

## Photographic documentation of a Swan Goose x Snow Goose *Anser cygnoides* x *Anser caerulescens* hybrid and its offspring with a Barnacle Goose (*Branta leucopsis*) – a unique three-species cross

Peter Dreyer and Carl Gunnar Gustavsson



Fig. 1. Early picture of both parent birds and the three-species hybrid. 22 June 2008. – Frühes Bild der beiden Altvögel und des dreifach hybriden Gössels (Dreifach-Hybride). 22. Juni 2008.

Photo: Peter Dreyer.

Fotografische Dokumentation einer Schwanengans x Schneegans *Anser cygnoides* x *Anser caerulescens* – Hybride und ihrer Nachkommen mit einer Weißwangengans *Branta leucopsis* – eine einmalige Dreifach-Hybride

Der Artikel dokumentiert anhand von Aufnahmen die Entwicklung einer hybriden Gans (Dreifach-Hybride), als deren Eltern eine Weißwangengans und eine Schwanengans x Schneegans-Hybride anzusehen sind. Nach bester Kenntnis der Autoren gibt es bislang keinen Bericht über einen vergleichbaren Fall.

Kreuzungen zwischen Gänsen verschiedener Arten sind zunächst nicht ungewöhnlich. Im vorliegenden Fall ist es sinnvoll, auf den Unterschied von 'Arthybriden' (Kreuzungen innerhalb einer Gattung) und 'Gattungshybriden' (Kreuzung zweier Arten aus verschiedenen Gattungen) hinzuweisen.

Die beiden Hybriden werden unter Bezug auf die vorliegenden Fotos beschrieben und es wird erläutert, wann die Gewissheit über die genaue Abstammung einer Hybride als „bestätigt“ (confirmed) oder als „vermutlich“ (presumed) angesehen werden kann.

Es wird ein kurzer Überblick über einschlägige Literatur gegeben, der unter anderem entnommen werden kann (McCarthy 2006), dass Schwanengänse und Schneegänse unter natürlichen Bedingungen hybridisieren und die Nachkommen teilweise fruchtbar sind.

Es sind keine Beobachtungen der Schwanengans x Schneegans-Hybride mit ihren Elternvögeln bekannt, es wird jedoch im Einzelnen ausführlich dargestellt, durch welche Merkmale von Schneegans und Schwanengans die Einstufung der Hybride als „vermutlich“ begründet ist.

Die Dreifach-Hybride könnte als „bestätigt“ eingestuft werden, da sie als Gösse mit beiden Elternvögeln beobachtet wurde und Merkmale aufweist, die bei einer solchen Abstammung zu erwarten sind. Da jedoch der hybride Elternvogel als „vermutlich“ angesehen werden muss, kann auch die Abstammung der Dreifach-Hybride letztlich nur als „vermutlich“ eingestuft werden.

Ergänzend wird die Dreifach-Hybride mit bekannten Hybriden von Weißwangengans und Schwanengans (domestizierte Variante) sowie Weißwangengans und Schneegans verglichen und es werden Übereinstimmungen bei bestimmten Merkmalen herausgearbeitet.

Grundsätzlich ist bei Gänsen eine 'Adoption' oder eine Befruchtung außerhalb der Paarbeziehung möglich. Daher werden zusätzlich mögliche Hybriden zwischen den während der Brutzeit am Speichersee auftretenden Gänsearten diskutiert. Außer der Weißwangengans sind diese Graugans, Streifengans und Kanadagans. Als Ergebnis kann eine Befruchtung außerhalb der Paarbeziehung oder eine Adoption mit vernünftiger Sicherheit ausgeschlossen werden, zumal die Dreifach-Hybride Merkmale zeigt, die zu einer Elternschaft der „vermutlichen“ Schwanengans x Schneegans-Hybride und der Weißwangengans passen.

Eine zutreffende Klassifizierung im Feld kann schon bei nur zwei beteiligten Arten schwierig sein. Bei drei beteiligten Arten muss man eher eine größere Variabilität des Phänotyps annehmen, so dass eine korrekte Klassifizierung eines zuvor unbekannten Vogels ohne Anwesenheit der Elternvögel praktisch unmöglich erscheint.

Es ist bekannt, dass sich in manchen Fällen hybride Gänse mit einer Elternart zurück kreuzen und damit ein genetisches Risiko für die Artreinheit darstellen. Gustavsson hat andere Gattungshybriden zwischen der Branta Art Weißwangengans und weiteren Anser Arten über mehrere Jahre verfolgt (Gustavsson 2009), ohne jemals Nachwuchs zu beobachten. Von der Dreifach-Hybride wird daher ebenfalls angenommen, dass sie steril ist.

Zusammenfassend wird u. a. festgestellt:

1. Dies ist vermutlich die erste Beschreibung einer derartigen Dreifach-Hybride.
2. Diese Hybride ist vermutlich steril.
3. Auch die Kreuzung Schwanengans x Schneegans ist sehr selten, den Autoren sind keine früher veröffentlichten Bilder eines ähnlichen Vogels bekannt.

**Keywords:** Hybrid, trigen, Swan Goose, Snow Goose, Barnacle Goose, Anser cygnoides, Anser caeruleus, Branta leucopsis

Peter Dreyer, Ahornring 73, D-85635 Siegersbrunn, Germany

Carl Gunnar Gustavsson, Blidvädersvägen 6B 1tr, S-22228 Lund, Sweden

Authors' correspondence address: [cg.gustavsson@gmail.com](mailto:cg.gustavsson@gmail.com)

## Introduction

Crosses between two goose species (F1 hybrids) are relatively common, but the majority of these fall into few categories (Kampe-Persson & Lerner 2007). A hybrid may back-cross with one of its parent species, e.g. a Canada Goose *Branta canadensis* x Barnacle Goose *Branta leucopsis* hybrid may breed with a pure Barnacle Goose. In a few cases, a hybrid may cross with a third species leading to three-species crosses which may also be referred to as three-way crosses (McCarthy 2006) or multiple hybrids, which, with three, four or five species involved can be specified as trigen, tetragen or pentagen, respec-

tively (Gillham & Gillham 1996). Furthermore, hybrids may be separated as "species-hybrids" (crosses between two species from the same genus) and "genus-hybrids" (crosses between two less closely related species from different genera). This article presents not only a presumed Swan Goose Anser cygnoides x Snow Goose Anser caeruleus hybrid, i.e. a species-hybrid, which in itself is very rare, but also the offspring of that hybrid and a Barnacle Goose, i.e. a genus hybrid between individuals from the genera Anser and Branta. To the best of our knowledge, there is no previous report on a similar three-species cross (Swan Goose x Snow Goose) x Barnacle Goose.

## The two hybrids

The pair of a normal Barnacle Goose and a hybrid goose was first seen with three goslings on 25th May 2008 at the Ismaning reservoir near Munich, Germany. The pair had already been observed in the area in the preceding winter, the hybrid having been seen at least since 14th December 2006. By 8th June and 11th June 2008, only one gosling remained. From 14th June 2008 onwards, the parents and the gosling were repeatedly documented photographically (Fig. 1).

We have classified the parent hybrid as a presumed Swan Goose x Snow Goose cross. Parentage is "presumed" because the bird has features which strongly suggest two specified species to be its origin (Gustavsson 2009) but there is no more direct evidence of its parentage (neither by observation nor genetic testing). The bill is long and straight, orange with a reddish tinge and a small black area on the mid culmen, and it has a black bill nail and a black cutting edge giving the impression of a "grinning patch" (Fig. 2-7). The bill-to-forehead line is very straight. There is a pale feathered area next to the bill. The darker greyish brown forehead, crown, nape and hindneck contrast with a pale chin, throat and breast area with a distinct border running from the gape, passing just below the eye and continuing along the sides of the neck. There is a tendency to brown spotting in the pale area with a darker streak from the gape towards the hindhead and there is some "water-combing" on the sides of the neck. At rest,



Fig. 2. The Swan Goose x Snow Goose hybrid with its Barnacle Goose mate. Head profile and a distinct border between dark and pale areas on cheek and neck as in Swan Goose but pinkish orange bill with „grinning patch“ and bright reddish pink legs as in Snow Goose. There is a patchy pattern within the pale head and neck area and a darker area from the gape towards the neck. 5th July 2008. – *Die Schwanengans x Schneegans-Hybride mit ihrem Weißwangengans-Partner. Kopfprofil und eine deutliche Grenze zwischen dunklen und hellen Bereichen auf Wangen und Hals wie bei Schwanengans, aber hellrosa-orangener Schnabel mit dem eigentümlich 'grinsenden' Eindruck (im Folgenden: 'grinning patch') und hellrötlich-rosa Beinen wie bei Schneegans. Im hellen Bereich von Kopf und Nacken zeigt sich ein fleckiges Muster und ein dunklerer Bereich reicht vom Schnabelwinkel zum Nacken. 5. Juli 2008.*

Photo: Peter Dreyer.

upperparts and flanks are greyish brown. The rump is pale grey (Fig. 7-8). The belly is pale and the ventral region and undertail-coverts as well as uppertail-coverts are white (Fig. 2-7). The tail has a small brown centre but is otherwise white. Upperwing-coverts are largely pale-



Fig. 3. The Swan Goose x Snow Goose cross and the three-species hybrid. 26th July 2008. – *Die Schwanengans x Schneegans Kreuzung und die „Dreifach-Hybride“. 26. Juli 2008.*

Photo: Peter Dreyer.



**Fig. 4.** The three-species hybrid and its Swan Goose x Snow Goose parent. Pale grey axillaries but otherwise dark underwing sides with somewhat pale-fringed coverts. 19th July 2008. – *Die Dreifach-Hybride mit dem Schwanengans x Schneegans-Elternvogel. Hellgraue Achselfedern bei sonst dunklem Unterflügel mit teilweise schwachweiß geränderten Deckfedern* 19. Juli 2008.

**Fig. 5.** The three-species hybrid and its Swan Goose x Snow Goose parent. Pale fringes on larger upperwing coverts and to some degree on tertials. 19th July 2008. – *Die Dreifach-Hybride mit dem Schwanengans x Schneegans-Elternvogel. Helle Ränder bei den großen Oberflügeldecken und teilweise auf den Schirmfedern*. 19. Juli 2008.

**Fig. 6.** The three-species hybrid with its Swan Goose x Snow Goose parent 9th August 2008. This is the last picture until 17th November 2008 (compare Fig. 14). At this date a white spotting was beginning to appear next to the bill in the three-species cross as well. In the parent bird now well developed dark wing feathers with broad pale fringes resembling those in blue phase Snow Geese. – *Die Dreifach-Hybride mit dem Schwanengans x Schneegans-Elternvogel am 9. August 2008. Dies ist das letzte Foto vor dem 17. November 2008 (vgl. 14). Zu dieser Zeit begann sich auch bei der Dreifach-Hybride ein weißer Fleck direkt am Schnabel herauszubilden. Beim Elternvogel gleichen die deutlich entwickelten dunklen Federn mit breiten hellen Rändern am Flügel denen der dunklen Morphe der Schneegans.*

**Fig. 7.** The Swan Goose x Snow Goose hybrid has an orange bill with a "grinning patch" and elongated pale-fringed wing feathers indicating Snow Goose heritage but also a colour distribution between dark and pale areas on head and neck which is normally diagnostic for Swan Goose. 26th July 2008. – *Die Schwanengans x Schneegans-Hybride hat einen orangenen Schnabel mit 'grinning patch' und längliche hell-umrandete Federn am Flügel, die auf Abstammung von Schneegans hinweisen, aber auch eine Farbverteilung zwischen dunklen und hellen Bereichen auf Kopf und Hals, die in der Regel für Schwanengans kennzeichnend ist.* 26. Juli 2008.

**Fig. 8.** The rump of the Swan Goose x Snow Goose resembles that of a Blue Goose (compare Fig. 18). 9th August 2008. – *Der Bürzel der Schwanengans x Schneegans-Hybride ähnelt dem der blauen Morphe der Schneegans (vgl. Fig. 18).* 9. August 2008.

**Fig. 9.** The head of the three-species hybrid. Wholly black bill with a cutting edge which may give some impression of a "grinning patch". 19th July 2008. – *Der Kopf der Dreifach-Hybride. Vollständig schwarzer Schnabel mit einer Form der Schneidekanten, die einen Eindruck von einem 'grinning patch' andeuten.* 19. Juli 2008.

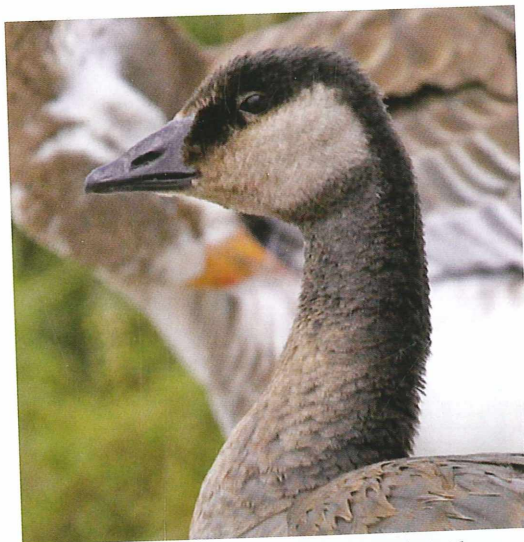
Photos: Peter Dreyer.

fringed, primaries and secondaries dark and tertials elongated and dark grey with pale fringes. Legs and feet are reddish-pink.

In the three-species hybrid, parentage might have been considered to be "confirmed" from the restricted hybrid x Barnacle Goose perspective because the gosling was observed together with both parent birds and its appearance corresponded to what could be expected from that parent combination (Gustavsson 2009). On the other hand, parentage as a whole has to be regarded as "presumed" because parentage in the Swan Goose x Snow Goose parent is presumed and not confirmed.

The bill of the three-species hybrid is clearly smaller than in its hybrid parent but larger than in pure Barnacle Geese and it was wholly black on all observations up to over one year of age. On some pictures, there also seems to be a "grinning patch" similar to what may be seen in Snow Goose x Barnacle Goose hybrids (Gustavsson 2009) but less conspicuous due to the all-black colour of the bill (Fig. 9). In the first calendar year (1st Cy) bird, the head was dark grey with a clearly brownish tone. There was a paler cheek patch with an extension from the gape to below the eye and then continuing with a shape which is rather similar to what is seen in Barnacle Geese (Fig. 3-7, 9-11). The neck was also grey with a brown tinge, darker on the hind-neck than over the throat but the border between the two colour tones did not stand out as distinctly as in the Swan Goose x Snow Goose hybrid and the colour difference between the two areas was smaller. The breast was pale greyish brown to an extension which roughly corresponded to the black breast area in Barnacle Geese. The upper parts were dark brownish grey due to grey feathers with browner fringes. The rump was brownish black (Fig. 12), the flanks brownish pale grey and the belly grey-white. The ventral region and undertail coverts were all white and the tail dark with pale feather tips and edges (Fig. 3, 11, 13). The greater upperwing coverts were grey with distinct whitish fringes and the median and lesser coverts grey with brown fringes (Fig. 3, 5, 11-12). Flight feathers were dark with greyer areas and tertials as well as medial arm feathers had thin pale edges (Fig. 12). Underwing coverts were pale-fringed and axillaries pale grey (Fig. 4).

Beginning in August but more obvious during the first winter, the dark forehead devel-



**Fig. 10.** The three-species hybrid with its hybrid parent in the background. This picture was taken under shadow condition. In addition to the wholly black bill with a possible "grinning patch" reminiscent of a Snow Goose, the dark nape area continues from the rear part of the pale cheek area along the whole length of the neck. This border between dark and paler neck areas recalls the distribution of dark and pale neck areas in Swan Geese and the parent hybrid Swan Goose x Snow Goose. 19th July 2008. – *Die Dreifach-Hybride mit dem hybriden Elternvogel im Hintergrund. Das Foto wurde unter schattigen Verhältnissen aufgenommen. Zusätzlich zu dem vollständig schwarzen Schnabel mit dem möglichen Anzeichen eines 'grinning patch', der an Schneegans erinnert, erstreckt sich der dunkle Nacken vom hinteren Teil der hellen Wangen längs des gesamten Halses. Diese Grenze zwischen dunklen und hellen Halsbereichen erinnert an die Verteilung von dunklen und hellen Halsbereichen bei der Schwanengans und der elterlichen Schwanengans x Schneegans-Hybride.* 19. Juli 2008.  
Photo: Peter Dreyer

oped some white spotting and the whole bird and especially the dark breast made a clearly darker appearance (Fig. 6 and 14).

In the following summer, i.e. at the age of one year, the pale cheek patch had expanded to cover the forehead to an extent rather similar to that of the cheek patch in pure Barnacle Geese (Fig. 15-17). The colour of this additional part of the pale cheek patch area was pale grey with darker brown or black spots and there was a black spot between the eye and the bill. The rest of the cheek patch was greyish brown with pale spotting to an extent which roughly corresponded to the cheek patch in the 1st Cy bird. The crown of the head, nape and neck was black



**Fig. 11.** The three-species hybrid. Wholly black bill. Head and neck colour distribution resembling 1st Cy Greylag Goose x Barnacle Goose but browner and neck paler over the throat than over the nape side. All-white tail coverts and white-tipped tail. Grey legs. 26th July 2008. – *Die Dreifach-Hybride. Vollständig schwarzer Schnabel. Farbverteilung an Kopf und Hals erinnert an Graugans x Weißwangengans-Hybride im 1. Kalenderjahr, aber die Färbung ist bräunlicher und der Hals heller auf der Kehlseite als auf der Nackenseite. Vollständig weiße Schwanzspitzen.* 26. Juli 2008.

**Fig. 12.** The three-species hybrid. Pale-fringed larger coverts and tertials. Coverts otherwise rather brown. 19th July 2008. – *Die Dreifach-Hybride. Weiß-gerandete Deck- und Schirmfedern. Sonstige Deckfedern ziemlich braun.* 19. Juli 2008.

**Fig. 13.** The three-species hybrid. Pale greyish brown underside with white vent, white under-tail coverts and white-tipped tail feathers. 19th July 2008. – *Die Dreifach-Hybride. Helle gräulich-braune Unterseite mit weißem Steiß, weißen Unterschwanzdecken und weißspitzigen Schwanzfedern.* 19. Juli 2008.

**Fig. 14.** The three-species hybrid in the first documentation since August (compare Fig 6). The bird was now clearly darker and the pale area next to the bill had expanded over the forehead. 17th November 2008. – *Die erste Aufnahme der Dreifach-Hybride seit August (vgl. Fig. 6). Der Vogel war nun deutlich dunkler und der helle Bereich direkt am Schnabel hatte sich ausgedehnt.* 17. November 2008.

Photos: Peter Dreyer

with a slightly brown tinge and a few white spots. The breast was medium brown to an extent similar to the black breast in pure Barnacle Geese. Upper parts and flanks were brown in a tone rather typical for Anser species, with pale-fringed feathers and a somewhat paler colour on the flanks as compared to the darker upper parts. The belly was pale brownish grey and the ventral region and undertail coverts were still almost wholly white with only one or two small dark spots (Fig. 17). The legs and feet were medium grey at all ages, though at one year of age a hint of a yellow or pink tinge could be detected.

## Discussion

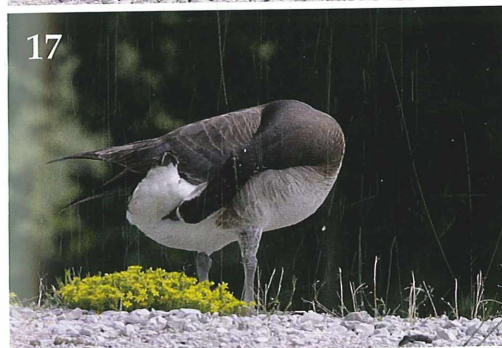
**Literature review.** We are not aware of any previously reported three-species hybrid (Swan Goose x Snow Goose) x Barnacle Goose. As to F1 hybrids between two of the involved species, McCarthy gives five references to previous publications on Swan Goose x Snow Goose hybrids, one on Swan Goose x Barnacle Goose hybrids, and six on Snow Goose x Barnacle Goose hybrids (McCarthy 2006). He also informs that Swan Goose and Snow Goose hybridise under natural circumstances and that hybrids are partially fertile.



**Fig. 15.** The three-species hybrid at about one year of age. Body colour rather similar to most Anser geese and especially to the Swan Goose x Barnacle Goose hybrid (Gustavsson 2009). Pale cheek area with a shape as in other Barnacle Goose hybrids but with a whiter area from the bill up over the front head and a duller area below a line from the gape to below the eye, i.e. an area roughly corresponding to the pale cheek area in the 1st Cy bird. 27th June 2009. – *Die Dreifach-Hybride im Alter von etwa einem Jahr. Körperfärbung ziemlich ähnlich zu meisten Anser Arten, besonders zur Schwanengans x Weißwangengans-Hybride (Gustavsson 2009). Der helle Wangenbereich hat eine ähnliche Form wie andere Weißwangengans-Hybriden, ist aber weißlicher von der Schnabelbasis bis über die Stirn und dunkler unterhalb einer Linie vom Schnabelwinkel bis unter das Auge, d.h. in einem Bereich, der in etwa dem hellen Wangenbereich im ersten Kalenderjahr entspricht.* 27. Juni 2009.



**Fig. 16.** The three-species hybrid. 27th June 2009. – *Die Dreifach-Hybride.* 27. Juni 2009.



**Fig. 17.** The three-species hybrid. The undertail coverts were almost wholly white also in the 2nd Cy bird. This is similar to Snow Goose x Barnacle Goose hybrids but contrary to what is usually seen in most other Anser Goose x Barnacle Goose crosses which have some degree of dusky coverts. 27th June 2009. – *Die Dreifach-Hybride. Die Unterschwanzdecken waren auch im zweiten Kalenderjahr fast vollständig weiß. Das ähnelt Schneegans x Weißwangengans-Hybriden, anders als bei den meisten Anser x Weißwangengans Kreuzungen, die in einem gewissen Ausmaß düstere Decken haben.* 27 Juni 2009.

Photos: Peter Dreyer

Kampe-Persson and Lerner pooled their own data with three large studies from Germany and Great Britain (Delany 1993, Randler 2000 and Rowell et al. 2004). Among almost 1100 F1 hybrids from these four studies, there was no Swan Goose x Snow Goose, no Swan Goose x Barnacle Goose but 5-6 Snow Goose x Barnacle Goose hybrids (Kampe-Persson & Lerner 2007). The proportions in numbers of individuals derived from these reports also fit well with our internet search which revealed a number of presumed or possible Snow Goose x Barnacle Goose hybrids but no Swan Goose x Barnacle Goose (except Gustavsson 2006b) and no Swan Goose x Snow Goose classified as such (see below). In conclusion, Swan Goose x Snow

Goose and Swan Goose x Barnacle Goose hybrids are extremely rare whereas Snow Goose x Barnacle Goose hybrids are observed in small numbers.

**Why is the presumed Swan Goose x Snow Goose what we claim it to be?** The bird has several features reminiscent of a Swan Goose, e.g. a flat bill-to-forehead profile with a long bill and a sharp margin between darker brown and pale areas extending from the bill along the sides of the head and neck as in a Swan Goose (Nishikawa 2006). This colour distribution is normally considered diagnostic for Swan Goose (Madge & Burn 1988). There are also features strongly reminiscent of a Snow Goose. The bird



**Fig. 18.** Blue phase Snow Goose. Dark and pale fringed tertials, pale fringed greater coverts, pale grey rump, pink legs. – *Dunkle Morphe der Schneegans. Dunkle, hell umrandete Schirmfedern, hell umrandete große Deckfedern, heller grauer Bürzel, rosa Beine.* Photo: C G Gustavsson



**Fig. 19.** Blue phase Snow Goose. Pink but also partly orange bill with wide black cutting edge, often referred to as "grinning patch". 19th July 2006. – *Dunkle Morphe der Schneegans. Rosa, teilweise orange-farbener Schnabel mit breiten schwarzen Schneidekanten, (in dieser Form) oft als 'grinning patch' bezeichnet.* 19. July 2006. Photo: C G Gustavsson.

thus has long tertials which, like the upper wing coverts, have broad whitish fringes (Fig. 3-7). The rump is pale grey of a tone and shape reminiscent of blue phase Snow Geese (Fig. 8 and 18). There is a conspicuous "grinning patch" on the bill which is pinkish yellow (Fig. 2-7). These colours may also be seen in Snow Geese though then more pink than yellow (Fig. 19). Yellow or yellowish bill colour may also occur in both Swan Goose hybrids (e.g. Swan Goose x Greylag Goose hybrids) and Snow Goose hybrids (e.g. Snow Goose x Barnacle Goose, Gustavsson 2009). The legs are reddish-pink as in Snow Geese.

We could not find any previously published pictures of a confirmed Swan Goose x Snow Goose hybrid for comparison. There are however on an internet site three non-classified birds which appear to be crosses between the domesticated form of Swan Goose (Chinese Goose) and Snow Goose, this seeming especially plausible since in one picture the hybrids are depicted together with a white phase Snow Goose (Lorenzen 2009). Plumage in these birds is rather similar to that in our bird but the shape of head and body are rather different presumably because the Swan Goose parent was of the domesticated variety.

**Comparison of the three-species hybrid to related two-species (F1) hybrids.** Comparison of the three-species hybrid (Swan Goose x Snow Goose) x Barnacle Goose to other individuals of the same combination has not been possible since apparently no such case has been previ-

ously reported. From a theoretical point of view, such a comparison would also presumably have been of less value than are comparisons between F1 crosses. In three-species hybrids, the heritage from the hybrid parent would be expected to vary widely. Chromosomes from the Swan Goose and Snow Goose components in the hybrid parent would in principal be transferred to the offspring in a random fifty-fifty distribution. Even though several gene combinations would be expected to be associated with non-viability, the number of possible combinations in three-species hybrids ought to be very much larger than in F1 hybrids, in which all chromosome pairs except the sex chromosomes are derived in equal proportions from the two parent species.

The hybrid was therefore compared to F1 crosses between Barnacle Goose and the other two species presumed to be involved, i.e. to Swan Goose x Barnacle Goose and to Snow Goose x Barnacle Goose. Such hybrids of confirmed or presumed parentage were previously presented in an overview of hybrids between Barnacle Goose and a number of Anser goose species (Gustavsson 2009). We are not aware of any other pictures of a Swan Goose x Barnacle Goose hybrid. The colour of that hybrid was rather similar to the three-species hybrid in this article, including an wholly black bill and dark legs which had a brown tinge. However, the build of the bird was quite different, recalling the heavy domesticated variety of Swan Goose (Chinese Goose).

The overall impression of Snow Goose x Barnacle Goose hybrids is often rather different, with larger white areas on head and neck, partly white body sides, variable grey (and possibly brown) areas on the upper parts and often well visible pinkish or yellowish bill colour usually in combination with dark areas. There is however a large variability between individuals ranging from pale to moderately dark (Lehto 2008). This variability may partly be due to differences in age (Gustavsson 2009). Several presumed Snow Goose hybrids have white-tipped or partly white tail feathers (Gustavsson 2003, Gustavsson 2006, Lehto 2008, Gustavsson 2009). White-tipped tail feathers were also seen in the three-species hybrid during its first summer and could be a heritage from a Snow Goose ancestor (Fig. 3 and 11). During the second summer, white tail feather tips could not be seen in the resting bird but this does not confirm their absence, since in other cases pale tail feather tips were difficult to see except on flying birds (Gustavsson 2003, Gustavsson 2006, Lehto 2008).

**Comparison to other hybrids.** Our three-species cross is in several respects rather similar to Greylag Goose *Anser anser* x Barnacle Goose hybrids. The 1st Cy three-species hybrid differs in having browner head and neck colour, paler throat and breast colour, pale fringed greater wing coverts and pale-tipped tail feathers (Fig. 3, 5, 11-13). The three-species cross also had pale grey axillaries (Fig. 4) which was not seen in the Greylag Goose x Barnacle Goose hybrids but in a presumed Snow Goose x Canada Goose hybrid (Gustavsson 2006) and thus may be suspected to be a Snow Goose heritage. The same applies to pale-fringed tertials, which were seen in presumed Snow Goose x Barnacle Goose (Gustavsson 2003, Gustavsson 2009) and Snow Goose x Canada Goose hybrids (Gustavsson 2006). Another feature which differed between the three-species cross and the five previously described Greylag Goose x Barnacle Goose hybrids (Gustavsson 2009) was that the former had white under-tail coverts whereas these feathers were more or less dusky in all five Greylag Goose x Barnacle Goose (Gustavsson 2008b) and to some degree also in the domestic Swan Goose x Barnacle Goose hybrid (Gustavsson 2008c) and two Bar-headed Goose x Barnacle Goose hybrids (Gustavsson 2008d). At the age of one year (i.e. 2nd Cy), the bill of

the three-species hybrid was still wholly black and its legs were dark grey with a pinkish tinge (Fig. 15-17). By that age, the Greylag Goose x Barnacle Goose hybrids had all developed adult colour pattern with at least some minimal but usually large pinkish-yellow areas on the dark-patched bill and the legs were in all of them distinctly pale pinkish-yellow (Gustavsson 2009). Even though many adult Snow Goose hybrids in our experience have had pale-pinkish legs, there are web pictures of grey legs in presumed Snow Goose x Barnacle Goose or Ross' Goose x Barnacle Goose hybrids (Lehto 2004, Lehto 2008, Appleton 2009). Furthermore, the presumed Swan Goose x Barnacle Goose (though a domesticated variety of Swan Goose) hybrid had a black bill and dark legs with a brown tinge (Gustavsson 2009). This clearly differed from the pure Swan Goose, in which legs and feet at all ages should be orange (Madge & Burn 1988) but might be explained as a mixture of black and orange in a similar way as the tinge of pinkish leg colour tone in the three-species hybrid might be regarded as a mixture between black and the pink leg colour in the Swan Goose x Snow Goose hybrid. We thus do not think the dark grey legs with a pinkish tinge in the presumed three-species hybrid is contradictory to but rather in support of the presumption that it is indeed a (Swan Goose x Snow Goose) x Barnacle Goose hybrid.

In the 2nd Cy three-species hybrid, the pale cheek patch had expanded to an extent very similar to that in adult Greylag Goose x Barnacle Goose hybrids and the domestic Swan Goose x Barnacle Goose (Gustavsson 2009). However, the cheek patch was in the three-species hybrid divided into a pale forehead part and a darker area with an extension roughly corresponding to the cheek patch in the 1st Cy bird. A rather similar cheek patch colour distribution was seen in a presumed Snow Goose x Barnacle Goose hybrid (Lehto 2008). Dual colour cheek patches were also seen in Greylag Goose x Barnacle Goose hybrids and the domesticated Swan Goose x Barnacle Goose hybrid but in them it was only seen as a transient phenomenon during autumn and winter (Gustavsson 2009) which was gone by the following springs.

In presumed F1 hybrids of Swan Goose and Canada Goose, all hybrids inherited the distinct border between dark brown crown and paler

cheek area though in the hybrids the colours were not dark brown but black and the paler cheek areas were whiter (Hvass 2007 and Danielsson 2009). A somewhat similar neck colour pattern could be seen also in the three-species cross but was then much less obvious (Fig. 9-10), presumably due to the smaller colour difference between the two areas, the varying colours within the pale area in the three-species hybrid and the distraction from the conspicuous pale cheek patch. It was however seen both in sunlight (Fig. 9) and in shadow (Fig. 10) so misinterpretation of a shadow phenomenon should be ruled out.

One out of the three Swan Goose x Canada Goose hybrids mentioned above also had a white forehead, so possibly the white forehead in the 2nd Cy three-species hybrid should instead be interpreted as a variation of the "white-area-next-to-the-bill" which is very often seen in Anser x Branta goose hybrids. The neck was then darker than in the 1st Cy and had developed some white spotting and the breast was darker though still brownish black and paler than in a pure Barnacle Goose. These features were rather similar to what is seen in Greylag Goose x Barnacle Goose hybrids. The body size of the three-species hybrid was approximately similar to that in Barnacle Geese, in Snow Goose x Barnacle Goose hybrids and in Bar-headed Goose Anser indicus x Barnacle Goose hybrids but probably somewhat smaller than in the Greylag x Barnacle Goose hybrids. Similar to many of the Greylag Goose x Barnacle Goose hybrids and the domestic Swan Goose x Barnacle Goose hybrid (Gustavsson 2009), the 2nd Cy three-species cross also has a black spot between the bill and the eye.

**Possible extra-pair fertilisation or adoption.** It could be claimed that the three-species hybrid might not have the presumed origin but instead be the result of an extra-pair fertilisation or that the pair had adopted a gosling from some other geese.

Alternative parent species should then be sought among the goose species which during breeding season occur at the Ismaning water reserve. These species are Barnacle Goose, Greylag Goose, Bar-headed Goose and Canada Goose. One parent species is obviously a Branta goose. The dark breast indicates that this is a Barnacle Goose since this is a common feature

in most Barnacle Goose hybrids with a possible exception for some hybrids with Snow Goose (Gustavsson 2009), and may be used to distinguish these from Canada Goose hybrids. On the other hand, body and wing colour pattern clearly differs from that in pure Barnacle Geese. The differences from Greylag Goose x Barnacle Goose hybrids have been detailed above. Adult Bar-headed Goose x Barnacle Goose hybrids differ from our hybrid in several respects such as coloured legs and bill, usually (but not always) a pale line along the sides of the dark neck, dusky under-tail coverts and a generally more slender body type (Gustavsson 2008d, Gustavsson 2009). Dusky under-tail coverts seem to be a regular feature in most Barnacle Goose x Anser goose species hybrids except Snow Goose x Barnacle Goose (Gustavsson 2008b, 2008c, and 2008d) and were not seen in the three-species hybrid. Barnacle Goose x Canada Goose F1 hybrids usually have a more Canada Goose like head colour pattern (McGilvray 2008) and in F1 hybrids as well as in presumed backcrosses with Barnacle Geese the cheek patch has a uniform even pale colour (Gustavsson 2008). We thus think extra-pair fertilisation or adoption can be ruled out with reasonable safety, especially since the hybrid has features which support the idea that it is indeed the offspring of the presumed Swan Goose x Snow Goose hybrid and the Barnacle Goose. This is also fully in agreement with the statement that Swan Goose x Snow Goose hybrids ought to be partly fertile (McCarthy 2006).

**Field classification aspects.** Correct field classification of hybrids may be difficult even in F1 hybrids. With a three-species cross, we think the phenotype will be so variable due to the genetic causes stated above, that it will often be virtually impossible to classify correctly when a previously unknown bird is observed in the field in the absence of its parents bird. In the present case, a misclassification as Greylag Goose x Barnacle Goose might have been arrived at if careful close-up examination had not revealed discrepancies. We therefore think that the possibility of a three-species or multiple-species cross should be kept in mind when a hybrid with somewhat atypical features is observed. It should also be remembered that hybrids of different parentage may tend to resemble one another (Gillham & Gillham 1996). Photogra-

phic documentation will in all cases allow comparison if the bird is observed again and will also allow "second opinion" evaluation of the observation. In some cases, classification as "unclassified goose hybrid" or "unclassified Anser x Branta goose hybrid" might be preferable to an attempt to always give a more specific and potentially wrong species classification.

### Fertility and conservation consequences.

Fertile hybrids potentially constitute a threat to pure species since they may produce offspring with one of the parent species (back-crossing) and after repeated backcrossing may ultimately have transferred some alien genes into that species. This process is often referred to as introgression. The presumed Swan Goose x Snow Goose in this article is obviously fertile but neither of its parent species is native to this area so the risk of back-crossing should be minimal. There is however the possibility that it may hybridise with a third Anser goose species which is native to Europe. Being a hybrid between three species which all belong to the genus Anser (i.e. it is a species hybrid), such a bird could very well be fertile and then constitute a genetic risk. It is for example well known that domestic Swan Goose x Greylag Goose hybrids have back-crossed repeatedly with Greylag Geese (Kampe-Persson & Lerner 2007). As to the three-species hybrid, we presume it to be sterile as were other genus-hybrids, between the Branta species Barnacle Goose and a number of Anser species, discussed in a previous report (Gustavsson 2009); these birds were all followed for several years and despite some of them obviously being mated, offspring was never observed.

### Conclusions

We conclude that:

1. This is presumably the first description of a unique three-species hybrid (Swan Goose x Snow Goose) x Barnacle Goose.
2. This hybrid would be expected to be sterile. Contrary to the Swan Goose x Snow Goose hybrid it should not constitute any potential conservation problem.
3. The Swan Goose x Snow Goose cross in one of the parent birds is also very rare and we are not aware of any previously published picture of a similar hybrid.

4. Whereas correct field classification of a Swan Goose x Snow Goose hybrid seems feasible, we do not think that correct classification of the three-species hybrid would have been possible without observing it together with its parents. However, the involvement of Barnacle Goose would have seemed rather obvious.
5. The possibility of a multi-species background should be kept in mind when a hybrid with atypical features is observed.

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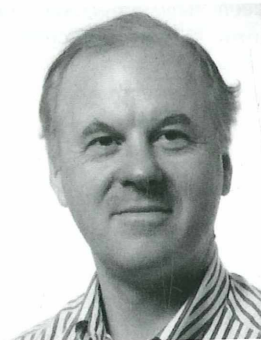
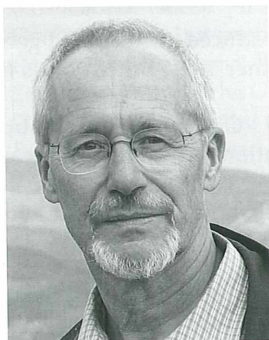
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**Peter Dreyer**, Dipl. Math., in retirement after a professional life in Civil Service and Industry, is now an active field ornithologist and photographer with an emphasis on bird photography. He participates in the regular water bird counts at Ismaning Reservoir.

**Carl Gunnar Gustavsson**, MD PhD, Associate Professor of Cardiology, Lund University, Sweden. Semi-professional bird photographer with goose hybrids as main ornithological research focus.

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