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## WEIGHTS OF *CYGNUS COLUMBIANUS COLUMBIANUS* AS AN INDICATOR OF CHANGING RESOURCES

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### Review of data

The weights of 2368 *Cygnus columbianus columbianus*, processed and banded between 1967 and 1978, have been analysed. One hundred and two birds, all adults, were captured moulting on their Alaskan breeding grounds. The rest were adults and juveniles (first winter) trapped on their eastern wintering grounds, mostly at Mattamuskeet and Pungo National Wildlife Refuges, North Carolina (1308) and in Maryland (946). The mean weight for all adults was 6.7 kg (males averaging 7.1 kg, females 6.3 kg). The mean weight for all juveniles (first winter) was 5.8 kg with males averaging 6.0 kg and females 5.5 kg (Table 1).

Table 1. Weights (kg) of 2368 *Cygnus columbianus columbianus*, 1967–1978.

Age	Male			Female			Totals	
	Mean	S.d.	N	Mean	S.d.	N	Mean	N
Adult	7.1	0.81	917	6.3	0.61	929	6.7	1846
First winter	6.0	0.81	235	5.5	0.62	287	5.8	522
						Totals	6.3	2368

### Variation in weight

The swans were heaviest on arrival at the wintering grounds in November and lightest before departure in spring for both ages and sexes. The relatively small sample (102) from Alaska showed males to average 0.7 kg heavier and females 0.2 kg heavier during their moult than in winter (Table 2).

Table 2. Mean weights (kg) of 2356 *Cygnus columbianus columbianus* in relation to area, 1967 to 1978.

Area	Adult						First winter						Totals	
	Male			Female			Male			Female			N	N
	Mean	S.d.	N	Mean	S.d.	N	Mean	S.d.	N	Mean	S.d.			
Maryland (1967 to 1977)	7.2	0.95	323	6.7	0.80	364	5.9	1.11	120	5.5	0.85	139	946	
North Carolina (1972 to 1978)	7.1	0.94	545	6.3	0.67	512	6.1	0.86	108	5.6	0.74	143	1308	
Alaska (1970 to 1977)	7.8	0.94	49	6.7	1.39	53	Not included as cygnets growing					102		

The large sample (2254) of winter weights, when averaged for the long study period, demonstrated that adult males and juvenile males and females were almost the same weight in Maryland in North Carolina, whereas adult females averaged 0.4 kg lighter in North Carolina (Table 2). However, within these periods there were fluctuations in weights which are believed to be due to changes in feeding habits and in weather conditions.

### Relation of weight changes to feeding habitats

During the 1971/72 winter, thousands of *C. c. columbianus* in Maryland shifted

from their traditional food resource, submerged aquatic vegetation, to feeding in fields of harvested corn (maize). At the same time an increasing number of swans flew farther south from the Chesapeake Bay to increase the numbers wintering in North Carolina. The data show that adult and juvenile male weights varied significantly in relation to their changing food resources, there being an increase of

Table 3. Mean weights (kg) of 656 *Cygnus columbianus columbianus* in winter grounds in relation to food resources, 1970 to 1973.

MD =Maryland; NC = North Carolina; SAV = submerged aquatic vegetation; F = field feeding (mostly harvested maize). Mean weight (sample size).

Winter	Location & food resource	Adults		First winter		Totals
		Male	Female	Male	Female	
1970/71	MD-SAV	7.7 (14)	6.5 (15)	6.6 (20)	5.6 (20)	69
1971/72	MD-SAV + F	7.1 (15)	6.6 (20)	5.6 (14)	5.8 (23)	72
	NC-F	7.9 (40)	6.9 (64)	6.7 (19)	6.2 (25)	148
1972/73	MD-F	7.6 (71)	6.5 (59)	6.6 (10)	6.6 (14)	154
	NC-SAV + F	7.1 (99)	6.3 (91)	6.2 (7)	6.0 (16)	213

weight when they were exploiting a new and abundant resource such as corn. The changes, though present, were less marked for adult and juvenile females (Table 3). The swans are successfully adapting to changes in their food resources.

Table 4. Mean weights (kg) of 522 adult *Cygnus columbianus columbianus* in winter grounds in relation to low temperatures, 1975 to 1978.

Winter	Degrees C below average	Male		Female		Totals
		Mean wt (N)		Mean wt (N)		
1975/76	0.2	7.5 (113)		6.9 (107)		220
1976/77	8.0	6.9 (76)		6.2 (46)		122
1977/78	6.0	7.0 (103)		6.1 (77)		180

The winters of 1976/77 and 1977/78 were unusually cold. Adult males averaged at least 0.5 kg and adult females 0.7 kg lighter during these winters than in a winter (1975/76) when the temperatures were average (Table 4).

### Summary

Weights of 2368 *Cygnus columbianus columbianus*, caught mainly on wintering grounds, with 102 from Alaskan moulting grounds, are presented by age and sex classes. The data show that

weights increased following a change from feeding on submerged aquatic vegetation to field feeding.

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## WEIGHT CHANGES IN *CYGNUS OLOR*

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### Introduction

Since 1968 a considerable number of biometric data on Danish *Cygnus olor* have been collected in connection with the swan investigations of the Zoological Museum in Copenhagen. Most of these data have been transferred to magnetic computer tape but not yet analysed. More than 10 000 data on weight are included. The present paper includes only a few chosen aspects concerning the weight of *C. olor* and the possible reasons for some of the differences in weight which have been found. The significance of the weight in relation to mortality will be shown with some examples.

It can be assumed that the growth period of the young and the moulting period represent periods when quality and quantity of food will have great effect on swan weights. The winter period, with frequent food limitation, is also of great significance for the survival of the swans, and the weight development in ice-winters will be dealt with, too.

### The Danish breeding population

The Danish population of *C. olor* has increased considerably. In 1925 there were only 4 to 5 pairs but today at least 4000 pairs breed. There are two main types of breeding habitat: freshwater lakes with solitary breeding pairs and brackish or salt shallows with swans breeding in colonies on isles. The number of colonial swans has been increasing over the last 20 years. In 1978 there were 1500 to 2000 pairs breeding in colonies. The biggest colony is on Klægbanken in Ringkøbing Fjord, Jutland, and consists of 662 pairs. Apart from this one the majority of colonies are situated in southeastern Denmark (Andersen-Harild and Preuss 1978).