Chapter 6:

HARVEST OF ROSS'S GEESE

Timothy J. Moser, U.S. Fish and Wildlife Service
David C. Duncan, Canadian Wildlife Service

Hunting Regulations

The hunting of Ross's geese was unregulated until 1918 when the Migratory Bird Treaty Act (MBTA) in the United States and the Migratory-Birds Convention Act (MBCA) in Canada were enacted. Prior to 1918, the total annual harvest of Ross's geese likely was small due to their low population level and restricted range. However, Ross's geese commonly were shot in portions of California during market-hunting days around 1900 and some considered shooting a risk to the species at that time (Grinnel et al. 1918).

From 1918 to 1931, goose hunting seasons in the U.S. and Canada generally were greater than 90 days in length and included aggregate goose bag limits (the number of individuals of a single species or any combination of species that could be taken per day), generally 8 per day in the U.S. Concern over low staging and wintering numbers led to the closure of Ross's goose hunting seasons in the U.S. from 1931 through 1962, in Alberta from 1941 to 1962, in the Northwest Territories from 1944 to 1962, and in the Yukon from 1953 to 1962.

In response to increasing population indices of Ross's geese during the winters of 1955-62 limited hunting seasons for Ross's geese were reestablished in the U.S. and Canada in 1963 (Table 1, Dzubin 1965). Daily bag and possession limits for Ross's geese in the Pacific and Central Flyways were restricted to 1 goose from 1963 to 1978. After 1978, harvest of Ross's geese in the U.S. was regulated under light goose aggregate bag limits (snow and Ross's geese combined). Subsequent regulations in the Pacific Flyway have been relatively stable while those in the Central and Mississippi Flyways have been liberalized incrementally in response to increasing populations (Table 1). By 1994, season lengths in all 4 U.S. flyways were at or near the maximum of 107 days allowed under the MBTA.

After reestablishing Ross's goose seasons in 1963, Canada did not establish specific regulations for Ross's geese, but opening dates for light goose seasons in Alberta and Saskatchewan were often delayed until after the first week of October to reduce Ross's goose harvest. During the 1970s in prairie Canada (AB, SK, MB), the total goose aggregate bag limit was 5/day. In response to increasing goose populations, separate aggregate bag limits were established for light and dark geese in the 1990s. The bag limit for light geese was increased further to 8-10/day in 1997-98, and to 10-20/day in 2000 in response to degradation of northern habitats and continued increases in light goose abundance. By 1994, hunting season lengths in Canada were at or near the maximum of

Table 1. Summarized[a] hunting frameworks for Ross's and snow geese in the Pacific, Central, and Mississippi Flyways, 1962-2000.

	PACIFIC FLYWAY				CENTRAL FLYWAY								MISSISSIPPI FLYWAY			
					WEST TIER - MT, WY, CO, NM, W. TX				EAST TIER - ND, SD, NE, KS, OK, E. TX							
	SEASON		BAG/POSS[b]		SEASON		BAG/POSS[b]		SEASON		BAG/POSS[b]		SEASON		BAG/POSS[b]	
YEAR	CLOSE	DAYS	SNOW	ROSS'S	CLOSE	DAYS	SNOW	ROSS'S	CLOSE	DAYS	SNOW	ROSS'S	CLOSE	DAYS	SNOW	ROSS'S
1962	Jan 6	75	6/6	Closed[c]	Jan 06	75	5/5 TGA	Closed[c]	Jan 13	75	5/5 TGA	Closed[c]	Jan 13	60	5/5 LGA	
1963	Jan 5	90	6/6	1/1	Jan 05	90	5/5 TGA	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	70	5/5 LGA	
1964	Jan 10	90	6/6	1/1	Jan 10	90	5/5 TGA	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	70	5/5 LGA	
1965	Jan 9	90	6/6	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	70	5/5 LGA	
1966	Jan 8	90	6/6	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	75	5/5 TGA	1/1	Jan 15	70	5/5 LGA	
1967	Jan 14	90	6/6	1/1	Jan 14	75	5/5 TGA	1/1	Jan 14	75	5/5 TGA	1/1	Jan 14	70	5/5 LGA	
1968	Jan 12	93	6/6	1/1	Jan 15	75	2/2 TGA	1/1	Jan 15	75	5/5 TGA	1/1	Jan 12	70	5/5 LGA	
1969	Jan 11	93	6/6	1/1	Jan 15	86	2/4 TGA	1/1	Jan 15	86	5/5 TGA	1/1	Jan 11	70	5/5 LGA	
1970	Jan 17	93	6/6	1/1	Jan 17	90	2/4 TGA	1/1	Jan 17	75	5/5 TGA	1/1	Jan 24	70	5/5 LGA	
1971	Jan 16	93	6/6	1/1	Jan 16	90	2/4 TGA	1/1	Jan 16	75	5/5 TGA	1/1	Jan 23	70	5/5 LGA	
1972	Jan 20	93	6/6	1/1	Jan 24	93	2/4 TGA	1/1	Jan 24	72	4/4 TGA	1/1	Jan 20	70	5/5 LGA	
1973	Jan 20	93	6/6	1/1	Jan 20	93	2/4 TGA	1/1	Jan 20	72	5/5 TGA	1/1	Jan 20	70	5/5 LGA	
1974	Jan 19	93	6/6	1/1	Jan 19	93	2/4 TGA	1/1	Jan 19	72	5/5 TGA	1/1	Jan 20	70	5/5 LGA	
1975	Jan 18	93	3/6	1/1	Jan 18	93	2/4 TGA	1/1	Jan 18	72	5/5 TGA	1/1	Jan 20	70	5/5 LGA	
1976	Jan 23	93	3/6	1/1	Jan 23	93	2/4 TGA	1/1	Jan 23	72	5/5 LGA	1/1	Jan 20	70	5/5 LGA	
1977	Jan 22	93	3/6	1/1	Jan 22	93	2/4 TGA	1/1	Jan 22	86	5/5 LGA	1/1	Jan 20	70	5/5 LGA	
1978	Jan 21	93	3/6	1/1	Jan 21	93	2/4 TGA	1/1	Jan 21	86	5/5 LGA	1/1	Jan 20	70	5/5 LGA	
1979	Jan 20	93	3/6 LGA		Jan 20	93	2/4 TGA		Jan 20	86	5/5 LGA		Jan 20	70	5/5 LGA	
1980	Jan 18	93	3/6 LGA		Jan 18	93	2/4 TGA		Jan 18	86	5/10 LGA		Jan 20	70	5/10 LGA	
1981	Jan 17	93	3/6 LGA		Jan 17	93	2/4 TGA		Jan 17	86	5/10 LGA		Jan 20	70	5/10 LGA	
1982	Jan 23	93	3/6 LGA		Jan 23	93	2/4 TGA		Jan 23	86	5/10 LGA		Jan 20	70	5/10 LGA	
1983	Jan 22	93	3/6 LGA		Jan 22	93	2/4 TGA		Jan 22	86	5/10 LGA		Jan 20	70	5/10 LGA	
1984	Jan 20	93	3/6 LGA		Feb 12	93	2/4 TGA		Feb 12	86	5/10 LGA		Jan 20	70	5/10 LGA	
1985	Jan 19	93	3/6 LGA		Feb 16	93	5/10 LGA		Feb 16	86	5/10 LGA		Jan 20	70	5/10 LGA	
1986	Jan 18	93	3/6 LGA		Feb 15	93	5/10 LGA		Feb 15	86	5/10 LGA		Jan 20	70	5/10 LGA	
1987	Jan 17	93	3/6 LGA		Feb 14	93	5/10 LGA		Feb 14	86	5/10 LGA		Jan 17	70	5/10 LGA	
1988	Jan 22	93	3/6 LGA		Feb 14	95	5/10 LGA		Feb 14	86	5/10 LGA		Jan 22	70	5/10 LGA	
1989	Jan 21	93	3/6 LGA		Feb 18	95	5/10 LGA		Feb 18	100	5/10 LGA		Jan 21	80	7/14 LGA	
1990	Jan 20	93	3/6 LGA		Feb 17	100	5/10 LGA		Feb 17	86;100	5/10;7/14 LGA		Jan 20	80	7/14 LGA	
1991	Jan 19	93	3/6 LGA		Feb 16	107	5/10 LGA		Feb 16	86;100	5/10;7/14 LGA		Jan 31	80	7/14 LGA	
1992	Jan 17	93	3/6 LGA		Feb 14	107	5/10 LGA		Feb 14	107	10/20 LGA		Jan 31	80	7/14 LGA	
1993	Jan 23	100	3/6 LGA		Feb 13	107	5/10 LGA		Feb 13	107	10/20 LGA		Feb 14	80	7/14 LGA	
1994	Jan 20	100	3/6 LGA		Feb 28	107	5/10 LGA		Feb 28	107	10/20 LGA		Feb 14	107	7/14 LGA	
1995	Jan 21	100	3/6 LGA		Mar 10	107	5/10 LGA		Mar 10	107	10/20 LGA		Feb 14	107	10/20 LGA	
1996	Jan 19	100	3/6 LGA		Mar 10	107	10/40 LGA		Mar 10	107	10/40 LGA		Mar 10	107	10/30 LGA	
1997	Jan 18	100	3/6 LGA		Mar 10	107	10/40 LGA		Mar 10	107	10/40 LGA		Mar 10	107	10/30 LGA	
1998 [d]	Jan 17	100	3/6 LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA	
1999 [d]	Jan 23	100	3/6 LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA	
2000 [d]	Jan 21	100	3/6 LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA		Mar 10	107	20/none LGA	

[a] Some spatial and temporal deviations from Flyway-wide regulations occurred.

[b] Daily bag and possession limits: LGA = Light goose aggregate; any combination of light goose species up to these limits may be taken unless additional restrictions apply (see Ross's goose column). TGA = Total goose aggregate; any combination of goose species may be taken up to these limits unless additional restrictions apply (see Ross's goose column).

[c] Ross's goose seasons were closed from 1931 through 1962.

[d] Special regulations were implemented in the Central and Mississippi Flyways that allowed new techniques and the take of light geese between Mar. 10 and Sep. 1.

107 days allowed under the MBCA and extended from early September to late November/early December.

Traditionally, Mexico has regulated goose harvest under total goose aggregate bag limits (generally 3-5/day during the 1990s). In 2000 however, several Mexican States liberalized goose regulations by implementing separate aggregate bag limits of 5 dark and 10-15 light geese per day (E. Carrera, Ducks Unlimited de Mexico, personal communication).

In February 1999, the U.S. Fish and Wildlife Service (USFWS) promulgated rules that allowed special provisions for light goose hunting (i.e., electronic calls, unplugged shotguns) when other waterfowl and crane seasons were closed, and implemented a conservation order in States of the Mississippi and Central Flyways (Federal Register; 64 FR 7507-7517). The conservation order allowed the take of light geese at any time of year given certain restrictions, allowed the special provisions above, extended shooting hours, and removed bag limits. The Canadian Wildlife Service (CWS) implemented special regulations that allowed for harvest of lesser and greater snow geese only (Ross's geese excluded) between 10 March and 1 September in areas of Manitoba and Quebec beginning in 1999, and in Saskatchewan and Nunavut beginning in 2001.

Currently, most Ross's geese are taken in North America under 3 types of regulations. Regular-season harvest occurs during annually promulgated hunting seasons for licensed or permitted hunters and is estimated by annual operational harvest surveys. Subsistence harvest and the take during conservation order periods in the U.S. are regulated and assessed by other methods.

Distribution of Ross's Goose Harvest

In the first half of the 20th century, anecdotal reports suggested that most Ross's geese were harvested in California and Alberta, although some Ross's geese were observed or shot in the Mississippi Flyway as early as 1910 (Dzubin 1965). Dzubin (1965) noted an eastward shift in the fall migration of Ross's geese during 1960-64. An easterly shift in the harvest distribution of Ross's geese was also apparent after banding and extensive harvest monitoring programs began in the 1960s. Maps of the band recoveries (i.e., a banded bird that is shot or found dead and reported to banding authorities) of all Ross's geese banded in North America (Fig. 1), the distribution of recoveries of Ross's geese banded only in the central Arctic (Table 2), and the estimated distribution of Ross's goose harvest in the U.S. (Table 3) all show a progressive eastward shift from the 1960s through the 1990s.

When biologists began estimating the harvest of Ross's geese in the 1960s by examining goose tails provided by randomly selected hunters, harvest of Ross's geese was recorded only in the Pacific Flyway, primarily California. The harvest of Ross's geese was first detected in harvest surveys in the Central Flyway in 1974, in the Mississippi Flyway in 1982, and in the Atlantic Flyway in 1996. The proportion of U.S.

regular-season harvest that occurred in the Pacific Flyway declined from 100% in the 1960s to 29% in the 1990s, while the proportions in the Central Flyway and the Mississippi Flyways increased from 0% to 56%, and from 0% to 15%, respectively (Table 3). The increased harvest that occurred in the east was in addition to, not in lieu of, increased harvest of Ross's geese in the Pacific Flyway (Table 4).

During the 1990s, 53% of the U.S. regular-season harvest has occurred in the 4 States of Arkansas, California, Louisiana, and Texas. The pattern of harvest of Ross's geese across the Canadian prairie Provinces during 1975-99 shows that the majority of birds are now harvested in Saskatchewan, with variable proportions harvested in Alberta and Manitoba (Table 3). The proportion of the Canadian and U.S. Ross's goose harvest that occurs in Canada has decreased from 52% during the 1970s to 36% and 32% during the 1980s and 1990s, respectively (Fig. 2).

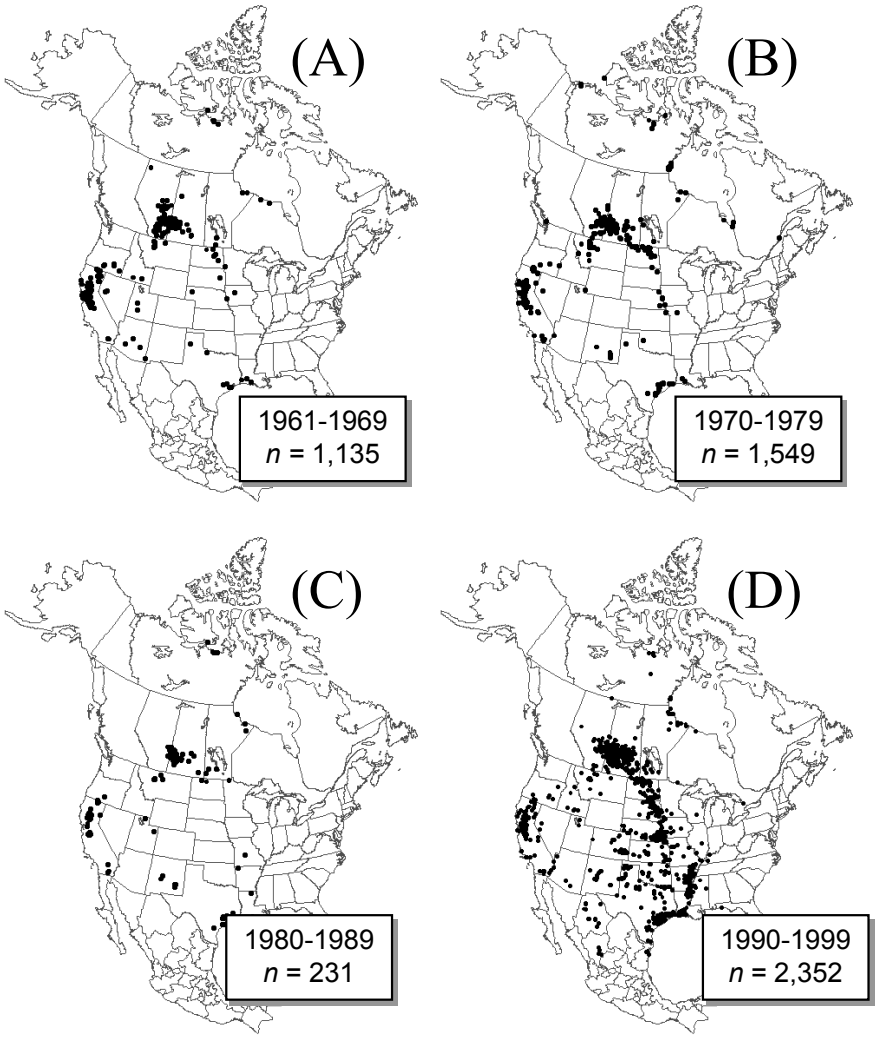

Fig. 1. Distribution of Ross's goose band recoveries in North America, 1961-99 (from Alisauskas 2001).

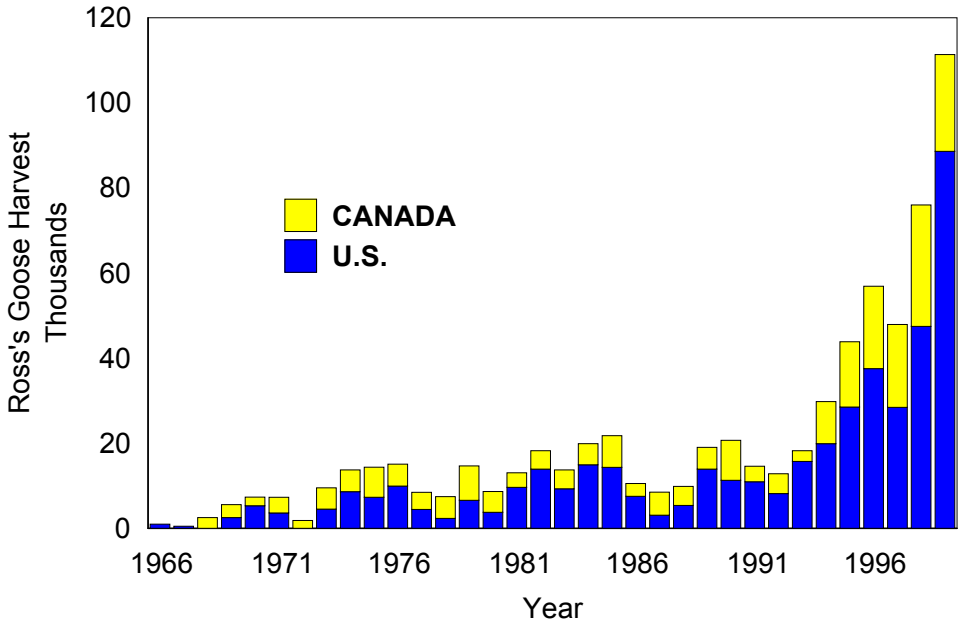

Fig. 2. Estimated regular-season harvest of Ross's geese in the United States and Canada, 1966-99.

Table 2. Flyway distribution (%) of United States recoveries (1960-98) of Ross's geese banded in the central Canadian Arctic[a].

	Period			
Flyway	1960-69 (n = 279)	1970-79 (n = 274)	1980-89 (n = 45)	1990-98 (n = 479)
Pacific	96	94	87	60
Central	3	5	13	32
Mississippi	<1	<1	0	8
Atlantic	0	0	0	0

[a] Ross's geese banded between 95 and 115 degrees west longitude.

Table 3. Distribution (%) of regular-season Ross's goose harvest in the United States among Flyways, and in Canada among prairie Provinces, 1966-99[a].

	Period			
	1966-69	1970-79	1980-89	1990-99
United States				
Pacific Flyway	100	92	60	29
Central Flyway	0	8	33	56
Mississippi Flyway	0	0	6	15
Canada				
Alberta		28	21	16
Saskatchewan		61	61	72
Manitoba		8	18	10

[a] Data includes harvest estimates from 1966 to 1999 for the U.S. and from 1974 to 1999 for Canada.

Table 4. Mean annual regular-season Ross's goose harvest in the United States and Canada by period during 1966-99 (Federal harvest estimates from Sharp and Moser 2000).

Period	Mississippi Flyway	Central Flyway	Pacific Flyway	U.S. total	Canada total	Total U.S. and Canada
1966-69[a]	0	0	512	512	2,808	4,078
1970-79	0	402	4,893	5,295	4,705	10,000
1980-89	611	3,190	5,803	9,605	4,745	14,350
1990-99	4,536	16,594	8,536	29,674	13,565	43,239

[a] Harvest estimates for Ross's geese were first derived in the U.S. in 1966 and in Canada in 1968.

Magnitude of Ross's Goose Harvest

Subsistence harvest of Ross's geese is negligible in their traditional Queen Maud Gulf nesting areas (Ryder and Alisauskas 1995) and very low numbers, if any, are taken during limited subsistence hunting of snow geese in the Northwest Territories, Nunavut, Manitoba, and Saskatchewan (Dickson 1996).

Dzubin et al. (1966) estimated that the 1965/66 harvest of Ross's geese in prairie Canada was 1,800-2,300 birds and harvest in California was about 3,600-4,500 birds. Standardized waterfowl harvest estimates for Ross's geese have been conducted in the

U.S. since 1966 and in Canada since 1968. The estimated harvest of Ross's geese in the U.S. and Canada increased slowly from the 1960s to the 1980s and then increased more rapidly through the 1990s (Table 4, Fig. 2). Harvest estimates fit an exponential growth curve during 1968-99 ($r^2 = 0.77$, $P < 0.0001$) with an annual growth rate of about 12% (Fig. 2). The rapid increase in harvest during 1992-99 appears linear ($r^2 = 0.88$, $P = 0.0006$) and represents an annual increase in harvest of 12,450 Ross's geese. Harvest has increased rapidly in the Central and Mississippi Flyways over time while the average harvest in the Pacific Flyway increased more gradually (Table 4). The estimated regular-season harvest in the U.S. and Canada reached a maximum level of 111,360 during the 1999/2000 season (Fig. 2).

Surveys to estimate waterfowl harvest in Mexico are not routinely conducted, but information from Kramer et al. (1995) suggests Ross's goose harvest there is negligible. They estimated that 1,391 light geese were harvested annually during 1987-93, a small but unquantified proportion of which were Ross's geese (G. W. Kramer, personal communication).

Federal harvest estimates in the U.S. do not include take of Ross's geese during conservation order periods, but the take of light geese during these periods is estimated by participating States. We estimated the take of Ross's goose during conservation order periods by multiplying the pooled State estimates of light goose harvest within the Central and Mississippi Flyways by the proportion of Ross's geese taken during regular hunting seasons in those Flyways. These calculations estimated that 17,508 and 43,055 additional Ross's geese were taken during 1998/99 and 1999/2000, respectively. The estimated continental take for Ross's geese during the 1999/2000 hunting season and conservation order periods was about 154,400.

Assessment of Recovery and Harvest Rates on Ross's Geese

We examined banding data to assess if recent increases in Ross's goose harvest corresponded to increases in the harvest rate of Ross's geese (i.e., harvest as a proportion of population size). Recovery rate (the probability a banded bird is shot or found dead and reported to banding authorities) is a relative index of the harvest pressure on a population. Alisauskas analyzed recoveries of banded Ross's geese in North America during 1961-99 (using Program MARK and BROWNIE time-specific models, R. T. Alisauskas, CWS, unpublished data). These estimates include reports of banded birds harvested during conservation order periods as well as during regular hunting seasons. Recovery rates (which are impacted by changes in reporting rates, see paragraphs below) peaked in the late 1960s and early 1970s, then declined to the late 1980s. Recovery rates generally increased from 1993 to 1999 for adults and from 1990 to 1999 for juveniles. However, average adult recovery rates for the 1990s are lower than all decades since the 1960s, and average juvenile recovery rates of the 1990s were lower than the 1960s and 1970s. Even the highest recent estimates (1999/2000) for adult and juvenile recovery rates (which are biased high due to recent increases in reporting rates) were surpassed in many years during the 1960s and 1970s.

Recovery rates may be misleading because they are influenced by band-reporting rates (i.e., the proportion of harvested banded birds that are reported to banding authorities). Dividing recovery rates by band-reporting rates yields an index to the harvest rate of the population. Estimates of band-reporting rates are obtained through periodic reward-band studies of mallards and have remained quite consistent from 1972 to 1991 (Henny and Burnham 1976, Nichols et al. 1991, Nichols et al. 1995). Although no reward-band studies have been conducted on geese, there is no information to indicate that band-reporting rates for geese differ substantially from mallards. Furthermore, if band-reporting rates for geese are consistent over time, the index to harvest rate remains valid regardless of the relationship to mallard reporting rates.

In an effort to increase band-reporting rates, North American waterfowl banders in 1995 began to use bands inscribed with a toll-free telephone number rather than the previously used abbreviated mail address. Band-reporting rates have increased drastically since 1995 due to this new band inscription and the associated public information campaigns. Estimated direct reporting rates for mallards have increased from 38% during 1988-91 (Nichols et al. 1995) to 91% in 1999 (J. A. Dubovsky, USFWS, personal communication). Of the band recoveries reported from the 1999/2000 waterfowl season, 92% of Ross's and lesser snow goose direct recoveries were reported via the 1-800 phone number, similar to the 93% of mallard bands that were reported via phone. The proportion of bands reported by phone in 1996/97 were 54% for Ross's and lesser snows and 68% for mallards (the mallard reporting rate estimate was 0.62, J. Dubovsky, USFWS, personal communication). These data suggest that increases in reporting rates for geese initially lagged behind mallards but increased to the same relative degree as mallards by 1998/99 (85% of light geese and 89% of mallards reported by phone).

We corrected estimated Ross's goose recovery rates (R. T. Alisauskas, CWS, unpublished data) with band-reporting rates referenced above (0.32 for 1961-87, 0.38 for 1988-94, Nichols et al. 1995), and for the years 1995-99 with both the "old estimate" (0.38, ignoring recent increases in reporting rates), and with "new estimates" of mallard direct reporting rates (0.62 in 1995 to 0.91 in 1999) to estimate harvest rates of Ross's geese (Fig. 3). We believe the actual harvest rate is best approximated using new reporting rates after the 1996/97 winter because the proportion of goose bands reported by phone quickly increased to levels similar to mallards. For 1995/96 and 1996/97, the best estimate of harvest rate likely lies between the rates derived with old and new estimates.

Estimates of harvest rates (Fig. 3) indicate the highest rates for adult and juvenile Ross's geese occurred around 1969 with subsequent declines in harvest rate at least through 1990. Figure 3 indicates that harvest rates of adults (using new reporting rate estimates) have been low and stable at about 3% since 1995. Similarly, harvest rates for juvenile geese are near historical lows, but have been increasing slowly since 1995 to a 1999 level of about 7%. Because Ross's goose populations have increased rapidly over

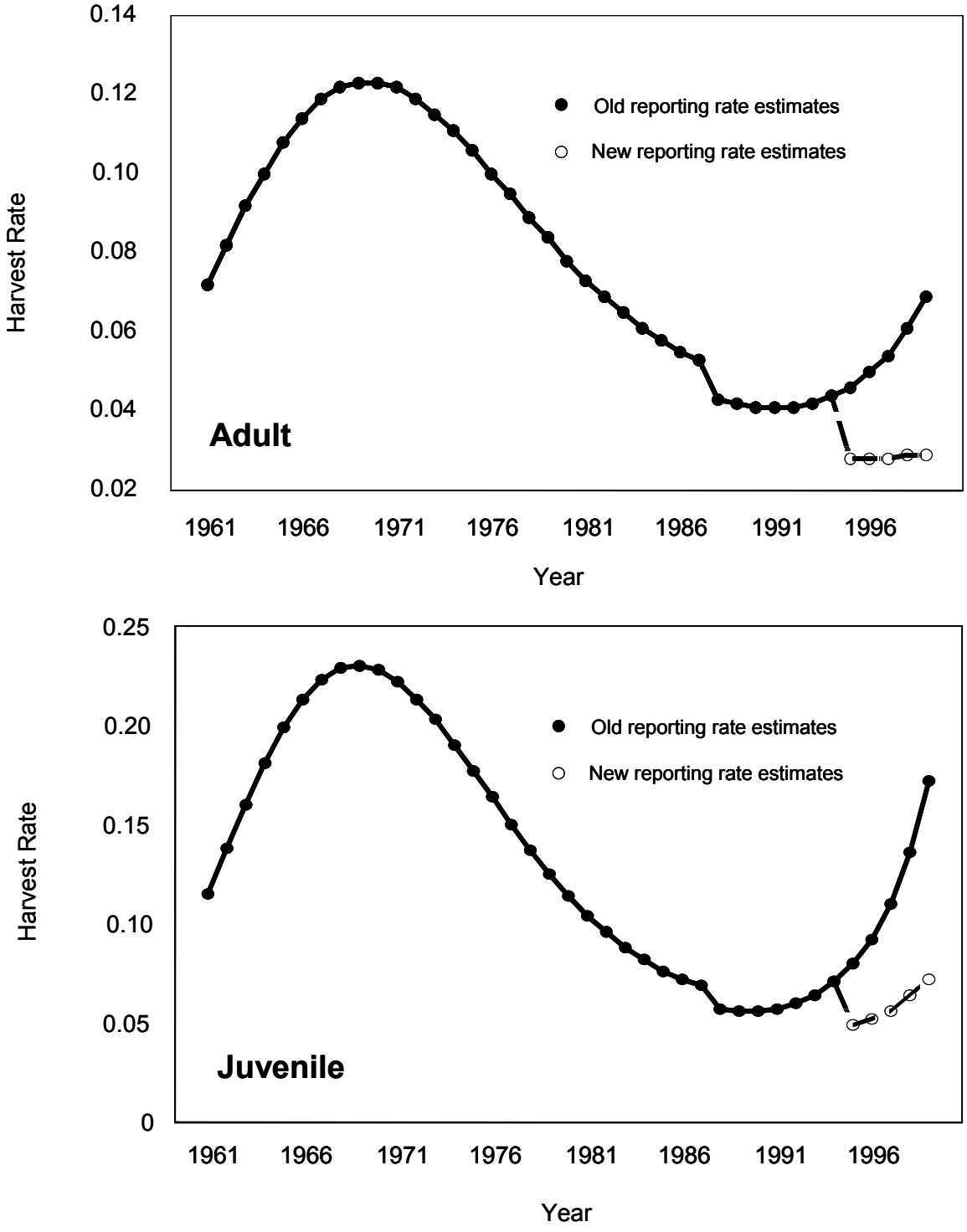

Fig. 3. Estimated harvest rates (recovery rate divided by reporting rate) for adult and juvenile Ross's geese banded in North America, 1961-99. Open circles indicate use of estimated reporting rates derived from reward band studies of banded mallards since 1995, when toll-free phone numbers were included on band inscriptions; closed circles

indicate use of estimated reporting rates from bands inscripted with traditional messages. See text for more information.
the last 40 years under harvest rates well above current levels, it is unlikely that current harvest strategies will curtail future population growth.

Proportion of Ross's Geese in the Harvest of Light Geese

Ross's geese have comprised an increasing proportion of the regular-season light goose harvest in the U.S. and Canada since the 1970s, when they constituted about 2% of the harvest. During 1990-99 Ross's geese represented a mean of about 5% of the light goose harvest.

The increased proportion of Ross's geese in the harvest could be explained by their higher population growth rate relative to midcontinent lesser snow geese (Alisauskas and Rockwell, this report), increased vulnerability to the gun (or hunter selection) of Ross's geese compared to snow geese, or increased numbers of snow geese being classified as Ross's geese in harvest surveys of tail fans due to reductions in snow goose body size (Cooch et al. 1991).

Dzubin (1965) included the opinion of J. D. Soper that Ross's geese are more vulnerable to the gun than are snow geese. Although anecdotal information from some hunters would support this contention, a comparison of banding data from of Ross's and snow geese banded in similar locations, time periods, and with similar marker types did not. We compared direct recovery rates of Ross's geese and lesser snow geese banded in the Queen Maud Gulf Bird Sanctuary during 1989-98. Analysis of variance indicated no significant differences in direct recovery rates between species (or interactions including species) in models including species, marker type, and year of banding for juveniles ($P > 0.90$) or adults ($P > 0.87$). This analysis took advantage of relatively simultaneous banding of both species in this sympatric breeding area and use of the same array of marker types (neck collars, colored legbands, and standard legbands only) but could not account for the more westerly wintering distribution of Ross's geese. However, band-reporting rates for mallards were higher in the Pacific Flyway than the Central Flyway (Nichols et al. 1995) which would have the effect of increasing the relative Ross's goose recovery rate and making Ross's geese appear more vulnerable to the gun in the analysis. The potential influence of declining snow goose body size on overestimation of Ross's goose harvest is under examination.

Production Estimation from Harvest Data

Harvest surveys, through the analysis of goose tails provided by hunters, also provide indices to the annual production of young geese. Because immature geese are more vulnerable to hunters than are adults (see recovery rates), age-ratio estimates are only relative indicators of gosling production among years. We compared age ratios of Ross's geese and snow geese to examine relative indices of gosling production and

changes in production over time. Although sample sizes for some years are small, these indices suggest that Ross's geese, on average, fledge more goslings per adult than do snow geese. Immature-to-adult ratios in the harvest were often twice as high for Ross's geese as those for snow geese in the U.S. harvest. This suggests that Ross's geese have been, and continue to be more productive than snow geese, although we note that if the vulnerability of young to adults varies between Ross's and snow geese, comparisons between species are less valid. Snow goose age ratios appear to be declining while Ross's goose age ratios appear to be increasing. Apparently, factors that may be reducing the productivity of snow geese are not impacting Ross's geese to the same extent.

LITERATURE CITED

Alisauskas, R. T. 2001. Nutritional ecology and population biology of Ross's geese, January, 2001. Unpublished report. Canadian Wildlife Service. Saskatoon, Saskatchewan.

Cooch, E. G., D. B. Lank, R. F. Rockwell, and F. Cooke. 1991. Long-term decline in body size in a snow goose population: evidence of environmental degradation? Journal of Animal Ecology 60:483-496.

Dickson, K. 1996. Wildlife harvests by aboriginal communities in Canada. Unpublished report. Canadian Wildlife Service. Hull, Quebec.

Dzubin, A. 1965. A study of migrating Ross geese in western Saskatchewan. Condor 67:511-534.

Dzubin, A., H. Miller, and G. Schildman. 1966. Distribution of recoveries of Ross' geese banded in the Kindersley district, Saskatchewan, 1961 to 1964. Unpublished report. Saskatoon, Saskatchewan.

Grinnel, J., H. C. Bryant, and T. I. Storer. 1918. The game birds of California. University of California Press. Berkeley, California.

Henny, C. J., and K. P. Burnham. 1976. A reward band study of mallards to estimate band reporting rates. Journal of Wildlife Management 40:1-14.

Kramer, G. W., E. Carrera, and D. Zaveleta. 1995. Waterfowl harvest and hunter activity in Mexico. Transactions of the 60th North American Wildlife and Natural Resource Conference. 60:243-250.

Nichols, J. D., R. J. Blohm, R. E. Reynolds, R. E. Trost, J. E. Hines, and J. P. Bladen. 1991. Band reporting rates for mallards with reward bands of different dollar values. Journal of Wildlife Management 55:119-126.

_____, R. E. Reynolds, R. J. Blohm, R. E. Trost, J. E. Hines, and J. P. Bladen. 1995. Geographic variation in band reporting rates for mallards based on reward banding. Journal of Wildlife Management 59:697-708.

Ryder, J. P., and R. T. Alisauskas. 1995. Ross' Goose (*Chen rossii*). Number 162 *in* The Birds of North America. A. Poole and F. Gill, editors. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Sharp, D. E., and T. J. Moser, compilers. 2000. Central Flyway harvest and population survey data book. U.S. Fish and Wildlife Service. Denver, Colorado.