Swans should not be hunted

WILLIAM J.L. SLADEN

North American swans

All four Northern Swans (Whooper, *Cygnus cygnus cygnus*; Trumpeter, *C.c.buccinator*; Tundra [Whistling], *C.columbianus columbianus*; Bewick's, *C.c.bewickii*) and the introduced Mute Swan, *C. olor*, occur in North America. The Whooper Swan is a regular winter visitor from USSR to the Aleutian Islands (Kenyon 1963), has been reported breeding or moulting in W. Alaska and is a rare vagrant (Palmer 1976, Allen pers. comm.) along the east coast. The Tundra and Bewick's Swan subspecies differ in the amount of yellow on the bill (Palmer 1976). Their distribution is circumpolar, breeding in the high arctic tundra. The Tundra Swan is now breeding in USSR on the Cutotskij Peninsula, having spread there from the Seward Peninsula, Alaska. In USSR it is intergrading with the Bewick's Swan (Kishchinski *et al.* 1975) and has been sighted in west and east USA (Evans & Sladen 1980).

The Tundra Swan is the most abundant swan in North America, there being an estimated 91,000 in the Eastern Population (EP) and 79,000 in the Western Population (WP) totalling about 170,00 birds (Serie 1989). There are about 12,000 Trumpeter Swans, about 10,000 of which breed in Alaska, the rest in west and midwest USA and Canada. Tundra and Trumpeter Swans have been steadily increasing in numbers since they were protected by the Migratory Bird Treaty Act of 1918 over 70 years ago (Bartonek *et al.* 1981a, Serie & Bartonek 1991a, Conant *et al.* 1991). The Mute Swan reached an all-time high of 7,900 in 1989. All but 1,000 are in the Atlantic Flyway. The current annual growth rate of this aggressive alien as indicated by numbers of near-fledged cygnets in summer 1986 was 13.5% (Allin *et al.* 1987).

The most abundant swans worldwide are the Mute (Weiloch 1991), Black, *C.atratus*, and Whooper (Ravkin 1991) Swans estimated at about 500,000 each. The Tundra Swan is fourth close to the Black-necked Swan, *C. melanocoryphus* (100,000). The rarest are the Trumpeter, Bewick's and Coscoroba, *Coscoroba coscoroba*, Swans.

The Tundra Swan is the only Northern Swan hunted for sport recreation and the USA the only country shooting them for this purpose. Elsewhere, including Canada and USSR where most of the Northern Swans breed, swans are completely protected.

The Tundra Swan hunt in USA

After 44 years of protection and as a result of intense pressure from state wildlife administrators the US Fish & Wildlife Service (USFWS) gave the option to Utah to legally hunt the WP Tundra Swan in 1982. Areas of Nevada and Montana where there was little chance of killing the rare Trumpeter Swan were also opened (Bartonek *et al.* 1981b). In 1984 USFWS, again after intense pressure from the eastern states, expanded the hunt into the EP as "experimental" in North Carolina. Thousands of protest letters were received which undoubtedly played a role in preventing the hunt in Maryland and Virginia at that time. The hunt in North Carolina went on regardless. In 1988 USFWS expanded the hunting options to the breeding grounds in Alaska, to the EP migration/staging areas and to other EP wintering areas of Delaware, New Jersey, Maryland and Virginia. All these, with the exeption of Delaware, New Jersey and Maryland, opted for "experimental" hunts starting 1988 (Serie & Bartonek 1991b).

This paper will concentrate on the EP hunt, especially in Virginia, and the WP hunt in the breeding grounds of Alaska. It will also discuss the scientific and ethical justifications for the hunt throughout USA giving alternatives and recommendations for future action. The Swan Research Program has been studying the North American swans for over 20 years (Allen *et al.*

Supplement No. 1 (1991): 368-375

1991, Bart *et al.* 1991, Limpert *et al.* 1991) developing, through the International Waterfowl and Wetland Bureau (IWRB), circumpolar neckband protocols (Sladen 1973 & 1976, Sladen & Kishchinski 1977).

The USFWS Management and Sport Hunt Plans for the EP Tundra Swan (anon. 1982, 1988, Sparrowe & Serie 1984) is to "stabilize the population" within a range of 60,000 to 80,000 swans. Initially the "harvest objective" is being set at 9,000-10,000 Tundra Swans killed annually based on a 10% harvest rate of the 1987 three-year running average winter index of 93,200 birds.

The Tundra Swan hunt in Virginia

1. Justifications

When a citizen writes to the Governor's office or the Virginia Dept. of Game and Inland Fisheries seeking information on the hunt in their state and/or requesting justification(s) they are told (letters to Sladen and others 1989) a total of 600 permits are issued, each permittee being authorized to take one swan during a 90 day season (1 Nov. to 31 Jan.). The justifications to shoot swans are listed as biological and based on: a) the welfare of the Tundra Swan.... "to attempt to hold swan populations within the carrying capacity of their habitat to ensure the continued viability of this species", b) excessive competition with other more fragile waterfowl species, c) reduction of crop damage, d) damage to commercial oyster beds, e) provision of recreational opportunities for the sporting public in the form of a trophy and/or food. These justifications can also be found in the Management (anon 1982) and Hunt (anon 1988) Plans for the EP issued by USFWS. The first four justifications have not been able to stand up to scientific scrutiny as evidenced by vague answers or the ignoring of cross questioning when posed in letters to the agencies. The relevant points are as follows:-

a) *Hold the population within the carrying capacity of their habitat to ensure the viability of the species.* There is no evidence for this. On the contrary, since Tundra Swans adapted to field - feeding in the early 1970s (Munro 1981b) they have available an almost unlimited food resource throughout their entire winter range. This source will vary according to weather, size of fields, disturbance, etc., but they have an enormous area between Pennsylvania and South Carolina to utilize. Moreover, the more abundant (x20) Canada Goose, *Branta canadensis*, throughout the northern part of the Tundra Swan's EP winter range, especially in Maryland and Delaware, has all the habitat it requires and does not appear to compete with the swan. Munro (1981b) predicted correctly that Tundra Swans would increase in numbers as a result of this adaptation. If the swans had not adapted to field feeding there would be (like the ducks) few for Marylanders and Virginians to admire because the Chesapeake Bay is still heavily polluted and submerged aquatic vegetation is only beginning to recover in a few places (Larry Hindman pers. comm.). If the carrying capacity is being limited anywhere, it is in their arctic breeding places by the increased encroachment of man there.

b) *Excessive competition with other waterfowl.* There is no evidence for this either. In fact the ducks have very severely declined in numbers and diversity in recent years in the Atlantic Flyway (Hodil & McMillan 1986) because they have been unable to adapt to man's perturbations of their habitat. When there is good submerged aquatic vegetation the beneficial association of ducks and swans of former years (Munro 1949) will be restored.

c) *Reduction of crop damage.* Tundra Swans mostly feed in harvested corn or soybean fields. They benefit the land by adding nutrients. They do, however, also feed in winter grain fields. Munro (1981b) indicated an 83% useage of corn or soyabean in contrast to 17% of winter grains. If grain is planted in the form of cover crops which are subsequently ploughed in the swans again benefit the land. Moreover, if they feed in winter grain under certain climatic conditions, they could do good. For example sheep are grazed in winter grain in Europe to increase the yield. General statements are made in the Management and Hunting plans and by Bartonek *et al.* (1981b), but USFWS and Virginia do not list evidence from the scientific literature or respond to letters asking for this. Nor do they respond when asked if they have funded research on so called crop damage by swans. There is, however, one study by the Swan Research Program which can stand up to scientific scrutiny which they do not mention.

In this two year study in Maryland, Allen *et al.* (1986) found a small decrease of 12% in wheat yields from Canada Goose grazing. These fields had been grazed to the point of almost no visible above-ground wheat plants except in the control plots. This grazing was far more intensive than anything seen from swans. Moreover, they found that other factors such as rainfall,

soil, species of grain, time of planting, etc. had to be considered before the accusing finger was pointed at the birds. Until more research is initiated crop depredation cannot be used to justify shooting swans. A final point on supposed crop damage (and oyster damage listed below). Hunting will not lessen these damages. The damage, if it is so, will go on regardless of the relatively few birds shot. Nuisance flocks should be dealt with where the nuisance occurs at the time of the year (usually after the hunt season) when they are being a nuisance, not by opportunistic hunting.

d) *Damage to commercial oyster beds.* Swans are reputed to bury young oysters in artificially seeded oyster beds (aquaculture) when they make treading holes for feeding in shallow water. A much quoted reference to this justification for a hunt is a letter (Oesterling 1981) and a half page in a Commercial Fishing Newsletter (anon 1981) claiming $70,000 of damage done in Virginia. This was a non-scientific survey of the watermen that were complaining. Oesterling further condemns this survey by writing:- "By no means should this be taken as a definitive work" and "It should be noted that all estimates of damage are just that, estimates".

e) *Recreational opportunities in sport hunting.* This appears to be the only justification left.

2. Biological concerns

The philosophies and ethics of the sport hunting of swans will be discussed later. First I will discuss four biological concerns which in themselves condemn USFWS for giving Virginia the option to hunt Tundra Swans.

a) There are only 5,500 (4 year average; it was 4,700 in 1987) Tundra Swans in Virginia. This is 6.2% of the EP, yet Virginia has authorized 600 swan hunting permits. Maryland's Dept. of Natural Resources did not accept the option to hunt even though their average swan population for the past 4 years was 26,600, the decision being "consistent with proper stewardship of the resource and in the best interests of the citizens of Maryland" (Brown 1989).

b) The Swan Research Program's neckband studies (Munro 1981a) showed that Tundra Swans are faithful to Maryland wintering grounds but at the time of adapting to field feeding some were resighted in North Carolina where submerged aquatic vegetation was still healthy. Serie & Bartonek (1991a, Fig. 5) demonstrates this trend in the 1970s. Tundra Swans increased in North Carolina at the expense of numbers in Maryland. However, the Virginian population remained fairly consistent at the former low level, suggesting that the Virginia wintering population is a special one which should be studied and encouraged to increase, not decreased through hunting.

c) The Tundra Swan EP has suffered four summers in a row of low productivity. Counts of age ratios (adults and grey-necked young) by the Swan Research Program mostly in Maryland and North Carolina during winter using telescopes and experienced observers reflect the previous summer productivity. For example, counts reflecting summers of 1983 and 1985 gave 17% young in contrast to the three summers of 1986 to 1988 which showed 3%, 8% and 8% respectively (sample about 5,000/yr: total 27,300 swans). Counts were made on a larger scale during 1989-90 winter (reflecting summer productivity of 1989). In a total sample of 13,429 swans there were 1,532 young (11.4%). There was a significant difference when broken down into counts of swans feeding in water or in fields, there being 15.2% young when counted feeding in fields (sample 6,353) in contrast to only 8.0% feeding in water (sample 7,076).

d) Virginia has chosen to hunt swans over an unacceptably long period of 90 days from 1 Nov. to 31 Jan. Since the major migration does not arrive until late Nov. and early Dec., hunters are thus allowed to shoot these birds as they arrive, not permitting them to settle in after their 2,000 km non-stop flight from the Dakotas (Sladen *et al.* 1969). The Fall migration is predictable (Sladen & Cochran 1976). It is also predictable that the commercial hunters will exploit this situation as they have done with the Canada Goose in Maryland.

The Tundra Swan hunt in Alaska

An estimated 5,000-6,000 Tundra Swans are taken by natives under the justification of "subsistence" in Spring and during the moult, as well as an estimated 500 eggs in one area of Alaska, the Yukon-Kuskokwim Delta (Copp 1989, Bartonek *et al.* 1991, Klein 1966). This taking is illegal under the Migratory Bird Treaty Act of 1918 but USFWS and State authorities do not enforce the Act. Moreover, snow toboggans and speed boats that can carry all-terrain vehicles, as well as modern shotguns,

have made these conspicuous and comparatively rare birds very easy targets. A swan is particularly vulnerable to a shotgun when defending its nest either on the ground or from the air.

Adding to this needless killing, Alaska has now completed its second season of an experimental hunt (300 permits issued) in the Seward Peninsula. This and subsistence hunting could already have had a catastrophic effect on a small population of Tundra Swans attempting to establish themselves in USSR from this peninsula (Kishchinski *et al.* 1975), as well as Whooper and Bewick's Swans (Evans & Sladen 1980) that are now wintering in USA from USSR (see first paragraph of this paper). In fact, Bewick's Swan is listed in the Red Data Book of USSR. Bewick's and Tundra Swans are also listed in the Red Data Book of Russian Soviet Federative Socialist Republic (RSFSR) (anon 1984, Senin 1989).

Ethics and philosophies of a swan hunt

If the only justification for a hunt is to provide the "sporting public" with "recreational opportunites" then we cannot avoid discussing ethics and sentiment (Heintzelman 1989). From the population viewpoint a Tundra Swan hunt can stand up to scientific scrutiny. Tundra Swans have adapted well to the perturbations of their environment by man and appear to be generally increasing in numbers (Serie & Bartonek 1991a).

But why shoot swans ? Swans are very special birds to the public. Kellert (1980) found that swan ranked with the robin, *Turdus migratorius*, and butterfly as the third most preferred animal in USA, following two domestic species, the horse and dog. Moreover, until recently the EP of Tundra Swan had been strictly protected for over 70 years. People were fined by USFWS up to $500 for shooting them. Thus they have become pleasingly trusting to man, earning a name as important emblems of wetland conservation.

Some birds - storks, pelicans, flamingos - should be left alone: Swans are such birds (Phillips 1988).

Does the USA tradition of hunting game birds justify shooting swans?

USFWS are quick to point out that the swan is a *traditional game bird*, having been hunted by natives and earlier settlers until the Migratory Bird Treaty Act of 1918 put a stop to the decimation. Does this justify "harvesting" the Tundra Swan ? Will the Trumpeter Swan be their next target, especially in Alaska where its population has reached 10,000 and is still increasing (Conant *et al.* 1991)?

Times have changed. Shooting swans again after 70 years of protection because of a former tradition of treating them as a game bird is a weak excuse to justify the hunt. Even avid hunters tend to change their minds (Phillips 1988). No better example can be found than that of the late Sir Peter Scott (1980) who wrote:-

> "wild swans (and wild geese) are very special birds because their society is based on a permanent pair bond and a family life which keeps the young with their parents until breeding time comes round again. It took me a little time after I had learnt these things before I decided to give up all shooting."

It is difficult to understand why USFWS and almost all State Game departments still manage waterfowl, the most popular, conspicuous and romantic of all bird families, as though hunting were the main recreational activity. Lip service only is given to bird watching despite the fact that the vast majority of citizens are non-hunters and wish to observe wild animals without the major disturbance that results from shooting them. The North American Waterfowl Management Plan (Hodil & McMillan 1986), as outlined for swans is a classic example of this: its goals for Tundra Swans are to maintain them at a winter index goal of 60,000 for the WP and at 80,000 for the Eastern one. When their populations reach these goals (as they already have) "stabilizing" them means killing them (Serie & Bartonek 1991b).

The dedication of the Flyway Councils is obvious but they have no scientific basis for declaring "index goals" for Tundra Swans which, when reached, justify "maintaining" or "stabilizing" the population at these levels by shooting them. These waterfowl biologists are making decisions that affect only a minute part of the recreational population. As stated below, there are many alternatives to shooting and, as already stated, the swans have not yet reached the carrying capacity of their wintering grounds.

There is an urgent need for the large USA conservation organizations such as National Audubon, National Wildlife Federation, Defenders of Wildlife, as well as the Trumpeter Swan Society (Weaver 1981), to issue statements on the swan hunt that they are willing to share with their members. Holdgate (1989) has made a challenging start at this for hunting in general, as follows:

"My position is that it is permissible to crop a wild population for human benefit provided that: (a) a real need is met or a real value derived; (b) the harvest is sustainable and does not disrupt the ecosystem or endanger other species; (c) the taking of animals is done humanely; (d) hunting is barred from properly defined refugia or areas where undisturbed populations are wanted for scientific or aesthetic reasons."

"I would add that there is, of course, no imperative to crop a population. We can decide to forego use of a resource (like whales) if we find the utilization repugnant".

This is a splendid ethical statement which could well be used by some conservation organizations and/or modified to fit their special philosophies. If USFWS were to adopt this, position (b) would be their only justification for the swan hunt.

Conclusions and recommendations

I conclude by emphasizing that there are many good and biologically sound actions that can be taken for a Tundra Swan population that is increasing at a healthy rate other than shooting them. For example:

1. Spend more public money in educating our citizenry, using swans as special emblems of wetland conservation. Celebrate the autumn Swanfall (Horton & Harp 1989) with festivities instead of shooting them as they land from their 2,000 km non-stop flight from the Dakotas.
2. If there were found to be a "surplus" of Tundra Swans, plan programmes to restore them to their former winter range in the Mississippi and Central Flyways.
3. Support the restoration program of the Trumpeter Swan in Eastern N. America (Lumsden 1984 & 1987) and particularly into the Chesapeake Bay and North Carolina where it used to be abundant (Lawson 1714; Banko 1960). For some twenty years the Trumpeter Swan Society (Weaver 1981) has been spearheading a restoration program in the midwest. This is now gaining momentum with approval of the Flyway Councils and participation of several states. Tundra Swans should not be hunted where Trumpeter Swans are being restored since they cannot be distinguished apart. Moreover, the smaller numbers of Trumpeter Swans being established are more vulnerable due to their greater tameness and their behaviour of flying lower and in smaller flocks than Tundra Swans.
4. Use our native Tundra and Trumpeter Swans (and the Eurasian subspecies *bewickii* migrating through Alaska) as magnificent emblems of wetland conservation in negotiations with natives to ban all species of swan for all time from subsistence hunting, as is the case in USSR.
5. Research the alien Mute Swan problem especially in relation to possible competition with the native swans and other wildlife. Mute Swans, like Tundra Swans, should not be hunted. Checking the population explosion of feral Mute Swans in the east by shaking eggs (Allin *et al.* 1987) is also undesirable and seems endless. Another method the Swan Research Program is using in Virginia is to return the birds pinioned into private or public ponds from where they originally escaped, preventing further increase by placing males with males and females with females. This method involves no killing. Moreover, these celibate swans are much less aggressive but still demonstrate their elegant beauty to the satisfaction of all.

I recommend that:

1. USFWS immediately stop the sport shooting and subsistence hunting of Tundra Swans in Alaska, on the migration routes (e.g. in N. Dakota) and on the Eastern wintering grounds other than in North Carolina.
2. All shooting of Tundra Swans where Trumpeter Swans formerly wintered and are being restored in the Mississippi, Central and Atlantic Flyways should be immediately banned. Restore former heavy penalties for anyone found in illegal possession of a Trumpeter and/or Tundra Swan.
3. The hunt in the West and in North Carolina be phased out within the next two years.
4. The policing of illegal waterfowl hunting be immediately improved using trained volunteers to augment the present inadequate numbers of government agents.
5. Wherever the swan hunt remains legal, State agencies be required to establish check stations (as is done for deer) so that the impact of hunting on the target species (Tundra Swan) and the rare species that is being restored (Trumpeter Swan) be properly quantified. Trained volunteers should be mobilized at little extra expense to the government. This will permit information on age, sex, bill

pattern and weight to be added to the data already being collected.

6. USFWS be advised that "managing" swans is a task to be shared with a Swan Advisory Committee made up of equal representation from non-hunting conservation organizations as well as Flyway Council representatives.
7. USFWS and State Wildlife departments work with non-governmental organizations through this Swan Advisory Committee in raising funds (matching government with non-government) for collaborative and well-coordinated research on the Tundra Swan throughout its range with an emphasis on monitoring the wintering population size, age ratios, survival rates, as well as their possible beneficial and/or harmful effects on agricultural land.
8. The public, especially the young, be encouraged to enjoy these special birds by creating observation centres in wetlands where swans are left undisturbed. In some places providing them with a limited amount of supplementary food (Hatakeyama 1981, Ohmori 1981) such as in Japan (Lesser 1973, Tamada 1981), the Wildfowl and Wetlands Trust in UK (Evans 1981), the Swan Research Program in USA (Parks *et al.* 1981) and elsewhere.
9. Influential American conservation organizations are encouraged to develop position papers that inform fully all of their members through their journals as to where they stand on controversial issues such as the hunting of swans.
10. We shout from the housetops, as the world awakens to its environmental problems, that swans are special emblems of wetland conservation. We remind ourselves that times have changed and are still changing. Shooting swans is a repugnant form of recreation. There are many alternatives which would involve a far greater proportion of our citizenry without offending them.

I am deeply indebted to the many volunteers of the Swan Research Program for good advice and encouragement; especially to Roland Limpert and Hubert Allen, and to Roger Tory Peterson who is unequivocally opposed to the hunting of swans.

References

Allen, H.A., Sammons, D., Brinsfield, R. & Limpert, R.J. 1986. The effects of Canada Goose grazing on winter wheat: an experimental approach. *Proc. 2nd Eastern Wildlife Damage Control Conf.* (ed. P.Bromley): 135-140.

Allen, H.A. Sladen, W.J.L. & Limpert, R.J. 1991. Methods of band survival analysis applied to studies of the Tundra Swan, *Cygnus columbianus*. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).

Allin, C.C., Chasko,G.G. & Husband,T.P. 1987. Mute Swans in the Atlantic Flyway, A review of the history, population growth and management needs. *Trans. NE Section Wildl. Soc.* 44:32-47

Anonymous. 1981. Swans damaging oysters. *Commercial Fishing Newsletter* 1(3);4.

Anonymous. 1982. Management Plan for the EP of Whistling Swans. Final Draft, revised Aug.1982. *Ad Hoc Whistling Swan Committee*. USFWS, Wash. DC.

Anonymous. 1984. *Red Data Book of the USSR* (in Russian).

Anonymous. 1988. *Eastern Population Tundra Swan sport hunting plan.* USFWS, Wash. DC.

Banko, W.E. 1960. *The Trumpeter Swan. Its history, habits and population in the United States.* USFWS, Wash.DC. pp 214.

Bart,J., Limpert,R.J., Earnst,S., Sladen, W.J.L., Hines, J. & Rothe, T. 1991. Demography of EP Tundra Swans, *Cygnus columbianus*. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).

Bartonek, J.C., Blandin,W.W., Gamble, K.E. & Miller, H.W. 1981a. Numbers of swans wintering in the United States. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 19-25.

Bartonek, J.C., Blandin,W., Gamble, K.E., Miller, H.W. & Rogers, J.P. 1981b. Management of swans in the United States. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 294-300.

Bartonek, J.C., Serie, J.R. & Converse, K.A. 1991. Mortality in Tundra Swans, *Cygnus columbianus*. In: J. Sears & P.J. Bacon (eds.), *Proc. 3rd Int. Swan Symp.*, Oxford, 1989. *Wildfowl.* (Special Supplement no.1).

Brown,T.C. 1989. Letter to Sladen from Secretary of Maryland's Dept. Nat. Resource, 23 January.
Conant, B. and Hodges, J.L. & King, J.G. 1991. Continuity and advancement of Trumpeter Swan, *Cygnus buccinator,* and Tundra Swan *C. columbianus* population monitoring in Alaska. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).
Copp, J.D. 1989. *Results of the 1987 survey of waterfowl hunting on the Yukon-Kuskokwim Delta, Alaska.* Oregon State Univ., Corvallis, Orgeon. Unpubl. rep. 40 pp.
Evans, M.E. 1981. The Swan Supporter Scheme at Slimbridge. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 338-341.
Evans, M.E. &Sladen, W.J.L. 1980. A comparative analysis of the bill markings of Whistling and Bewick's Swans and out-of-range occurences of the two taxa. *Auk* 97:697-703.
Hatakeyama, M. 1981. The feeding of swans and its results. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 247-248.
Heintzelman, D.S. 1989. Tundra Swan hunting: a biological, ecological and wildlife crisis. *Wildlife Conservation Report* 5:1-9. Wildlife Information Center, Allentown PA.
Hodil, D.P. & McMillan, T. 1986. *North American Waterfowl Management Plan.* US Dept.Interior, Fish and Wildlife Service.
Holdgate, M. 1989. Letter to Sladen from Dir.-General, IUCN. 13 Nov.
Horton, T. & Harp, D. 1989. Swanfall. Sun Magazine. *Baltimore Sun,* Baltimore Maryland:12-19.
Kellert, S.R. 1980. Americans' attitudes and knowledge of animals. *Trans. N. Amer. Wildl. Conf.* 45:111-124.
Kenyon, K.W. 1963. Further observations of Whooper Swans in the Aleutian Islands. *Auk* 80:539-541.
Kishchinski, A.A., Zlotin, R.I. & Flint, V.E. 1975. The breeding of the Whistling Swan (*Cygnus columbianus*) in the USSR. *Zoologicheskii Zhurnal* 54:1525-1528.
Klein, D.R. 1966. Waterfowl in the economy of the Eskimos of the Yukon-Kuskokwim delta, Alaska. *Arctic* 12:319-336.
Lawson, J. 1714. *History of North Carolina.* Reprinted by Observer Printing House, Charlotte, NC, 1903. pp 171.
Lesser, R. 1973. Hyoko: winter habitat of wild swans at Swibara. *Wildfowl* 24:33-41.
Limpert, R.J., Sladen, W.J.L. & Allen, H.A. 1991. Winter distribution of Tundra Swans, *Cygnus columbianus,* breeding in Alaska and western Canadian Arctic.In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).
Lumsden, H.G. 1984. Pre-settlement breeding distribution of Trumpeter and Tundra Swans in Eastern Canada. *Canadian Field Naturalist* 98: 415-424.
Lumsden, H.G. 1987. *The Trumpeter Swan restoration program in Ontario.* 1987 Progress Rep. (unpubl.)
Munro, J.A. 1949. *Can. Journ. Research Sect.D.* 27:289-307.
Munro, R.E. 1981a. Traditional return of *Cygnus columbianus columbianus* to wintering areas in Maryland's Chesapeake Bay. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 81-98.
Munro, R.E. 1981b. Field feeding by *Cygnus columbianus columbianus* in Maryland. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 261-272.
Oesterling, M.J. 1981. Commercial Fisheries Specialist. Letter to Fax Settle, Virginia Game & Fish Commission. 25 March.
Ohmori, T. 1981. Artificial feeding of swans in Japan. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp.. 244-246.
Palmer, R.S. 1976. *Handbook of North American Birds.* Vol.2. Yale.
Parks, F.L., Evans, J. & Hake, E. 1981. Non-professional contributions to swan research. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp.335-338.
Phillips, A. 1988. One shooter's Swan Song for hunting a graceful creature. *Washington Post,* 24 January.
Ravkin, Yu.S. 1991. Number and distribution of Mute Swans, *Cygnus olor,* Bewick's Swans *Cygnus bewickii,* and Whooper Swans *C. cygnus,* in the West Siberian Plain. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).
Scott, P. 1980. *Observations of Wildlife.* Phaidon, Oxford

Senin, V.N. 1989. Letter to Sladen from Vice-Chief of State Committee of Nature Conservation of RSFSR, Moscow USSR.

Serie, J.R. 1989. *Results of the Midwinter Waterfowl Survey in the Atlantic Flyway States.* USFWS, Laurel MD.

Serie, J.R. & Bartonek, J.C. 1991b. Population status and productivity of Tundra Swans, *Cygnus columbianus,* in North America. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).

Serie, J.R. & Bartonek, J.C. 1991a. Harvest management of Tundra Swans *Cygnus columbianus* in North America. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).

Sladen, W.J.L. 1973. A continental study of Whistling Swans using neck collars. *Wildfowl* 24:8-14.

Sladen, W.J.L. 1976. International colour marking codes for swan and goose studies. *Proc. Int. Conf. on Conservation of Wetlands and Waterfowl,* Heiligenhafen, Fed. Rep. Germany, Dec.1974 (Ed. M. Smart), IWRB, Slimbridge UK. pp 310-317.

Sladen, W.J.L., Gunn, W.W.H. and Cochran, W.W. 1969. Studies on the migrations of the Whistling Swan, 1969. *Proc. World Conf. on Bird Hazards to Aircraft:* 231-244. Sept. 1969, Queen's Univ., Kingston Ont., Canada.

Sladen, W.J.L. & Cochran, W.W. 1976. *Studies on the migration of the Whistling Swan.* Report for Air Force Off. of Scient. Res.

Sladen, W.J.L. & Kishchinski, A.A. 1977. Some results from circumpolar marking programs on Northern Swans and geese. *Proc. XIII Internat. Congress of Game Biologists,* Atlanta, Georgia, March 1977 (ed. T.J. Peterle), Wildl.Mangt.Inst. and Wildl.Soc., Washington DC:498-507.

Sparrowe, R.D. & Serie, J.R. 1984. Proposed hunting regulations on EP of Whistling (Tundra Swan) Swans, 1984. USFWS, Wash. DC.

Tamada, M. 1981. The wild swans at Lake Tofutsu-ko, Hokkaido, Japan. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 322-323.

Weaver, D.K. 1981. The Trumpeter Swan Society. In: G.V.T. Matthews & M. Smart (eds.), *Proc. 2nd Int. Swan Symp,* Sapporo, 1980. IWRB, Slimbridge Pp. 323-326.

Weiloch, M. 1991. Population trends of the Mute Swan in the Palearctic. In: J. Sears & P. J. Bacon (eds.). *Proc. 3rd Int. Swan Symp.* Oxford, 1989. *Wildfowl* (Special Supplement no.1).

William J.L. Sladen, Swan Research Program, Johns Hopkins University and Airlie Center, Airlie, Virginia 22186 USA