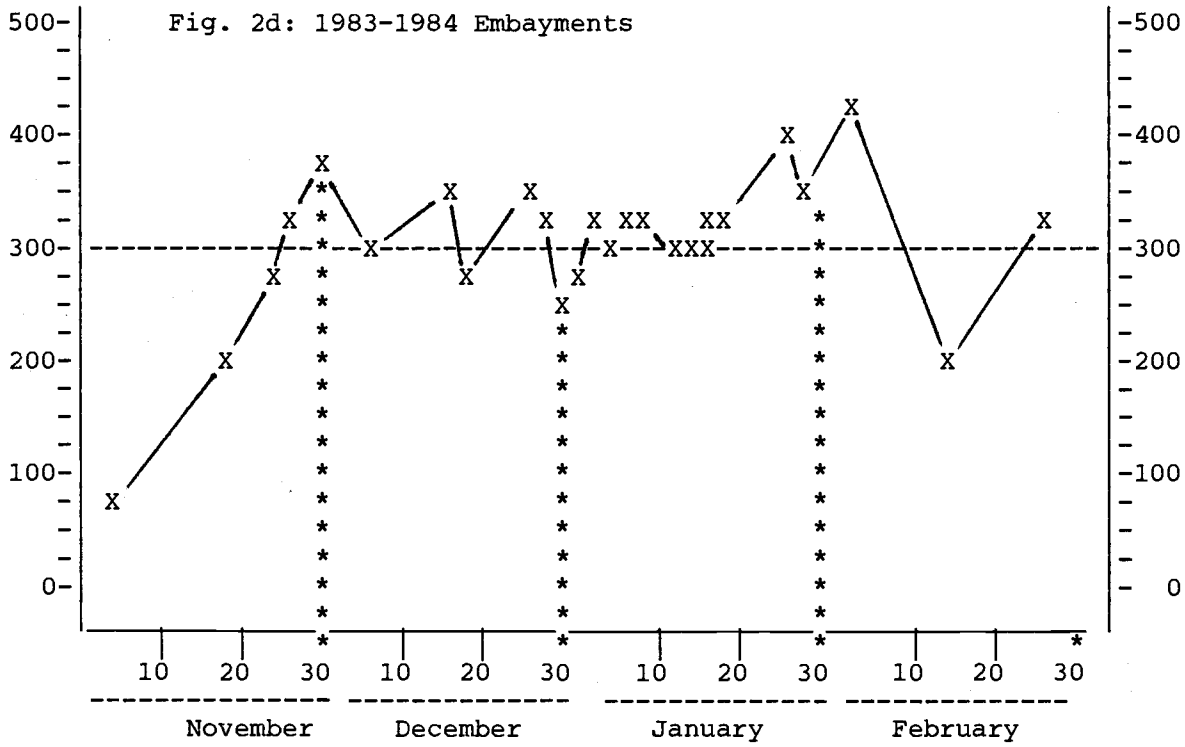
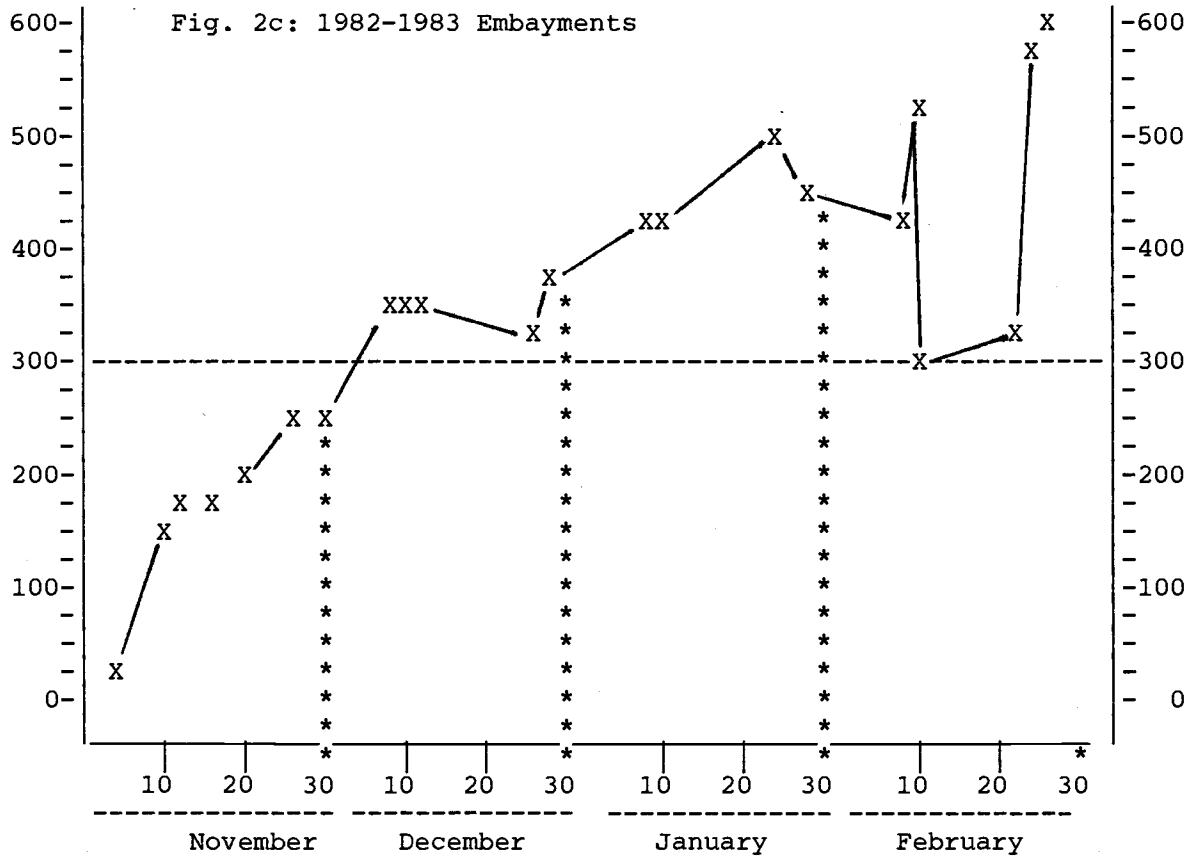


FIGURE 2. Number of Brant at embayments (i.e., sum of Idaho Flats, Sallys Bend, and South Bay) during November-February for five winters with censuses each month. Fig. 2a-2e data are from Table 11. Numbers pointing to a "X" refer to the number of censuses for that graphical point.





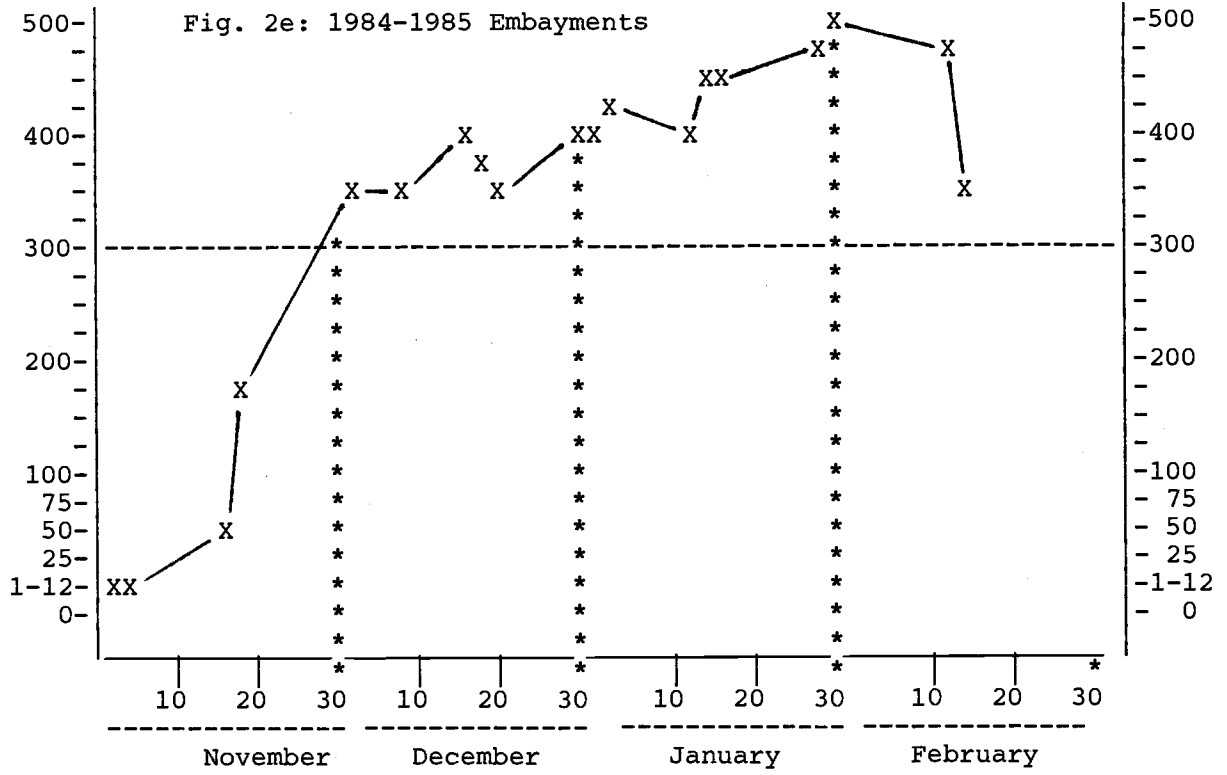


FIGURE 3. Number of Brant at embayments (i.e., sum of Idaho Flats, Sallys Bend and South Bay) during December-January for nine winters with several censuses each month. Data are from Table 11. Each winter is to the same scale. X=number of Brant, @=border between graphs, and *=December 30. Numbers pointing to a "X" refer to the number of censuses for that graphical point.

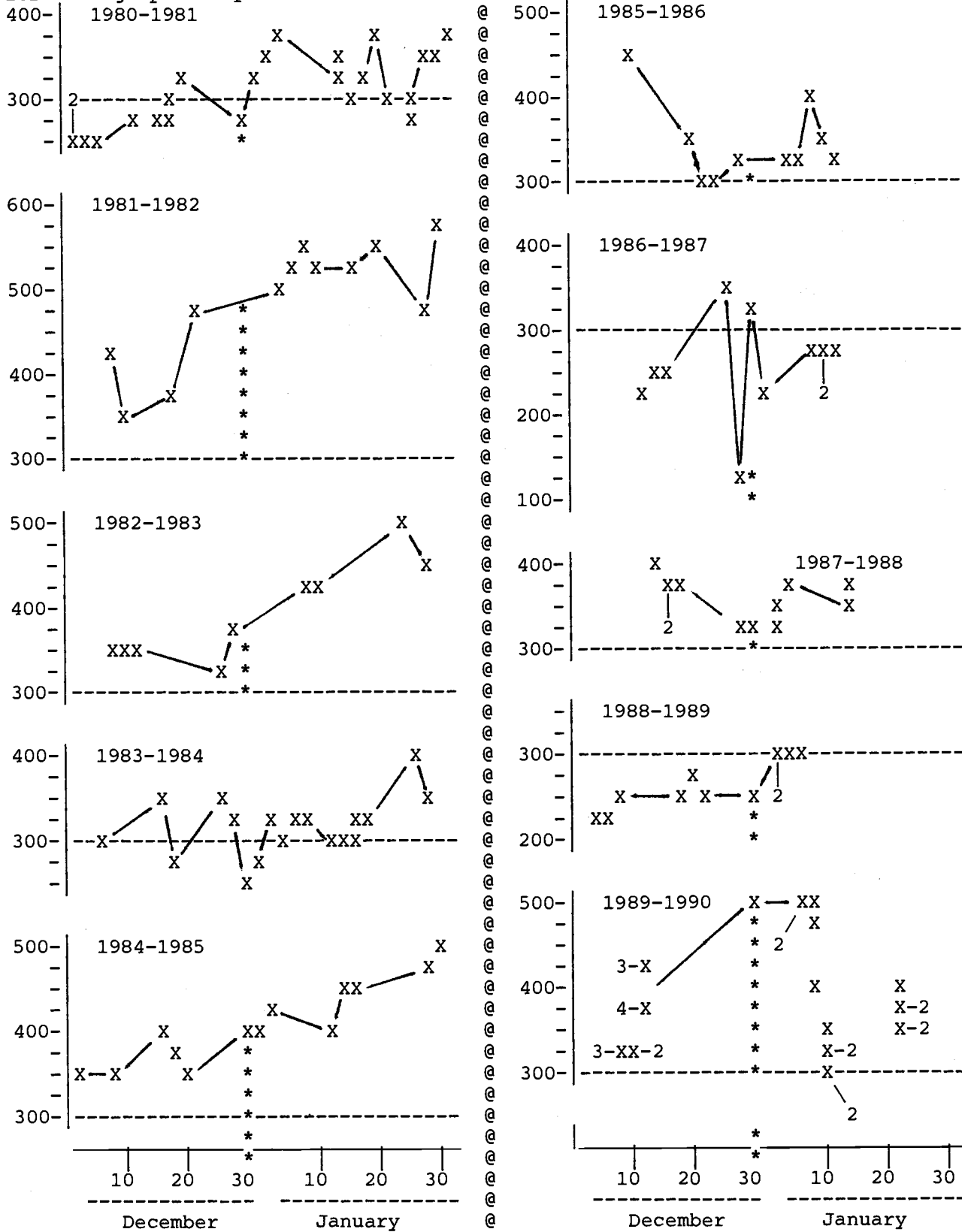


TABLE 1. Arrival dates of Brant at Yaquina Estuary. Most of these arrivals were also published in Bayer (1983:83, 1995:425) and Dau (1992:89); however, some dates have been adjusted with updated data, and 1982 and 1995 dates are later than in those publications because Brant in those years were first seen in Lincoln County away from Yaquina Estuary (see footnotes d and f). Large counts of Brant in October are also given in the footnotes.

Fall	Brant Arrival at Yaquina Estuary... Date	Number	Prior Observation Effort	Observer
1942	Nov. 14	?	Poor	Fred Evenden, Jr.
1974	Nov. 11	5	?	Range Bayer
1975	Nov. 3	6	?	Range Bayer
1976	Oct. 29	16	?	Range Bayer
1977	Oct. 22 a	? a	Good	Range Bayer
1978	Nov. 4	?	?	Jerry Smith
1979	Oct. 23 b	2 b	Good	Range Bayer
1980	Nov. 3	16	Good	Range Bayer
1981	Oct. 25 c	4 c	Good	Jan & Rick Krabbe
1982	Oct. 29 d	20 d	Good	Range Bayer
1983	Oct. 23 e	? e	Good	Jerry Smith
1984	Oct. 27	10	Good	Range Bayer
1985	Oct. 26	?	Good	Range Bayer
1986	Nov. 4	8	?	Roy Lowe; Range Bayer
1987	Nov. 4	18	Good	Range Bayer
1988	Oct. 29	3	Good	Range Bayer
1989	Oct. 26	4	Good	Range Bayer
1990	Oct. 23	4	Good	Range Bayer
1991	Nov. 20	1	Poor	Terry Morse
1992	Nov. 2	2	?	Range Bayer
1993	Nov. 7	65	?	Kathy Merrifield
1994	Nov. 1	10	?	Roy Lowe
1995	Nov. 4 f	12 f	?	Matt Hunter
1996	Oct. 25 g	10 g	?	Range Bayer

a On 10/31/77, George Brown counted 100 Brant.

b On 10/29/79, Range Bayer counted 40 Brant.

c On 10/29/81, Range Bayer found 18 Brant.

d On 10/24/82, Phil Pickering saw seven at DeLake by Lincoln City.

e On 10/24/83, Paul Reed counted 29; on 10/26, Rob Lawrence counted 38; and, on 10/29, Range Bayer counted 71 Brant.

f On 10/20/95, Bureau of Land Management staff saw a flock of eight at Yaquina Head, which is along the open coast north of Newport.

g On 10/28/96, Dave Pitkin counted 31 Brant; on 10/30, Robert Olson counted 29; and, on 10/31 and 11/1, Bayer counted only 11 Brant, so some Brant did not remain.

TABLE 2. Days with five censuses within minutes of each other at embayments. All counts were by Bayer with a 20x telescope. The weather, water chop, and light conditions were good for making observations; there was no rain and negligible wind. Each census is given in Table 11.

Codes:

Distance=estimated distance between the observer and the approximate mid-point of a Brant flock; this was estimated using a map.

Elevation=estimated elevation of telescope above the mudflats.

SD=Standard Deviation.

CV=Coefficient of Variation (%) (i.e., $[SD/Mean] \times 100$)

MAX=maximum.

MIN=minimum.

Census Date	Dist- ance (km)	Elev- ation (m)	5 Censuses.....				MIN/ MAX (%)
			Mean	SD	CV (%)	Range	
12/12/89	0.5	3-4	392.6	22.7	5.8	370-419	88.3
1/10/90	0.8	2-3	323.0	17.4	5.4	302-345	87.5
1/22/90	0.2-0.8	2-3	365.8	22.2	6.1	342-398	85.9

TABLE 3. Comparison of December through January USFWS aerial censuses within three days of ground censuses of Brant at Yaquina Estuary. This time period was chosen for comparison because Brant numbers should be about the same within a few days of each other then. My 1/18/80 census is from Table 6, and the remainder are from Table 11; USFWS censuses are courtesy of the USFWS. Note that USFWS surveys were of the entire estuary, but that my counts were usually only of embayments; this probably would not make much difference because Brant were usually not at West Bridge during this period.

Codes:

JA=John Annear

JC=John Cornely

RL=Roy Lowe

CS=Carey Smith

N=number

USFWS/Bayer=(number of Brant in USFWS census)/(number of Brant in Bayer's census) expressed as a percentage

USFWS Aerial Census.....			Bayer's Ground Census.....				USFWS/Bayer (%)
Date	Brant (N)	Obser- ver(s)	Date	Brant (N)	Embay- ments	West Bridge	
1/18/80	130	JA	1/18/80	283	X		46
12/11/80	207	CS, JA	12/12/80	268	X	X	77
1/11/83	25	JC	1/11/83	428	X		6
12/15/83	75	JC	12/16/83	338	X		22
1/6/84	0	JC	1/6/84	320	X		0
12/13/84	137	JC	12/16/84	412	X		33
12/9/85	45	RL	12/10/85	446	X		10
1/6/86	427	RL	1/6/86	361	X		118
1/5/87	382	RL	1/8/87	286	X	X	134
1/5/88	305	RL	1/3/88	372	X	X	82
12/3/88	450	RL	12/5/88	215	X		209
1/7/89	205	RL	1/6/89	298	X		69

TABLE 4. Records of Brant at Yaquina Estuary after sunset in 1974. These records were made while I was studying Great Blue Herons. It was not raining during any of these observations. I judged Brant as not flying if their calls were not moving like when they fly and if the calls appeared to be coming from the water surface or mudflats.

Min. Temp.=minimum daily air temperature as given for Newport in the monthly Climatological Data for Oregon (U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration). Note that the temperature at the time of observation is much more appropriate but is not available, so the daily minimum temperature, which may occur several (many ?) hours before or after the observation is only a rough index of air temperature.

Tide measurements were made at the Wecoma Dock just north of the HMSC (Fig. 1); tide heights were interpolated from hourly data.

Sunset times are corrected for latitude and longitude for sunset times given in Tide Tables for West Coast of North and South America (U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration).

Codes:

?=unknown

+ =time after event

- =time before event

CLR=clear

Ht.=height

Ida=Idaho Flats

OV=overcast

PST=Pacific Standard Time

Sal=Sallys Bend

WBr=West Bridge

1974 Date	Time (PST)	Time Relative to...			Tide Ht. (ft)	Site	Brant.....		Weather.....		Min. Temp (F)
		Full Moon (days)	Sun- set (hr)	Low Tide (hr)			Fly- ing	Heard or Seen	Wind	Sky	
3/30	2345	-7	+5.1	+0.8	+4.4	Sal	?	Heard	none	OV	42
4/12	1945	+6	+0.9	-2.1	+4.1	Ida	No	Heard	?	?	33
4/16	0050	+10	+5.8	-0.7	+3.2	Sal	No	Heard	none	CLR	31
"	0130	+10	+6.5	0	+3.0	Sal	No	Heard	?	?	31
"	0200	+10	+7.0	+0.5	+3.0	Sal	No	Heard	?	?	31
"	0240	+10	+7.7	+1.2	+3.3	Sal	No	Heard	none	CLR	31
"	0305	+10	+8.1	+1.6	+3.4	Sal	No	Heard	none	CLR	31
4/28	2300	-8	+3.7	-0.2	+2.7	WBr	No	Heard	calm	CLR	43

TABLE 5. Percentage of embayment censuses with Brant present at Sally's Bend, South Bay, or Idaho Flats during November-January. Only November-January periods with at least 10 censuses and only censuses in which all three areas were surveyed are included. Percentages do not sum to 100% because Brant were not always present during these censuses or Brant could be at more than one area during a census. Data are calculated from Table 11 for high and low tides.

Codes:

N=number

Winter=November-January period

SD=Standard Deviation

CV=Coefficient of Variation.

Nov.-Jan.	% of Embayment High & Low Tide Censuses with Brant at.....			Total Censuses (N)
	Sally's Bend	South Bay	Idaho Flats	
1980-1981	66.7	51.9	37.0	27
1981-1982	45.0	10.0	70.0	20
1982-1983	37.5	18.8	62.5	16
1983-1984	62.5	4.2	58.3	24
1984-1985	38.9	16.7	77.8	18
1985-1986	20.0	0	80.0	10
1986-1987	63.6	0	45.5	11
1987-1988	33.3	20.0	60.0	15
1988-1989	41.7	25.0	33.3	12
1989-1990	42.9	21.4	67.9	28
No. of Winters	10	10	10	
Mean	45.2	16.8	59.2	
SD	14.9	15.3	16.1	
CV	32.9	91.0	27.2	
Range	20.0-66.7	0-51.9	33.3-80.0	

TABLE 6. Incidental counts of Brant during November-January at Yaquina Estuary prior to the summer of 1980; however, John Annear's (USFWS biologist) aerial censuses were much more systematic. These counts may underestimate the number of Brant present because observers were not attempting to count all Brant or only counted Brant at one part of the estuary. Wetzel's (1996) censuses during the spring of 1976 are not included; censuses starting in the 1980 summer are in Tables 11 and 12.

Observer (Obs.) codes: MSC=daily checklist kept at the MSC (now HMSC) through October 1977
 JA=John Annear (USFWS) RO=Robert Olson
 RB=Range Bayer PR=Paul Reed
 BB=Bob Buchanan VT=Verda Teale
 CBC=Yaquina Bay Christmas Bird Count YB Tr=monthly field trip by Yaquina Birders
 FE=Fred Evenden, Jr.
 IG=Ira Gabrielson

Site (see Fig. 1 for locations) codes:
 ?="Yaquina Bay" Idaho=Idaho Flats WestBr=West Bridge
 EastBr=East Bridge Sallys=Sallys Bend

Brant abundance (N=number of Brant counted) codes:
 +=at least the indicated number of Brant were present
 X=Brant present, but not counted
 (#)=maximum number of Brant counted by one group during Yaquina Bay CBC.
 Sometimes Brant could be recounted by two groups and added together to give the "official" count (see Table 7 and section O-4).

Date	Obs.	Site	Brant (N)	Date	Obs.	Site	Brant (N)
1/21/23	IG	?	"Common"	11/3/75	RB	EastBr	6
				11/4/75	RB	Sallys	6
11/14/42	FE	?	X	11/5/75	PR	?	14
				11/8/75	YB Tr	?	50
12/6/47	FE	?	11+	11/17/75	RB	WestBr	16
				11/17/75	RB	Idaho	163
1/14/67	VT	?	X	11/23/75	RB	Sallys	20
				12/13/75	YB Tr	?	75
1/1/68	VT	?	X	12/19/75	MSC	?	100+
1/1/68	BB	?	85	1/3/76	CBC	?	143(134)
1/21/68	BB	?	123	1/25/76	YB Tr	?	155
12/20/73	CBC	?	246 (?)	11/2/76	RB&RO	Idaho	66
1/2/74	RB	Idaho	X	11/8/76	RO	?	100
1/16/74	MSC	?	24	11/13/76	YB Tr	?	100
				12/11/76	YB Tr	?	127
11/11/74	RB	Sallys	5	1/2/77	CBC	?	324(200)
11/12/74	RB	Sallys	75	1/14/77	RB	Sallys	218
11/16/74	YB Tr	?	67				
12/2/74	MSC	?	45	11/1/77	RB	Sallys	23
12/3/74	MSC	?	20	1/2/78	CBC	?	265(201)
12/8/74	RB	Sallys	160				
12/11/74	MSC	?	50	11/17/78	JA	aerial	85
12/17/74	RB	Sallys	180	12/10/78	PR	?	300
12/21/74	CBC	?	146 (?)	12/19/78	JA	aerial	460
12/25/74	RB	Sallys	188	12/31/78	CBC	?	535(400)
1/8/75	RB	Sallys	84				
1/10/75	MSC	?	170	12/29/79	CBC	?	499(252)
1/15/75	RB	Sallys	159	1/18/80	JA	aerial	130
1/18/75	RB	Sallys	150	1/18/80	RB	Sallys	283
1/20/75	RB	Sallys	203				
1/22/75	RB	Sallys	103				
1/27/75	MSC	?	125				
1/31/75	RB	?	117				

 TABLE 7. Number of Brant reported during Oregon coastal Christmas Bird Counts (CBC's). CBC sites are arranged from north to south. Means and frequency of occurrence data for 1973-1982 CBC's are in Bayer and Krabbe (1984).

I searched Watson (1982:1-6, 60) to verify that I had all CBC's published from the 1947 Audubon Field Notes through the 1981 American Birds and have double-checked more recent reports to be sure that I did not miss any CBC's published in American Birds, Oregon Birds, and National Audubon Society Field Notes. But it is possible that I missed CBC's published in Bird-Lore (through 1940) and Audubon Magazine (1941-1946).

CBC site codes:

CE=Columbia Estuary

TB="Tillamook" Bay (Owen Schmidt, recent Count Compiler, indicates in a 29 February 1996 letter that the northern tip of Netarts Bay is included in the Tillamook Bay CBC and that in the 1995 CBC, 490 Brant were counted by the group that had north Netarts Bay. Thus, Brant reported during this CBC could be for Tillamook Bay and at least part of Netarts Bay.)

Net=Netarts Bay

Nes=Nestucca Bay

LC=Lincoln City (Siletz Bay)

YB=Yaquina Bay

AB=Alsea Bay

FL=Florence (Siuslaw Estuary)

CB=Coos Bay

CV=Coquille Valley (Coquille Estuary)

PO=Port Orford

GB=Gold Beach

Reference codes:

+ = first page of two or more pages.

(#) = maximum number of Brant counted by one group during Yaquina Bay CBC.

Sometimes Brant could be recounted by two groups and added together to give the "official" count (see section O-4).

AB=American Birds

AFN=Audubon Field Notes

BL=Bird-Lore

NFN=National Audubon Society Field Notes

OB=Oregon Birds

(Table 7 continued on the next page)

(Table 7 continued)

Winter	CBC Sites.....											Reference	
	CE	TB*	Net	Nes	LC	YB.....	AB	FL	CB	CV	PO		GB
1914/15	-	-	0a	-	-	-	-	-	-	-	-	-	1915 BL 17:46
1920/21	-	-	0	-	-	-	-	-	-	-	-	-	1921 BL 23:31
1935/36	-	-	125	-	-	-	-	-	-	-	-	-	1936 BL 38:81
1936/37	-	-	800	-	-	-	-	-	-	-	-	-	1937 BL 39:68
1938/39	-	-	818	-	-	-	-	-	-	-	-	-	1939 BL 41:51-52
1939/40	-	4100*	-*	-	-	-	-	-	-	-	-	-	1940 BL 42:131
1949/50	-	100*	-*	-	-	-	-	-	-	-	-	-	1950 AFN 4:170
1964/65	-	177*	-*	-	-	-	-	-	-	-	-	-	1965 AFN 19:321
1965/66	-	255*	-*	-	-	-	-	-	-	-	-	-	1966 AFN 20:361+
1966/67	-	147*	-*	-	-	-	-	-	-	-	-	-	1967 AFN 21:359
1967/68	-	170*	-*	-	-	-	-	-	-	-	-	17	1968 AFN 22:372+
1968/69	-	123*	-*	-	-	-	-	-	-	-	-	1	1969 AFN 23:401+
1969/70	-	201*	-*	-	-	-	-	-	-	-	-	0	1970 AFN 24:431+
1970/71	-	1761*	-*	-	-	-	-	-	-	-	-	0	1971 AB 25:477+
1971/72	-	294*	-*	-	-	-	-	-	-	-	-	15	1972 AB 26:495+
1972/73	-	6*	-*	-	-	-	-	-	0	-	-	0	1973 AB 27:494+
1973/74	-	135*	-*	-	-	246 (?)	-	-	-	-	-	-	1974 AB 28:509+
1974/75	-	8*	-*	-	-	146 (?)	-	-	50	-	-	7	1975 AB 29:546+
1975/76	-	80*	-*	-	-	143 (134)	-	-	11	-	-	0	1976 AB 30:570+
1976/77	-	484*	-*	-	-	324 (200)	-	-	2	-	-	0	1977 AB 31:837+
1977/78	-	1734*	-*	-	-	265 (201)	-	-	10	-	-	1	1978 AB 32:842+
1978/79	-	238*	-*	-	-	535 (400)	-	-	5	-	-	-	1979 AB 33:636+
1979/80	0	350*	-*	-	-	499 (252)	-	-	1	-	0	-	1980 AB 34:626+
1980/81	0	36*	-*	-	-	378 (213)	-	-	5	-	106	1	1981 AB 35:686+
1981/82	0	455*	-*	-	-	441 (266)	-	-	3	-	0	-	1982 AB 36:723+
1982/83	0	141*	-*	-	-	321 (321)	-	-	8	-	0	-	1983 AB 37:736+
1983/84	0	146*	-*	-	0b	445 (445)	-	0	0	-	-	-	1984 AB 38:768+
1984/85	0	915*	-*	-	0b	268 (223)	-	6	0	-	-	-	1985 AB 39:763+
1985/86	0	700*	-*	-	0	450 (450)	-	0	0	-	0	-	1986 AB 40:969+
1986/87	0	210*	-*	-	-	385 (232)	-	17	0	-	0	-	1987 AB 41:1216+
1987/88	0	625*	-*	-	-	542 (362)	-	0	0	-	0	-	1988 AB 42:1077+
													1988 OB 14:360+
1988/89	0	186*	-*	-	-	460 (234)	-	0	0	-	0	-	1989 AB 43:1119+
													1990 OB 16:273+
1989/90	0	326*	-*	-	-	503 (503)	-	1	-	-	-	-	1990 AB 44:946+
1990/91	0	549*	-*	-	-	777 (477)	-	0	43	-	-	-	1991 AB 45:951+
1991/92	0	3175*	-*	0	0	360 (360)	-	1	31	0	-	-	1992 AB 46:951+
1992/93	0	457*	-*	0	0	320 (320)	-	0	3	2	-	-	1993 AB 47:922+
1993/94	0	2641*	-*	-	0	108 (108)	1b	0	5	0	-	-	1994 NFN 48:807+
1994/95	0	166*	-*	-	-	275 (275)	-	1	1	5	-	-	1995 NFN 49:777+
1995/96	?	?	?	?	?	168 (168)	-	?	?	?	?	?	Table 11

*The Tillamook Bay CBC can at least sometimes include part of Netarts Bay (see Table legend).

a=This CBC is listed as "Tillanook [sic], Ore.) 7 miles southeast";
7 mi SE would put it at about the location of Netarts and since the following CBC's through 1938/39 were listed as being at Netarts and were done only by Alex Walker and sometimes by his son Kenneth Walker, this CBC was probably for Netarts, not Tillamook Bay.

b=From Pickering et al. (1996).

TABLE 8. Maximum monthly counts of Brant at Yaquina Estuary during 1980-1985.

Maxima either are from when the embayments (sum of Sally's Bend, South Bay, and Idaho Flats) and West Bridge were censused at about the same time or the monthly maximum (designated by a "+") for either embayments or for West Bridge, if the maximum for either was greater than for censuses when both were censused together.

Monthly maxima at the embayments and West Bridge are in Table 9. Observation effort was variable, and sometimes there was only one census in a month. These data are calculated from Tables 11 and 12.

Codes:

-=no census.

+ =at least the indicated number of birds was present (i.e., not all of the embayments and West Bridge areas were censused together).

Monthly Maximum Census for Yaquina Estuary.....												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	-	-	-	-	-	-	0	0	0	0	265+	328+
1981	380	561+	914	630	12	0	2+	0	0	18+	327+	485+
1982	576	688	780	691	67	7	1	1	1	1	261+	367+
1983	499+	607	469+	542+	15+	13+	0	0	0	71+	365+	351
1984	388	419	381+	294	206	0	0	0	1+	10+	172+	412+
1985	490+	475+	429	345+	0	0	0	0	0	-	-	446+

TABLE 9. Maximum monthly counts of Brant at embayments (sum of Sally's Bend, South Bay, and Idaho Flats) or West Bridge (area between the Highway 101 Bridge and the "jaws" of the jetties, see Fig. 1) during 1980-1995. Observation effort was variable, and sometimes there was only one census in a month. These data are calculated from Tables 11 and 12.

Codes:
 -=no census.
 +=at least the indicated number of birds was present (i.e., not all of the constituent areas were censused).

Monthly Maximum Census at Embayments.....												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	-	-	-	-	-	-	0	0	0	0	265	328
1981	380	463	647	157+	0	0	2	0	0	18	327	485
1982	576	592	650	331	2	0	0	0	0	0	261	367
1983	499	607	469+	198+	0	-	0	0	0	71	365	351
1984	388	419	212	45	0	0	0	0	1	10	172	412
1985	490	475	291	345	0	0	0	0	0	-	-	446
1986	389	-	-	-	-	-	-	-	-	-	-	351
1987	286	-	-	-	-	-	-	-	-	0	18	391
1988	372	-	-	-	-	-	-	-	-	3	163	269
1989	299	-	-	-	-	-	-	-	-	4	-	503
1990	509	-	-	-	-	-	-	-	-	4	-	477
1991	-	-	-	-	-	-	-	-	-	-	-	360
1992	-	-	-	-	-	-	-	-	-	-	-	-
1993	320	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	275
1995	-	-	-	-	-	-	-	-	-	-	-	168

Monthly Maximum Census at West Bridge.....												
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1980	-	-	-	-	-	-	0	0	0	0	-	36
1981	0	561	877	630	12	0	-	-	-	-	1	0
1982	0	658	780	691	67	7	1	1	1	1	0	0
1983	0	0	287	542	15	13	0	0	-	-	0	0
1984	0	1	381	287	206	-	-	0	0	0	-	-
1985	-	-	225	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	1	-	-	-	0
1987	0	-	-	-	-	-	-	-	-	-	0	0
1988	0	-	-	-	-	-	-	-	-	-	-	-
1989	-	-	-	-	-	-	-	-	-	-	-	-
1990	0	-	-	-	-	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-	-	-	-	-	-
1992	-	-	-	-	-	-	-	-	-	-	-	-
1993	-	-	-	-	-	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 10. Summary of total number of Brant at embayments (sum of Sally's Bend, South Bay, and Idaho Flats) during the first and last halves of November-February. Only the range is given if there are less than three censuses. Calculations are from data in Table 11.

Codes:

N=number of censuses

SD=Standard Deviation

CV=Coefficient of Variance (%) (i.e., [SD/Mean] X 100)

MIN/MAX=minimum census divided by the maximum census.

Sum of Embayments (Sallys Bend + South Bay + Idaho Flats).....							November 1-15.....						November 16-30.....					
YR	N	Brant/census.....				MIN/ MAX (%)	N	Brant/census.....				MIN/ MAX (%)						
		Mean	SD	CV	Range			Mean	SD	CV	Range							
80	3	108.3	80.1	73.9	16-159	10.1	4	210.0	43.4	20.7	163-265	61.5						
81	4	113.3	83.4	73.6	10-212	4.7	4	278.0	38.9	14.0	234-327	71.6						
82	4	131.0	69.7	53.2	30-186	16.1	3	241.0	33.8	14.0	202-261	77.4						
83	1	-	-	-	75	-	4	288.3	68.6	23.8	206-365	56.4						
84	2	-	-	-	5-12	-	2	-	-	-	50-172	-						
85	0	-	-	-	-	-	0	-	-	-	-	-						
86	0	-	-	-	-	-	0	-	-	-	-	-						
87	4	4.5	9.0	200.0	0-18	0	0	-	-	-	-	-						
88	1	-	-	-	163	-	0	-	-	-	-	-						
89	0	-	-	-	-	-	0	-	-	-	-	-						
90	0	-	-	-	-	-	0	-	-	-	-	-						
91	0	-	-	-	-	-	0	-	-	-	-	-						
92	0	-	-	-	-	-	0	-	-	-	-	-						
93	0	-	-	-	-	-	0	-	-	-	-	-						
94	0	-	-	-	-	-	0	-	-	-	-	-						
95	0	-	-	-	-	-	0	-	-	-	-	-						

Sum of Embayments (Sallys Bend + South Bay + Idaho Flats).....							December 1-15.....						December 16-31.....					
YR	N	Brant/census.....				MIN/ MAX (%)	N	Brant/census.....				MIN/ MAX (%)						
		Mean	SD	CV	Range			Mean	SD	CV	Range							
80	5	255.0	9.3	3.6	243-268	90.7	6	299.2	21.4	7.1	277-328	84.5						
81	2	-	-	-	361-433	-	2	-	-	-	364-485	-						
82	3	354.7	11.0	3.1	342-362	94.5	2	-	-	-	317-367	-						
83	1	-	-	-	306	-	6	300.0	43.2	14.4	250-351	71.2						
84	2	-	-	-	349-358	-	4	386.8	24.6	6.4	361-412	87.6						
85	1	-	-	-	446	-	4	315.3	23.0	7.3	291-346	84.1						
86	3	248.7	12.7	5.1	234-257	91.1	4	252.0	105.6	41.9	113-351	32.2						
87	1	-	-	-	391	-	5	352.2	16.3	4.6	332-365	91.0						
88	3	234.0	19.0	8.1	215-253	85.0	4	258.3	9.7	3.8	246-269	91.4						
89	12	371.2	34.6	9.3	313-419	74.7	1	-	-	-	503	-						
90	0	-	-	-	-	-	1	-	-	-	477	-						
91	0	-	-	-	-	-	1	-	-	-	360	-						
92	0	-	-	-	-	-	0	-	-	-	-	-						
93	0	-	-	-	-	-	0	-	-	-	-	-						
94	0	-	-	-	-	-	1	-	-	-	275	-						
95	0	-	-	-	-	-	1	-	-	-	168	-						

(Table 10 continued on next page)

(Table 10 continued)

Sum of Embayments (Sallys Bend + South Bay + Idaho Flats).....							January 16-31.....					
January 1-15.....							January 16-31.....					
YR	N	Brant/census.....				MIN/ MAX	N	Brant/census.....				MIN/ MAX
		Mean	SD	CV	Range	(%)		Mean	SD	CV	Range	(%)
80	0	-	-	-	-	-	0	-	-	-	-	-
81	4	349.5	23.7	6.8	318-375	84.8	9	327.8	36.0	11.0	273-380	71.8
82	5	525.4	15.3	2.9	503-541	93.0	3	534.3	47.2	8.8	483-576	83.9
83	2	-	-	-	417-428	-	2	-	-	-	462-499	-
84	7	310.4	17.1	5.5	287-330	87.0	4	345.8	31.7	9.2	312-388	80.4
85	4	425.5	24.8	5.8	406-460	88.3	3	465.3	25.5	5.5	439-490	89.6
86	5	353.4	26.9	7.6	319-389	82.0	0	-	-	-	-	-
87	4	277.5	8.3	3.0	269-286	94.1	0	-	-	-	-	-
88	5	356.2	19.5	5.5	325-372	87.4	0	-	-	-	-	-
89	5	297.0	2.0	0.7	294-299	98.3	0	-	-	-	-	-
90	10	398.5	86.7	21.7	302-509	59.3	5	365.8	22.2	6.1	342-398	85.9
91	0	-	-	-	-	-	0	-	-	-	-	-
92	0	-	-	-	-	-	0	-	-	-	-	-
93	1	-	-	-	320	-	0	-	-	-	-	-
94	0	-	-	-	-	-	0	-	-	-	-	-
95	0	-	-	-	-	-	0	-	-	-	-	-

Sum of Embayments (Sallys Bend + South Bay + Idaho Flats).....							February 16-end.....					
February 1-15.....							February 16-end.....					
YR	N	Brant/census.....				MIN/ MAX	N	Brant/census.....				MIN/ MAX
		Mean	SD	CV	Range	(%)		Mean	SD	CV	Range	(%)
80	0	-	-	-	-	-	0	-	-	-	-	-
81	11	324.3	130.8	40.3	0-463	0	11	96.7	135.8	140.4	0-344	0
82	5	301.0	228.3	75.9	0-504	0	6	398.0	195.8	49.2	30-592	5.1
83	3	418.0	115.2	27.6	296-525	56.4	3	497.3	155.0	31.2	320-607	52.7
84	2	-	-	-	212-419	-	1	-	-	-	321	-
85	2	-	-	-	357-475	-	0	-	-	-	-	-
86	0	-	-	-	-	-	0	-	-	-	-	-
87	0	-	-	-	-	-	0	-	-	-	-	-
88	0	-	-	-	-	-	0	-	-	-	-	-
89	0	-	-	-	-	-	0	-	-	-	-	-
90	0	-	-	-	-	-	0	-	-	-	-	-
91	0	-	-	-	-	-	0	-	-	-	-	-
92	0	-	-	-	-	-	0	-	-	-	-	-
93	0	-	-	-	-	-	0	-	-	-	-	-
94	0	-	-	-	-	-	0	-	-	-	-	-
95	0	-	-	-	-	-	0	-	-	-	-	-

TABLE 11. Number of Brant censused at Sally's Bend (Sal), South Bay (SBa), Idaho Flats (IdF), and West Bridge (WBr). West Bridge counts are included here only if they were done within 30 min of embayment censuses; all censuses of West Bridge, including those given here are in Table 12. All counts were by Bayer, unless otherwise noted; see section C for methods of censusing.

Note that sometimes the number of Brant were not separated for each embayment but were pooled as a sum for all embayments.

There are a total of 596 censuses in this Table.

Codes:

Time=Pacific Standard Time at the start of a census of embayments (not West Bridge); times were recorded prior to the winter of 1985-1986 but were not easily accessible for this paper.

Ti=tidal conditions at time of census were within 3 hr of a predicted high tide (H), were within 3 hr of a predicted low tide (L), were between high or low tides (B) (i.e., more than 3 hr from a high or a predicted low tide), or were not known (?).

?=unknown

+ =at least the indicated number of birds was present (i.e., not all of the constituent areas were censused).

X=Brant present at area but were not counted separately for the area

Sum=sum of Brant at Sally's Bend, South Bay, and Idaho Flats (note that sometimes the number of Brant at each area was not recorded separately)

ALL=sum of Sum and Brant at West Bridge.

CBC=Yaquina Bay Christmas Bird Count.

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
7/2/80	L	0	0	0	0	0	0
7/11/80	L	0	0	0	0	0	0
7/15/80	L	0	0	0	0	0	0
7/16/80	L	0	0	0	0	0	0
7/21/80	L	0	0	0	0	0	0
7/30/80	L	0	0	0	0	0	0
7/31/80	L	0	0	0	0	0	0
8/8/80	L	0	0	0	0	0	0
8/12/80	L	0	0	0	0	0	0
8/13/80	L	0	0	0	0	0	0
8/21/80	L	0	0	0	0	0	0
8/27/80	L	0	0	0	0	0	0
8/29/80	L	0	0	0	0	0	0
9/3/80	L	0	0	0	0	0	0
9/9/80	L	0	0	0	0	0	0
9/11/80	L	0	0	0	0	0	0
9/26/80	L	0	0	0	0	0	0
10/1/80	L	0	0	0	0	0	0
10/14/80	H	0	0	0	0	?	?
10/16/80	L	0	0	0	0	?	?
10/21/80	L	0	0	0	0	?	?
10/25/80	H	0	0	0	0	?	?
10/30/80	L	0	0	0	0	?	?
11/3/80	H	?	?	?	16	?	?
11/11/80	H	?	?	?	159	?	?
11/12/80	L	0	55	95	150	?	?
11/19/80	L	163	0	0	163	?	?
11/20/80	H	?	?	?	192	?	?
"	L	220	0	0	220	?	?
11/26/80	L	4	0	261	265	?	?
12/1/80	L	12	222	17	251	?	?
12/2/80	L	0	254	0	254	?	?
12/4/80	L	0	259	0	259	?	?
12/5/80	L	0	12	231	243	?	?

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
12/12/80	L	0	268	0	268	0	268
12/16/80	L	119	166	0	285	0	285
12/17/80	L	228	49	0	277	0	277
12/18/80	L	305	0	0	305	0	305
12/19/80	?	170	158	0	328	?	?
12/30/80	L	0	281	0	281	0	281
12/31/80	L	0	319	0	319	?	?
1/1/81	?	?	?	?	349	0	349
1/3/81	L	375	0	0	375	?	?
1/14/81	L	318	0	0	318	0	318
1/15/81	L	356	0	0	356	0	356
1/16/81	L	243	0	50	293	0	293
1/17/81	L	330	0	0	330	?	?
1/19/81	?	0	0	365	365	0	365
1/23/81	H	23	0	286	309	0	309
1/26/81	L	120	139	14	273	0	273
"	H	274	14	13	301	0	301
1/27/81	H	311	0	43	354	?	?
1/29/81	L	0	345	0	345	?	?
1/31/81	L	380	0	0	380	0	380
2/1/81	L	374	0	0	374	0	374
2/2/81	L	370	0	0	370	0	370
2/3/81	L	376	0	0	376	0	376
2/6/81	L	0	0	463	463	0	463
2/8/81	H	290	0	8	298	0	298
2/10/81	L	0	0	325	325	0	325
2/11/81	L	418	0	28	446	0	446
2/12/81	L	138	0	91	229	0	229
"	H	256	0	3	259	0	259
2/13/81	L	169	121	137	427	0	427
2/14/81	?	0	0	0	0	0	0
2/17/81	H	22	21	301	344	0	0
2/19/81	L	0	0	0	0	561	561
2/20/81	L	0	0	0	0	333	333
"	H	7	19	52	78	248	326
2/21/81	L	0	0	0	0	358	358
2/22/81	L	0	0	0	0	367	367
2/24/81	L	0	0	0	0	120	120
2/25/81	H	240	0	8	248	120	368
2/26/81	H	88	0	0	88	256	344
"	L	256	50	0	306	0	306
2/27/81	L	0	0	0	0	386	386
3/2/81	L	0	27	0	27	375	402
3/4/81	L	0	0	0	0	288	288
3/5/81	L	40	0	0	40	176	216
3/6/81	L	73	0	0	73	27	100
3/7/81	L	0	0	68	68	355	423
3/12/81	L	0	0	0	0	396	396
3/13/81	L	440	0	0	440	0	440
3/16/81	L	346	0	0	346	86	432
3/17/81	L	0	0	180	180	403	583
3/18/81	L	75	0	1	76	509	585
3/19/81	L	76	0	0	76	789	865
"	H	4	9	446	459	455	914
3/20/81	L	0	0	0	0	550	550
3/22/81	L	0	0	0	0	633	633
3/24/81	H	260	0	387	647	6	653
3/26/81	L	0	0	0	0	560	560
3/27/81	L	0	0	0	0	530	530
3/31/81	L	0	0	0	0	877	877
4/1/81	L	0	0	0	0	630	630

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
4/2/81	L	9	0	0	9	587	596
4/3/81	L	4	0	0	4	607	611
4/8/81	L	?	?	157	?	199	?
4/9/81	L	0	0	0	0	87	87
"	H	0	0	0	0	399	399
4/10/81	L	0	0	51	51	339	390
4/12/81	H	0	0	0	0	365	365
4/13/81	L	0	0	0	0	345	345
4/14/81	L	0	0	0	0	198	198
4/15/81	H	0	0	0	0	209	209
4/16/81	H	0	0	0	0	174	174
4/17/81	L	0	0	0	0	69	69
4/20/81	L	0	0	0	0	29	29
4/21/81	L	0	0	0	0	30	30
4/23/81	L	0	0	0	0	16	16
4/24/81	L	0	0	0	0	0	0
4/27/81	L	0	0	0	0	0	0
5/1/81	L	0	0	0	0	12	12
5/3/81	L	0	0	0	0	10	10
5/10/81	L	0	0	0	0	4	4
5/14/81	H	0	0	0	0	0	0
5/19/81	L	0	0	0	0	0	0
5/20/81	L	0	0	0	0	0	0
5/27/81	L	0	0	0	0	0	0
6/6/81	L	0	0	0	0	0	0
6/9/81	L	0	0	0	0	0	0
6/21/81	L	0	0	0	0	0	0
6/22/81	L	0	0	0	0	0	0
6/23/81	L	0	0	0	0	?	?
6/24/81	L	0	0	0	0	?	?
7/1/81	L	0	0	0	0	?	?
7/4/81	L	0	0	0	0	?	?
7/5/81	L	0	0	2	2	?	?
7/14/81	L	0	0	0	0	?	?
7/15/81	L	0	0	0	0	?	?
7/16/81	L	0	0	0	0	?	?
7/20/81	L	0	0	0	0	?	?
7/21/81	L	0	0	0	0	?	?
8/2/81	L	0	0	0	0	?	?
8/3/81	L	0	0	0	0	?	?
8/4/81	L	0	0	0	0	?	?
8/13/81	L	0	0	0	0	?	?
8/14/81	L	0	0	0	0	?	?
8/17/81	L	0	0	0	0	?	?
8/18/81	L	0	0	0	0	?	?
8/31/81	L	0	0	0	0	?	?
9/15/81	L	0	0	0	0	?	?
9/22/81	L	0	0	0	0	?	?
9/28/81	L	0	0	0	0	?	?
10/9/81	L	0	0	0	0	?	?
10/12/81	L	0	0	0	0	?	?
10/20/81	L	0	0	0	0	?	?
10/29/81	L	0	0	18	18	?	?
11/2/81	L	0	0	10	10	0	10
11/5/81	L	0	0	101	101	?	?
11/6/81	L	0	0	130	130	0	130
11/10/81	L	0	0	212	212	?	?
11/19/81	L	0	111	174	285	0	285
11/20/81	H	0	0	234	234	?	?
11/23/81	L	0	327	0	327	?	?

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
11/24/81	L	266	0	0	266	?	?
12/8/81	L	0	0	433	433	0	433
12/9/81	L	361	0	0	361	?	?
12/18/81	L	210	0	154	364	?	?
12/22/81	L	387	0	98	485	?	?
1/4/82	L	10	0	493	503	?	?
1/6/82	L	0	0	518	518	0	518
1/7/82	L	0	0	541	541	0	541
1/10/82	H	0	0	537	537	0	537
1/15/82	L	528	0	0	528	?	?
1/21/82	L	544	0	0	544	?	?
1/28/82	L	483	0	0	483	0	483
1/29/82	L	565	0	11	576	0	576
2/1/82	L	397	0	0	397	0	397
2/2/82	L	504	0	0	504	0	504
2/4/82	L	1	0	0	1	0	1
2/5/82	L	0	0	117	117	0	117
2/12/82	L	486	0	0	486	0	486
2/17/82	L	0	3	27	30	658	688
2/21/82	L	446	0	0	446	0	446
2/22/82	L	399	0	0	399	0	399
2/23/82	L	592	0	0	592	0	592
2/24/82	L	526	0	0	526	0	526
2/27/82	L	350	0	45	395	0	395
3/2/82	L	46	4	375	425	0	425
3/3/82	L	0	0	418	418	0	418
3/4/82	L	0	0	610	610	0	610
3/5/82	L	650	0	0	650	0	650
3/14/82	L	0	0	0	0	526	526
3/16/82	L	0	0	0	0	337	337
3/17/82	L	0	0	0	0	510	510
3/18/82	?	0	0	0	0	780	780
3/19/82	L	0	0	0	0	772	772
3/20/82	?	0	0	0	0	631	631
"	?	0	0	0	0	619	619
3/21/82	L	0	26	0	26	701	727
3/22/82	L	517	0	46	563	213	776
3/24/82	H	39	297	97	433	125	558
3/31/82	L	434	146	1	581	0	581
4/1/82	L	0	0	0	0	664	664
4/3/82	L	0	0	8	8	630	638
4/4/82	L	0	0	0	0	545	545
4/5/82	L	0	0	0	0	628	628
4/8/82	L	0	0	331	331	243	574
4/12/82	L	0	0	0	0	691	691
4/14/82	?	0	0	0	0	603	603
4/16/82	?	0	0	0	0	375	375
4/18/82	L	0	0	0	0	427	427
4/19/82	L	0	0	0	0	379	379
4/20/82	L	0	0	0	0	233	233
4/28/82	L	0	0	0	0	115	115
4/29/82	L	0	0	0	0	106	106
4/30/82	L	0	0	0	0	103	103
5/1/82	L	0	0	0	0	67	67
5/2/82	L	0	0	0	0	35	35
5/3/82	L	0	0	0	0	47	47
5/5/82	L	0	0	1	1	60	61
5/8/82	L	0	0	0	0	60	60
5/10/82	L	0	0	0	0	12	12
5/12/82	H	0	0	0	0	16	16
"	L	0	0	0	0	13	13

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
5/14/82	L	0	0	0	0	0	0
5/19/82	L	0	0	0	0	0	0
"	H	0	0	0	0	0	0
5/27/82	B	0	0	2	2	0	2
5/28/82	L	2	0	0	2	0	2
5/29/82	L	0	0	0	0	0	0
6/2/82	L	0	0	0	0	0	0
6/8/82	L	0	0	0	0	0	0
6/9/82	L	0	0	0	0	3	3
6/10/82	L	0	0	0	0	3	3
6/12/82	L	0	0	0	0	3	3
6/13/82	H	0	0	0	0	0	0
6/14/82	L	0	0	0	0	3	3
6/15/82	L	0	0	0	0	0	0
6/16/82	L	0	0	0	0	0	0
6/17/82	H	0	0	0	0	3	3
"	L	0	0	0	0	4	4
6/18/82	L	0	0	0	0	3	3
6/21/82	H	0	0	0	0	0	0
6/24/82	L	0	0	0	0	0	0
"	L	0	0	0	0	3	3
"	B	0	0	0	0	0	0
6/25/82	H	0	0	0	0	0	0
6/27/82	L	0	0	0	0	?	?
6/28/82	L	0	0	0	0	7	7
"	H	0	0	0	0	0	0
6/29/82	L	0	0	0	0	0	0
6/30/82	L	0	0	0	0	0	0
7/1/82	H	0	0	0	0	0	0
7/3/82	B	0	0	0	0	0	0
7/4/82	L	0	0	0	0	0	0
7/5/82	L	0	0	0	0	0	0
7/6/82	L	0	0	0	0	0	0
7/7/82	L	0	0	0	0	0	0
"	B	0	0	0	0	0	0
"	H	0	0	0	0	0	0
"	L	0	0	0	0	1	1
7/8/82	L	0	0	0	0	?	?
7/17/82	H	0	0	0	0	0	0
7/18/82	H	0	0	0	0	0	0
7/19/82	H	0	0	0	0	0	0
7/22/82	L	0	0	0	0	1	1
"	L	0	0	0	0	0	0
"	L	0	0	0	0	0	0
7/23/82	L	0	0	0	0	?	?
7/24/82	L	0	0	0	0	?	?
7/28/82	H	0	0	0	0	1	1
"	H	0	0	0	0	0	0
"	L	0	0	0	0	0	0
7/30/82	H	0	0	0	0	0	0
"	H	0	0	0	0	0	0
"	H	0	0	0	0	1	1
8/4/82	L	0	0	0	0	?	?
8/5/82	L	0	0	0	0	1	1
"	H	0	0	0	0	0	0
8/6/82	L	0	0	0	0	?	?
8/12/82	L	0	0	0	0	0	0
8/19/82	L	0	0	0	0	1	1
"	L	0	0	0	0	0	0
"	L	0	0	0	0	0	0
8/21/82	L	0	0	0	0	?	?

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
8/23/82	L	0	0	0	0	?	?
8/26/82	H	0	0	0	0	1	1
"	H	0	0	0	0	0	0
"	H	0	0	0	0	0	0
9/2/82	L	0	0	0	0	1	1
9/3/82	L	0	0	0	0	1	1
"	H	0	0	0	0	0	0
"	H	0	0	0	0	0	0
9/4/82	L	0	0	0	0	?	?
9/8/82	L	0	0	0	0	?	?
9/16/82	L	0	0	0	0	1	1
"	L	0	0	0	0	1	1
"	L	0	0	0	0	0	0
9/18/82	L	0	0	0	0	?	?
9/19/82	L	0	0	0	0	?	?
9/23/82	L	0	0	0	0	?	?
9/29/82	L	0	0	0	0	?	?
10/2/82	L	0	0	0	0	?	?
10/3/82	L	0	0	0	0	?	?
10/8/82	L	0	0	0	0	?	?
10/16/82	L	0	0	0	0	?	?
10/18/82	L	0	0	0	0	?	?
10/30/82	L	0	0	0	0	?	?
11/4/82	L	0	0	30	30	?	?
11/11/82	L	0	0	142	142	?	?
11/12/82	L	0	0	166	166	?	?
11/15/82	H	0	0	186	186	?	?
11/19/82	L	0	0	202	202	?	?
11/26/82	L	0	0	260	260	?	?
11/30/82	H	0	0	261	261	?	?
12/7/82	L	342	0	0	342	?	?
12/10/82	L	261	0	101	362	?	?
12/11/82	L	360	0	0	360	?	?
12/26/82	L	0	34	283	317	?	?
12/27/82	L	0	112	255	367	?	?
1/9/83	L	428	0	0	428	?	?
1/11/83	L	417	0	0	417	?	?
1/25/83	L	0	499	0	499	?	?
1/27/83	L	462	0	0	462	?	?
2/8/83	L	0	433	0	433	?	?
2/9/83	L	525	0	0	525	?	?
2/10/83	L	296	0	0	296	0	296
2/22/83	L	X	0	0	X	0	X
2/23/83	L	0	0	320	320	?	?
2/24/83	L	565	0	0	565	0	565
2/25/83	L	607	0	0	607	0	607
3/7/83	L	142	?	0	142+	?	?
3/15/83	B	0	?	469	469+	?	?
3/18/83	H	37	?	178	215+	?	?
3/20/83	B	33	?	392	425+	?	?
4/1/83	H	64	?	25	89+	?	?
4/7/83	L	0	?	10	10+	?	?
4/11/83	L	7	?	198	205+	?	?
4/18/83	B	0	?	0	?	?	?
4/29/83	H	0	0	1	1	0	1
5/6/83	L	0	0	0	0	0	0
5/21/83	H	0	0	0	0	0	0
5/26/83	L	0	0	0	0	0	0
7/14/83	L	0	0	0	0	?	?
7/15/83	L	0	0	0	0	?	?

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL	
7/16/83	L	0	0	0	0	0	0	
7/25/83	L	0	0	0	0	?	?	
7/26/83	L	0	0	0	0	?	?	
7/28/83	L	0	0	0	0	0	0	
7/29/83	L	0	0	0	0	0	0	
8/12/83	L	0	0	0	0	?	?	
8/13/83	L	0	0	0	0	?	?	
8/22/83	L	0	0	0	0	?	?	
8/23/83	L	0	0	0	0	?	?	
9/7/83	L	0	0	0	0	?	?	
9/9/83	L	0	0	0	0	?	?	
9/22/83	L	0	0	0	0	?	?	
9/24/83	L	0	0	0	0	?	?	
10/1/83	L	0	0	0	0	?	?	
10/5/83	L	0	0	0	0	?	?	
10/6/83	L	0	0	0	0	?	?	
10/9/83	L	0	0	0	0	?	?	
10/18/83	L	0	0	0	0	?	?	
10/22/83	L	0	0	0	0	?	?	
10/24/83	?	?	?	29	29+	?	?	Count by Paul Reed.
10/26/83	?	?	?	38	38+	?	?	Count by Rob Lawrence.
10/29/83	L	0	0	71	71	?	?	
11/5/83	L	0	0	75	75	?	?	
11/18/83	L	0	0	206	206	?	?	
11/24/83	H	18	0	246	264	?	?	
11/26/83	L	168	0	150	318	?	?	
11/29/83	L	0	0	365	365	?	?	
12/6/83	H	X	0	X	306	?	?	
12/11/83	L	195	0	X	X	0	X	
12/16/83	L	0	0	338	338	?	?	
12/17/83	L	0	0	267	267	?	?	
12/27/83	L	252	99	0	351	0	351	
12/28/83	L	9	0	317	326	?	?	
12/29/83	L	250	0	0	250	?	?	
12/31/83	L	0	0	268	268	0	268	
1/3/84	L	327	0	0	327	?	?	
1/4/84	H	287	0	0	287	?	?	
1/6/84	L	320	0	0	320	?	?	
1/7/84	L	317	0	0	317	?	?	
1/11/84	?	296	0	0	296	0	296	
1/13/84	L	0	0	296	296	0	296	
1/15/84	?	330	0	0	330	?	?	
1/16/84	L	312	0	0	312	0	312	
1/17/84	L	0	0	336	336	0	336	
1/26/84	L	0	0	388	388	0	388	
1/27/84	L	347	0	0	347	?	?	
2/1/84	H	0	0	419	419	0	419	
2/7/84	H	X	0	0	X	1	X	
2/15/84	H	212	0	0	212	0	212	
2/17/84	H	X	0	X	X	0	X	
2/26/84	L	321	0	0	321	?	?	
3/10/84	L	212	0	0	212	163	375	
3/18/84	L	X	0	X	X	381	X	
3/29/84	L	0	X	0	X	314	X	
4/5/84	H	17	0	28	45	185	230	
4/13/84	L	0	0	7	7	287	294	
4/22/84	L	0	0	0	0	59	59	
4/29/84	H	12	0	0	12	155	167	
5/4/84	H	0	0	0	0	206	206	
5/14/84	H	0	0	0	0	61	61	

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
5/24/84	L	0	0	0	0	9	9
6/20/84	L	0	0	0	0	?	?
6/21/84	L	0	0	0	0	?	?
6/22/84	L	0	0	0	0	?	?
6/27/84	L	0	0	0	0	?	?
6/29/84	L	0	0	0	0	?	?
7/1/84	L	0	0	0	0	?	?
7/2/84	L	0	0	0	0	?	?
7/4/84	L	0	0	0	0	?	?
7/5/84	L	0	0	0	0	?	?
7/7/84	L	0	0	0	0	?	?
7/9/84	L	0	0	0	0	?	?
7/15/84	L	0	0	0	0	?	?
7/17/84	L	0	0	0	0	?	?
7/18/84	L	0	0	0	0	?	?
7/19/84	L	0	0	0	0	?	?
7/20/84	L	0	0	0	0	?	?
7/24/84	L	0	0	0	0	?	?
7/27/84	L	0	0	0	0	?	?
7/28/84	L	0	0	0	0	?	?
7/29/84	L	0	0	0	0	?	?
7/30/84	L	0	0	0	0	?	?
8/1/84	L	0	0	0	0	?	?
8/2/84	L	0	0	0	0	?	?
8/5/84	L	0	0	0	0	?	?
8/8/84	L	0	0	0	0	?	?
8/11/84	L	0	0	0	0	?	?
8/12/84	L	0	0	0	0	?	?
8/16/84	L	0	0	0	0	?	?
8/19/84	L	0	0	0	0	?	?
8/21/84	L	0	0	0	0	?	?
8/25/84	L	0	0	0	0	?	?
8/26/84	L	0	0	0	0	?	?
8/30/84	L	0	0	0	0	?	?
9/1/84	L	0	0	0	0	?	?
9/2/84	L	0	0	0	0	?	?
9/3/84	L	0	0	0	0	?	?
9/6/84	L	0	0	0	0	?	?
9/8/84	L	0	0	0	0	?	?
9/9/84	L	0	0	0	0	?	?
9/10/84	L	0	0	1	1	?	?
9/11/84	L	0	0	0	0	?	?
9/13/84	L	0	0	1	1	?	?
9/22/84	L	0	0	0	0	?	?
9/23/84	L	0	0	0	0	?	?
9/24/84	L	0	0	0	0	?	?
9/30/84	L	0	0	0	0	?	?
10/6/84	L	0	0	0	0	?	?
10/14/84	L	0	0	0	0	?	?
10/15/84	B	0	0	1	1	?	?
10/16/84	L	0	0	0	0	?	?
10/21/84	L	0	0	0	0	?	?
10/22/84	L	0	0	0	0	?	?
10/23/84	L	0	0	0	0	?	?
10/27/84	H	10	0	0	10	?	?
11/3/84	L	0	0	12	12	?	?
11/5/84	L	0	0	5	5	?	?
11/17/84	L	50	0	0	50	?	?
11/18/84	L	0	172	0	172	?	?
12/1/84	L	9	340	0	349	?	?

(Table 11 continued on next page)

(Table 11 continued)

	Ti	Sal	SBa	IdF	Sum	WBr	ALL
12/8/84	L	0	0	358	358	?	?
12/15/84	L	317	0	X	X	?	?
12/16/84	H	0	0	412	412	?	?
12/18/84	L	0	0	371	371	?	?
12/19/84	L	0	0	361	361	?	?
12/31/84	L	0	0	403	403	?	?
1/1/85	L	0	0	409	409	?	?
1/3/85	L	44	0	383	427	?	?
1/13/85	L	33	0	373	406	?	?
1/15/85	L	0	0	460	460	?	?
1/16/85	L	0	0	439	439	?	?
1/29/85	L	467	0	0	467	?	?
1/30/85	L	1	X	X	490	?	?
2/12/85	?	440	35	0	475	?	?
2/13/85	L	357	0	0	357	?	?
3/1/85	L	0	0	75	75	?	?
3/2/85	L	0	0	204	204	225	429
3/13/85	L	0	0	291	291	?	?
3/18/85	H	0	0	0	0	?	?
3/29/85	L	0	0	0	0	?	?
4/12/85	L	0	0	219	219	?	?
4/14/85	L	0	0	345	345	?	?
4/29/85	L	0	0	0	0	?	?
4/30/85	L	0	0	0	0	?	?
5/10/85	L	0	0	0	0	?	?
5/12/85	L	0	0	0	0	?	?
5/26/85	L	0	0	0	0	?	?
5/27/85	L	0	0	0	0	?	?
6/8/85	L	0	0	0	0	?	?
6/9/85	L	0	0	0	0	?	?
7/20/85	L	0	0	0	0	?	?
8/4/85	L	0	0	0	0	?	?
8/5/85	L	0	0	0	0	?	?
8/19/85	L	0	0	0	0	?	?
8/20/85	L	0	0	0	0	?	?
8/31/85	L	0	0	0	0	?	?
9/1/85	L	0	0	0	0	?	?
9/15/85	L	0	0	0	0	?	?

	Time	Ti	Sal	SBa	IdF	Sum	WBr	ALL
12/10/85	1400	B	0	0	446	446	?	?
12/20/85	1317	L	0	0	346	346	?	?
12/21/85	1439	L	291	0	0	291	?	?
12/23/85	1540	L	0	0	308	308	?	?
12/28/85	1517	B	0	0	316	316	?	?
1/5/86	1600	L	336	0	0	336	?	?
1/6/86	1528	L	0	0	361	361	?	?
1/7/86	1500	L	0	0	389	389	?	?
1/9/86	1630	?	0	0	362	362	?	?
1/11/86	1650	L	0	0	319	319	?	?
10/22/86	?	?	?	0	0	0	?	?
11/4/86	1507	B	0	0	8	8	?	?
12/13/86	1555	L	0	0	234	234	?	?
12/14/86	1605	L	0	0	255	255	?	?
12/15/86	1453	B	0	0	257	257	?	?
12/27/86	1534	L	351	0	0	351	?	?
12/28/86	1545	L	113	0	0	113	0	113
12/29/86	1538	L	314	0	0	314	0	314
12/30/86	1553	L	0	0	230	230	0	230

(Table 11 continued on next page)

(Table 11 continued)

	Time	Ti	Sal	SBa	IdF	Sum	WBr	ALL	
1/8/87	1510	L	270	0	16	286	0	286	
1/11/87	1524	L	269	0	0	269	0	269	
1/12/87	1544	L	272	0	0	272	0	272	
1/13/87	1645	?	283	0	0	283	0	283	
10/30/87	1330	L	0	0	0	0	?	?	
10/31/87	1404	L	0	0	0	0	?	?	
11/1/87	1352	L	0	0	0	0	?	?	
11/2/87	1459	L	0	0	0	0	0	0	
11/3/87	1331	H	0	0	0	0	?	?	
11/4/87	1400	H	0	0	18	18	?	?	
12/15/87	1348	L	333	0	58	391	?	?	
12/16/87	1416	L	0	0	364	364	0	364	
12/17/87	1556	L	315	50	0	365	?	?	
12/18/87	1554	L	10	33	320	363	?	?	
12/28/87	1400	L	0	0	337	337	?	?	
12/29/87	1552	L	0	0	332	332	0	332	One boat with hunters was at Sallys Bend and a second boat with hunters was at Idaho Flats.
1/1/88	1600	L	0	0	351	351	0	352	3 hunters have set up Brant silhouettes at Idaho Flats; a boat appears to be chasing Brant towards Idaho Flats.
1/2/88	1627	L	325	0	0	325	?	?	One boat with hunters is stationary at Sallys Bend; a second boat appears to be trying to drive Brant towards the hunter's boat.
1/3/88	1625	L	372	0	0	372	?	?	
1/14/88	1409	L	0	102	259	361	0	361	
1/15/88	1535	L	0	0	372	372	0	372	
10/22/88	1230	H	0	0	0	0	?	?	
10/24/88	1615	L	0	0	0	0	?	?	
10/25/88	1530	B	0	0	0	0	?	?	
10/26/88	1400	H	0	0	0	0	?	?	
10/27/88	1345	H	0	0	0	0	?	?	
10/28/88	1330	H	0	0	0	0	?	?	
10/29/88	1345	H	0	0	3	3	?	?	
10/31/88	1335	H	0	0	3	3	?	?	
11/12/88	?	?	?	?	?	163	?	?	Count by Dale Snow
12/5/88	1535	L	0	215	0	215	?	?	
12/6/88	1545	L	0	234	0	234	?	?	
12/7/88	1545	L	0	0	253	253	?	?	
12/19/88	1400	L	0	0	256	256	?	?	
12/20/88	1555	L	0	0	269	269	?	?	
12/21/88	1630	L	246	0	0	246	?	?	Tight flock; I may have missed some Brant during this count because they were so close together.
12/31/88	1300	L	0	262	0	262	?	?	A hunter shot a Brant.
1/2/89	1550	L	294	0	0	294	?	?	
1/3/89	1545	L	296	0	0	296	?	?	
1/4/89	1505	L	298	0	0	298	?	?	
1/5/89	1600	L	0	0	299	299	?	?	
1/6/89	1620	L	298	0	0	298	?	?	

(Table 11 continued on next page)

(Table 11 continued)

	Time	Ti	Sal	SBa	IdF	Sum	WBr	ALL	
10/20/89	1430	H	0	0	0	0	?	?	
10/23/89	1430	L	0	0	0	0	?	?	
10/24/89	1250	B	0	0	0	0	?	?	
10/25/89	1400	L	0	0	0	0	?	?	
10/26/89	1245	B	0	0	0	0	?	?	
10/27/89	1445	L	0	0	4	4	?	?	
12/8/89	1350	L	0	0	313	313	?	?	
12/9/89	1505	L	337	0	0	337	?	?	
"	"	L	330	0	0	330	?	?	
12/10/89	1515	L	0	0	351	351	?	?	
"	"	L	0	0	361	361	?	?	
12/11/89	1620	L	0	0	415	415	?	?	
"	"	L	0	0	384	384	?	?	
12/12/89	1555	L	0	0	419	419	?	?	
"	1600	L	0	0	377	377	?	?	
"	1605	L	0	0	415	415	?	?	
"	1610	L	0	0	382	382	?	?	
"	1615	L	0	0	370	370	?	?	
12/30/89	1645	B	503	0	0	503	?	?	During CBC
1/6/90	1445	L	509	0	0	509	?	?	
"	"	L	498	0	0	498	?	?	
1/7/90	1515	L	290	0	207	497	?	?	
1/8/90	1445	L	0	288	188	476	?	?	
"	1555	L	390	0	0	390	?	?	
1/10/90	1610	L	0	41	304	345	?	?	The first count
"	"	L	0	38	264	302	?	?	started at 1610 and the last count started at 1625.
"	"	L	0	331	0	331	?	?	
"	"	L	0	328	0	328	?	?	
"	1625	L	0	309	0	309	?	?	
1/22/90	1500	L	37	0	305	342	?	?	
"	1505	L	38	0	310	348	?	?	
"	1510	L	38	0	335	373	?	?	
"	1515	L	39	0	329	368	?	?	
"	1522	L	38	0	360	398	0	398	
10/23/90	1630	H	0	0	4	4	?	?	
12/30/90	?	?	?	?	?	477	?	?	During CBC
12/29/91	?	?	?	?	?	360	?	?	During CBC
1/3/93	?	?	320	0	0	320	?	?	During CBC
12/31/94	1530	L	0	0	275	275	?	?	During CBC
12/30/95	?	L	168	0	0	168	?	?	During CBC

TABLE 12. Number of Brant at West Bridge (Fig. 1). Bayer conducted all censuses. These censuses include those for West Bridge in Table 11 as well as those in which only the West Bridge area was censused.

There are a total of 573 censuses in this Table.

Codes:

Time=starting time of census in Pacific Standard Time

?=unknown

L=count within 3 hr of low tide

H=count within 3 hr of high tide.

Date	Time	Brant	Date	Time	Brant	Date	Time	Brant
7/2/80	L	0	2/2/81	1130	0	3/17/81	1200	4
7/11/80	L	0	2/3/81	1315	0	"	1700	403
7/15/80	L	0	2/5/81	1300	0	3/18/81	0930	319
7/16/80	L	0	2/6/81	1700	0	"	1715	509
7/21/80	L	0	2/8/81	1700	0	3/19/81	1720	789
7/30/80	L	0	2/10/81	1118	0	"	H	455
7/31/80	L	0	"	1312	0	3/20/81	1700	550
8/8/80	L	0	2/11/81	L	0	3/22/81	0745	362
8/12/80	L	0	2/12/81	1300	0	"	1740	633
8/13/80	L	0	"	H	0	3/23/81	1400	63
8/21/80	L	0	2/13/81	1515	0	3/24/81	1150	6
8/27/80	L	0	2/14/81	1600	0	3/26/81	1010	560
8/29/80	L	0	2/15/81	0800	0	3/27/81	1500	530
9/3/80	L	0	"	1700	0	3/28/81	1700	0
9/9/80	L	0	2/16/81	1646	0	3/31/81	1830	877
9/11/80	L	0	2/17/81	0700	0	4/1/81	1605	630
9/26/80	L	0	"	1605	0	4/2/81	1710	587
10/1/80	L	0	2/19/81	1715	561	4/3/81	1630	607
12/10/80	1330	36	2/20/81	0750	333	4/5/81	1700	458
12/12/80	0900	0	"	1200	248	4/6/81	1845	0
12/16/80	1300	0	2/21/81	0745	155	4/7/81	0645	5
12/17/80	1415	0	"	1715	358	4/8/81	1245	243
12/18/80	1600	0	2/22/81	0745	367	"	1700	199
12/19/80	1615	0	"	1700	0	4/9/81	L	87
12/30/80	1430	0	2/24/81	1115	120	"	1845	399
12/31/80	0830	0	2/25/81	1530	120	4/10/81	1200	339
"	1415	0	2/26/81	1500	256	4/11/81	0800	247
1/1/81	?	0	"	L	0	"	1730	340
1/6/81	1330	0	2/27/81	1300	386	4/12/81	0800	338
1/7/81	1415	0	2/28/81	0748	76	"	1720	365
1/8/81	1330	0	"	1715	208	4/13/81	L	345
1/9/81	0930	0	3/1/81	0745	89	4/14/81	1545	198
1/14/81	1420	0	"	1700	328	4/15/81	1000	209
1/15/81	1430	0	3/2/81	1535	375	"	1700	190
1/16/81	1455	0	3/3/81	1300	256	4/16/81	1100	174
1/18/81	1730	0	3/4/81	1639	288	4/17/81	1200	186
1/19/81	1030	0	3/5/81	1715	176	"	?	69
1/23/81	1540	0	"	1757	27	4/18/81	0800	134
1/24/81	1730	0	3/6/81	L	27	"	1725	136
1/25/81	1715	0	3/7/81	1800	355	4/19/81	0800	122
1/26/81	1046	0	3/10/81	H	0	"	1730	69
"	H	0	3/11/81	L	271	4/20/81	0900	29
1/28/81	1325	0	3/12/81	1240	396	"	1500	12
1/30/81	1430	0	3/13/81	1400	0	4/21/81	L	30
1/31/81	0800	0	3/14/81	0745	0	4/23/81	0941	16
"	1600	0	3/15/81	1700	0	4/24/81	0930	0
2/1/81	0800	0	3/16/81	1615	86	4/25/81	0800	0
"	1600	0	"	"	"	"	1705	0

(Table 12 continued on next page)

(Table 12 continued)

Date	Time	Brant	Date	Time	Brant	Date	Time	Brant
4/26/81	0700	12	1/29/82	0900	0	4/29/82	1441	106
"	1800	12	2/1/82	1350	0	4/30/82	1355	103
4/27/81	1300	0	2/2/82	1250	0	5/1/82	1330	67
5/1/81	1630	12	2/4/82	1500	0	5/2/82	1430	35
5/2/81	0700	8	2/5/82	1415	0	5/3/82	1500	47
"	1600	0	2/8/82	1715	0	5/5/82	1414	60
5/3/81	0700	9	2/9/82	1315	0	"	1835	59
"	1630	10	2/12/82	1400	0	5/8/82	?	60
5/5/81	1400	0	2/15/82	1435	0	5/10/82	0740	12
5/7/81	1300	0	2/16/82	1447	645	5/12/82	1446	16
5/8/81	1100	5	2/17/82	1324	658	"	1840	13
5/9/81	0730	4	"	1700	0	5/14/82	0915	0
"	1630	0	2/20/82	1415	330	5/19/82	1409	0
5/10/81	0700	4	2/21/82	1200	0	"	1846	0
"	1130	4	"	1650	0	5/27/82	1248	0
5/11/81	1315	0	2/22/82	1400	0	"	1855	0
5/12/81	1300	0	"	1700	0	5/28/82	1248	2
5/14/81	0730	0	2/23/82	1320	0	"	?	0
5/17/81	1100	0	2/24/82	1350	0	5/29/82	1015	0
5/18/81	1355	0	"	1736	0	6/2/82	1305	0
5/19/81	0640	0	2/25/82	1345	0	6/3/82	1246	0
5/20/81	L	0	"	1630	0	6/4/82	1302	1
5/21/81	0700	0	2/27/82	0830	0	6/8/82	1255	2
"	1400	0	3/1/82	1640	0	"	?	0
5/22/81	0700	0	3/2/82	1315	0	6/9/82	1526	3
"	1600	0	3/3/82	1500	0	6/10/82	1307	3
5/24/81	1100	0	3/4/82	1415	0	"	1403	0
5/25/81	1600	0	3/5/82	1515	0	"	1643	0
5/27/81	1208	0	3/8/82	1400	118	6/12/82	L	3
5/28/81	0820	0	3/13/82	1300	85	6/13/82	1548	0
5/30/81	1200	0	3/14/82	0630	526	6/14/82	1327	3
6/6/81	L	0	3/16/82	1100	337	6/15/82	1256	3
6/9/81	L	0	3/17/82	1520	510	"	?	0
6/21/81	L	0	3/18/82	0800	140	6/16/82	1232	0
6/22/81	L	0	"	1445	780	"	1635	0
			3/19/82	1500	772	"	1750	0
11/2/81	1430	0	3/20/82	0816	96	"	1900	0
11/3/81	1545	0	"	1130	631	6/17/82	0457	0
11/6/81	1400	0	"	1430	619	"	0703	3
11/8/81	1545	0	3/21/82	1615	701	"	0808	0
11/12/81	1400	0	3/22/82	1730	213	"	1336	4
11/14/81	1000	1	3/23/82	1335	70	6/18/82	0950	0
11/19/81	1315	0	3/24/82	H	125	"	1452	3
11/22/81	1200	0	3/26/82	1330	30	6/20/82	1250	0
11/26/81	1645	0	3/27/82	1200	6	6/21/82	1740	0
11/27/81	1645	0	3/29/82	1500	0	6/24/82	0729	0
12/8/81	1406	0	3/31/82	1454	0	"	0840	0
12/10/81	1400	0	4/1/82	1230	664	"	1052	3
12/13/81	1350	0	4/3/82	1430	630	"	1212	0
12/19/81	1600	0	4/4/82	1600	545	"	1332	0
12/29/81	1500	0	4/5/82	1520	628	6/25/82	0848	0
1/5/82	1445	0	4/8/82	1530	243	"	1617	0
1/6/82	L	0	4/9/82	?	379	6/28/82	1241	7
1/7/82	L	0	4/12/82	0956	691	"	1833	0
1/10/82	1635	0	4/14/82	1500	603	6/29/82	1112	0
1/12/82	1400	0	4/16/82	1413	375	"	1235	0
1/18/82	1445	0	4/18/82	1452	427	"	1828	0
1/26/82	1445	0	4/19/82	1500	379	6/30/82	1207	0
1/28/82	0845	0	4/20/82	1420	233	7/1/82	0713	0
"	1710	0	4/28/82	0923	115	"	0923	0

(Table 12 continued on next page)

(Table 12 continued)

Date	Time	Brant	Date	Time	Brant	Date	Time	Brant
7/3/82	1324	0	1/28/83	1505	0	6/17/83	1224	0
7/4/82	1431	0	1/31/83	1505	0	6/21/83	1530	0
7/5/82	1525	0	2/2/83	1622	0	6/22/83	1502	0
7/6/82	1507	0	2/10/83	L	0	6/23/83	1616	0
7/7/82	0649	0	2/11/83	1355	0	6/28/83	0750	0
"	1142	0	2/15/83	1203	0	6/29/83	0648	0
"	1855	1	2/22/83	L	0	7/5/83	1223	0
7/17/82	1238	0	2/23/83	1742	0	7/6/83	1307	0
7/18/82	1307	0	2/24/83	1610	0	7/7/83	1544	0
7/19/82	1414	0	2/25/83	1524	0	7/8/83	1634	0
7/22/82	0515	1	3/7/83	1415	287	7/9/83	1624	0
"	0619	0	3/15/83	1407	16	7/14/83	0825	0
"	0949	0	3/18/83	1357	0	7/15/83	0926	0
7/28/82	0740	1	4/1/83	1447	0	7/16/83	1025	0
"	0952	0	4/7/83	1408	542	7/17/83	1205	0
"	1740	0	4/11/83	1340	168	7/18/83	1223	0
"	1843	0	4/12/83	1400	15	7/19/83	1301	0
7/30/82	0700	0	4/13/83	1325	19	7/20/83	1440	0
"	0828	0	4/14/83	1541	175	7/21/83	1427	0
"	0947	1	4/15/83	1313	30	7/22/83	1631	0
"	1055	0	4/18/83	1317	139	7/28/83	0754	0
"	1320	0	4/19/83	1535	138	7/29/83	0907	0
"	1752	0	4/20/83	1412	157	7/31/83	1026	0
8/5/82	0621	1	4/21/83	1534	170	8/1/83	1058	0
"	0752	0	4/26/83	1306	0	8/4/83	1307	0
"	1329	0	4/29/83	1446	0	8/6/83	1610	0
"	1558	0	4/30/83	1627	0	8/9/83	0705	0
8/12/82	0917	0	5/1/83	0647	0	8/10/83	0751	0
"	1203	0	"	1634	0	8/12/83	0840	0
"	1334	0	5/2/83	1342	0	8/13/83	0835	0
8/19/82	0610	1	5/3/83	1257	4	8/15/83	1147	0
"	0715	0	5/4/83	1350	3	8/16/83	1248	0
"	0832	0	5/6/83	1444	0	8/17/83	1349	0
"	1535	0	5/7/83	0642	0	8/18/83	1448	0
8/26/82	0643	1	5/9/83	1513	0	11/14/83	1254	0
"	0923	0	"	1610	0	11/24/83	1500	0
"	1505	0	5/10/83	1625	0	12/11/83	1419	0
"	1712	0	"	1712	0	12/15/83	1402	0
"	1813	0	5/11/83	1717	0	12/17/83	1607	0
9/2/82	0751	1	"	1813	0	12/27/83	1412	0
9/3/82	0710	1	5/16/83	0818	0	12/31/83	L	0
"	0824	0	"	0909	0	1/2/84	1437	0
"	1254	0	5/19/83	1200	0	1/7/84	1541	0
"	1358	0	5/20/83	1114	0	1/11/84	1313	0
9/16/82	0639	1	"	1201	0	1/13/84	1340	0
"	1027	0	5/21/83	0459	0	1/16/84	1326	0
"	1244	0	"	0550	15	1/17/84	1320	0
"	1508	1	"	0657	0	1/19/84	1352	0
10/1/82	1333	1	"	0759	0	1/26/84	1444	0
10/10/82	1654	1	"	0854	0	2/1/84	1415	0
10/19/82	1225	1	"	0958	0	2/7/84	1333	1
10/24/82	1605	0	"	1052	0	2/15/84	1432	0
11/4/82	1640	0	"	1141	0	2/17/84	1355	0
11/15/82	1400	0	5/24/83	1524	0	3/2/84	1243	0
12/7/82	1453	0	5/25/83	1659	1	3/10/84	1358	163
12/13/82	1500	0	5/26/83	0635	0	3/18/84	1645	381
12/20/82	1617	0	6/7/83	1409	0	3/19/84	1221	65
12/30/82	1555	0	6/10/83	1350	13	3/29/84	1413	314
1/10/83	1431	0	6/14/83	0844	0	4/5/84	1441	185
1/19/83	1609	0	6/15/83	0747	0	4/13/84	1637	287

(Table 12 continued on next page)

(Table 12 continued)

Date	Time	Brant
4/22/84	1317	59
4/29/84	1328	155
5/4/84	1246	206
5/14/84	1253	61
5/24/84	1219	9
8/21/84	1239	0
9/10/84	1217	0
9/23/84	1656	0
9/30/84	1042	0
10/15/84	1244	0
3/2/85	1452	225
8/17/86	?	1
12/28/86	1605	0
12/29/86	1558	0
12/30/86	1613	0
1/8/87	1530	0
1/11/87	1544	0
1/12/87	1604	0
1/13/87	1605	0
11/2/87	1505	0
12/16/87	1436	0
12/29/87	1618	0
1/1/88	1620	0
1/14/88	1429	0
1/15/88	1555	0
1/22/90	1550	0

S. ACKNOWLEDGMENTS

I am grateful to my parents Don and Ruth Bayer (both deceased), whose support aided in making it possible to do and complete this project.

I thank Dave Pitkin (USFWS biologist) for his Brant research at Yaquina Estuary during the 1995/1996 winter that inspired me to complete this paper and for his comments and unpublished observations.

I am grateful to Roy Lowe (USFWS biologist) for his insights and his comments on an earlier draft of this paper and to USFWS biologists John Annear, John Cornely, and Roy Lowe for graciously sharing their unpublished USFWS aerial censuses.

I thank David J. Wetzel for sharing his 1976 senior student project (Wetzel 1996) that provided important perspective to this paper.

I appreciate Paul Reed's access to unpublished Yaquina Bay CBC data and Owen Schmidt's correspondence about the 1995 Tillamook Bay CBC including part of Netarts Bay.

I thank George Brown, Bob Buchanan, Fred Evenden, Jr., Ira Gabrielson, Matt Hunter, Jan and Rick Krabbe, Rob Lawrence, Robert Loeffel, Roy Lowe, Kathy Merrifield, Terry Morse, Robert Olson, Phil Pickering, Paul Reed, Jerry Smith, Dale Snow, and Verda Teale for their Brant arrival dates or unpublished observations.

I am grateful to Janet Webster, Susan Gilmont, and Liz Fox of the HMSC Library for obtaining library references and to Henry Pittcock III of the OSU School of Oceanic and Atmospheric Sciences for providing tidal data.

Field research prior to March 1976 was done while I was a graduate student at OSU--I am grateful to my major professor, John A. Wiens, for his assistance in allowing me to complete a degree.

I thank the OSU Cooperative Wildlife Research Unit for the loan of an U.S. Army surplus starlight nightscope for an M-60 machine gun that I used during some of my night observations in 1973/1974. Although it did not work well for me in doing night observations of waterbirds, their loan made it possible for me to try it.

Finally, I am grateful to the HMSC for intermittent employment in recent years and Oregon Aqua-Foods (now defunct), who hired me to census fish-eating birds during the April-September periods of 1982 and 1983, during which I also sometimes counted Brant.

T. LITERATURE CITED

- Baldwin, J. R. and J. R. Lovvorn. 1994a. Expansion of seagrass habitat by the exotic *Zostera japonica*, and its use by dabbling ducks and Brant in Boundary Bay, British Columbia. *Marine Ecol. Progress Series* 103:119-127.
- Baldwin, J. R. and J. R. Lovvorn. 1994b. Habitats and tidal accessibility of the marine foods of dabbling ducks and brant in Boundary Bay, British Columbia. *Marine Biology* 120:627-638.
- Ball, I. J., R. D. Bauer, K. Vermeer, and M. J. Rabenberg. 1989. Northwest riverine and Pacific Coast. Pp. 429-449 in L. M. Smith, R. L. Pederson, and R. M. Kaminski (Eds.), *Habitat management for migrating and wintering waterfowl in North America*. Texas Tech Univ. Press.
- Batterson, W. 1954. All about Brant. Oregon State Game Comm. Bull. 9(11):5-6.
- Batterson, W. 1968. All.....about Brant. Oregon State Game Comm. Bull. 23 (11):3-5
- Bayer, R. D. 1979. Intertidal zonation of *Zostera marina* in the Yaquina Estuary, Oregon. *Syesis* 12:147-154.
- Bayer, R. D. 1980. Birds feeding on herring eggs at the Yaquina Estuary, Oregon. *Condor* 82:193-198.
- Bayer, R. D. 1983. Seasonal occurrences of ten waterbird species at Yaquina Estuary, Oregon. *Murrelet* 64:78-86.
- Bayer, R. D. 1987. Winter observations of Bald Eagles at Yaquina Estuary, Oregon. *Murrelet* 68:39-44.
- Bayer, R. D. 1989. Records of bird skins collected along the Oregon Coast. *Studies in Oregon Ornithology* No. 7.
- Bayer, R. D. 1995. Semimonthly bird records through 1992 for Lincoln County, Oregon, part II: records sorted by species. *Journal of Oregon Ornithology* 4:395-543.
- Bayer, R. D. 1996. Macrophyton and tides at Yaquina Estuary, Lincoln County, Oregon. *Journal of Oregon Ornithology* 6:781-795.
- Bayer, R. D. and J. Krabbe. 1984. CBC analysis: comparison of coastal Christmas Bird Counts. *Oregon Birds* 10:115-125.
- Bayer, R. D. and R. W. Lowe. 1988. Waterbird and mammal censuses at Siuslaw Estuary, Lane County, Oregon. *Studies in Oregon Ornithology* No. 4.
- Broome, L. S. 1985. Sightability as a factor in aerial survey of bird species and communities. *Australian Wildl. Res.* 12:57-67.
- Carney, S. M., M. F. Sorensen, and E. M. Martin. 1975. Distribution in states and counties of waterfowl species harvested during 1961-70 hunting season. U. S. Fish and Wildlife Service, Spec. Sci. Rep.--Wildlife No. 187.
- Caughley, G. 1974. Bias in aerial survey. *J. Wildl. Mgmt.* 38:921-933.
- Caughley, G., R. Sinclair, and D. Scott-Kemmis. 1976. Experiments in aerial survey. *J. Wildl. Mgmt.* 40:290-300.
- Chapman, A. 1889. *Birdlife of the borders*. London. (Not seen; cited in Ranwell and Downing 1959:43.)
- Chattin, J. E. 1960. Pacific Flyway Report No. 43. U. S. Fish and Wildlife Service. (Not seen; see Chattin 1961.)

- Chattin, J. E. 1961. Pacific Flyway Report No. 45. U. S. Fish and Wildlife Service. (Not seen; cited in Denson and Murrell 1962. The Pacific Flyway Report series [also see Chattin 1960] may exist in some office or library.)
- Contreras, A. 1977. Coast birding weekend. Oregon Birds 2:20-24.
- Contreras, A. 1996. Wampole's 1957-1959 annotated checklist of birds of Coos Bay, Oregon. Journal of Oregon Ornithology 5:545-557.
- Cottam, C., J. J. Lynch, and A. L. Nelson. 1944. Food habits and management of American sea Brant. J. Wildl. Mgmt. 8:36-56.
- Dahlgren, R. B. and C. E. Korschgen. 1992. Human disturbances of waterfowl: an annotated bibliography. U. S. Dept. of Interior, Fish and Wildlife Service, Resource Pub. 188.
- Dau, C. 1992. The fall migration of Pacific Flyway Brant Branta bernicla in relation to climatic conditions. Wildfowl 43:80-95.
- Denson, E. P., Jr. 1964. Comparison of waterfowl hunting techniques at Humboldt Bay, California. J. Wildl. Mgmt. 28:103-120.
- Denson, E. P., Jr. and W. W. Bentley. 1962. The migration and status of waterfowl at Humboldt Bay, California. Murrelet 43:19-28.
- Denson, E. P., Jr. and S. L. Murrell. 1962. Black Brant populations of Humboldt Bay, California. J. Wildl. Mgmt. 26:257-262.
- Einarsen, A. S. 1955. Food crises and the interrelationship of waterfowl. Murrelet 36:39-40.
- Einarsen, A. S. 1965. Black Brant: sea goose of the Pacific Coast. Univ. of Washington Press, Seattle.
- Gabrielson, I. N. and S. G. Jewett. 1940. Birds of Oregon. Oregon State Monographs, Studies in Zoology No. 2. (Reprinted in 1970 by Dover Publications as "Birds of the Pacific Northwest.")
- Gaston, A. J. and G. E. J. Smith. 1984. The interpretation of aerial surveys for seabirds: some effects of behaviour. Can. Wildl. Svc. Occasional Paper No. 53.
- Gaumer, T., D. Demory, L. Osis, and C. Waters. 1974. 1970-71 Yaquina Bay resource use study. Fish Commission of Oregon, Div. of Management and Research.
- Gerow, J. 1939. Bald Eagle kills Black Brant. Murrelet 20:44.
- Giesler, J. C. 1952. Summering birds of the Cape Arago region Coos County, Oregon. M.S. Thesis, Oregon State Univ., Corvallis.
- Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: status and distribution. Cinclus Publ., McMinnville, Oregon.
- Hansen, H. A. and U. C. Nelson. 1957. Brant of the Bering Sea--migration and mortality. Trans. No. Am. Wildl. Conf. 22:237-254.
- Haramis, G. M., J. R. Goldsberry, D. G. McCauley, and E. L. Derleth. 1985. An aerial photographic census of Chesapeake Bay and North Carolina Canvasbacks. J. Wildl. Mgmt. 49:449-454.
- Henry, W. G. 1980. Populations and behavior of Black Brant at Humboldt Bay, California. M.S. Thesis, Humboldt State Univ., Arcata.
- Henson, P. and J. A. Cooper. 1994. Nocturnal behavior of breeding Trumpeter Swans. Auk 111:1013-1018.
- Hesse, W. and H. Hesse. 1965. Northern Pacific Coast region. Audubon Field Notes 19:505-507.
- Hodder, J. 1986. Production biology of an estuarine population of the green algae, *Ulva* spp. in Coos Bay, Oregon. Ph.D. Thesis, Univ. of Oregon, Eugene.
- Hoffman, W. and W. P. Elliott. 1974. Occurrence of intergrade Brant in Oregon. Western Birds 5:91-93.
- Jorde, D. G. and R. B. Owen, Jr. 1988. The need for nocturnal activity and energy budgets of waterfowl. Pp. 169-180 in M. W. Weller (Ed.), Waterfowl in winter. Univ. of Minnesota Press, Minneapolis.
- Kramer, G. W. 1976. Winter ecology of Black Brant at San Quintin Bay, Baja California, Mexico. Humboldt State Univ. (Not seen--cited in GooseRef Online Database.)

- Kramer, G. W., L. R. Rauen, and S. W. Harris. 1979. Populations, hunting mortality and habitat use of Black Brant at San Quintin Bay, Baja California, Mexico. Pp. 242-254 in R. L. Jarvis and J. C. Bartonek (Eds.), Management and biology of Pacific Flyway geese: a symposium. Sponsored by the NW Section of the Wildlife Society. Oregon State Univ. Bookstores, Corvallis. (Also see Kramer 1976.)
- Lane, S. J. and M. Hassall. 1996. Nocturnal feeding by Dark-bellied Brent Geese *Branta bernicla bernicla*. *Ibis* 138:291-297.
- Leopold, A. S. and R. H. Smith. 1953. Numbers and winter distribution of Pacific Black Brant in North America. *Cal. Fish and Game* 39:95-101.
- Madsen, J., T. Bregnballe, and F. Mehlum. 1989. Study of the breeding ecology and behaviour of the Svalbard population of Light-bellied Ecolong Goose *Branta bernicla hrota*. *Polar. Res.* 7:1-21. (Not seen and not at OSU Libraries; this is cited in Henson and Cooper 1994.)
- McLandress, M. R. 1979. Status of Ross' Geese in California. Pp. 255-265 in R. L. Jarvis and J. C. Bartonek (Eds.), Management and biology of Pacific Flyway geese: a Symposium. Sponsored by the NW Section of the Wildlife Society. Oregon State Univ. Bookstores, Corvallis.
- Moffitt, J. 1941. Eleventh annual Black Brant census in California. *Cal. Fish Game* 27:216-233.
- Moffitt, J. and C. Cottam. 1941. Eelgrass depletion on the Pacific Coast and its effect on the Black Brant. U. S. Dept. of Interior, Fish and Wildlife Service Leaflet 204.
- Munson, C. 1976. A survey of the avifauna of Netarts Bay, Oregon. Pp. 156-168 in H. Stout (Ed.), The natural resources and human utilization of Netarts Bay, Oregon. Student-Originated-Study, Oregon State Univ., Corvallis.
- ODFW. 1978. Habitat map of Yaquina Estuary. Oregon Dept. of Fish and Wildlife, Research and Development Section.
- ODFW. 1996. Game bird hunting in Oregon: a guide to public hunting opportunities. Oregon Dept. of Fish and Wildlife.
- Oregon State Game Commission. 1972. Annual report: 1972. Oregon State Game Commission, Game Division. (This is SK439.A714 at OSU Libraries; this series appears to extend from 1946 to at least 1982.)
- Oregon State Land Board. 1973. Oregon estuaries. State of Oregon, Div. of State Lands.
- Owens, N. W. 1977. Responses of wintering Brent Geese to human disturbance. *Wildfowl* 28:5-14.
- Page, G. W., L. E. Stenzel, and D. G. Ainley. 1982. Beached bird carcasses as a means of evaluating natural and human-caused seabird mortality. Point Reyes Bird Observatory. NTIS Report DE82016736. (Abstract cited in 1983 Gov. Report Announcements 1983[8]:1474).
- Palmer, R. S. 1976. Handbook of North American birds, Vol. 2: waterfowl (first part). Yale Univ. Press, New Haven, Connecticut.
- Phillips, R. C. 1984. The ecology of eelgrass meadows in the Pacific Northwest: a community profile. U. S. Dept. Interior, Fish and Wildlife Service, FWS/OBS-84/24.
- Pickering, P., D. Faxon, and R. D. Bayer. 1996. Three mid-winter bird counts along the Oregon central coast. *Journal of Oregon Ornithology* 6:709-714.
- Pitkin, D. S. and R. W. Lowe. 1995. Distribution, abundance and ecology of Aleutian Canada Geese in Oregon and Washington: 13 October 1994 to 1 May 1995. Unpubl. Report, U. S. Fish and Wildlife Service, Oregon Coastal Refuges, Newport, Oregon.
- Pollock, K. H. and W. L. Kendall. 1987. Visibility bias in aerial surveys: a review of estimation procedures. *J. Wildl. Mgmt.* 51:502-510.
- Ranwell, D. S. and B. M. Downing. 1959. Brent Goose (*Branta bernicla* (L.)) winter feeding pattern and *Zostera* resources at Scolt Head Island, Norfolk. *Anim. Behav.* 7:42-56.
- Reed, A., M. A. Davison, and D. K. Kraege. 1989. Segregation of Brent Geese *Branta bernicla* wintering and staging in Puget Sound and the Strait of Georgia. *Wildfowl* 40:22-31.

- Reiger, G. 1982. Return of the sea goose. *Field and Stream* 87 (Nov.):66-67, 141-144.
- Samuel, M. D., E. O. Garton, M. W. Schlegel, and R. G. Carson. 1987. Visibility bias during aerial surveys of elk in northcentral Idaho. *J. Wildl. Mgmt.* 51:622-630.
- Shirzad, F. F., S. P. Orlando, C. J. Klein, S. E. Holliday, M. A. Warren, and M. E. Monaco. 1988. Physical and hydrologic characteristics: the Oregon estuaries. *National Estuarine Inventory: Supplement 1. National Oceanic and Atmospheric Admin., National Ocean Service, Office of Oceanography and Marine Assessment, Ocean Assessments Division, Strategic Assessment Branch.* (This is GC856.P561 at OSU Libraries.)
- Smith, H. 1961. Summer record of Black Brant in Oregon. *Murrelet* 42:7.
- Smith, R. H. and G. H. Jensen. 1970. Black Brant on the mainland coast of Mexico. *Trans. No. Am. Wildlife Conference* 35:227-241.
- Springer, P. F., R. W. Lowe, R. K. Stroud, and P. A. Gullett. 1989. Presumed drowning of Aleutian Canada Geese on the Pacific Coast of California and Washington. *J. Wildlife Diseases* 25:276-279.
- Stone, W. B. and H. Knoch. 1982. American Brant killed on golf courses by Diazinon. *New York Fish and Game Journal* 29:95-96.
- Stott, R. S. and D. P. Olson. 1972. An evaluation of waterfowl surveys on the New Hampshire coastline. *J. Wildl. Mgmt.* 36:468-477.
- Summers, R. W., J. Stansfield, S. Perry, C. Atkins, and J. Bishop. 1993. Utilization, diet and diet selection by Brent Geese *Branta bernicla bernicla* on salt-marshes in Norfolk. *J. Zoology* 231:249-273.
- Vickery, J. A., W. J. Sutherland, A. R. Watkinson, S. J. Lane, and J. M. Rowcliffe. 1995. Habitat switching by dark-bellied Brent Geese *Branta b. bernicla* (L.) in relation to food depletion. *Oecologia* 103:499-508.
- Ward, D. H. and R. A. Stehn. 1989. Response of Brant and other geese to aircraft disturbance at Izembek Lagoon, Alaska. *U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center.* (This is QL696.A52 W371 at Oregon State University Library; also see Ward et al. 1994.)
- Ward, D. H., R. Stehn, and D. V. Dersen. 1994. Response of staging Brant to disturbance at the Izembek Lagoon, Alaska. *Wildl. Soc. Bull.* 22:220-228.
- Watson, C. H. 1982. Index to Oregon bird reports in Audubon Field Notes and American Birds, 1947-1981. *Oregon Field Ornithologists Special Publication No. 3.*
- Wetzel, D. R. 1996. Brant use of Yaquina Estuary, Lincoln County, Oregon in the spring of 1976. *Journal of Oregon Ornithology* 6:715-722.
- Wilson, U. W. and J. B. Atkinson. 1995. Black Brant winter and spring-staging use at two Washington coastal areas in relation to eelgrass abundance. *Condor* 97:91-98.
- Woodcock, A. R. 1902. Annotated list of the birds of Oregon. *Oregon State University, Oregon Agric. Exper. Station No. 68.*
- Wooten, W. 1954. Waterfowl losses in the surf along the northern California Coast. *J. Wildl. Mgmt.* 18:140-141.
- Yocom, C. F. and M. Keller. 1961. Correlation of food habits and abundance of waterfowl, Humboldt Bay, California. *Cal. Fish and Game* 47:41-53.