

## ***Cygnus olor immutabilis* in Poland**

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*Between 1979-89 the "Polish Swan" was recorded breeding in Poland at over 60 sites. Its distribution appeared uneven, perhaps due to incomplete cover.*

*The proportion of pairs producing white cygnets varied from 3% to 17%, and the frequency of white young from 2% to 9%. At moulting areas, the proportion of adult "Polish Swan" ranged from 0% to 11%, but on winter quarters, it was less common, ranging from 1% to 6%. No significant differences were found in the proportion of white young in broods between the birds living in Poland and in Denmark. The proportion of "Polish Swan" in the Mute Swan population in Poland is compared with data from other European countries.*

One of the problems intriguing researchers working on the Mute Swan *Cygnus olor* is the distribution and the frequency of the leucistic form of this species, (called by Yarrell (1841) "*immutabilis*"). It was later shown to be a sex linked plumage polymorph not a subspecies or variety (Munro *et al.* 1968). This form, characterized, among other things, by white down in cygnets, white plumage in juveniles, and pale, slightly pinkish legs in adults, is called the "Polish Swan" (Scott 1972, Owen 1977, Scherner 1984). This name was commonly used several centuries ago when swans were exported from Baltic countries, including Poland, to Western Europe (Great Britain, the Netherlands) (e.g. Birkhead & Perrins 1986). Lack of any data from Poland on this subject until 1989 inclined some authors to think that this form did not occur in Poland at all (van Dijk *et al.* 1985, Scherner pers. comm.), whereas other authors suggest that it accounted for as many as 20% of the Polish Mute Swan population (Munro *et al.* 1968, Bacon 1980, Birkhead & Perrins 1986). We accordingly present data collected in 1978-1986 concerning the occurrence of the "Polish Swan" in Poland, although it is far from complete (Czapulak & Wieloch 1988).

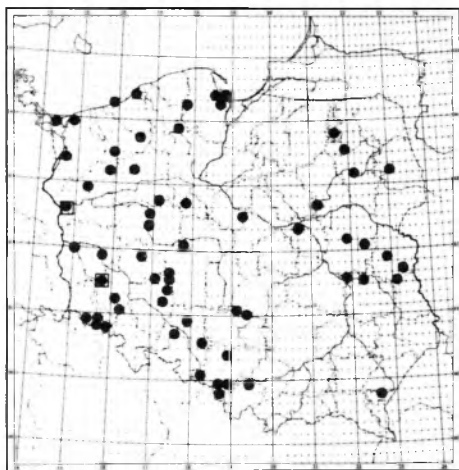
### **Factors influencing the number of "Polish Swans".**

The occurrence of the "Polish Swan" has depended on both natural and human-related

factors. The latter, such as introduction of aviary-reared birds, or hunting for meat, are now less important (Scott 1972). Young birds (in juvenile plumage) were preferred as food because of the higher quality of their meat. Because their white plumage mimicked that of the less-palatable adults, young "Polish Swans" were unintentionally protected (Owen 1977, Bacon 1980). This has not been confirmed for the population living in the British Isles, where swans were also intensely ranched, yet the proportion of the "Polish Swan" in the population remained low at about 1% (Bacon 1980).

In Denmark it was commonly believed that the proportion of "Polish Swan" was extremely low (Andersen-Harild 1978, after Tofft & Nielsen 1988), but in Southern Jutland they account for as many as 15% (Tofft & Nielsen 1988). In the Netherlands, the swan population originated from captive-bred individuals that were selected for white cygnets because they were more attractive and hence more valuable. Some of the captive swans escaped and joined wild birds, from the southern Baltic coast, that remained there after winter. Here the proportion of "Polish Swans" has reached 50% (van Dijk *et al.* 1985, Birkhead & Perrins 1986).

Aggression of parents against their own white cygnets has been a factor limiting the number of "Polish Swans" in the wild. Some cases are known in which young were wounded or killed by males (Baltzer 1955, McWilliam 1959, Hilprecht 1970, Kear 1972). The white plumage of cygnets is considered to be the reason for this



● 1 □ 2  
 Figure 1. Distribution of breeding and moulting "Polish Swans" in Poland in 1980s. 1. breeding site, 2. moulting site.

aggression, since "Polish" young look older than they are, and may be considered to be adult as territorial intruders. The mortality of these cygnets is 14% higher than that of grey cygnets (Reese 1980), since grey colouration of normal nestlings inhibits aggressive behaviour from adults.

Young "Polish Swans" at 10 months old look one year older. The sex ratio of this form is biased in favour of females because the gene is sex-linked (Munro *et al.* 1968, Scherner 1984). According to Bacon (1980), this may be an advantage because females of the "Polish Swan" can form pair bonds one year earlier than males, that is, they may gain experience earlier and consequently might have a higher breeding success in following seasons.

For males no such advantage would exist, as males do not become territorial until two years old when normal males are also white.

According to Bloch (1971) and Bacon (1980), "Polish Swans" are more frequent in expanding populations, when males can breed earlier since it is easier to acquire a territory. This finding is confirmed by recent observations from Austria, Czechoslovakia, Hungary and Norway (Herredsveld 1985, unpubl., Horvath & Karpati 1985, Hora 1987, unpubl., Dorowin 1989).

**Occurrence of the "Polish Swan" in Poland**

*Breeding season*

The "Polish Swan" was reported from more

**Table 1. Proportion of breeding "Polish Swan" and their cygnets of white form in Poland.**

Study area	No of breeding pairs surveyed	% of "Polish" individuals among breeding pairs	% of white cygnets of total cygnets
Gdańsk area	85	1.8	1.2
Przemków Ponds Reserve	42	8.3	8.7
Barycz Valley	52	4.8	4.0
Lublin region	157	2.2	2.1

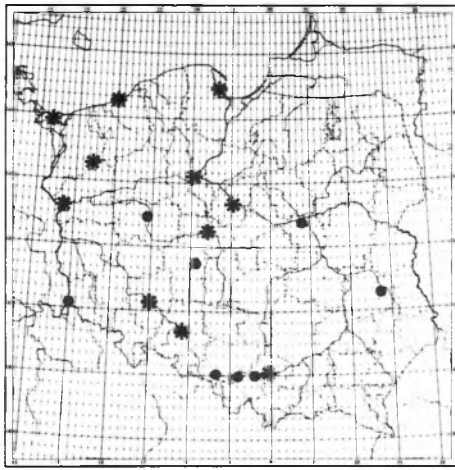
regional differences, adult individuals:  $\chi^2 = 6.62$ , 3df,  $P = 0.09$ .

than 60 sites in Poland (Figure 1) between 1979-89. The map shows that the morph is widespread but does not indicate its frequency. Table 1 gives frequency data for areas of Poland where comprehensive surveys were possible. Around Gdańsk, where a female "Polish Swan" nested in 1989, no "Polish" cygnets were found. The number of cygnets of the "Polish Swan" hatched per nest ranged in Poland from one to four, accounting for 14% to 50% of the brood. In January of 1987, a pair of swans with four white juveniles was observed on Rogozińskie Lake, but it is not known where they had nested (J. Dąbrowski pers. comm.). The proportion of breeding pairs where at least one adult has a "Polish" gene can be underestimated if they do not have any white cygnets, because it is more difficult to see the pale coloured legs of adults rearing grey young, than the white colour of cygnets. Frequency of Polish individuals in four more intensively surveyed breeding populations averaged 3% (Table 1), and did not vary between regions ( $\chi^2 = 6.52$ , 3df,  $P > 0.05$ ). However, proportion of pairs producing white cygnets (3-17%, mean 7%, the same data as in Table 1) did vary regionally ( $\chi^2 = 10.21$ , 3df,  $P = 0.017$ ).

**Table 2. Proportion of "Polish Swan" on moulting grounds in Poland.**

Study area	Number of Swans	% of "Polish" Swans
Ptaś Raj Reserve	76	0
Augustów, Necko Lake	135	0
Słońsk Reserve	226	7.1
Przemków Ponds Reserve	210	10.9

$\chi^2 = 22.97$ , 3df,  $P = 0.00004$



● 1 \* 2  
**Figure 2.** Distribution of wintering "Polish Swans" in Poland in 1980s 1. site with unknown proportion of "Polish Swans" in wintering flock, 2. site with detailed information about number of "Polish Swans" in wintering flock.

Among cygnets, frequency of white morph was 1-9%.

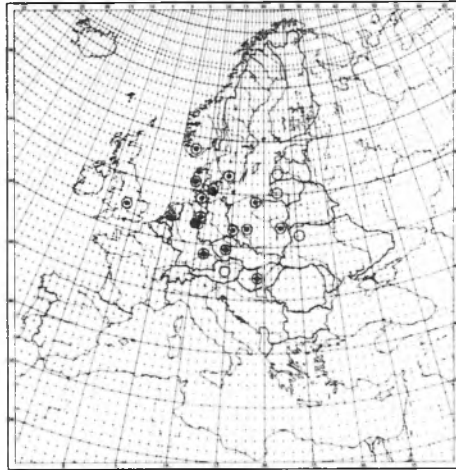
*Moultng grounds*

The proportion of "Polish Swans" (identified by the colour of their legs) was noted at four moulting sites. This form was not found in two northern moulting flocks : in the Reserve Ptasi

**Table 3.** Proportion of "Polish Swan" on different wintering grounds in Poland.

Study area	Number of examined Swans	% of "Polish" Swans
Swinoujście	213	2.8
Kolobrzeg	683	2.0
Gdańsk-Gdynia	2,500	0.5
Choszczno	300	2.0
Bydgoszcz	93	2.1
Włocławek	67	6.0
Kostrzyn/Oder	382	3.9
Konin	70	5.7
Wrocław	240	5.0
Opole	100	4.0
Kraków	870	1.0

$\chi^2=73.14$ , 10df,  $P<0.001$



○ 1 ⊙ 2 ⊕ 3 ⊗ 4 ● 5  
**Figure 3.** Proportion of white cygnets in different area in Europe. 1. single information, 2. 1-10%, 3. 11-25%, 4. 26-50%, 5. over 50%.

Raj (Gdańsk region) and at Augustów ( Suwalki region) (Table 2). While its frequency in two western moulting grounds : at the Slonsk Reserve (Gorzów region) and the Przemków Ponds Reserve was 7% and 11% respectively. The differences between these regions are very significant ( $\chi^2 =22.97$ , 3df,  $P<0.001$ ) (Table 2, Figure 1).

*Wintering grounds*

The information so far available on the wintering of the "Polish Swans" in Poland is presented in Figure 2. The proportion in wintering flocks varied from 1% to 6% (Table 3). They were also observed in many other places. In contrast to the breeding birds, these values do not seem to be underestimated since in winter swans approach closer, and typically walk on the ground so that the pale colour of their legs can readily be seen.

**Occurrence of the "Polish Swan" in other parts of the world**

The frequency of "Polish Swan" in Europe shows large variation, between 2% and 100% (Table 4, Figure 3, Baltzer 1955, Thyselius 1968, Andersen-Harild 1979, Ruitenbeek & Andersen-Harild 1980, Horvath & Karpati 1985, Scherner 1985, Tofft & Nielsen 1988). The lowest proportion of the "Polish Swan" (1%) was recorded in Britain (Kear 1972, Bacon 1980) and also in Denmark (1-2%) (Clausen & Hansen 1967, Andersen-Harild 1978, after Tofft

Table 4. Frequency of occurrence (%) of "Polish Swan" in different parts of Europe and in the USA.

Region	breeding		Status		Source of information	
	ad	pull	moulting	wintering		
Poland						
Gdańsk area	4	2		<1	M. Wieloch	
Słońsk Reserve			7	7	A.Czapulak, M. Wieloch & P.Majewski	
Przemków Ponds						
Reserve	17	9	11	5	A.Czapulak	
Barycz Valley	10	4			A.Czapulak	
Lublin region	4	2		+	A.T.Buczek	
USSR						
Lithuania		+			P.Kurlavicius	
Latvia		+			E.Lipsberg	
Ukraine		+			I.Gorban	
GDR						
Frankfurt/O					4 Rutschke 1983	
Potsdam					23 Rutschke 1983	
Czechoslovakia						
Bohemia, Moravia	40	20			Hora 1984,1985, pers. comm.	
Austria		+		+	Dorowin 1989, pers. comm.	
Italy					+	C. Pascoli pers comm.
Hungary		25			Horvath & Karpati 1985	
FRG						
Sch.-Holstein		9			5 Berndt 1986	
Wolfsburg	18	19			Latzel & Scherner 1985	
Göttingen	76	100			Latzel & Scherner 1985	
Bavaria		25			Ranfil & Utschick 1983	
The Netherlands						
Groningen county	50	31-49		50	van Dijk <i>et al.</i> 1986	
Lake IJsselmeer			41		van Dijk in press	
Switzerland	28				Hilprecht 1970	
Denmark						
S.Jutland		1-2			Andersen-Harild 1978, 1982	
		15			Tofft & Nielssen 1988	
Belgium		+			Jacob 1983	
Norway		1-7			Herredsvela pers. comm.	
Sweden		+		+	Kear 1972	
Great Britain		+		1	Bacon 1980	
USA						
Chesapeake Bay	27				Reese 1980	
Yellowstone					13 Mccoy 1967	
Greenwich, Connecticut		+			A.Semmes pers. comm.	

& Nielsen 1988). The recent data show, however, that in southern Jutland "Polish Swans" account for 15% of the cygnets (Tofft & Nielsen 1988). The highest proportion (76%) was recorded from the Gettingen, FRG (Latzel & Scherner 1985a, 1985b), with 50% from the region of Groningen, the Netherlands (van Dijk *et al.* 1985). On Chesapeake Bay (Maryland, USA) where swans have nested in the wild for merely 25 years, cygnets of the "Polish" form accounted for 27% (Reese 1980). On the Rhode Island near New York, adult "Polish Swans" accounted for 17% of the population (Munro *et al.* 1968), and in Yellowstone, where swans have bred in the wild for a long time, "Polish Swans" accounted for 13% (Mccoy 1967). The newest (first) information about white cygnets is from 1988, Greenwich, Connecticut, USA (A.Semmes pers. comm.)

A comparison of the number of white cygnets in broods in Poland and in Denmark shows that most often (in 63% and 47% of nests, respectively) one young per brood is of the "Polish" form (Figure 4).

In Denmark, the absolute number of white cygnets per brood increases with family size ( $G=21.316$ ,  $df=2$ ,  $P<.001$ ) so the proportion of Polish cygnets is quite constant across brood size.

In Poland, however, in most cases only one white cygnet per brood was present, irrespective of brood size ( $G=3.495$ ,  $df=2$ , ns). Thus, frequency of leucistic cygnets in large broods was lower than expected. This might be consequence of male-biased sex-ratio among cygnets or selective mortality of white cygnets (infanticide?). However, overall differences between Poland and Denmark are insignificant ( $G=4.096$ ,

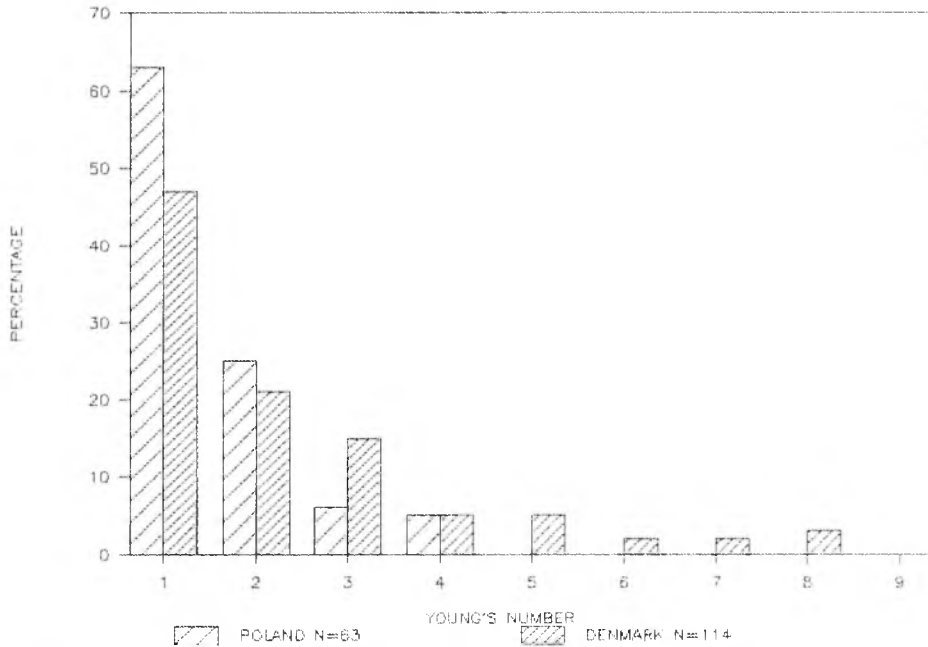


Figure 4. Proportion of young "Polish Swans" in mixed broods in Poland and Denmark.

df=2, ns), so more data are needed to examine this phenomenon.

Little information is available on differences in the condition between normal and Polish morph. It is known, however, that after hard winters the latter are in poorer condition (van Dijk *et al.* 1985). In the Netherlands, the breeding success of the "Polish Swan" was typically lower. The reduction in the number of white cygnets may result not only from a poorer condition of their parents but also from a higher mortality of young birds before they start flying. Data from southern Jutland (Tofft & Nielsen 1988) show that there is no difference in size between broods consisting of white and mixed young, which implies that the condition of the two types of nestlings is similar. Reese (1980),

however, found that in Chesapeake Bay, USA, the mortality of white young was 27% and 13% for grey young (higher by 14%).

As this review shows, the information on the occurrence of the "Polish Swan" is far from complete, but it is rarer than some reports suggest. From Lithuania and Latvia, the "Polish" Swan was recorded for the first time in 1987 and 1988 (P. Kurlavicius & E. Lipsberg pers. comm.).

In Ukraine, the first observation of a family of *Cygnus olor* with four white cygnets comes from the Shack National Park in 1989 (I. Gorban pers. comm.).

We hope this review will stimulate interest in the "Polish Swan" so that it will be possible to analyse its occurrence in all parts of the world.

Table 5. Number of white cygnets and the brood size in Denmark.

		N white	
		1	1+
Brood size	2,3	21	8
	4-6	23	37
	6+	1	15

G=21.316, df=2,  $P<.001$   
Data from Tofft & Nielsen 1988, recalculated.

Table 6. Number of white cygnets and the brood size in Poland.

		N white	
		1	1+
Brood size	2,3	7	1
	4-6	28	19
	6+	3	4

G=3.495, df=2, ns

## References

- Andersen-Harild, P. 1978. *Knopsvanen*. Holte, SKARV.
- Bacon, P. 1980. A possible advantage for the "Polish" morph of the Mute Swan. *Wildfowl* 31:51-52.
- Baltzer, E. 1955. Verhalten eines Schwans gegenüber weissen Jungen. *Orn. Beob.* 52:62.
- Birkhead, M. & Perrins, C. 1986. *The Mute Swan*. London, Croom Helm.
- Bloch, D. 1971. Ynglebestanden af knopsvane (*Cygnus olor*) i Danmark i 1966. *Danske Vildundersogelser* 16:1-47.
- Clausen, L. & Hansen, P. M. 1967. Knopsvaner i Guldborgsund. *Feltornithologen* 9:7.
- Czapulak, A. & Wieloch, M. 1988. On "Polish" morph (*immutabilis*) of Mute Swan. *Not. orn.* 29:43-52.
- Dijk, van K. in press. Ruiende Knobbelzwanen *Cygnus olor* op het IJsselmeer. *Limosa*
- Dijk, van K., Voslamber B., Esselink H. & Beekman J. 1986. The Mute Swan as a breeding bird in the county of Groningen, 1984 and 1985. *De Grauwe Gros*, magazine of Avifauna Groningen 1:12-24.
- Dorowin, H. 1989. Zur Herkunft von in Linz und Steyer uberwinternden Höckerschwanen. *Oko.l.* 11:10-12.
- Herredsvæla, H. 1985. Knoppsvana pa jaeren Historisk tilbakeblikk og utviklingen fram til og med 1984. *Falco suppl.* 1.:1-28.
- Hilprecht, A. 1970. *Höckerschwan, Singschwan, Zwergeschwan*. Wittenberg NBB.
- Hora, J. 1987. Vznik a vyvoj populace labute velke (*Cygnus olor*) v CSR *Vodni Ptaci* :95-111.
- Horvath, J. & Karpati, L. 1985. A butykos Hattyu (*Cygnus olor*) Magyar-orszagi Terjeszedese. *Puszta* 3:97-115.
- Jacob, J-P. 1983. Anatides nicheurs en Wallonie et en Brabant. *Aves* 20:65-91.
- Kear, J. 1972. Reproduction and family life. In: *The Swan*. P. Scott and the Wildfowl Trust. Michael Joseph. London.
- Latzel, von G. & Scherner, E. R. 1985a. Der Brutbestand des Höcker Schwans (*Cygnus olor*) im Stadtkreis Wolfsburg. *Vogelkd. Ber aus Niedersachsen* 17:1-13.
- Latzel, von G. & Scherner E. R. 1985b. Genfrequenzen als Ausdruck der populationsdynamik: das immutabilis - Allel bei Höckerschwanen (*Cygnus olor*) in Wolfsburg und Göttingen (BRD, Niedersachsen). *Zool. Jb. Syst.* 112:537-543.
- MacWilliam, G. P. 1959. White cygnets of Mute Swan at Dalbeattie. *Scot. Birds* 1:93-94.
- Mccoy, J. J. 1967. *Swans*. New York.
- Munro, R. E., Schmith, L. T. & Kupa, J. J. 1968. The genetic basis of colour differences observed in the Mute Swan (*Cygnus olor*). *Auk* 85:504-505.
- Norman, D. O. 1977. A role for plumage color in Mute Swan (*Cygnus olor*) parent-offspring interaction. *Behaviour* 42:314-321.
- Owen M. 1977. *Wildfowl of Europe*. London.
- Ranftl, H. & Utschick, H. 1983. Der Höckerschwan (*Cygnus olor*) in Bayern. *Vogelwelt* 114:121-135.
- Reese, J. G. 1980. Demography of European Mute Swans in Chesapeake Bay. *Auk* 97:449-464.
- Ruitenbeek, W. & Andersen-Harild, P. 1979. *De Knobbelzwaan*. Amsterdam und Antwerpen.
- Rutschke, E. (Ed.) 1983. Die Vogelwelt Brandenburgs. *Jena*, pp. 116-117.
- Scherner, E. R. 1984. Die immutabilis-Mutante als Grundlage populationsgenetischer Untersuchungen am Höckerschwan (*Cygnus olor*). *Ököl. Vögel* (Ecol. Birds) 6:175-183.
- Scherner, E. R. 1985. Der Brutbestand des Höckerschwan (*Cygnus olor*) im Landkreis Göttingen. *Mitt. zur Fauna und Flora Sud-Nieder-sachsens* 7:39-52.
- Scott, P. & The Wildfowl Trust. 1972. *The Swans*. Michael Joseph. London.
- Thyselius, B. 1968. Falsk albinism hos Knolsvan (*Cygnus olor*) vid Kvismaren. *Var Fagelvarld* 27:265.
- Tofft, J. & Nielsen K. 1988. Kuldstorrelse og frekvens af "polske" unger hos Knopsvaner *Cygnus olor* i Sonderjylland 1980-87. *Dansk Orn. Foren. Tidsskr.* 82:51-60.
- Yarrell, W. 1841. On a new species of swan (*Cygnus immutabilis*). *Proc. Zool. Soc. Lond.* 9:70.
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