

the next decade, and many of these will be executed on a basis of joint cooperative action with an eye toward protecting key wildlife habitats. As a result, swans and other wildlife can only benefit.

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#### RELATIONSHIPS BETWEEN TRUMPETER SWAN DISTRIBUTION AND CABINS IN THE SUSITNA BASIN, ALASKA

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"Hiline Lake: 45 minutes flying time from Anchorage; 26 acres with 1,025 ft. of lake frontage; large trees; no marsh; beautiful building sites; good subdivision potential." This ad, in a recent edition of the Anchorage Times, typifies the boom in recreational site development which has occurred in parts of Alaska.

After flying a State-wide Trumpeter Swan survey in 1975, King et al. (1976) said this about the possible effects of cabin development on swans: "In the Cook Inlet unit disturbance from recreational cabin building may be a problem. Adjacent to the road system there are cheek-to-cheek cabins around all the major lakes and no swans were seen on any of these lakes. Throughout the rest of the Cook Inlet area every lake large enough to land a float plane has one or more cabins mostly built in the last ten years since the State selected these lands. A few swans were seen on lakes with cabins; however, this was the exception and numbers of lakes with good-looking habitat, some of which had swans in 1968, are now swanless."

Hansen et al. (1971) also discussed some implications of human disturbance and its effects on swans. However, they did not specifically address the effects of human disturbance which results from cabin construction.

The purposes of this paper are to: 1) quantify the relationships between swan distribution and increased human disturbance which results from cabin construction in the Anchorage area; and 2) discuss some long-term implications of this and other sources of Trumpeter Swan habitat alteration.

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#### AREA DESCRIPTION

The Susitna Basin Trumpeter Swan habitat unit lies to the west and north of Cook Inlet and is bounded by Redoubt Bay on the south, the Alaska Mountain Range on the west and north, and the Talkeetna Mountain Range and Cook Inlet on the east. King (1968) estimated that there were 5,625 square miles of potential Trumpeter Swan habitat in the area. The Basin is a composite of land covered by spruce, birch, and aspen, lakes and muskeg-covered lowlands, large coastal river deltas, and numerous river valleys beginning at glaciers and ending at salt water. This region is in a rain shadow and the combination of warm, dry summers and numerous large lakes make the Susitna Basin a summer playground for residents of the Anchorage area where over half of all Alaskans live.

#### METHODS

To evaluate the hypothesis that cabin construction was altering the distribution of swans, it was necessary to know the locations of swans observed in the 1968 and 1975 surveys relative to cabin locations at the time of each survey. Although the exact locations of swans were plotted on 1 inch:1 mile maps, cabin sites were not recorded in either survey.

Land status records were reviewed at the State Division of Lands, Bureau of Land Management, Chugach National Forest, and the Matanuska-Susitna and Kenai Boroughs. However, these records proved inadequate to allow determination in most instances where, when, or even if cabins had been built.

On July 6 and 7, 1978, I conducted an aerial survey of the Susitna Basin. At the sites where swans were seen in 1968, 1975, and 1978, the following data were recorded: number of swans seen, number and approximate age of cabins, distance between swans and cabins, and the presence and approximate age of roads or other developments. Land status records supplemented some of the visual observations. A subjective determination was also made of whether a float plane could operate on lakes or streams where swans were seen.

When comparing individual swan observations for each of the three surveys, I assumed a single-use area occurred when adult birds were 1.0 mile or less apart and adults with young were 2.5 miles or less apart. The size of family group territories was provided by Hansen et al. (1971). This assumption does not necessarily mean that the same birds returned to a given location over a 10-year period. It does, however, indicate habitat acceptable to Trumpeter Swans.

One practical limitation of the 1978 survey was that cabins were readily detected only on the same lake that swans occurred or within 0.5 miles overland from the birds. Cabins were recorded, however, when observed at distances up to 2 miles overland from the swans.

#### RESULTS

On the basis of the criteria described, swans were seen at 343 different swan-use areas during the 1968, 1975, and 1978 surveys. In 1978, 303 (88 percent) of these areas were inspected and swans were present at 170 sites. Cabins were present at 30 (10 percent) of these 303 locations.

In Tables 1 and 2, the reuse rates of swan-use areas are provided for adult birds, adults with young, and all birds. In both 1975 and 1978, swans were seen in 47 percent of the swan-use areas observed first in 1968 and in which no cabins were present through 1978 (Table 1). Fifty-seven percent of the swan-use areas with no cabins present, which were observed in 1975, were occupied by swans in 1978. Adults with broods had an average return rate of 62 percent, while the return rate for adults without young averaged 46 percent. Hansen *et al.* (1971) recorded an average annual return rate of 80 percent for mated pairs to established nest sites on the Kenai Peninsula.

Table 1. Reuse rates for Trumpeter Swans in areas with no cabins present.

Year resurveyed	1968 Survey (%)			1975 Survey (%)		
	Adults only	Ad/yg	All birds	Adults only	Ad/yg	All birds
1975	39	67	47	-	-	-
1978	44	54	47	54	65	57
All years average: adults only = 46%; ad/yg = 62%; all birds = 50%						

Table 2. Reuse rates for Trumpeter Swans in areas with cabins present.

Year resurveyed	1968 Survey (%)			1975 Survey (%)		
	Adults only	Ad/yg*	All birds	Adults only	Ad/yg*	All birds
1975	25	75	35	-	-	-
1978	13	40	22	37	0	32
* Small sample						
All years average: adults only = 25%; ad/yg = 38%; all birds = 30%						

Determining the reoccupancy rate by swans of areas associated with cabins was complicated by several factors. In some instances, swans were observed near existing cabins, while in other instances cabins were built between survey years. Also, the relative age of cabins may have been incorrectly determined in 1978. As seen in Table 2, for occupied swan-use areas in 1968 with one or more cabins nearby, 35 percent were reoccupied in 1975 and only 22 percent had swans in 1978. For occupied swan-use areas in 1975, the reuse rate in 1978 was 32 percent compared to 57 percent for areas with no cabins. The lowest incidence of swan reuse (13 percent) occurred for adult birds in areas surveyed in 1968 and again in 1978.

The number of cabins had a marked effect on the return rate of swans, as demonstrated in Table 3. Where one or two cabins were present, the rate of reuse was 48 percent, compared to a 50 percent rate for areas without cabins. However, in areas with three to five cabins the reuse rate was 36 percent. When six or more cabins existed, the probability of swans returning to that area was only 8 percent.

Table 3. Number of cabins related to Trumpeter Swan use, 1968, 1975, and 1978 surveys.

No. of cabins present	Reuse of Swan-use areas	Avg. no. adult swans per use area
1-2	48%	1.3
3-5	36%	0.5
6+	8%	0.15
Average	30%	0.95
No cabins present	50%	2.3

For all surveys, an average of 2.3 adult swans was seen per observation in areas with no cabins. As seen in Table 3, in areas with cabins, an average of 0.95 adult swans was seen per observation. Depending on the number of cabins present, there were from 43 percent to 93 percent fewer swans present in areas with cabins, compared to those areas without cabins. Although individual situations vary, it seems apparent that the amount of human disturbance associated with one or two cabins is not sufficient to displace swans. However, when three or more cabins are present, the area rapidly becomes unacceptable to the birds.

In 1978, 15 percent of the 170 observations of swans occurred on lakes large enough for float plane operation, while 18 percent of the total birds were seen in these areas. This habitat type is selected against by adults with broods, paired adults without broods, and single adults. However, adults in flocks (three or more birds) appear to prefer this habitat type as 33.1 percent of grouped birds were seen on larger lakes.

In 1978, five instances of new roads were recorded in swan-use areas. In two instances, cabins had been built on the road and in both cases swans were displaced. The roads had no apparent effect on swan distribution in the other three instances.

#### DISCUSSION AND PREDICTIONS

Although the number of cabins near the 303 swan-use areas evaluated in 1978 has increased from 21 to 75 (257 percent) since 1968, swans have continued to increase in the Susitna Basin. Direct comparisons of populations between survey years were impossible due to different sampling intensities and survey design. However, for adult swans only, a population increase of 33.6 percent was indicated between 1968 and 1975. Between 1975 and 1978, an increase of 22.7 percent occurred. When young of this year were included, I projected the population in 1978 to be 766 birds, compared to 617 in 1975. These figures were based on 79 percent habitat coverage. The actual population in 1978 was conservatively estimated to be 800 birds.

On the Copper River Delta, Alaska, pairs of Trumpeter Swans with nests or young were more sensitive to human disturbance than adults without young (Peter E. K. Shepherd, pers. comm.). In the Susitna Basin, the reoccupancy rate of areas with cabins was 25 percent for adult birds and 38 percent for adults with young. However, only 10 family groups were observed in areas with cabins. Furthermore, only four of the observations occurred in areas where three or more cabins were present.

The proportions of pairs with broods in 1968, 1975, and 1978, were 32, 36, and 42 percent, respectively. This may indicate increasing productivity. However, 1978 was an early year for ice and snow melt while 1968 and 1975 were average (J. G. King, pers. comm.). This probably contributed to the greater percentage of pairs with broods in 1978.

As explained previously, cabins were readily located if they occurred on the same lake or 0.5 miles or less overland from swans. However, cabins were recorded up to 2.0 miles overland from the birds. It appeared that swans were apt to be displaced when cabins occurred on the same lake where swans were found, regardless of the size of the lake. However, an overland separation of even 0.5 miles appeared to be an adequate buffer to human disturbance. This is reasonable because even one-half mile of muskeg or dense spruce forest presents a formidable obstacle to human travel during summer months.

It is inevitable that the Susitna Basin Trumpeter Swan population, as well as other expanding populations across Alaska, will eventually reach levels limited to a large extent by human disturbance. At that point each successive expansion of permanent human disturbance will reduce the number of Trumpeter Swans in Alaska.

Roads will be established, power lines erected, new communities created, and perhaps thousands of new cabins built within Trumpeter Swan habitat. For example, a voter initiative, which is currently blocked in the courts, provides for up to 30 million acres of State land to be given to Alaskan residents. Up to 160 acres could be obtained by each citizen, depending on residency. Even if this initiative fails, Alaskans are demanding -- and politicians are responding -- that more land should be transferred to private ownership.

Fortunately, a large proportion of the Trumpeter Swans in Alaska prefer habitat that has little appeal to most urbanites seeking recreation during the summer months. Cabins built in the future will, in most cases, be restricted to larger lakes and rivers which afford aircraft access. Even if roads open up habitat, few people will build cabins for summertime recreation in mosquito-infested swampy areas with poor building sites, no view, and little or no water recreation potential. Such areas are preferred by waterfowl, including Trumpeter Swans.

I believe that there will be Trumpeter Swans in Alaska 10, 100, and 1,000 years from today. Whether there will be more or fewer will depend on the dynamic balance struck between economic, political, and social needs and attitudes. For example, although the State may transfer millions of acres of land to private individuals, concurrent events dictate that management authority for up to 120 million acres of (d) (2) lands will be placed under various Federal resource managing agencies.

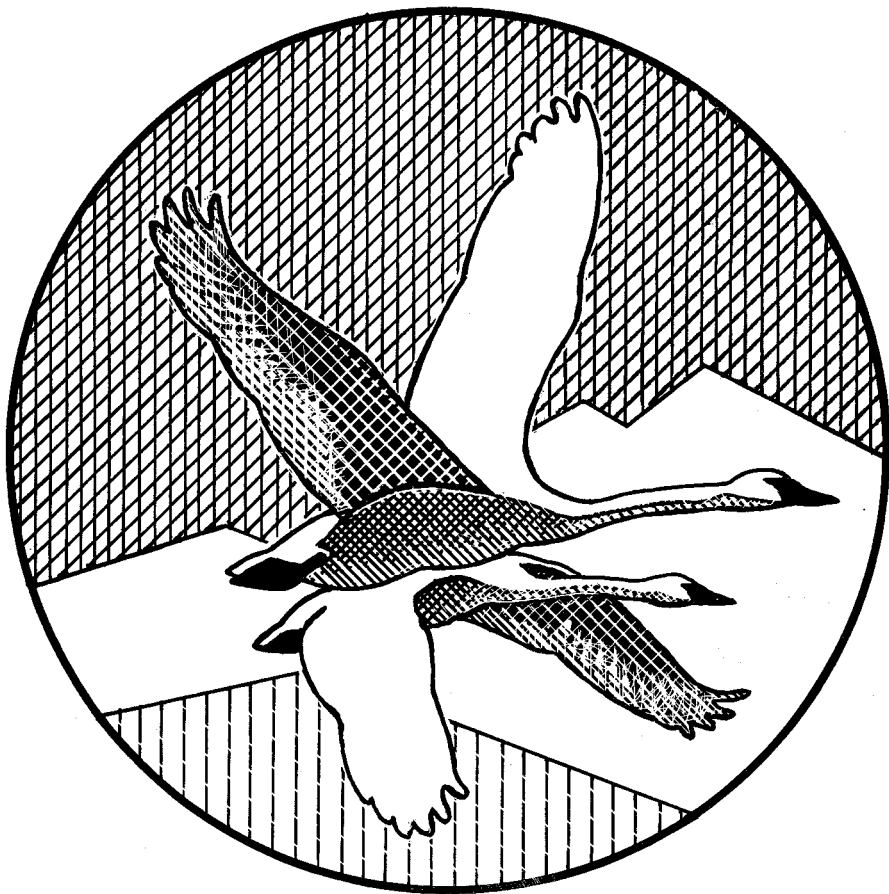
At this point in Alaska's history, Hansen's et al. (1971) statement has never been more appropriate: "Perhaps the most we dare hope for the future of the trumpeter swan as well as for many other of earth's threatened species is a partially satisfying 'half-load' predicated upon the current man/environment relationship."

I, for one, am confident that if we who are interested in the welfare of the Trumpeter Swan remain vigilant, there will be a balance struck and the welfare of the Trumpeter Swan will be assured. The challenge will be to use knowledge such as that presented here, to temper the actions of those who have little regard for nature or understanding of its complexities, and to insure that such a balance is truly achieved in the future.

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