

The chinese cormorant *Phalacrocorax carbo sinensis* Blumenbach 1798, an alien bird
by Christer Olburs 2008-10-15

**The chinese cormorant, *Phalacrocorax carbo sinensis*
Blumenbach 1798, an alien bird**

- An attempt to understand a complex biological question

by Christer Olburs, 15/10/2008

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To Sven, Esbjörn and Curt

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1. Introduction

Few animals arouse such strong feelings as the cormorant and the “cormorant issue” is one of the last century’s most hotly-debated environmental policy issues in Sweden and other parts of Europe. No other issue, with the possible exception of the “wolf issue”, has so sharply divided the population into two categories, *cormorant lovers* and *cormorant haters*.

The dividing line also separates a united establishment of authorities, environmental organisations and researchers on the one hand and a coastal and rural population, fishermen, hunters and many others who actively make use of nature on the other.

The cormorant lovers maintain that the cormorant is a natural part of the Swedish and European fauna that, at last, has returned to its original breeding areas after a long period of persecution. The incredibly fast expansion of the cormorant numbers is explained by “water eutrophication” and the cormorant’s effect on the fish stocks is toned down. Usually moderate environmental debaters use expressions like “chavs of the animal kingdom” to highlight the prejudice of the cormorant haters.

The cormorant haters emphasise the reduction in fish stocks and ruined fishing, dirty skerries and spoiled islands plus a generally unpleasant, reptile-like appearance. Some have also maintained that “The cormorant is the reason for both lack of fish fry and the cause of algal bloom in the Baltic Sea” and that the cormorant was artificially introduced into Sweden. The cormorant haters suspect a conspiracy and blame most of the coastal and freshwater fishing problems on the cormorant and a large number of proposals requiring different measures against the cormorant have been submitted to the Swedish Parliament from all parties except for the Green Party.

Similar cormorant debates are held in most of the countries in North-Western Europe; in Denmark, Germany, the United Kingdom and France. There is also a similar cormorant debate on the Double Crested Cormorant (*Phalacrocorax auritus*) in North America.

For those who are interested in nature and birds and have seen the great interplay between human and cormorant in several films on fishing with cormorants in China, it can be difficult to understand the strong feelings surrounding the cormorant in the environmental policy debate.

The explosive increase of the cormorant numbers throughout North-Western Europe has few equivalents in the bird world. In **1999**, the Swedish Ornithological Society (SOF) made an inventory of the Swedish numbers of:

The Great Cormorant (race: Lesser Great Cormorant) and found **26 000 pairs**. A new inventory made by the SOF in 2006 showed around 45 000 pairs and is the highest figure taken thus far for any country in Western Europe. The increase is a part of one of the ongoing re-establishment from numbers that were previously decimated by humans. The expansion is also explained by improved feeding conditions linked to eutrophication, the establishment of fish breeding and fishponds around Europe. A long-term warmer climate may also be assumed to promote the survival possibilities and distribution of cormorants.

The above quote principally summarises the current picture of the cormorant issue that is presented by “the cormorant lovers”.

The **environmental and politically correct** attitude is obviously “for the cormorant” and to be happy about its “return”. However, is the attitude **scientifically correct**; is it supported by the facts of the case? Since a largely unified environment and scientific establishment is on the side of the cormorant lovers, the answer should be obvious. However biology is a very complex science and assessments often have to take place on a very limited and sometimes difficult-to-interpret factual basis, and there are still some uncertainties in the cormorant issue. There is a considerable risk of carrying out erroneous assessments based on inadequately supported facts and the biological, economic and political consequences can be very negative and lead to a marked loss of trust in authorities and researchers.

“The cormorant” should be one of the most studied birds and there are huge quantities of published material on “the cormorant”, spanning a large number of biology’s sub-areas: systematics, taxonomy (incl. nomenclature, genetics, zoogeography, population ecology, etc. On top of this we have the more and more relevant discipline of “invasion biology” as well as a not insignificant dose of cultural history.

At first glance, the cormorant issue appears to be a confused case that is impossible to untangle. The clues are difficult to follow and often lead to dead ends since there is a significant lack of hard facts.

However, are the right questions being asked and debated – is it the alleged harmful nature or the harmless nature of the cormorant that is the key question? Do we have to go along with one of these attitudes or are there other options to choose? Are there other ways of interpreting the facts of the case?

For several years I have collected material, read and re-read it, tested and rejected hypotheses and under much agony have built up a somewhat clearer picture, but several bits of the puzzle are still missing. Limited private resources also mean limited access to source material. The source material includes everything from my private books, finds in second-hand bookshops, correspondence with researchers, scientific essays as well as material available on the Internet and is a long way off completely examining all relevant literature that is available on the subject.

The scientific method is to critically and objectively examine details, to question, find weaknesses or try to “falsify” the details and preferably, in accordance with good journalistic practice, have at least two sources that are independent of one another. It is pretty difficult to assess the reliability of the details. Details are often quoted in many places and are often incomplete, but even conclusions drawn from well-documented facts can be incorrect. Details that are in writing are usually considered to be more reliable than verbal details, details published in scientific publications to be more reliable than those in popular publications, more recent details to be more so than older ones, etc. However, details published in renowned scientific magazines also often have to be based on second-hand details and quotations.

In order to avoid repetitions, details based on quotations from earlier works have been carefully sifted through since the fact that information has been repeated does not make it more reliable. I have therefore endeavoured to adhere to the key works regarding the issue and those in which information is reported for the first time.

2. A few biological concepts and units

According to modern biology's grand old man Ernst Mayr, one peculiarity of biology that segregates it from the other sciences of physics and chemistry is the legitimacy of asking and attempting to answer the questions of **What?, How? and Why?** (Mayr, E. 1997, **This is biology - the science of the living world**). **What?** concerns biodiversity, species formation etc., **How?** concerns proximate (functional) causes (physiology, ecology, etc.) and **Why?** concerns ultimate (evolutionary) causes. Other peculiarities for biology include the significance of **concept formation** and historical courses of events (historical narratives, tentative scenarios).

In "**What Makes Biology Unique, Considerations on the Autonomy of a Scientific Discipline**" (2004), Mayr writes: "The **species**, together with the gene, the individual and the local population, are the most important **units** in biology".

Unfortunately, the **species concept** is often confused with the **species category** and the **species taxa** which, according to Mayr (1997), is something that has created "endless confusion in the literature".

As well as this species concept there are "vaguer" concepts like *subspecies* (subspecies/geographical race; designated by three names (trinomen); generic name, generic epithet as well as subspecies epithet), *polytypic species* (polytypic species, consists of several morphologically (and sometimes geographically and thereby in practice genetically isolated) different *subspecies* (Mayr, 1997)) and *superspecies* ("A superspecies consists of a monophyletic group of entirely or essentially allopatric species that are morphologically too different to be included in a single species"; Mayr, E. 1970, **Populations, Species and Evolution**), which can create additional confusion.

Other difficulties to avoid are **category errors**, e.g. comparing an apple with "the apple from China", i.e. oranges, as well as making **rank errors**, placing a taxon in the wrong category and thereby giving it an erroneous rank in the hierarchical system, e.g. assigning a subspecies to the species rank or vice versa.

An additional complication is that the content of the biological concepts has been considerably changed throughout the course of history. The way in which the biological thinking has changed has been described in detail by Mayr in "**The Growth of Biological Thought**" (1982). This gives a description of the modern **species concept's** historical growth and evolution, a process that is still ongoing.

The **typological (morphological) species concept** was the predominant one from Plato and Aristotle to Linné and still remains to a certain extent in parts of modern biology. In the 1800s, particularly after Darwin's "**The Origin of Species**"(1859), and primarily during the 1900s, new perceptions gradually grew on the concept of species, including the "**biological species concept**" as defined by Mayr (1982) as follows: "A species is a reproductive community of populations (reproductively isolated from others) that occupies a specific niche in nature".

However, there are considerable difficulties in applying the "biological species concept" since both species and concepts are changing constantly. This applies in particular to the more subjective categories under the species such as subspecies/geographical races, *subspecies*.

There is a continuous fight in the systematics between splitters and lumpers. For example, in 1910, the bird group (Aves) was considered to be made up of no fewer than 19 000 species, but by using the concept of polytypic species, it was possible to reduce the number of species to around 8 600 (Mayr, 1970).

In order to make it possible to avoid rank errors, e.g. showing a *subspecies* to actually be a *species* or if a *superspecies* or *polytypic species* consists of several species, one method may be to “construct a historical narrative” (Mayr, 1997), i.e. use all available data and criteria, allow molecular biology to supplement morphological and historical details as well as draw a conclusion from this (**inference**). Each such **historical narrative** is open to falsification and can be retested again and again. “The cormorant issue” appears to be a very suitable area to test this method.

One method: What? Where? and When?

All biological questions are complicated. In order not to drown in the abundance of information available on the cormorant, one must attempt to identify and filter out the biological concepts and units that are relevant to the cormorant issue as well as place these in space and time.

One method may be to attempt to answer the following three main questions within each sub-area or aspect of “the cormorant issue”:

- **What?** type of **biological unit** is being dealt with – is it an individual, a local population, subspecies, species or superspecies? When the question of **quality** has been answered, the unit can also be **quantified**.
- **Where?** does it occur (**space**), within a biogeographical or an administrative area?
- **When?** does it occur (**time**), during which time period, biological or cultural-historical?

It is therefore of particular biological interest to highlight the following aspects of the cormorant issue:

- Details on the subspecies/geographical races (systematics/taxonomy) (**unit**)
- Details on breeding (zoogeography) (**space and time**)
- Details on subfossil (archaeology, distribution history) (**time and space**)

Details on the subspecies/geographical races of Great Cormorant *Phalacrocorax carbo* L., *P.c. carbo* and *P.c. sinensis*, that occur in Europe today have therefore as far as possible been kept separate and concentrated in particular on details on *P.c. sinensis*, which is the subspecies around which the cormorant issue in Europe revolves.

In order to facilitate interpretation possibilities as well as avoid losing important information, the quotations are very comprehensive. In order to facilitate their reading, longer consecutive quotations are printed using the Cambria font, and all scientific names are written in italics, even if this was not the case in the original text. Bold is used for **titles** as well as for certain **names, questions, years and concepts**.

Each section ends with comments that briefly summarise the section’s **What?, Where? and When?**

Details in each section are as far as possible reported in chronological order and continuous references are made in the text.

The scope and complexity of the cormorant issue means there are difficulties in giving the report a logical, consistent structure and sequence. I have therefore chosen to largely follow the pathway of my own thoughts that have sometimes taken me straight ahead and sometimes reached a dead end.

It therefore begins with the cormorants' systematics and taxonomy and the modern cormorant debate in Sweden, ends after various digressions with a summarising discussion as well as some conclusions proposing the way in which the dim elements of the cormorant issue can be more strongly highlighted.

3. The “Great Cormorant’s” systematics, taxonomy and nomenclature

Three species in the Phalacrocoracidae family are usually said to be naturally occurring in Europe, a small species, the Pygmy Cormorant (*Phalacrocorax pygmaeus*), a medium-sized species, the shag (*Phalacrocorax aristotelis*) and a large cormorant, the Great Cormorant (*Phalacrocorax carbo*).

Cormorants have been known by people in Europe since “ancient times” and in many cases were identified in early history and given various local, popular names (see Bernström, 2008 below). Linné was the one who in 1758 first described the species of Great Cormorant scientifically and placed it in the *Pelecanus* family where the type species was *Pelecanus Onocrotalus*, “**the white pelican**”, and gave it according to his binary nomenclature the generic name *Pelecanus* and the species epithet *Carbo* (Linnaeus, C. 1758), “**the black pelican**”. The information under *Carbo*; 3, “Habitat in Europe; nidificat in altis arboribus” (Lives in Europe; nests in high trees (my translation.)) is interesting.

Not until 40 years later in 1798 did Johann Friedrich Blumenbach in Göttingen, one of Germany’s major nature researchers and perhaps best known as the person who tried to describe the human from a physical anthropological perspective, describes another **species** to which he gave the name *Pelecanus Sinensis*, indicating the type location **China** (Blumenbach, J.F. 1798 “**Abbildungen naturhistorischer Gegenstände**”. 3tes Heft. Göttingen. from AnimalBase search page SUB Göttingen). Directly translated, the name means “**the pelican from China**” (cf. orange) (orange = Chinese apple, recorded in Swedish since 1689 *Citrus sinensis* (L.) *Sinensis* = from China, from Arabic Sin = China.). However, Blumenbach’s description from 1798 does not appear to have been particularly well known, and name and priority did not make an impact until well into the 1900s.

Since the end of the 1700s, several names and descriptions have been used for the “smaller variety of cormorant” that has otherwise come to be called *Phalacrocorax carbo sinensis* (Blumenbach, 1798) which certainly shows in the Swedish cormorant debate during the 1800s and at the start of the 1900s (see section entitled Older details on cormorant breeding in Sweden and the Nordic countries).

The abovementioned source (AnimalBase search page, SUB Göttingen) gives the following background to the change of the generic name to *Phalacrocorax*: “Genus taxon name: *Phalacrocorax* (Brisson, 1760). Originally described in Brisson, M.J. 1760. Ornithologie ou méthode contenant la division des oiseaux a ordres, sections, genres, especes & leur variétés. Paris (Bauche)”.

Modern Great Cormorant systematics

The “Great Cormorant” systematics are complicated and the species that we commonly call the Great Cormorant, *Phalacrocorax carbo* L., consists of several subspecies according to several authors. The European cormorant issue revolves around two of these, *P.c. carbo* (Linnaeus, 1758) and *P.c. sinensis* (Blumenbach, 1798).

In recent decades, several works have been published concerning the systematics/taxonomy and biogeography of cormorants in greater detail

“**Phylogeny of the Phalacrocoracidae**” (Siegel-Causey, D. 1988, **The Condor 90**) gives an overview of the cormorant systematics based on studies of skeletons (137 osteological). Siegel-Causey divides the cormorants into a broader number of genera, one of which includes “large

cormorants” (macrocormorants) with just two species: “the Great Cormorant, *Phalacrocorax carbo* and the Japanese Cormorant, *P. capillatus*”, but writes that “It is very likely that *P. carbo*, as currently recognized, is a superspecies” as well as that “certain varieties (e.g. *P.c. lucidus*, *P.c. maroccanus*, *P.c. novaehollandiae*) may be specifically distinct”.

A few years later, the *Phalacrocoracidae* family (Cormorants) are described as consisting of 1 genus, 39 species and 57 taxa. (**HANDBOOK OF THE BIRDS OF THE WORLD, Volume 1 Ostrich to Ducks, Hoyo et al, 1992**).

The following appears below the heading “4. Great Cormorant, *Phalacrocorax carbo*”:

Taxonomy. *Pelecanus Carbo*, 1758 Linnaeus, Europe.

May form **superspecies** with *P. capillatus*. Race *lucidus* often considered separate species. Race *novaehollandiae* may be good species; alternatively replaced by further races *carboides* (Australia) and *staedi* (New Zealand area). Race *hanedae* may better be considered synonymous with *sinensis*. Six subspecies normally recognized.

P.c. carbo (Linnaeus, 1758) - E Canada through Greenland and Iceland to Norway and British Is.

P.c. sinensis (Blumenbach, 1798) - C & S Europe to India and China.

P.c. hanedae Nagamichi Kuroda, 1925 - Japan.

P.c. maroccanus Hartert, 1906 - NW Africa.

P.c. lucidus (Lichtenstein, 1823) - coastal W & S Africa, inland E Africa.

P.c. novaehollandiae Stephens, 1826 - Australia, Tasmania, New Zealand, Chatham Is.

The related Japanese cormorant, *P. capillatus*, is described as follows:

9. Japanese Cormorant

Phalacrocorax capillatus

Taxonomy. *Carbo capillatus* Temminck and Schlegel, 1850, Japan.

Synonymous with *P. filamentosus*. May form superspecies with *P. carbo*. Monotypic.

The following is written under the heading “Systematics”:

...there is a wide variety of opinions as to the exact number of species that should be recognized. The total figure range from 26 to 40 species,...

Extensive chopping and changing has led to considerable confusion with scientific names, and even so more with vernacular names.

...

The Ice Ages may also have influenced the process of speciation and subspeciation, by isolating populations for long periods, during which they were able to differentiate. This is presumably the case of the Japanese Cormorant, which probably originated from a population of Great Cormorants that was isolated during the glacial periods.

In a recently published overview, “**Pelicans, cormorants and their relatives**” (Nelson, B.J. 2006), you can read the following:

Phalacrocorax (2 species), the genus to which even a quite recent classification (Dorts and Mougín 1979) ascribed all extant cormorants and shags, in Siegel Causeys scheme contain only the great (*P. carbo*) and Japanese cormorants (*P. cappillatus*).

...

The Great Cormorant has such a vast distribution that it is likely to be a superspecies or, alternatively, currently recognized sub-species may be species.

Comments

What?

Phalacrocorax carbo and *P. cappillatus* are considered to be very closely related to one another and may constitute a superspecies. *P. carbo* (polytypic) is thought to have up to 8 subspecies, some of which possibly should be considered **species**.

Where? *P. carbo* occurs on all continents except for South America. The current distribution areas of the **subspecies** partly overlap in some cases, e.g. *P.c. carbo* and *P.c. sinensis*.

When? The time when *P. carbo* split into **subspecies** is assumed to have occurred in connection with the last ice age.

4. A few details and contributions to the debate on the cormorant in Sweden after 1990

An examination of the details on the cormorant in Sweden and the positioning of different organisations in Sweden in the cormorant issue in recent decades shows a marked unity. The common opinion is that the cormorant has returned to Sweden following a long period of persecution.

However, if you read that which has been published on the Swedish cormorant issue with the questions **What?**, **Where?** and **When?** as a filter, the picture becomes more complex. For example, which details are reported concerning each of the two subspecies *P.c. carbo* and *P.c. sinensis*, as well as each subspecies' breeding and distribution history in Sweden?

At the end of the 1980s and the start of the 1990s, the cormorant numbers in Sweden increased very rapidly from a low level. The cormorant debate was already starting to heat up at that time but, from having been a local question in the area around Kalmarsund, it became a national issue during the mid 1990s in line with the cormorants' rapid expansion in Sweden.

In 1994, "**The cormorants in Kalmarsund**" (Lindell et al, 1994, Vår Fågelvärld [Our Bird World], Suppl. 20) was published, which summarised a large part of the ever more heated cormorant debate and the knowledge that was then relevant on the cormorant.

The following can be read under the heading "It concerns me!":

Swedish name: Mellanskarv [Lesser Great Cormorant].

Scientific name: *Phalacrocorax carbo sinensis*.

Domicile: The Lesser Great Cormorant is found from France, Holland and Denmark in the West, through Europe and eastwards to India, China and Japan. The Lesser Great Cormorant is a race (geographical part of a complete population) of the Great Cormorant species (complete population). Other races of Great Cormorant are found in the North Atlantic and in Africa and Australia.

The chapter called "The cormorant – introduced or natural in Kalmarsund?" contains the following:

The very word "returned" is correct in this context. The Lesser Great Cormorant has a well-documented historical prevalence around the Baltic Sea where excavation finds on Öland show that the bird has been found in these parts for a very long time.

...

Its disappearance was probably due to persecution, and had this not occurred, the cormorant may have enjoyed an uninterrupted presence at Kalmarsund.

...

The Lesser Great Cormorant is now well-established in Sweden and has a history of longer than a millennium in Sweden. The argument by those negative to the cormorant that it is an introduced bird and therefore should be specially treated is of less importance.

The chapter called “The cormorant - the persecuted bird” contains the following:

In 1950 Bengt Berg reported that breeding had taken place for a few years in the heron colony on Svartö. Some thought that Bengt Berg himself had placed cormorant eggs among the herons for hatching, but there is much to indicate a spontaneous immigration.

Some years later, Henri Engström writes in an essay in the Swedish Ornithological Society's (SOF) magazine (Vår Fågelvärld [Our Bird World] 7/1997) “**The Lesser Great Cormorant, a bird that's gaining ground**”:

The primary reason for the small numbers of cormorants for a very long time is widespread human persecution and sabotage of the cormorants' breeding areas. Hunting and other methods to limit the number of birds were so effective that the cormorants more or less disappeared from large parts of the distribution area as early as the 1800s.

In connection with the essay there was a facts box of the SOF's view of the cormorant:

SOF's attitude to the Lesser Great Cormorant has always been consistent and positive – it is an asset when numbers of a bird species develop favourably.

SOF is looking for more level-headed treatment of the cormorants. According to the society's policy, there is no reason to segregate the cormorant from other species in its bird protection work.

In the following year, the Swedish Board of Fisheries publishes a report (Report 1: 1998 Engström, H.) with the title “**The Lesser Great Cormorant's ecology and effects on fish and fishing, Compilation of current knowledge of the Lesser Great Cormorant, *Phalacrocorax carbo sinensis***”.

Of the approximately 30 species of cormorant that exist worldwide, three breed in Europe. The Great Cormorant is the most common and widespread species and occurs in Europe in two races: *Phalacrocorax carbo carbo* and *P. carbo sinensis* (Harrison 1983). *P. c. sinensis* (or Lesser Great Cormorant) is generally described as a predominantly domestic race that is linked to lakes and river systems but is also common in the shallow coastal areas.

The distribution area stretches over Continental Europe and in an easterly direction all the way over the Asiatic continent. *P. c. carbo* or the Great Cormorant is a coastal race and breeds in the North Atlantic. Its strong expansion in recent years in terms of both population and geographic distribution applies to both of the races, and parts of the distribution area of both races have now coincided (Marion 1989). The races are remarkably similar and, outside the breeding season, indistinguishable in the field. Their similarity during the breeding period has also led to uncertainty as to which race parts of the coastal numbers in the United Kingdom and France belong to (Marion 1989). However, all cormorants breeding in Sweden are highly likely to be Lesser Great Cormorants.

...

The cormorant then and now

Near the cormorants' core areas in the Netherlands, their persecution never led to the complete disappearance of the cormorant, but the birds disappeared from Denmark at the end of the 1800s. In Skåne, the cormorant disappeared as a breeding bird in the 1890s and in Sweden altogether in 1909 (Blekinge). Towards the end of the 1930, the cormorants began to re-appear in Denmark. Ten years later (1948), the birds began to breed in Sweden on the island Svartö in southern Kalmarsund (probably as a consequence of cormorants being driven away by humans on the island of Rügen in Germany).

...

From an historical perspective, the knowledge of the cormorant is less but there are spread-out archaeological finds that can shed some light on where the cormorants used to occur. From the core areas in Western Europe, bones have been preserved dating from 4000-2000 BC (Zijlstra, 1989). As of the 1500s, there are details of cormorant occurrences but also how they fluctuate in number. The fluctuations were due to changes in habitat but also due to human exploitation of eggs and young. The archaeological finds also tell us that the cormorant has been part of the Swedish bird fauna with right of domicile in southern and central Sweden, but even here, their persecution was so widespread that they ultimately disappeared.

...

From Hagestad in Skåne, cormorant bones have been found in connection with excavations of settlements from the 1000s – 1300s AD (Andersson, 1995). On Björkö (Birka), 900 year-old cormorant bones have been found in refuse tips, some of which belonged to young birds, which indicates that the species was also breeding in the area at that time (Fredriksson, 1996). Written details are available on breeding cormorants from places like Krageholmssjön in south-eastern Skåne in the 1870s (Andersson, 1984).

Hunting and protection issues – what does the EU say?

It should be emphasised that only the Lesser Great Cormorant is covered by the EU's Bird Directive, which does not cover the Great Cormorant (*P.c. carbo*). This may seem strange since the Western European population of Lesser Great Cormorants is currently significantly larger than the Great Cormorant population. The Great Cormorant is also more geographically limited compared with the Lesser Great Cormorant. On the other hand, the Lesser Great Cormorant's breeding environments are generally speaking more vulnerable (to exploitation) compared with that of the Great Cormorant.

In the year 2000, **The Swedish Royal Academy of Sciences (KVA)** writes in a response to Mönsterås Municipality (see SOF News Archive, 2000) regarding the request to hunt nuisance cormorants within the nature reserve on the island of Kungsholmen which is owned by the KVA, outside Mönsterås Paper Mill in Kalmarsund:

The Lesser Great Cormorant is a species that naturally belongs to the Swedish fauna. After many years of absence, it has been re-established in the country.

The Lesser Great Cormorant is a species of bird that has belonged to the Swedish fauna for a very long time and for which there is archaeological proof.

It is important to ascertain that the Lesser Great Cormorant is a natural part of the Swedish fauna.

In the same year, Edling Olsson of Öland writes in a debate article: “**The plague of cormorants in the county of Kalmar**” in the Professional Fishermen magazine (edition 3, year 2000) regarding the arrival of cormorants in the county:

... One of these was Svartö close to the southern border. This was where Bengt Berg planted out cormorant eggs from Denmark. He placed the eggs in a heron's nest on the protected area of Svartö. On the way from Denmark, Berg first showed the eggs to Count Wachtmeister outside Karlskrona and then to Axel and Emilie Mannerskantz at Wärnanäs. This was in 1942.

Bengt Berg then lived at and owned the Bokenäs property. At Wärnanäs, he leased a large park area that was surrounded by a high wire fence. He kept deer and some other animals there as well as a number of cages containing other birds. The property was sold in 1975 and the leased area was returned to the estate.

In 2001, an essay entitled: “**The occurrence of the Great Cormorant *Phalacrocorax carbo* in Sweden, with special emphasis on the recent population growth**” was published (ORNIS SVECIA 11:155-170, 2001). There, the author Henri Engström quotes a work by (Ericson, P.G.P. et al, 1997) under “Results”:

Archeological data

Based on bone sizes, the prehistoric Baltic cormorants appear all to have belonged to the nominate subspecies (*Ph.c.carbo*).

...

Recent history

In the literature, the presence of cormorants in Sweden was mentioned probably for the first time, in 1555 (Olaus Magnus). Possibly, cormorants (*sinensis*?) bred in Sweden at that time. Later, in the 1690s, the famous naturalist Olof Rudbeck the Younger observed cormorants on several occasions at an expedition to northern Sweden (Brusewitz 1985). A cormorant in breeding plumage was also shot by this expedition in the Bothnian Bay. Neither Olof Rudbeck (1660-1740) nor Linnaeus (1707-78) mentioned any presence of breeding cormorants from their journeys in Sweden, and most likely, cormorants did not breed in Sweden during the 17th and 18th centuries.

In the 19th century, cormorants are known to have inhabited some lakes and coastal areas in the provinces of Skåne and Blekinge (Ekman 1922, Andersson et.al 1984 and references therein). In Blekinge, colonies were known from Saltärna (Ronneby archipelago), Dragsö (Hoby parish) and Tromtö (Karlskrona), and possibly they bred also at other sites. It is unknown when cormorants became established in Blekinge, but probably it occurred in the early 19th century. The distribution of cormorants in Skåne seems to have been somewhat more restricted than in Blekinge, and colonies are only known from Lake Krageholm and Lake Snogeholm. The colony at Lake Krageholm probably became established some time during the early 1870s. The total population within Skåne, and possibly also in Blekinge during the 19th century, most likely was small, breeding irregular, and never included any large concentrations similar to present day levels. For example, the colony at Lake Krageholm contained some 50 pairs after some years of existence. Two *Ph.c. sinensis* shot at Lake Krageholm in April and May 1881 (stored at Lund Zoological Museum) suggest that breeding cormorants in Skåne and Blekinge belonged to the subspecies *Ph.c. sinensis*. At Lake Krageholm, and probably Skåne as a whole, the cormorants seem to have disappeared at around 1881 due to destruction of nests and hunting (Neander 1918). ...

Nevertheless, probably no breeding occurred in Sweden after 1909, at the latest, and the cormorant did not reappear as a breeding species in Sweden until the late 1940s.

...

Discussion

Historic populations

Archaeological data indicate that the Great Cormorant has a long history in Sweden and inhabited the Baltic region since the last ice-age. Although the precise geographical distribution and the numerical abundance of these cormorants cannot be determined, it is highly probable that the populations seen today are larger and cover a wider area than any time before. When the former breeding subspecies *Ph.c.carbo* became extinct and replaced by present day *Ph.c. sinensis* is unknown, but the youngest remains of *Ph.c.carbo* found at archaeological excavations are from around 800 – 975 AD (nestlings) and for adults around 1300+/-50AD(Ericson & Hernandez Carrasquilla 1997). It seems therefore to me that breeding populations of *carbo* must have become extinct at the earliest around 1000AD, and no later than around late 1600AD. The cormorants observed (and also shot) by Rudbeck in the late 17th century most likely were *Ph.c.carbo*, coming from the coast of Barents Sea or the White Sea where this subspecies breeds. The occurrence of breeding *Ph.c. sinensis* for the first time in the early 19th century, indicates a minimum time period of at least 100-200 years when most likely no cormorants bred in Sweden.

In the early 19th century *Ph.c. sinensis* became established probably for the first time in Sweden. Cormorants established also in Denmark around this time (Jespersen 1949 in Berglund 1958).

...

At a European level, most of the few existing colonies during the 19th and early 20th century in the Netherlands and Denmark were subjected to human persecution (Zijlstra & van Eerden 1989; Gregersen 1989). Although the existing information being fragmentary, human persecution presumably was an important factor responsible for the disappearance of the cormorant as a breeding species in Sweden sometime in the late 19th or early 20th century.

2001

Very worthy of consideration is the signature Ture Tætting chronicle called “**The Swedish Board of Fisheries and the Cormorant**” in *Vår Fågelvärld* [Our Bird World] 6, 2001. TT attacks the Swedish Board of Fisheries’ ignorance where cormorant systematics are concerned as manifested in the report entitled “**Small-scale coastal fishing and lake fishing - an analysis**” (The Swedish Board of Fisheries, 2001). TT suggests that the Swedish Board of Fisheries should, rather than the “madness” in the report, write something such as the following:

Cormorants are birds that live on fish and are distributed virtually world-wide. Three species occur in Europe, but of these, only the Great Cormorant (*Phalacrocorax carbo*) conflicts with fishing. Of the latter-mentioned, two races occur in European waters: the “lesser great cormorant” (*Ph. c. sinensis*), which is primarily linked to lakes and brackish water environments, and the Atlantic Great Cormorant (*Ph. c. carbo*), which is linked to the marine environment.

...

“The strong cormorant expansion in recent years in terms of both population and geographic distribution applies to both the Lesser Great Cormorant and the Great Cormorant”. This is a modified truth. Counts at the southern half of the Halland coast in January instead indicate a reduction in the number of overwintering Great Cormorants (there are mainly Atlantic cormorants in the winter).

Both of these races should be differentiated between in the debate on the cormorant. If in the near future we were to be allowed to hunt the cormorant, this permission would need to be formulated so that hunting covered the expanded population of the “Lesser Great Cormorant”, and not the far less expansive population of the Atlantic Great Cormorant.

SOF drew up an information sheet in the same year with the support of the **Worldwide Fund for Nature (WWF)**: “**The cormorant is better than its reputation**”, (Engstöm, H. 2001). There, you can also read:

The Great Cormorant disappeared as a breeding bird in Sweden at the end of the 1800s, probably due to human persecution.

Vår Fågelvärld [Our Bird World] (2 of 2002) contains an informative paragraph on the cormorant:

The black bald-headed raven from China

The cormorants' genus name *Phalacrocorax* comes from the Greek falakros “bald” and korax “raven”. Now, the cormorant is neither bald nor a raven, but the thinking is comprehensible. Owing to their size and colour, cormorants have sometimes been called sea ravens (even sea capercaillie for that matter), and with the lighter colour and shorter head plumes, may perhaps be said to give the impression of being bald. The Great Cormorant's species name *carbo* comes from the Latin *carbo* “(char)coal” and refers of course to the bird's black plumage. If we also specify the Lesser Great Cormorant, the race that breeds in Sweden, we get the race name *sinensis*, which is Latin for “from China”. This seems reasonable to the extent that the race actually exists in China. Otherwise, it is unfortunately not uncommon to have species who are named after places where they absolutely do not exist.

By way of summary, *Phalacrocorax carbo sinensis* means the black-headed raven from China.

Tommy Tyrberg

In 2002, the Swedish Environmental Protection Agency in consultation with the Swedish Board of Fisheries drew up a “**Management plan for the Lesser Great Cormorant and Great Cormorant, Species designation: Great Cormorant (*Phalacrocorax carbo carbo*) and Lesser Great Cormorant (*Phalacrocorax carbo sinensis*)**” (Engström, H. 2003, Report 5261).

Summary

The overall aim, just as for other naturally-occurring plant and animal species in Sweden, is to give the cormorant conditions to survive under natural conditions and in robust numbers. The cormorant's increase in recent years should be seen as a re-colonisation of an earlier distribution area.

...

Status description

Distribution and status

From the management point of view, the races are comparable in several cases but not in some cases. Some literature uses the Great Cormorant synonymously for both races. All cormorants breeding in Sweden are highly likely to be Lesser Great Cormorants. The Great Cormorant breeds primarily in central Norway and on the United Kingdom's coasts but is found on Sweden's coasts and lakes during winter.

...

Final comment

Finally, we should emphasise the positive aspect of having a species that has been heavily persecuted by humans for a long time and has disappeared from many countries, including Sweden, returned and is now once more a natural part of the Swedish bird fauna.

The Swedish Board of Fisheries has handled the cormorant in a number of contexts. Examples include the article entitled "**Charming and Frightening**" (Sött & Salt 1: 2004), where it is written:

The cormorant is protected in the EU and, irrespective of what people think of the bird, it has made a strong comeback in the Swedish fauna.

Under the heading "**Which bird?**" (Vår Fågelvärld [Our Bird World] 66:6, 2007), Magnus Ullman describes the way in which the Great Cormorant is determined in the field and finishes with the comment:

there is no reason to distinguish between the Lesser Great Cormorant and Great Cormorant.

The book called **Bird life – an insight into the way of life of 30 Nordic bird species** (Ulfstrand, S. 2007) contains a particular chapter entitled Great Cormorant (with an asterisk) and a note which reads as follows:

Unless otherwise indicated, this chapter refers to the race of the Great Cormorant, *Phalacrocorax carbo sinensis*, which is the one that breeds in Sweden and is sometimes called the "Lesser Great Cormorant". As discussed in Chapter 3, we do not, unless there are special reasons, give Swedish names to races, only to species. There is no reason to use the designation "Lesser Great Cormorant" for the Great Cormorants that breed in Sweden.

...

...sole representative of the order of pelicans in our breeding bird fauna, returned to our country after having been persecuted and eradicated, original in appearance as well as easy to see and recognise – surely a species with these characteristics must be warmly welcomed by the whole of the Swedish population?

...

It is proven that the Great Cormorant has bred in Sweden for thousands of years.

...

Periodically, the species has probably been common, e.g. in the 1500s, but at other times few in number, perhaps completely disappeared from our fauna.

...

The species was protected in the Netherlands in 1965 and in Denmark in 1971, and in 1979 it was excluded from hunting throughout the EU as a result of what is known as the Bird Directive. Sweden's entry into the EU in 1995 meant that it ultimately came to be protected by us as well;...

...

If not totally impossible, it is unlikely and not fully proven that Bengt Berg made an attempt to return the eradicated Great Cormorant to our country.

The Great Cormorant is just as natural a part of our fauna as something like the whooper swan or bean goose. It has probably existed in our country for at least equally as long as people have lived here.

...

Two races of Great Cormorant occur in Europe. The one that this Chapter focuses on, *Phalacrocorax carbo sinensis*, breeds in trees and on the ground and prefers to fish in fresh or brackish water. Birds of this particular race are usually tamed and used by fishermen in Chinese rivers; the race name *sinensis* means Chinese. The other race, whose full scientific name is *Phalacrocorax carbo carbo*, breeds on cliffs along the White Sea's, Norway's and the British Isles' coasts as well as in Brittany and Normandy.

However, molecular biology studies have shown that the Atlantic race is not uniform but consists of two genetically different populations: one Norwegian-Scottish, one English-French. As in other parts of North-western Europe, the British Isles the number of Great Cormorants has increased in recent times, not in the coastal colonies but probably inland. Many of the cormorants that breed along United Kingdom's rivers have proven to be hybrids between the "Atlantic race" and "the Baltic Sea race". An interesting circumstance is that all subfossil finds from cormorants in Sweden can definitely or highly likely be traced back to the Atlantic race. This applies also to those found around the Baltic Sea and the Gulf of Bothnia. As recently as 1695, Olof Rudbeck the younger painted a cormorant from the Norrbotten coastline, and his picture actually also definitely shows an Atlantic Cormorant in full breeding plumage. The Baltic Sea race clearly only colonised our country in later on.

"**Living Archipelago Nature 2008**", published by The Archipelago Foundation in the County of Stockholm in cooperation with Stockholm County Council, Stockholm University, The Museum of Natural History in Stockholm and The Swedish Society for Nature Conservation, gives an account of an inventory of Lesser Great Cormorant colonies in Stockholm's Archipelago in 2007, as well as some facts on the species:

The Great Cormorant (*Phalacrocorax carbo*) is one of around 30 cormorant species around the world. In large parts of Europe and in Sweden, a subspecies of the Great Cormorant that is usually called the Lesser Great Cormorant (*Phalacrocorax carbo sinensis*) breeds and thrives primarily in the shallow coastal area and lakes.

...

Cormorants are increasing not only in Sweden but also in other parts of the world where coastal waters and lakes are eutrophicated. The cormorant was previously a breeding bird in Sweden but disappeared, probably due to human persecution, at the end of the 1800s. It did not return until the 1940s where it bred in Kalmarsund, but it was not until the cormorant was given full protection (the Bird Directive, EU, 1979) within Europe that its growth took off and numbers recovered.

Sweden, Denmark and the Netherlands have the most important breeding areas for the species in Europe. We therefore have a special responsibility to protect and preserve cormorants and the environments in which the cormorants live.

Comments

The works quoted above are only a small selection from everything that has been published on the cormorant in Sweden in recent decades and much about the cormorant debate is both contradictory and confusing.

There are primarily two things that are bewildering - the incredibly fast exponential increase and the distribution of the cormorant in Sweden and throughout North-Western Europe, as well as the inconsistent handling of the taxon.

What? type of unit (taxon) do the details concern? Sometimes it is *P. carbo*, sometimes *P.c. carbo*, sometimes *P.c. sinensis*, sometimes both and sometimes it is unclear. Sometimes it is considered to be important to differentiate between *P.c. sinensis* and *P.c. carbo* while, particularly in later contributions, the relevant unit seems to be *P. carbo* since hybridisation between *P.c. carbo* and *P.c. sinensis* is common.

Where? and **When?** do we find details on each taxon?

Subfossils show that after the last ice age, *P.c. carbo* bred along Sweden's Eastern and Western coast. On the other hand, the claim that subfossils show that *P.c. sinensis* has bred in Sweden (or around the Baltic Sea) since ancient times is erroneous.

The first historical details on breeding of *P. carbo* in Sweden are from 1555 (Olaus Magnus) and are interpreted by the majority to be *P.c. sinensis*.

The instances of breeding that are documented in Skåne and Blekinge from the 1800s and possibly as late as the 1910s are most likely to be *P.c. sinensis*.

Breeding of *P.c. sinensis* was ascertained once more in 1948 in Kalmarsund and detailed information is available that is considered to verify that *P.c. sinensis* was introduced, which is something that is questioned by others.

Several of the quoted details and sources can be interpreted and assessed in another way and it is also possible to draw other conclusions. Particularly surprising is the uncritical interpretation of the details from Olaus Magnus in 1555 as well as the trifling impact that the scientific facts in the form of subfossils have had in the debate on the distribution history of *P.c. sinensis* in Sweden.

5. The distribution history of *P.c. sinensis* in Sweden based on subfossils

The details on existing subfossils of cormorant in Sweden and the rest of Europe have been strangely handled or completely disregarded. As early as 1997, an essay was published under the title of “**SUBSPECIFIC IDENTITY OF PREHISTORIC BALTIC CORMORANTS *PHALACROCORAX CARBO***” (Ericson, P.G.P. et al 1997, ARDEA 85:1-79).

This work is also quoted in some of the above works but, strangely enough, has had only a limited impact in the cormorant debate. The essay gives an account of studies of archaeological relics of skeletal parts, particularly the humerus (upper arm bone, my note.) of cormorants from habitats in Sweden on the West and South coast as well as the East coast up as far as Uppland.

Cormorants of the subspecies *Phalacrocorax carbo sinensis* breed in large numbers in the Baltic. They migrate to the Mediterranean region to winter and are replaced in the Baltic by wintering individuals of the Norwegian population of the nominate subspecies *carbo*. Cormorants bred in the Baltic during prehistoric times too, but as evident from comparison of skeletal measurements in present-day and prehistoric Cormorants, these individuals belonged to the nominate subspecies *carbo*. The Swedish subfossil record of the Cormorants available for study, does not include any remains small enough to suggest the presence of *sinensis*. Precisely when the subspecies *sinensis* immigrated into the Baltic is unknown, but it must have occurred sometimes between 1500 and 1800 AD.

....

A small sample of *P.c. sinensis* from the Neolithic (c. 3000 BP) of Bulgaria, kept at the Institute für Paläoanatomie, Domestikationsforschung Und Geschichte der Tiermedizin der Universität München, is also included in the study.

...

Discussion

The realization that prehistoric Baltic Cormorants belong to a subspecies that does not breed in the Baltic today, raises the question of how long Cormorants have bred in the region. The archeological record tells us that it is most likely they began to breed here as soon as favourable breeding conditions became available at icefree shorelines c. 10 000-12 000 years ago. Bone remains of nestlings and juveniles have been found at Skedemosse (Lepiksaar 1977), Stora Förvar and Birka (Ericson pers. obs.), indicating breeding on both Öland and Gotland, as well as in Stockholm archipelago. Thus, it is plausible that the nominate subspecies of the Cormorant has been widely distributed in the Baltic during most of Holocene. The subspecies *carbo* must have become extinct in the late Medieval (c 1500 AD) at the earliest, however, and replaced by *sinensis* to which subspecies the few breeding colonies in south Sweden in the last century belonged.

Principally the same details are also presented a few years later in **2004** in a book entitled **THE EARLY HISTORY OF THE SWEDISH AVIFAUNA, A review of the subfossil record and early written sources** (Ericson & Tyrberg 2004).

The following is written under the heading “Species accounts”:

PHALACROCORACIDAE

Comorant *Phalacrocorax carbo* (Linnaeus 1758)

...

Today, Cormorants of the race *Phalacrocorax carbo sinensis* breed in colonies along the Baltic coast of Sweden from Scania to Norrbotten and, more sporadically, along the west coast. Numbers have increased explosively in recent years, and many colonies have also become established inland in southern Sweden. At least one inland colony also existed in Scania during the nineteenth century, and it seems quite likely that the subfossil birds from Skedemosse may be from birds breeding in the vicinity.

The *P.c. sinensis* population winters in the central Mediterranean and is then replaced in the Swedish waters by individuals of the nominate subspecies *P.c. carbo* which have their closest breeding grounds along the coast of Norway. The subfossil records show that Cormorants have existed in Swedish waters at least since the Preboreal, and they may have found favourable breeding conditions quite soon after the shorelines became ice-free. The question of which subspecies the subfossils belong has, due to lack of comparative material, not been addressed until recently (Ericson & Hernandez Carrasquilla 1997). This analysis shows that no *P.c. sinensis* can be definitely identified in the subfossil record. The size range of the subfossil Cormorants from Gotland, at least, corresponds to *P.c. carbo*, and exceeds by far that of *P.c. sinensis*. Since bones from fledglings occur in the material it is clear that Cormorants of the nominate subspecies bred in the Baltic from the Atlantic to the Middle Ages.

Though the Cormorant was apparently a common breeder in Sweden during the sixteenth century (Olaus Magnus 1555), by the eighteenth century it was regarded as an uncommon non-breeding visitor along the Baltic coast of Sweden (e.g., Ödmann 1792), though it apparently still bred in Finland (Gadd 1769). Rudbeck (1669-71, Rudbeck et al 1985), however, painted an individual in full breeding plumage on the coast of Norrbotten in the summer of 1695. This bird is *P.c. carbo*, which suggests that this subspecies bred at least occasionally along the coast of Norrbotten. From the nineteenth century a few breeding colonies are known from Scania and Blekinge, but the species was obliterated as a breeding bird around 1909, and it was then extinct as a breeding bird in Sweden for about 40 years.

Comments

What?

It is possible to identify *P.c. carbo* and *P.c. sinensis* in subfossils with great certainty.

Where? and When?

Subfossils of *P.c. carbo* have been found at a large number of sites along Sweden's coast but none of *P.c. sinensis*.

A find of around 3 000 year-old relics of *P.c. sinensis* from Bulgaria indicates a "prehistoric" existence in the Black Sea area.

There is no evidence in either the subfossil finds from historical sources (sic), apart from Olaus Magnus in 1555, to indicate that *P.c. sinensis* bred in Sweden before 1800. It is slightly surprising how uncritical Ericson & Tyrberg (2004) are in their repetition of the details from Olaus Magnus in 1555 as well as their lack of analysis and discussion of the fact that *P.c. carbo* "was replaced" by *P.c. sinensis*. An in-depth analysis of the details in the sources that are listed in "References", "Unpublished sources" and "A comprehensive list of references on the Swedish avifauna before 1800" should be able to throw additional light on *P.c. sinensis*' distribution history in Sweden.

An in-depth analysis of the finds and habitats and times accounted for in "**Pleistocene Birds of the Palearctic: A Catalogue**" (Tyrberg, T., 1998) (unfortunately not available to me) under the designation *P. carbo* should be able to provide additional important information on the "prehistorical" occurrence of *P.c. sinensis* in Europe and the Western parts of Asia.

6. Distribution and development of *P.c. sinensis* in Europe

The debate on the Swedish cormorant expansion must be seen in a wider European context. The expansion, in terms of both numbers and geography, of *P.c. sinensis* that has taken place in Europe in recent decades has started from two “core areas”, one in North-Western Europe (the Netherlands/Germany/Denmark) and one in South-Eastern Europe (where the Black Sea opens out). There are significant likenesses between the areas of the time for the expansion, but also significant differences, particularly where historical documentation is concerned.

Some of the works cover both of the “core areas” while others cover mainly one of them. There are a significant number of studies from the North-Western core area while the details from the South-Eastern core area are for various reasons more difficult to get hold of and also more fragmented.

The following shows some literature details from the 1960s onwards in chronological order.

An often quoted work concerning the distribution history of cormorants in Europe, particularly on the Continent and east thereof is the “**Handbuch der Vögel Mitteleuropas**” (Bauer, K.M. et al, 1966). Here, the following is written on the systematics and distribution of the species and subspecies:

Phalacrocorax carbo (Linné 1758)- Kormoran

Verbreitung der Art. Europa, Asia, Africa, Australien, NordAmerica und Grönland.

...

Rassengliederung. 7 Rassen, davon fünf in der Paläarktis: *carbo* an der the coast NW-Europes, *sinensis* in Mittel- und SE-Europe und weiten Teilen Asias, *hanedae* (kleiner als *sinensis*) in Japan, *maroccanus* (...) an der the coast im Sudwesten Marokkos und *lucidus* auf the Kapverden und an the the coast Africas sudwärts von Senegal und Kenya.

Phalacrocorax carbo carbo (Linné 1758)

... **Brutgebiet.** Kola-Halbinsel, Nordfinnland, Norwegische Kuste (sudwärts bis Rogaland, jetzt bis Lofoten), Britishce Inseln (verbreitet), Färöer (spärlich), Island, im Süden und Westen Greenlands nordwärts bis 72o N und NordAmerica (von Sudlabrador bis Neuschottland).

...

Vorkommen in Mitteleurope. (NB: Far too comprehensive to quote: Various finds in the Netherlands and Germany. Not yet in Luxemburg, Austria, Hungary and Czechoslovakia², my summary).

...

Biotop. Vorwiegend marin. Brutet meist auf Klippen, nur ausnahmsweise auf Bäumen (Gregory, Brit. Birds 41, 1948). Hält sich auch zur Zugzeit and die Kuste; fischt aber regelmässig auch in brackigen und the coastnahen sussen Gewässern.

Phalacrocorax carbo sinensis (Shaw & Nodder 1801)

not 1 syn.: *Ph. carbo subcormoranus* Brehm

Brutgebiet. In Europe sporadishers Vorkommen in SW-Schweden (Kalmarsund), Dänemark (seit 1938 wieder in Fjorden Ostjutlands und der Inseln Seeland und Laaland), Polen, Norddeutschland, in the Niederlanden, in Belgien und

² Translator’s note: it is assumed that this name is intended, although it is now known as “the Czech Republic.” This also applies elsewhere.

Nordfrankreich (Picardie, Normandie, Bretagne; 1920 ausnahmsweise im Binneland, nämlich am Stausee von Settons/Nièvre, Guichard, Alauda 22 1954). Für Sardinien, Mittel- und Südeuropa und Sizilien fehlen mindestens aus neuerer Zeit Brutnachweise. - In SE-Europa von Österreich, Tschechoslowakei und Ungarn über Jugoslawien, Albanien und Griechenland bis zum Schwarzen und Asowschen Meer, am Unterlauf des Dnjepr nordwärts bis Tscherkassy, dann am Kaspischen Meer im Mündungsgebiet des Terek und an der Südküste (Murdab, Namakrudmündung, Nauschar, Mahmudabad, Schüz 1959) (Schüz, E.: Die Vogelwelt des Südkaspischen Tieflandes. Schweizerbart, Stuttgart 1959 min. kompl.), am Unterlauf der Wolga nordwärts bis Stalingrad/Wolgograd und an der Ostküste südwärts bis Karabogaz. Ferner (additional, min. übers.) an einigen Seen zwischen Unterlauf von Wolga und Ural.

In Asien am Aralsee und am Unterlauf von Amu Darja, Syr Darja und Tschu (nördlichste Vorkommen in Westsibirien am Tschany-See in der Barabasteppe unter 550 n. Br. und am Tschornoje-See zwischen Tjumen- und Kurgan-Distrikt bei 560 n. Br.); weiter ostwärts in den Senken von Balchasch-See, Saissan-See und verschiedenen Seen in der Gegend von Tuwa (im Altaigebirge brütet er bis zu 2200 m Höhe), dann am Baikalsee am Oberlauf des Amur und im Stromgebiet des Ussuri. Ferner auf dem indischen Subkontinent vom Tal des Sind bis Assam und südwärts bis Ceylon (Ripley 1961 (Ripley, R.S.D.: A synopsis of the birds of India and Pakistan, together with those of Nepal, Sikkim, Bhutan and Ceylon. Bombay Nat. Hist. Soc. & Peabody Museum, Yale Univ., New Haven 1961, my com.). In Nordafrika soll *sinensis* an der tunesischen Küste ganzjährig beobachtet werden und auf der Insel Chikli als Brutvogel nachgewiesen sein (Deleuil, Oiseau 28, 1958).

“Verbreitung in Mitteleuropa”

A very comprehensive chapter is devoted to the distribution of *P.c. sinensis* in Central Europe. The first documented breedings were in heron colonies. In Germany, one colony was established in Holstein in 1810 but was hunted in 1816 (1660 nests were destroyed, whereupon the cormorants spread to other heron colonies). Up until 1870, breeding occurred in several places in East Holstein, in 1876 by Haderslebener Fähre and until 1881 in one heron colony in Julianka by Itzehoe, and there are further details on breedings in the 1900s. In East Prussia, it has bred by Mahrungensee at Osterode since 1823. The following is written where the Netherlands are concerned; “In den Niederlanden brütet der Kormoran seit Menschengedenken” and, more specifically, that in the mid 1800s there were three large colonies “auf der Insel Schollewaarse bei Nieuwerkerk an der IJssel (A), am Hørsensee bei Vreeland (B) und in einer Entenkoje bei Geithoorn (5)....

In Belgium, cormorants have bred only in a few small colonies over the past few years.

In Austria, breeding of *Ph. carbo* is “im Bereich der Donauen des Wiener Beckens” and until 1924, a large colony by Lobau near Vienna.

In Czechoslovakia, it is thought to have bred in Böhmen “in the past”, but this is not discussed in “Die Wirbelthiere Böhmens” from 1873. In Hungary, breeding was ascertained only in 1947.

In Switzerland, the “Cormorant” does not appear as a breeding bird during C. Gesner’s (great Swiss nature researcher, my note) time, 1516-1567.

Another important and often-quoted work on the bird fauna in Europe is “**The birds of western Palearctic. Vol I.**” (Cramp, S. & K.E.L. Simmons eds., 1977).
In this, the following is written about cormorants, quoting the above work among other things:

Family PHALACROCORACIDAE cormorants, shags

...

About 30 species...

In west Palearctic, 2 of breeding species found only in south; of remaining 3, Cormorant *P. carbo* and Pygmy Cormorant *P. pygmeus* reduced, especially inland colonies, by drainage but also by human persecution, while the marine Shag *P. aristotelis* has shown no marked changes in range. Only continental race (*sinensis*) of *P. carbo* and Caspian population of *P. pygmeus* truly migratory.

...

***Phalacrocorax carbo* Cormorant**

...

Polytypic: Nominate *carbo* (Linnaeus, 1758), coasts North Atlantic; *sinensis* (Blumenbach, 1798), central and south Europe, Asia east to Japan and south to Ceylon; *maroccanus* Hartert 1906, coast north-west Africa; *lucidus* (Lichtestien, 1823), coasts west and south Africa and inland east Africa. Extralimital: *novaeollandiae* Stephens, 1826, south New Guinea, Australia, New Zealand, and Chatham Islands.

...

Field characters

...other west Palearctic races. Eurasian race *sinensis*: plumage glossed dull green, throat whiter than in *carbo* and hair plumes over crown to back and sides of neck complete and silvery-white; but old males of *carbo* often show similar marks.

...

Population

...

Britain and Ireland: ... Probably decreased in 19th century when tree-nesting colonies in Norfolk abandoned...

Denmark: bred until c. 1876 when became extinct...

Sweden: also became extinct 19th century, but has bred again since late 1940s,...

West and East Germany: Formerly bred in northern areas with many lakes; full history of numerous small and large colonies in Bauer and Glutz (1966).

Hungary: only 1 regular colony, .., found after 1962, ..

Rumania: numbers decreasing sharply owing to destruction of nests by fishermen (MT).

Greece: nearly extinct, in 1971, only 2 colonies with 540-570 pairs (WB).

Turkey: 4 known colonies, c. 800-900 pairs (OST).

...

Geographical variation

P.c. sinensis smaller than nominate *carbo*, especially bill; plumage glossed bluegreen rather than blue-purple, but variable and some *carbo* have green-glossed chest, some west European *sinensis* slight purple gloss;...

East and south-east populations of *sinensis* (those of Japan sometimes named *hanedae* Kuroda, 1925) average smaller in size but much overlap, *P.c. lucidus* like *sinensis* but smaller and greener; throat, breast, and sometimes belly white, *P.c. maroccanus* intermediate between *sinensis* and *lucidus*; throat and upper chest white (Mackworth-Praed and Grant 1970; Vaurie 1965)...

A full description of the cormorant population's development in **North-Western Europe** is given in an essay entitled "**Long-term changes in the Northwest European population of cormorants *Phalacrocorax carbo sinensis***" (van Eerden et al 1995 *Ardea* 83:61-79 1995). It states that since "immemorial" (ancient) times, cormorants have bred in the Netherlands, Northern Germany and Denmark. The oldest finds are dated as 4-6000 years ago in the Netherlands (Clason & Brinkhuizen 1978) (my translation):

Probably the species colonised the region much earlier, i.e. during the boreal, some 8-9 thousand years ago (Hansen 1984). Habitat loss occurred from 1200 on when man began to create new land out of lakes and the sea (cf. Zijlstra & Van Eerden 1991). However, the scarce descriptions from that period (1200-1500) do not indicate huge colonies to be present in the low parts of The Netherlands. At least they were not mentioned in mixed colonies at places with breeding Grey herons *Ardea cinerea* and Night herons *Nycticorax nycticorax*. From 1500-1600 Cormorants were reported to breed in several localities in The Netherlands (Brouwer 1954) and Denmark (Hansen 1984). The famous colony Zevenhuizensche Bosch in the province of Zuid-Holland flourished between 1600 and 1700, the birds being subsequently driven away by the peat diggers who destroyed the breeding marsh.

...

During the 19th century the birds became more and more persecuted as man faced a supposed competitor on their common fishing grounds. Similar developments in Germany during the 19th century caused a number of breeding pairs to move out into Denmark where a marked influx was noted again in the period 1820-1840, especially in the southern part of the country. In Denmark around 1775 an invasion became apparent which led to thousands of breeding pairs near Hvidkilde (province Svendborg) between 1780 -1790. Also here the persecution became so intense that in Denmark the species completely vanished between 1860-1880 (Gregersen 1982) while also from Schleswig-Holstein and Niedersachsen (1891) no breeding colonies were reported anymore (Knief & Witt 1983). Birds of the race *sinensis* were then strictly confined to The Netherlands, in the most western part of their range. The first half of the 20th century brought no relief with strongly fluctuating numbers and the breeding population never exceeded 4000 pairs. Even then the numbers were perceived as being too high, which resulted in an agreement with the Fisheries Authorities, stating that country-wide no more than 1200 breeding pairs should breed successfully (Coomans the Ruiter 1966). Recolonisation of Denmark occurred at Vorö, Jylland in 1944, during the Second World War, only two years after the huge land reclamation of the Noordoostpolder (42 000 ha, 1942) in the area of lake IJsselmeer in the Netherlands, which had caused the birds to switch colonies again. After a strong decline of the population during the 1950s and early 1960s, due to the combined effects of land reclamation (Oost-Flevoland, 54 00 ha, 1957), disturbance and the new factor of chemical pollution (Koeman et al. 1972) critical numbers of just 800 pairs in two colonies remained in 1962 (G.A. Brouwer). After protection measures had been taken, first in Netherlands (1965) and later in Denmark, a recovery started which coincided

with a European-wide protection under Annex 1 of the EC Bird Directive (1979) resulting in an expansion of the population which was hitherto unexperienced.

At about the same time as the essay above, another essay, “**Status and population development of breeding cormorants *Phalacrocorax carbo sinensis* of the central European flyway**” (Lindell et al *Ardea* 83:81-92, 1995) was published which, in spite of its title, instead describes the development of the Eastern expansion of the *P.c. sinensis* “population” in the “North-Western” core area.

...

The continental subspecies of the European Cormorant *Phalacrocorax carbo sinensis* traditionally had a significant breeding nucleus in central and eastern Europe from Czech Republic and Slovakia in the south to southern Sweden in the north (Cramp & Simmons 1977).

...

Discussion

After the severe human persecution until halfway this century, the continental Cormorant had become a scarce and very local breeding bird all over Europe, with its strongholds in The Netherlands and Denmark (Hansen 1984). Any recovery would have been likely to start in its western range, first increasing there and then expanding eastwards. Indeed the first sign of recovery were noted in the Netherlands and Denmark during the 1970s, with the most impressive growth rates being reached from 1980 onwards (Van Eerden & Gregersen 1995).

...

It is therefore likely to assume that the increase of Swedish, eastern German and Polish Cormorant populations was initiated simultaneously with and independently from the increase of Dutch and Danish populations. The more recent settlements in the Czech Republic, Slovakia and the Baltic states would seem to represent an expansion of the range of the growing central European population into areas abandoned in the past.

In 1996, the essay entitled “**The development in the population of Lesser Great Cormorants in Northern and Central Europe 1960-1995**” (Bregnballe, T. 1996 *Danish Ornithological Society’s Magazine*. 90) was published:

Introduction

The Lesser Great Cormorant, *Phalacrocorax carbo sinensis*, which now breeds and is represented in several populations in Europe and Asia (del Hoyo et al 1992) have over the past 25 years managed to build up a large breeding population in Northern and Central Europe and have now spread to most countries in Europe.

...

Results

In the 1960s, conditions in Europe were difficult for the Lesser Great Cormorant ... In Holland, the number of breeding pairs fell from a maximum of around 4622 pairs in 1940 to 800 pairs in 1962 due to damming, interference and pollution. In Belgium, the last colonies disappeared in 1964, in Germany there were between 920 and 1260 pairs in 1961-64 (of which only 50-60 pairs were in West Germany), in Poland there were 1800 pairs in 1959 and 1500 pairs in 1965, in Denmark 150-255 pairs in 1960-65, and in Sweden 100-150 pairs in 1965. So, at the start of the 1960s, a total of 3500-4300 pairs of Cormorants bred in these countries. In 1971, the total population was still only around 4900 pairs.

...

In line with the growth in Northern Europe, the Cormorant expanded its distribution area and the number of colonies throughout Northern and Central Europe grew from around 15 at the start of the 1960s to around 176 in 1992. Between 1982 and 1999, the Lesser Great Cormorant migrated back to at least 11 countries.

...

England, France, Belgium, Italy, the Czech Republic, Slovakia, Estonia, Latvia, Lithuania, Russia and Belarus.

In England and France, it is still unclear as to how large a share of birds of the subspecies *P.c. carbo* makes up the breeding pairs that have established themselves in the country, but there is much to indicate that *P.c. sinensis* is dominant (Marion 1995b). In several cases, the expansion to the South and West took place in a way that Cormorants stayed in the overwintering area and established colonies in locations used for daily rest or staying overnight. Readings of colour ringed cormorants have shown that Danish Cormorants have helped to form colonies in Italy, Southern Germany, England and France.

...

Discussion

The marked growth that has brought the Northern and Central European populations of Lesser Great Cormorants to more than 40 % of the world population (del Hoyoo et al, 1992, Rose & Scott, 1994) was in any case partly caused by a less control and more preservation measures.

An abstract from an essay entitled “**The cormorant *Phalacrocorax carbo* in Ukraine**” (Poluda et al, 1997 *Ecologia Polska* vol. 45) contains the following information:

During the last 10-15 years a significant increase of the cormorant (*Phalacrocorax carbo*) breeding population has been observed in Ukraine, in 1984-1987 the total number of breeding cormorants fluctuated from 1000-4500 pairs. The current total population is estimated at c. 24 000 breeding pairs. The main breeding area is situated along the coastal habitats in the southern parts of the country.

“**Kormorane im Niedersächsischen Binnenland**” (Akkerman, R. 2001 BSHMerkblatt 65):

Westliche und östliche Unterart

...Die Vertreter der östlichen Rasse mit ursprünglich zwei Populations-Schwerpunkten in den Anreinerländern der Ostsee und der Ukraine/Donau haben sich jetzt in Dänemark, Holland und Deutschland vorherrschend angesiedelt.

...

Historischer Rückblick

...Kormorane wurden ununterbrochen verfolgt, manchmal sogar mit militärischen Einsätzen...

Im Binnenland des heutigen Niedersachsens gab es nach Brinkmann (1933) Kormorane bei Poppenburg an der Leine (1788) auf dem Kirchturm in Zwischenahn (1790), in Hannover-Münden (1792, 1913) in Wolfenbüttel (1826) und Riddagshausen (1896). Auch brüteten Kormorane wiederholt bei Schnakenburg (1867) Im Jahre 1867 erschienen “enige Dutzend” in der etwa 100 Nester zählenden Reiherkolonie Bleckede an der Elbe und verblieben dort bis Juli. Wiepken & Greve (1876) erwähnen einzelne Vorkommen der “Kormoran-Scharbe” an der Küste und im Binnenland. Im Jahre 1900 galt der Kormoran in Deutschland und Dänemark als ausgestorben (ÖKF 1966).

Comments

What?

The majority of the works discuss *P.c. carbo* and *P.c. sinensis* as two separate units.

Where? and When?

There are relatively few available details on *P.c. sinensis* in South-Eastern Europe and these indicate an expansion of the breeding area from Austria to the South-East to where the rivers flow into the Black and Caspian Seas, from there in a continuous course up to the Tien Shan mountains and further eastwards to China. It is unclear as to whether the details from Shuz (1959) and Ripley (1961) refer to breeding during the 1950-60s or earlier.

There are few older historical details, no details on “Cormorant” breeding in Switzerland during the 1500s (Gesner). The details that are available on breedings in South-East Europe are principally from the 1800s and thereafter.

During recent decades, *P.c. sinensis* has expanded strongly in the Ukraine and the neighbouring areas, despite lack of special legislative “protection”, which led to a rapid increase in the number of overwintering *P.c. sinensis* in Israel.

The details on *P.c. sinensis* in North-Western Europe are more comprehensive. Most of the details are from the Netherlands, Germany and Denmark.

Some works indicate that cormorants have bred in the Netherlands “seit Menschengedenken” and “immemorial times”, although it is unclear as to whether the details on the 4-6000 year-old subfossil “Great Cormorant” finds from the Netherlands (Clason & Brinkhuizen, 1978) are *P.c. carbo* or *P.c. sinensis*, but it seems reasonable to assume that they are *P.c. carbo*. There are no details on “cormorant breedings” in the Netherlands between 1200 and 1500.

The first details on (tree?) breeding cormorants (*P.c. sinensis?*) are from the Netherlands and Denmark “from 1500-1600” and are more common during the 1700s and 1800s.

An initial major spreading that started from the Netherlands, right up to Sweden (Skåne and Blekinge) appears to have occurred at the end of the 1700s and during the 1800s and was combated using military means. The decimation was so effective that at the start of the 1900s, only a few remnants remained in various countries. In the Netherlands, there were only 800 breeding pairs in 1962. From around 1970, the second wave of expansion resulted in a distribution of *P.c. sinensis* principally from the Netherlands/Germany/Denmark northwards to Sweden and Finland, eastwards to Poland, the Czech Republic, Lithuania, etc., westwards to the British Isles, south-west towards France as well as south-east to Italy. Part of this spreading, to the south and south-west, is explained by the fact that young overwintering birds stay and breed in the overwintering area.

There are no historical details confirming breeding *P.c. sinensis* around the Baltic Sea before the end of the 1700s.

The new establishment (introduced or spontaneous) that took place in Sweden as early as 1948 in Kalmarsund may coincide with earlier, smaller waves of distribution.

The majority of information indicates that *P.c. sinensis* during historical times, particularly after the year 1700, extended its breeding area in Europe far beyond that which can be scientifically verified through things such as subfossil finds.

7. Older details on cormorant breeding in Sweden and the Nordic countries

There are details on “cormorants” in several early works concerning the bird fauna in Sweden and the Nordic countries. The earliest, for reasons that can be explained, do not differentiate between *P.c. carbo* and *P.c. sinensis*, whereas works from 1800 and the early 1900s comprehensively discuss different “varieties”, species or subspecies of Great Cormorant. Of particular interest are details on breeding, particularly tree breeding, although the works that do not show such details are also of great interest.

1539

In Venice in 1539, Olaus Magnus published a large woodcut map of the Nordic countries, **Carta Marina**. In the picture of Carta Marina that is reproduced on www.wikipedia.org, you can distinguish two depictions of web-footed birds eating eel that are very probably supposed to represent “cormorants”. On the map one is positioned somewhere that could be Trondheimsfjorden and the other is in the White Sea. Both may represent *P.c. carbo* since the places coincide with the current distribution the (my note).

1555

In Olaus Magnus’ “**HISTORY OF THE NORDIC PEOPLE**” (in an extract by Knut Hagberg, Gebers, 1963), written during the exile of Sweden’s last Catholic Archbishop and originally issued in Rome in 1555, the cormorant is mentioned in a Chapter:

On sea ravens (cormorants)

*Water ravens predatory - Very annoying birds - Start of winter - Morfex - Fat prevents flight
Humusculus*

There is also another type of raven called the water raven or eel crow. These are charcoal apart from on the chest and abdomen where they are grey. Their greed is extraordinary. They hunt fish, fly sluggishly and stay underwater for a long time when they dive. Their bill is equipped with a crooked tip like a Grim Reaper’s sickle. With this, they grab hold of fish, particularly eels, that they hunt and devour with such greed that they are allowed to exit the gut alive as though through a chute. These birds also have the most annoying habit of allowing their droppings to dirty the tree’s bark and branches in the place where they congregate to the extent that these suddenly wither. And so the heron which, like this raven, also builds its nest in high trees close to water abounding with fish, as do nearly all water birds. In the spring, they will be hatching out their eggs.

There is yet another raven species (the halcyon) that at the start of winter builds a nest in seven days and sits on the eggs for seven days. At the start of winter, here meaning the period when one quarter of the sky leads to winter, i.e. from the time when the sun enters Capricorn’s winter sign until it reaches Aeries. Related to this unpleasant raven species is yet another water bird called Morfex (cormorant), which is totally black. It looks very much like the former and has a saw-like bill and strong claws. It uses them to grip large fish while hunting, diving down into the sea and then eating them up. They build in big crowds in trees close to water and feed their young with fish. If they have a heavy stomach when they leave the nest, they vomit what they last ate, otherwise it would be lost. When they are full they spread out their wings to dry them in the sun and ship along the water with their tail before taking flight. They have therefore also been given another name: *Humusculus* or *Humidusculus* (wet tail). This bird occurs on all beaches in the Nordic countries in summer and winter.

The details from Olaus Magnus have been used very uncritically in the Swedish cormorant debate. In an essay entitled “**Swedish bird knowledge of older times**” (Bernström, J. in SWEDISH ANIMALS, The Birds, ed. Svärdsson, G. and Durango, S. 1950), the following comments are made on “Historia de gentibus septentrionalibus”:

In a certain way, “History of the Nordic People” can be seen as a verbose comment on an older work, Olaus Magnus’ large woodcut map of the Nordic countries, the “Carta Marina”, printed in Venice in 1539. This map depicts, among much else, a number of birds that the author thought were typically Nordic; for reasons of space, they have been placed within the map’s outer area and with one single exception, outside Sweden’s current borders. These are the oldest printed depictions of Nordic birds: ..., Great Cormorant (in Nordland in Norway and in the White Sea),...

...

... unfortunately, seen as an historical Swedish ornithological document, the importance in no way corresponds to its scope. Most of the representation consists of as good as word-for-word reproduced literary loans from a large number of older authors, particularly Plinius and the learned scholars Albertus Magnus and Vincent de Beauvais, both of whom lived in the 1200s; first-hand details concerning the Nordic bird world are thus few and far between and only with exceptions suitable to shed light on bird distribution during the first decades of the 1500s. When formulating his lengthy work, Olaus Magnus probably availed himself of what are now unknown original drawings that he replaced with quotations from literature to a deplorable extent when these seemed to him to correspond to actual conditions.

...

The Lesser Great Cormorant is said (by Olaus Magnus, my note) (XIX:8) to exist on all beaches in the Nordic countries in summer and winter; their nest building is comparable with that of the heron”.

...

The Swedish subfossil bird bone finds are relatively few in number and almost always difficult to use to determine the species. ... As good as all finds have been made in cultural layers and could therefore as a rule be perceived to be remains of our ancestors’ meals;...

...

Not until **1611**, the year of Carl IX’s death, were known literary works jointed up from this stage, all of which concern ornithological questions, i.e. “Physical or Natural things, Description of Qualities and Characteristics”, a hitherto unprinted natural philosophical work (manuscript in the Swedish Royal Library) by the remarkable priest Sigfrid Aron Forsius. One of its Chapters (VI:7) discusses sea birds, i.e. all birds with webbed feet and another (VIII:15) land birds; they are divided because the author thought that the former was made of water (cf. 1 Mos. 1:20-21), but the latter of earth and air. Aristotle is quoted in several contexts, but the majority of the depiction reproduces bird fables from the middle ages:...

...

...the birth of Swedish ornithology history can probably be said to be the afternoon of 22 May 1695 when Olof Rudbeck the younger at Älvkarleby in northernmost Uppland shot a male wryneck and gave it a scientific description.

...

Olof Rudbeck tells in "Nora Samoland" [Northern Sami Land (issued in **1701** in Uppsala, my note) of his intention to gradually publish a work illustrated with copper plates "concerning all birds here in the Nordic countries, their havens, places, shapes, characteristics, species and nature". The renowned Rudbeck bird pictures that brilliantly reproduce in colour almost half (47 %) of the bird fauna that in 1951 was considered to be Swedish, and that with few exceptions are still intact, could be thought to have come about as preliminary works to a similar project.

Regrettably it was never completed, although not prevented Rudbeck from indirectly having an unparalleled influence on later Swedish bird research. A careful comparative study of Carl von Linné's ornithological works shows that no fewer than 144 of the 191 bird species and -races in the current sense, that were included in "Fauna Svecica" in 1761 clearly refer to the Rudbeck illustrations. Linné has not managed to distinguish an additional 11 birds depicted by Rudbeck as being independent varieties. Although much has already been written about the Rudbeck bird pictures, including by such prominent ornithologists as Sven Nilsson (1816-17), Carl Jacob Sundevall (1872) and Einar Lönnberg (1930 and 1932), a good deal still remains to be added. The subsequent printing of the pictures would certainly not simply be a legacy of Sweden's first real ornithologist but would also come to constitute a considerable contribution to our bird literature, the scant existence in older times of which this depiction may have been able to provide an idea.

Very happily, Bernström's hopes were fulfilled through a fax edition of "**Fogelboken [the Bird Book] I-II, Rudbeck, Olof D.Y.**" (1985 René Coeckelbergh) (Unfortunately not available to me.)

However, a selection of Rudbeck's bird illustrations were published in "**Olof Rudbeck's Bird Book 1693 - 1710**" (in an extract by Gullander, B., 1971). One illustration depicts the "Great Cormorant" (very probably *P.c. carbo*, my note) and is supplemented with the text *Pelecanus carbo*, Linn. Syst. p. 133 no. 3 *Hafs-tiäder (Sea Capercaillie)*. The opposite page shows the following quote (in four languages):

Phalacrocorax carbo

Great Cormorant

Also got a sea capercaillie, which is completely black and the size of a wood capercaillie but with feet like a goose, black, strong and steady. His throat has some white speckles and the back is dark brown, he has a long bill, whitish, and at the end the upper part bends over the lower part. He always keeps this open while flying and, when he shrieks and flies away from the sea, the mariners take this as a sign that they can always expect storms and bad weather. The female sea capercaillie is just as big but somewhat greyer in colour. (From **Rudbeck's manuscript from the Lapland Trip, 1695**).

Corvus marinus aquaticus. Sea Capercaillie. Swims deep down. Is completely black with a bit of white under its bill and above the leg. In England they use him to take fish as falcons take birds, and tie a band around its throat to stop him from swallowing the fish; pillages quite quickly. However, the band must be tied no tighter than to enable him to breathe. He lays eggs (sic) in tall trees, white eggs like hen's eggs. The meat is hard and rough." (From **Linné's notes after Rudbeck's lectures, 1728**.)

Linné

A detailed essay, “**Linné as bird watcher**” (Landell, N.E. 2007 Vår Fågelvärld [Our Bird World] 1) gives an interesting background to Linné’s ornithological contribution:

...

In the autumn of 1728, Carl Linnaeus registered to study medicine at Uppsala University. Professor of Medicine Olof Rudbeck the younger devoted this autumn to the birds and lectured to hand-painted illustrations depicting *Aves Sueciana* (Swedish birds)... The depictions were so beautiful “that they did not seem to be human work” wrote Linnaeus...

...

In spring 1730, Carl Linnaeus was asked to take care of botanical demonstrations and to live as informer at Olof Rudbeck the younger’s where he had plenty of opportunities to study *Fogelboken (Book of Birds)*. In the book’s splendid, hand-painted illustrations, Linnaeus saw for the first time the birds as so interesting that they should be systematised.

...

The manuscript *Methodus avium Sveciarum* – Methodical description of Swedish birds – was written in Latin and dated exactly one year later, 1 January 1731.

...

In his methodical description of Swedish birds, Linnaeus unintentionally became a cautionary example of the danger of getting close to the bird world solely by reading books. Others concentrated on different plumage details belonging to the same bird so that the descriptions seemed to portray different species. Linnaeus’ own field observations were scant and he therefore did not dare to clean up the old bird descriptions, particularly as he wanted to substantiate his systematics with as many species as possible. In Rudbeck the younger’s library, Linnaeus was able to study foreign bird books of the 1500s and 1600s with clumsy depictions that were typical of the times.

...

Nonetheless, the bird systematics that Linnaeus wrote at the age of 24 were more detailed and easier to apply than his later compilations.

...

In 1732, Linnaeus established himself for the first time as a field ornithologist. He shot the Northern Hawk Owl in flight...

...

In spring 1735, Linnaeus travelled to the university town of Harderwijk in Holland to dispute his medicine thesis on malaria.

...

In 1735, *Systemae Naturae* was published, ... He wrote in Latin, a language that everyone learned during the 1700s. The birds were ordered principally according to the appearance of their bills.....

In later editions, thousands of plants and animals were depicted.

...

As usual, Linnaeus found influential patrons and was soon engaged by the well-to-do Director of a Dutch East Indian company, the hypochondriac George Clifford in Hartecamp.

...

In the magnificent work *Hortus Cliffortianus* (Clifford’s Garden), Linnaeus lyrically depicted in Latin his first meeting with all the mammals and birds that existed in the well-to-do Director’s large garden, which was translated into Swedish: “I found your

menageries charming, full of tigers, monkeys, wild dogs, Indian deer and goats, South American and African pigs; sounds of these mixed with others from bird cages: American falcons, various types of parrot, pheasants, peacocks, guinea fowl, American wood grouse, Indian hens, swans, coots, gulls, merganser, various types of duck and goose, sandpipers, American crossbills, linnets, finches, siskins, goldfinches, sparrows, turtle doves, all types of dove plus countless other bird species with whose sounds the garden echoed”.

...

In spring 1741, Carl Linnaeus was made Professor of Medicine and simultaneously began his Öland and Gotland trip. On his travels, Linnaeus continuously came across new bird species. The 1700s was the never-ending century of discovery opportunities.

...

In 1749, Linnaeus allowed the student Isac Isacson Biberg to put forward the thesis *Oeconomia naturae*, in which the interplay between plants, animals and environment was depicted as part of nature’s cycle as being the best for humans and all beings... This is where it says that the red kite must not be shot in London...

...

Carl von Linné came to love the birds more and more. In the tenth edition of *Systema naturae* in 1758 (from which the zoologists now base their naming), he wrote in Latin: “*Aeae vocale Volucres pulcherimae*”. Airborne, gifted with song, winged, fairest of all.

Linné did not describe the Great Cormorant until **1758** in **Systemae Naturae** and placed it in the *Pelecanus* family where the type species was the white pelican (*Pelecanus Onocrotatus*) as well as giving it, according to its binary nomenclature, the generic name of *Pelecanus* and the species epithet *Carbo* (Linnaeus, C. 1758) “the black pelican”. The information under *Carbo*. 3; “Habitat in Europe; nidificat in altis arboribus” (Lives in Europe; nests in high trees?? (my translation.)) is interesting. Do the details in the description refer to “atypical” tree breeding English *P.c. carbo* or maybe *P.c. sinensis* and where does the animal type exist?

Ericson & Tyrberg, 2004 (see above) make the following comment on the influence of Rudbeck’s bird pictures had on Linné:

Rudbeck unfortunately published very little, but his lectures on ornithology in Uppsala in 1727-29 and his exquisite paintings of Swedish birds greatly influenced Linnaeus. As a matter of fact these paintings are in several cases the “type specimens” (iconotypes) of the Linnean species. (*Pelecanus Carbo*??? My note.)

In the spring and summer of 1741, Linné travelled to Öland and Gotland but no details on cormorants are reported from this (Öland trip made in 1741, Gotland trip a made in 1741, Nature and Culture, 1957 or 1958) and, as far as is known, nor from the travels in Västergötland and Skåne.

1838

In a “**Description of Mörkö Parish**” (1838), one of Sweden’s big men of distinction in biology, C.U. Ekström, writes:

Around 150 different bird species have been found.

...

The “Albroken” (*Carbo Cormoranus*) is less rare here during certain seasons and is easily caught because he is less than timid.

The name “Albroken” is slightly confusing because it is also used for the oyster catcher in older literature like “**Old –Ante, A book about the sea eagle and other archipelago birds**” (Högdahl, T., 1923).

However, no details from either Ekström or Högdahl indicate that cormorants bred in the eastern archipelago at the time of the writing.

1814-1858

According to details in several of the works quoted below, **Sven Nilsson** was the one in Sweden who first noticed the occurrence of a smaller variety of cormorant. Unfortunately, I have not had access to any of the works published by Sven Nilsson between 1814 and 1858. **Scandinavia’s Fauna (1858)** particularly appears to contain valuable “first-hand details” of the cormorant in Sweden.

1894

In **THE SWEDISH BIRDS** (Aurivillius, Chr., 1894) you can read the following:

112. The cormorant family, *Phalacrocorax*, Briss.

...

1 The Great Cormorant or the eel crow, *Phalacrocorax carbo*, Linné.

...

We see two varieties of this species, a large one and a smaller one, the former of which stays in the western and the latter by the eastern coast. During the winter and the migration period, the Great Cormorant sometimes appears inland by rivers and lakes. Non-migratory (and migratory) bird.

1915

In an essay in *Fauna and Flora* 1915 (115-121) “**What we should understand by Lesser Great Cormorant (*Phalacrocorax carbo medius*, Sv. Nilsson)**”, Einar Lönnberg writes:

Sven Nilsson had observed that some Swedish cormorants were smaller than others and therefore divided up Linné’s “*Pelecanus Carbo*” (subsequently called *Carbo carbo* or, as is maybe more often the case, although incorrect, written *Phalacrocorax* (note: Brisson is quoted as the author of the name *Phalacrocorax*, but since he did not apply the binary nomenclature, his name could not be used as per established nomenclature rules) *carbo*) in two varieties”. His opinion of these was that they “are so different in size and various other ways that they will probably be found to constitute a 2nd species when they have been examined closely enough (Scand. Fauna, the Birds, Book 2, 3rd edition. p. 515). However, he states only size characteristics and these are as follows for both varieties. Table (with morphological characters, my note)

"The Great Cormorant (<i>Phalac. Carbo major</i> N.)	The Lesser Great Cormorant (<i>Phalac. Carbo medius</i> N.)
Length...	Length ...
Etc.	Etc.

...
On the other hand, the important message is given about its settlement area and way of life that "the smaller variety (*Phac. carbo medius*) occurs in our country on forest-covered islands and islets in the Baltic Sea and on beaches at least as far up as Blekinge, where he breeds in various woodlands that will be mentioned below".

...
A few other cormorants belonging to Lund Museum, which I have also had the opportunity to see, originate from Nilsson's own time. They are both labelled "*Phalacrocorax medius* Nilss., the Lesser Great Cormorant" and are probably determined by the particular author himself.

...
It seems as though we can assume that all four examples belong to this variety that Sv. Nilsson called "the Lesser Great Cormorant, *Phalacrocorax medius*". Had we been able to use the thus acquired clue to summarise what should be understood by this "Lesser Great Cormorant", it may well have been expressed as follows in brief: a cormorant variety that is smaller than and has a greener plumage than *C. carbo* and breeds in trees. However, the Lesser Great Cormorant did also breed in Denmark, ...
...in Denmark, that breeding cormorant was eradicated long ago.

...
Kjaerbølling also mentions in the quoted work that cormorants previously bred in several places in Denmark, and he counts up various locations, including...

...
The cormorants were victims of extreme persecution, partly because they did damage to the fishing and partly because their excrement killed the trees in their settlements. At a colony formed in 1823 in Vaarsö in Horsens fjord, for example, more than 10,650 cormorants were shot from 1827 until 1845. In another colony in 1860, no fewer than 597 pairs, etc. Even if the number of birds starts off being large, it is clear that there will be none left under such circumstances.

How far back in time the history of cormorants breeding in trees goes here in our country is uncertain. However, it can be noted that Anders Johan Retzius does not seem to have known of similar birds when he published his edition of *Fauna Suecica* in 1800. He says: "Nidificat in scopulis" (breeds on rocks, my translation), which simply refers to the larger variety. It is likely that in around 1800, no cormorants were found to be breeding in Skåne.

With regard to the occurrence of such cormorants in Denmark, Chr. L. Brehm says in 1831: "Sie ist einigen 30 Jahren in Dänemark eingewandert" - -. Brehm simultaneously gives this "Baumscharbe" the name *Carbo arboreus*, a name, if it can be determined with certainty, takes precedence over Sv. Nilsson's name *medius* from the year 1835.

...

He (Chr. L. Brehm, my note) also has one further name in this case that fairly obviously refers to the same cormorant variety. This name is "Die kleine Kormoranscharbe, *Carbo subcormoranus* Brehm". The cormorant that is given this name is described as being even smaller than the "*arboreus*"; the bill is particularly small. However, it then expressly says that since this small cormorant has 14 quills, it cannot be confused with the shag (*C. graculus*). – It is also pointed out that small cormorant is not as blue-black in display colours as the common one but tends more towards being blue-green. It is said that its home is in Holland. In this case, it is the small size and the green colour that tally with Sv. Nilsson's *medius*. There are thus at least two names that have been given to the Lesser Great Cormorant before *medius*, and of these, Brehm's *arboreus* takes precedence. How far the distribution of this smaller cormorant goes is not yet clear, but the countries by the Baltic Sea are probably its northern limit (note 1). In a south-easterly direction, it is probably found way into Central Asia, at least until the Tien Shan-area, since I had the opportunity 10 years ago to buy two cormorants from there, which I was able to assign to the *medius* variety.

...

However, the literature does also include details on small cormorants of the *C. carbo* species from even more distant tracts so that the case is still far from having a satisfactory explanation.

...

This vagrant lifestyle is clearly not just that of the large, glossy blue, North Atlantic cormorant, but also that of the smaller, greenish inland cormorant.

1917

"The Lesser Great Cormorant's scientific name" (Fauna and Flora 1917 12(1):47 smaller notifications Lönnberg, E.):

In the 1915 edition of this magazine, it is mentioned in an essay on the Lesser Great Cormorant (pp. 115-121) that in 1831, Cr. L. Brehm previously used no fewer than two species names, *arboreus* and *subcormoranus*, for this greener, smaller in size variety of cormorant that was often found breeding in trees. According to the ranking, the first-mentioned should take precedence. However, the well-known ornithologist Dr. Ernst Hartert has now pointed out in "Novitates Zoollogicae" for 1916 that the name *subcormoranus* was presented by Brehm no fewer than 7 years previously or in "Ornis" in 1824, and it thus takes indisputable precedence. The Lesser Great Cormorant's scientific name is thus *Carbo carbo subcormoranus* (Brehm).

Finland

In "Medd. Soc. pro F. et FL. Fenn. 43" (1916), R. Palmgren shows a comment in a memorandum **"The Great Cormorant, *Phalacrocorax carbo* (L.) breeding in Finland"** about breeding on an islet (Kukri) in Ladoga: "When the Great Cormorant that was previously unknown was found within the political borders of our country...", and writes the following:

But also in the inner parts of the Eurasian continent, the species was also found breeding here and there; so it has gradually penetrated further along the Oder deeper into Pommern and also followed the Donau from its mouth right up to the Hungarian plains, besides which it is building nests and living by the Caspian Sea and Lake Baikal. By the Baltic Sea the cormorant still breeds in large colonies in Pommern and on the Danish islands. It previously also occurred in Skåne and Blekinge, but has now been completely eradicated.

The cormorants breeding by the North Sea and the Baltic Sea were previously considered to be a separate geographical variety, which Nilsson called the Lesser Great Cormorant, *Ph. carbo medius* which, through its smaller body size and unusual method of breeding – it is questionable whether cormorants build nests in trees while their northern relatives expect to build their nests on precipices – are probably different from the typical Great Cormorant. However, modern ornithologists appear to question the justification of this distinction, to which they simply attach the importance of an individual variation as well as adaptation to existing terrain conditions for the breeding site.

...

It is an interesting phenomenon that the Great Cormorant has settled in Kukri in order to breed, but offers up no surprises on closer reflection. The location of the breeding site by the major emigration path, its attractive exterior with the wide Ladoga around about has probably attracted the species in the same way as the steep rocky islets on the Arctic Ocean's coasts. If we take into account the development of Ladoga from the Yoldia Sea, we will understand that the Great Cormorant's nesting sites there were marine ones, which they largely tended to be until current times, and the phenomenon is not just temporary and local but a noteworthy historical perspective.

The 1920s

In **Brehm's Djurens liv [The Life of Animals]** (after Brehm, A.E.), 4th fully reworked and extended edition, translated and reworked into Swedish, issued by Alarik Behm, Stockholm 1926:

The subfamily of Cormorants (*Phalacrocoracinae*)

...

The best known and perhaps most widespread species is the Great Cormorant, also called, among other things, the eel crow, in the Baltic Sea sometimes "sea capercaillie" and kormoran, *Phalacrocorax carbo* L.

...

As a whole, this species has had a very widespread breeding area. It lives in Europe and Asia, large parts of Africa, Australia and New Zealand as well as North America's east coast from central Greenland down to Nova Scotia. It is obvious that the bird within this huge area appears in several geographical races. However, some of these have yet to be finally investigated. In Europe, we are in any case able to distinguish between two different varieties of the Great Cormorant.

The main species, designated by German ornithologists as the North Atlantic Great Cormorant, is found as a breeding bird on Greenland, Iceland and The Faeroe Islands, by Norway's coast and from there up to The Kola Peninsula, in Scotland and surrounding islands and by the coast of England as well as in Ireland. Furthermore, this is the race that breeds in North America. Already on Greenland and Iceland he is largely a non-migratory or vagrant bird, and only a comparably trifling number appear to fly southwards. However, this is probably the race of which a few examples show in the winter as far down as the Canary Islands and the Azores. In North America, it overwinters from southern Greenland down to Long Iceland and is occasionally found down as far as South Carolina. This variety very much resembles the following but has deeply blue-black, almost purple feathers, large size and, most of all, a very strong bill which, from the feathers on its brow to the tip is 68-77 mm long, right up to 82 mm. The other European race, which in Germany is usually called the common Great Cormorant, in our country the Lesser Great Cormorant (*Phalacrocorax carbo subcormoranus* BREHM), according to HARTERT has a wing length of 33-35.6 cm and a

bill length of around 6.5-7 cm. This race lives as a breeding bird in central and southern Europe up as north as Holland and the Baltic Sea provinces, south to Italy as well as the Dragonera island off Mallorca's south-west coast. Its distribution also stretches over South-Eastern Europe to Central and Eastern Asia. Many birds of this variety overwinter in Greece, by the Caspian Sea as well as in Egypt. It also occasionally spends the winter in Algeria. This is the variety that in bygone days bred in Denmark and in southern Sweden. It now probably does not breed anywhere in our country, but there used to be colonies of cormorants breeding in trees in Skåne and Blekinge. With regard to the connection of these cormorants to a smaller cormorant, Lönnberg notes: "This breeding cormorant is said to have been smaller than the common one and is therefore called "medius" by Sv. NILSSON. However, since the Great Cormorant varies widely in size and there is no proof that this smaller size has been constant, it is uncertain as to whether there was a separate race". Following a subsequent examination, however, he did classify it as a geographical race.

During the winter, the Great Cormorant, i.e. the main variety, is generally found by the Bohuslän coast. According to LÖNNBERG, he also does not appear to be rare in Stockholm's archipelago and occurs there quite constantly, and also elsewhere by the Baltic Sea. From time to time, Great Cormorants – mostly younger birds – are also seen by lakes inland. However, it is not known whether he breeds anywhere in Sweden.

...

...limits my depiction to the Great Cormorant. He inhabits beaches or fresh water wherever suits him best. Large rivers or watercourses surrounded by forest are preferred, and the enterprising bird also settles down in the immediate vicinity of built up areas and scarcely or at least only very reluctantly allows himself to be driven away. An example is known of a cormorant having settled down in a church tower in the middle of a town. The Great Cormorants appear in great numbers by the coast, although only in certain places. They stay in places where the coast is rocky and hard to access or surrounded by skerries. Along the coasts of Norway, Iceland, the Faeroe Islands, the Hebrides, the Orkneys, etc. they are as equally common as the shag, while humans there are not in a position to pursue them to any great extent. They gather in really large numbers in southerly seas during the winter. Already in Greece people see them generally all year round by large lakes and by the sea. In Egypt they sometimes cover the lagoons for as far as the eye can see, and go out to sea every morning. They appear in equal quantities in Southern China and India. One might venture to say that each place is adequate for them and that they know how to adapt anywhere where there is water and fish.

...

The place preferred by the Great Cormorants for nesting, or the Lesser Great Cormorants to be precise, is trees, but the typical Great Cormorants nest in rock ledges and similar places. Inland or in places where the forest goes right down to the beach, they requisition crow' or herons' nests. The former birds are driven away immediately, the latter following a hard battle.

...

In captivity, the cormorants last for many years if they are given plenty of food. These birds scarcely require anything else, and in small ponds they also often proceed to reproduce.

...

We consider the cormorant meat totally unpalatable, but Lapps, archipelago inhabitants and Arabs are of a different opinion and think that, due to its fat content, it is a real delicacy.

1922 About the Great Cormorant (*Phalacrocorax carbo* L.) by Dr. Ivar Hortling (Hälsingfors) (Fauna and Flora 1922.):

On Åland, I saw a flock of cormorants in June and, according to fully reliable details (fisherman Gustaf Sjöberg Klöfskär) the cormorant is there all year round. The species also overwinters in Ladoga (cf. Palmgren in the Mediterranean Sea 43, 1916-197).

...

Regarding the different geographical varieties of great cormorant, Hartert (Die Vögel der paläarkt. Fauna H. XI-XII, p. 1387 and onwards) distinguishes between two varieties, *Phalacrocorax carbo carbo* (L.) and *Phalacrocorax carbo subcormoranus* (Brehm).

...

On the other hand, other ornithologists are of the opinion that they should be divided into two varieties. This is what Nilsson and Holmgren say of "the Great Cormorant" and "the Lesser Great Cormorant", the former of which is found in the Western archipelago, the smaller race in the Baltic Sea at least as far up as Blekinge. Wright-Palmén stated two different races with the same colouring, *Phal. carbo major* (Nilss.) and *medius* (Nilss.), both with different distributions. Palmén believes that the smaller race has not taken his destructive emigration within the Baltic Sea towards the Nordic countries (p. 558). And Hartert, as said, makes a clear distinction between *carbo carbo* and *carbo subcormoranus*. According to Hartert, the former is a breeding bird in Greenland, Iceland, The Faeroe Islands, along Norway's coast and further east to the Kola Peninsula, in Scotland with islands, Ireland and England (the smaller one also occurs there, although not breeding). This variety will breed on rocks. – The smaller one inhabits Central and Southern Europe to Holland and the Baltic Sea provinces, South-Eastern Europe, previously Denmark and Southern Sweden to Blekinge (cf. above). This variety prefers to breed inland in colonies in trees, bushes, even reeds.

1929

Einar Lönnberg writes in the magnificent "SWEDISH BIRDS by M., W. and F. von Wright" (1929) about:

The cormorant genus, *Phalacrocorax* Briss.

Two of these species now occur in our country, but an additional race also used to breed in Southern Sweden. These are distinguished as follows...

Great Cormorant *Phalacrocorax carbo*

Lesser Great Cormorant *Ph. Subcormoranus*

The generic name of *Phalacrocorax* used here should actually have been discarded according to the nomenclature rules, in as much as it was given by BRISSON who did not use binary nomenclature. LACÉPÉDE'S name *Carbo* should have been used instead, but since the former had been adopted by the nomenclature commission, one must submit to this, partly because it has been in use for so long.

The Great Cormorant, *Phalacrocorax carbo* LIN.
(*Carbo carbo*, *Phalacrocorax*, *cormoranus*).

The Great Cormorant has a widespread distribution on both sides of the North Atlantic and goes as high up the Nordic countries as Greenland. It also breeds by the coasts of Labrador, New Foundland, Nova Scotia, etc. It is a breeding bird by Iceland, the Faeroe Islands, the United Kingdom, along the Norwegian coast from the Stavanger area and northwards right up to Kola. As a more or less temporary guest, it is also found nearly everywhere, even a long way away from its breeding sites in North America and Europe, and close relatives, often races that are difficult to distinguish between, are found in Europe and Asia. In Sweden, the Great Cormorant breeds, as far as we know, somewhere, but it is nevertheless periodically by no means rare by either our Western or Eastern coast and some also appear by the lakes here and there in most different parts of the country. However, it is far rarer by lakes than by some coastal stretches. In Bohuslän it is really common, sometimes numerous from the autumn, during the winter and up until the spring. In the Baltic Sea, it occurs most often during spring and autumn, also in the winter if there is open water, but I have also seen it during the summer, e.g. in Södermanland's archipelago. It seems strange that you can see not just young birds but also those that are in full display colours with the white thigh spots and the small silky plume feathers on its head, e.g. in Stockholm's archipelago also way into the spring. The National Museum has a similar example from Bullerö, shot on 24/4. The Great Cormorant is thus a definite vagabond. The following can also be given as some spread examples of its occurrence in freshwater, Lapland, Mälaren, Vättern, Vänern, etc." (and Erken, my note.) Regarding its occurrence, lecturer Hortling quotes in Fauna and Flora, 1922: "The majority of finds were made in Sept. - Oct., but it is said that cormorants sometimes stay throughout the summer, e.g. in Åland's archipelago. Judging by the plumage details, most of the birds mentioned have clearly been young, usually one or two years old"

..., that a sort of irregular move takes place in conjunction with a certain aimless moving around. ... As mentioned previously, the Great Cormorant does not breed in our country, but certainly in Norway. There it nests on shelves in steep mountains or up on the crests of skerries. It usually breeds in colonies, often close together...

...

The generic name has no beautiful meaning, i.e. "bald" raven, Greek = bald. The species name *carbo* is often thought to refer to the dark colour since *carbo* = coal. This interpretation seems to me to be less likely, however. LINNÉ took the name from older authors, although not classical, e.g. GESNERUS. The latter speaks of *carbo aquaticus* and compares the first word with the German "Scharb", which of course means the same as our "scarf" [cormorant] and is thus onomatopoeic like this. GESNERUS himself believes that it is the same as the German "scharf" [sharp] since the bill is sharp. However, this is unlikely, as is the origination from *corvus* = raven. On the other hand, different languages have often used the name cormoran for this bird and its relatives have

appeared from a merger of "Corvus marinus", i.e. sea raven. This is clearly shown by Italian and Spanish names that are still used.

THE LESSER GREAT CORMORANT, *Phalacrocorax carbo subcormoranus*, BREHM.
(*Phalacrocorax, Carbo arboreus, carbo medius*.)

Sven Nilsson was the first in this country to notice that there were two different races of cormorant, and he called the smaller one the Lesser Great Cormorant and distinguished it by the name *medius* in accordance with this. However, Chr. L. BREHM had already in 1824 previously given the name *subcormoranus* to a cormorant that existed in Holland and that was smaller. Later, in 1831, he used this name and the name *arboreus* for the smaller and greener variety. The latter thus has an abundance of names of which the oldest should be retained.

The distribution of the Lesser Great Cormorant is southern and south-eastern in comparison with the Great Cormorant. It also stays more by fresh water. It now occurs (1929, my note) in Central and Southern Europe as well as a long way from there towards Central Asia at least until the Tien Shan area, from where the National Museum has specimens. How much further east it lives is probably not yet known in that the East-Asian cormorants' systematic status has yet to be adequately examined. The one westernmost occurrence in Europe is probably in Holland, where there still are a few colonies, particularly in Southern Holland. In Germany, there used to be large numbers everywhere that formed large colonies, but they have now been totally or virtually completely eradicated. There was also a cormorant, probably this species, breeding in Kurland, but it has also disappeared from there. In South-Eastern Europe it is common on the other hand. Around 1800, this cormorant invaded Denmark in large numbers and bred in large colonies there, but the birds came to be thought of as obnoxious, partly because of the damage they did to the fishing and partly because they killed the trees in their settlements through their strong excrement. They therefore became the victims of very heavy persecution. At one colony that arose in 1823 in Horsens fjord, KJAERBÖLLING says that during 1827-1845, more than 10,000 cormorants were shot and in another colony in 1860, no fewer than 597 pairs. It is not surprising that there were none left. Skanderborg Sø on Jutland is the place where they seem to have lived the longest, at least until the 1870s.

The immigration in question also went as far as Sweden so that SVEN NILSSON was able to state in 1858 that they bred "in some forests in Blekinge, particularly in the parish of Hoby". Even in some places in Skåne like Snogeholm and Krageholm. As late as 1888, cormorants were found in the latter mentioned place breeding in a heron colony according to Count Thage Thott, but the last ones were already eradicated before the end of the century. My brother, Dr. I. Lönnberg, has been told by a fisherman that cormorants were meant to have bred in a large oak on Vagnsö, Hoby parish in Blekinge, right until around 1909. However, they have now disappeared from there as well, and this species has therefore probably gone from our fauna, and as the same also applies to the countries south of us, no new immigration should be expected. In its lifestyle, the Lesser Great Cormorant deviates from the ordinary larger race in that it prefers to remain by fresh water. It is happy to settle in trees and, as pointed out by LEHN-SHIÖLER in connection with this, its claws seem longer and more bent than those of the Great Cormorant.

...

A distinguishing biological feature of the Lesser Great Cormorant is that it lives in trees... SVEN NILSSON had this information on those that lived in Blekinge in an oak forest, that they come to their breeding site around 25 May. It is also said... in the same tree crowns there are heron nests, sometimes close to those of the eel crows.

...

The cormorants' great skill in catching fish has sometimes been used by humans. This may now simply be the case in China and Japan...

...

Similar fishing with cormorants was also previously generally practised in England and the Master of Cormorants, says NEWTON, belonged to the Royal Court as well as the falconer. In order to tame the cormorants, they were taken from their nests as young and brought up because the old ones did not become tame in captivity.

1950

One of the first details on cormorant breeding in Sweden after 1909 is seen in “**SWEDISH ANIMALS, The birds**” (ed. Svärdsson, G. and Durango, S. 1950). “The Lesser Great Cormorant” is mentioned in several of the chapters, usually very positively.

The chapter entitled “**Pelican and Fulmars**” by Gunnar Svärdsson states the following:

GREAT CORMORANT, *Phalacrocorax carbo* (LINNÉ)

...The Great Cormorants you see in winter in the thirties were greater in number than those now belonging to the nominate race, which breeds primarily in Norway and Russia. ...Another race with the name *sinensis* differs from the nominate race by having more grey-white or purely white down on its neck, which can appear whiter or less white, but outside the breeding period, the races cannot be distinguished in the field. This race, also called the Lesser Great Cormorant, inhabits a southerly area and breeds in places like in Germany, Holland and Denmark and has bred in our country in Skåne, e.g. by Snogeholmssjön at the end of the previous century. It remained in Blekinge until 1909. After being persecuted, it disappeared and the population fell throughout Western Europe, but after a quarter of a century, numbers began to increase again. They re-immigrated in Denmark, from where they had also disappeared, and the species was expected to return as a Swedish breeding bird throughout the 1940s.

On a small island one mile north of Bergkvara in Kalmarsund, Great Cormorants appeared in 1948 under conditions that were indicative of breeding. They have subsequently returned each summer in greater numbers and 30 or so birds remained at the site in the summer of 1951. Breeding also unquestionably took place and has probably taken place annually since 1948. There are nests in tall pines and right up in the middle of a heron colony.

...

The Great Cormorant breeds on rocky shelves or in trees, and this habit appears to be peculiar to the race so that only the *sinensis* race (the Lesser Great Cormorant) lives in trees. The cormorant breeds in large colonies.

...

Our Great Cormorants winter guests arrive from the north in September-November and leave once more when the ice starts to melt in March-April. The breeding pairs probably lay in May.

...

Picture caption On the outskirts of the archipelago, you can see the Great Cormorants on a low islet or sandbank in the winter. Now and then they flutter their wings – typical of the species

The chapter entitled “**Disappearing profiles - and new ones**” by Durango, S. (in Svärdsson, G. and Durango, S. 1950) is an early contribution to the subject of “invasion biology” and indicates that climate changes are a main cause of fluctuations in the bird fauna:

The dehydration of South-Eastern Continental Europe, a climate that has been warmer during the summer in recent decades with an unusual number of favourable springs in this period...

...

As early as the end of the 1800s, the Lesser Great Cormorant, a race of the Great Cormorant, was eradicated in Skåne, and in 1909, the bird suffered the same fate in Blekinge and had thereby disappeared as a Swedish breeding bird. It now looks as though it is on the verge of trying its luck once more in this country.

...

Until 1909, the Great Cormorant bred in Blekinge but was persecuted and disappeared. It now looks as though it might return. Breeding seems to have occurred again. (picture caption beneath cormorant on branch, (*P.c. sinensis?* my note)

2008

A book giving additional details on “the cormorant” in Europe from ancient times until the 1500s was recently published, “**Bernström’s Bestiarium - An Animal’s Nordic Cultural History**” (Otterberg, H. ed., Atlantis, 2008). The book constitutes a comparison of the articles written by John Bernström for “Kulturhistoriskt Lexikon for Nordisk Medeltid” [Cultural-Historical Lexicon for Nordic Mediaeval Times] (KLNLM), 22 books issued between 1956 and 1978.

The following can be read under the heading “Cormorants”:

... represented in Southern Europe by three species that classical authors and their medieval epigoni discussed either as being in an undifferentiated cormorant concept (Greek text) or as variants of a more extensive diving bird category (... Merganser... morfex..., etc.)....

...

Along the Nordic countries’ rocky Atlantic and Arctic Ocean coasts where cormorants are said to have previously been generally prevalent at all times of the year (cf. Olaus Magnus, XIX:20), people seem on the other hand to have been early aware of the species difference between the two varieties of cormorant breeding there, i.e. the nominate race of Great Cormorant, (eel crow, Danish also *kormoran*, *ålekrage*, Finnish *merimetso*, Icelandic (*díla*)*skarfur*, *didli*, Faeroese *hiplingur*; *Phalacrocorax c. carbo* (L.) (Old High German *Scarva*, *scarba*, *scarbo*, probably after their cry and sooner referring to their breeding in trees *Ph.c. sinensis*...)

...that is a tall bird with white cheeks and white chin as well as the shag,...

Regarding the shag, Bernström writes:

...: note that the species name *aristotelis* given by Linné after Aldrovandus: *Fauna Svecia*, ed. 2, Stockholm, 1761, unnumbered table of contents no. 146, is completely misleading in that marine “...cormorants...” described by Aristotle in the 2nd paragraph, large as storks and breeding in trees, were obviously the Lesser Great Cormorant (see below);

....., which is smaller (shag, my note), lacking white in its plumage and during spring and just before the summer wears an upstanding short head crest.

However, cormorants observed in Central Europe and the countries around the Baltic Sea did not belong to these pronounced marine varieties but to another, particularly through its deviating reproduction biology-characterised geographical race of Great Cormorant, known as the Lesser Great Cormorant, da. *mellemskarv*, no. *Mellomskav*, *Ph.c. sinensis* (Shaw & Nodder) (= *Ph. subcormoranus* auctt.) (in S&N's Naturalists Miscellany 1789-1813 there is a picture of a light cormorant called the Chinese Pelican, my comment), that, unlike its mentioned relatives, does not breed in the coastal cliffs and boulder areas but in colonies in trees (often with the heron – see the former) normally by inland water that is full of fish. During the spring, many Lesser Great Cormorants have a more or less white head (cf. the difficult-to-explain naming of *phalacrocorax* above). This variety of cormorant seems to have been the main one in days gone by, although the description has in some instances also borrowed features from the Pygmy Cormorant, Danish *Dvaergskarv*, Norwegian *dvergskarv*, *Haliator pygmaeus* (Pallas) (= *Ph. Haliator pygmaeus auctt.*) breeding bird in South-Eastern Europe and the Near East - which under the name of *morfex* partly after classical models has been depicted by the High Middle Ages' encyclopaedia writers and their epigoni, including Olaus Magnus, who devoted a full chapter to cormorants (...). The portrayal of the cormorants' greedy eel catching and breeding in high trees, the foliage of which was destroyed by their corrosive waste, indicates that it was seen with his own eyes (note that the picture of a mixed cormorant and heron colony, Olaus Magnus XIX:2, is perceived to be independent in relation to the scantier *morfex* depiction in *Hortus Sanitatis*, 2nd paragraph)

...

A wood engraving in Olaus Magnus (XVIII:16) depicts according to a foreign model (...) a fishing and retrieving tame *utter* [otters] (see the former) and above the animal an awkwardly drawn flying bird with a fish in its bill. It is conceivable that this bird picture, to which there is no reference in Olaus Magnus' text, aimed to depict a Lesser Great Cormorant: both this bird and the otter (mammal) have been trained to catch fish since at least the 400s AD in East Asia, and this was reputedly last known in Europe at the start of the 1300s. Chinese river fishing using tame cormorants had thus been observed and sketched in detail by Friar Odoricus de Pordenone (...) in 1330; the latter's travel book was widespread during the late Middle Ages and may have been known to Olaus Magnus in handwritten or printed form (Paris, 1529), whose picture is remarkable since cormorant training was not thought to have occurred in European environments until around 1625 (cf. T. Pennant: *British Zoology* II ed. 4, London 1776, p. 610). Both *Skarfr* and *Hrókr* existed during the Viking era with the true or feigned Icelandic given name (...). As a first element of Icelandic place names, the majority refer to isthmi, islets or skerries where cormorants tended to spend time, *Skarf-* is common in documents from the 1300s or later (...).

A few details on the word cormorant

Many works endeavour to find the origin and explain the word cormorant. Sweden, and certainly large parts of the rest of Europe, have many names of skerries, islands and places that can shed additional light on the distribution history of “the cormorant”. One example is the details in “**Place names in Stockholm’s Archipelago**” (Stahre, N.G., 1986):

The Great Cormorant (storskarven) is probably what gave rise to names like *Skarvgrundet* (Skarfgrunden in 1691), a small islet in the gulf between Klubbskaten and Stortornö, Longvik, Möja sn, and *Skarvstenarna*, an islet north-east of Råknö, Länna sn; leading on to *Skarv* (Skarff in 1572) which is the name of a group of islands in Rådmansö sn. Another name for the Great Cormorant is the eel crow. The word is part of the name *Stora* and *Lilla Ålkråkhäll*, small rocks east of Öja’ northpoint. Olivecrona’s Description...(1833), p. 96 mentions a 6-foot bank with the name of *Ålkroksgrund*. Probably refers to a bank north of small *Ålkråkhäll*.

Svenska Akademiens Ordbok [Swedish Academy’s Dictionary] (SAOB) contains the following on the word cormorant (the bird):

skar⁴v, noun.²,

m. or cdef. -en; pl. -ar.

[cf. previously mentioned *skarfr*, m., nor. dial. *skarv*, m., High German *scarbo*, m., *scarba*, *scarva*, f. (German *scharbe*), old Eng. *scræf*, m.; probably of onomatopoeic origin] zool. web-footed bird belonging to the family *Phalacrocorax* Briss.; special info. on the species *Phalacrocorax carbo* Lin., Great Cormorant, kormoran, eel crow, sea capercaillie; also (and in zoological specialist language now preferably) in extended use: bird belonging to the *Phalacrocoracidae* family (special pl. = i for this family).

FORSIUS Phys. 163 (1611). The Chinese Cormorant (*Phalacrocorax sinensis*) (trans.) by the Chinese . . . to catch fish. 1Brehm 2: 552 (1875). MALM Fauna 337 (1877; on the Great Cormorant). FoFl. 1907, p. 97 (*i = pl. for the family*). Same source 1936, p. 85 (on birds of the species *Phalacrocorax capillatus* Temm. lb Schleg.). *DjurVärld* [Animal World] 8: 271 (1960).–

Nynorsk etymologisk ordbok [Norwegian Etymological Dictionary] (Torp, A. 1919) “Skarf ...bare cliff, ...” (! My note)

Comments

What?

The ancient cormorant concept (Aristoteles, 300 BC) probably included *P. carbo* and *P. aristotelis* as well as *P. pygmeus*.

Aristotle's details from the Eastern Mediterranean Sea may indicate *P.c. sinensis* (size, tree breeding, etc.), but *P.c. carbo* may have had a wider distribution in the Mediterranean Sea, a relic colony has been ascertained on Sardinia and *P.c. carbo* has bred in trees on the British Isles.

Linné described *Pelecanus Carbo* in 1758, probably a type specimen from *P.c. carbo*. Unclear if Rudbeck's pictures are "type specimens (iconotypes) of the Linnean species" *Pelecanus Carbo*?

Nilsson (1858) was the first to describe a smaller "cormorant variety" from Sweden and called it *Phac. carbo medius* or *Phalacrocorax medius*.

Thereafter follow a large number of details on a smaller, tree-breeding variety of cormorant from Sweden.

Where? and When?

The location of the pictures of cormorants in the Nordic countries on Carta Marina (**Olaus Magnus, 1539**) makes it likely that the depiction was of *P.c. carbo* and the details from Olaus Magnus (1555) on "cormorants" breeding in trees along the beaches of the Nordic countries are probably mixed with details from the Mediterranean Sea area.

Olof Rudbeck's depiction of a Great Cormorant in 1701 from Bottenviken is highly likely a *P.c. carbo*. Details on "cormorant" breeding during the 1700s are available in Ericson & Tyrberg (2004): "though it apparently still bred in Finland (Gadd, 1769)".

Linné's own experiences of cormorants in Sweden appear to be very limited; there are no details on breeding cormorants in his travel stories from Öland and Gotland (and, as far as we know, nor are there any from Skåne and Västergötland), and the description of the species *Pelecanus Carbo* (**1758**) appears to be based on Rudbeck's pictures as well as on details from England or Holland which he visited in 1735.

(In **1798**, Blumenbach describes *Pelecanus Sinensis*, later *P.c. sinensis* Blumenbach 1798)

Some of the details in Bernström (2008) can be interpreted in another way. The name *Ph. c. sinensis* (Shaw & Nodder) is given for the "tree-breeding cormorants observed in Central Europe and countries around the Baltic Sea"... (In Shaw & Nodder's Naturalists Miscellany, **1789-1813**, there is a picture of a light cormorant called the *Chinese Pelican!*? Bernström does not mention *Pelecanus Sinensis* (Blumenbach, 1798). He did not know of this name? my notes).

In Fauna Suecica in 1800 (in Lönnberg, 1915), **Retzius, A.J.** mentions only rock breeding cormorants, most likely to be *P.c. carbo*.

In **1824**, Sven Nilsson (published in Skand. Fauna in **1858**) was (according to Lönnberg, 1915) the first in Sweden to provide reliable details on a "smaller variety of cormorant" (species) that breeds in trees from Skåne, and called the species *Phalacrocorax medius* Nilss. (several specimens in Lund Museum, my note).

C.U. Ekström (1838) writes that the species *Carbo Cormoranus* is common at certain times of the year in the Baltic Sea's archipelago around Mörkö in Södermanland but gives no details on breeding.

Einar Lönnberg (1915, 1917, 1929) discusses “the Lesser Great Cormorant”'s name, systematic rank, morphology, distribution and breeding history in detail and indicates that the name in 1917 is *Carbo carbo subcormoranus* (Brehm) and in 1929 “the Lesser Great Cormorant, *Phalacrocorax carbo subcormoranus* (BREHM) (*Phalacrocorax*, *Carbo arboreus*, *carbo medius*.)

“Around **1800**, this cormorant invaded Denmark in large numbers...”

More details on breeding from Skåne and Blekinge between **1858** and **1909**.

In **1916**, **Palmgren, R.** reports on breeding of “the Great Cormorant, *Phalacrocorax carbo* (L.)” on a rock in **Ladoga**, probably *P.c. carbo*.

In **1922**, Hortling, I. reports on cormorants on **Åland** in June and “according to fully reliable details (fisherman Gustaf Sjöberg Köfskär), the cormorant is found there all year round”. May be *P.c. sinensis* but breeding has not yet been ascertained.

In **1923**, Högdahl, T. reports no details of breeding cormorants from Stockholm's archipelago.

In **1948**, cormorant breeding is ascertained (*P.c. sinensis*) in Kalmarsund.(Svärdsson, G. 1950)

Regarding the Swedish the name of *P.c. sinensis*, this should be changed from “mellanskarv” [Lesser Great Cormorant] to that of *Phalacrocorax sinensis*, “**kinesisk skarv**” [Chinese Cormorant] used by Brehm (Brehm, A.E., The Life of Animals, Translated 1-3. Stockholm, 1874-76).

7. The cormorant in service to the human being

Even cultural-historical details from literature, art, etc. can contribute many valuable pieces to the puzzle where the historical cormorant occurrence in Europe is concerned, particularly the details available on Europe's contacts with its surrounding world and trade in living animals.

Gunnar Brusewitz writes in "**Silverlöjan och den fattiges tröst**" from 1977:

As early as the 1500s, the Dutch took along to Europe trained cormorants from China and fishing with cormorants soon became one of the most aristocratic sports in Western Europe, primarily in England where even a special job with the title Master of the Royal Cormorants was established.

Trained cormorants were a common gift from the king to princes on the Continent. There are more details in the royal household's accounts telling of the way in which different members of the Wood family (the Master's of cormorant fam., my note) was sent with cormorants to the Head of State and other high-up men in his majesty's noble command.

One such trip did not end well. In 1624, the Master of cormorants was given the task of transporting three cormorants to Venice, probably to the Doge but the sought-after birds were stolen from him on the way by no less than the Duke of Savoy! To heal the wound, a sum of 98 pounds, 8 shillings and 6 pence were paid from the royal fund.

It is unclear as to which sources Brusewitz' details come from, but they are very probably largely from Harting (1883) below.

In "**Essays on sport**" (Harting, J.E., 1883), Harting writes that one of the first that the reports (sic) on fishing with cormorants in China by an European is by one Galotti Pereira from the mid 1500s, first printed in Venice around 1550. However, Harting also refers to some information from "Sir George Staunton" in the preface to Padre Juan Gonzales Mendoza's work *The Historic of the Great and Mighty Kingdome of China*" (1585 and 1588) that the first report on cormorant fishing came from monk William van Ruysbroeck following a missionary trip to Karakorum in around 1254.

According to Harting, fishing with cormorants was introduced to Europe at the end of the 1500s or the start of the 1600s, and then simultaneously at the English and French courts. "The Dutch were probably the first to take it to Europe who, as well as being skilled navigators and tradesmen with the East, had always been known as skilled falconers and bird lovers" (my translation.).

"Perhaps the Cormorants used at Thetford came from Reedham in the same county, where as we learn from Sir Thomas Browne, they used formerly to build upon trees, and whence, he says, "King Charles the First was wont to be supplied". (1678)

The interest in fishing with cormorants in North-Western Europe declined during the 1700s but was reawakened in the mid 1800s, so even trade in cormorants (sic) in 1846 a Mr "Newcome brought over a trained cormorant from Holland."

...

Cormorants are by no means difficult to train,... They may be taken from the nest just as they are ready to fly, or may be caught later in the year when they are fully feathered".

To catch them is only necessary to visit some tidal harbour wherein there are large posts set....

On getting ashore, ... the left wing should be cut neatly with a large pair of scissors. The Chinese method of fishing with Cormorants differs but little from that employed by English and French amateurs at the present day. In China, however, the birds, smaller than ours, and of a different species (*Phalacrocorax sinensis*),...

In an essay entitled “**FISHING WITH THE CORMORANT I. IN CHINA**” (The American Naturalist vol. LX no. 666, 1926) Gudger, E.W. writes that fishing with trained cormorants was established in China during the Sung dynasty (960-1298) and in Japan possibly slightly earlier, as early as the end of 500s.

When and how the Europeans learned how to fish with cormorants is not totally clear but there is much to indicate that the knowledge came to Europe as early as the 1300s. Marco Polo says nothing about fishing with cormorants from his stay in China in 1275-1292 but the Franciscan monk, Odoric av Pordenone, who travelled in China between 1323 and 1328 does. The travel description “Odorichus de Rebus Incognitis” was first published in 1513 in Pesaro, Italy and slightly later in a French version in Paris 1529 and then in English in 1599.

Others who reported from China on fishing with cormorants were Galetto Pereira in **1577**, Juan Gonzales de Mendoza in **1585**, English vers. in 1588, and Maffei in **1589**.

Two of the most detailed and illustrated descriptions were given through two ambassadors to China from the Dutch East-Indian company, one by Johan Nieuhof which was published in Dutch in Amsterdam in **1665** (translated into English in 1669), and the other by Olfert Dapper in **1670**.

During the latter half of the 1600s and way into the 1800s, a large number of descriptions of fishing with cormorants from China were published, “too numerous to mention”.

The descriptions include comprehensive trade in trained cormorants, hatched and bred in captivity between China’s different provinces and transportation of cormorants from China to England, something that was not entirely without complication. Food during transportation was living eels and finely-chopped meat and small fish.

Gudger, E.W. also refers to one S. Wells Williams, who wrote the following:

...the fishing cormorant of China (*Phalcororax sinensis*) is called (by the Chinese) loo-sze, the etymology of which is “the black (bird) in the reeds”, another name is the “old water crow”, which is similar to the French name *corbeau marin*, from whence comes our English word cormorant;....

What is maybe the most comprehensive description of fishing with trained cormorants in China and Japan was given by Berthold Laufer in the essay “**The domestication of the Cormorant in China and Japan**” (Laufer, B.1931. Field Museum of Natuaral History, Publication 300, Anthropological Series Volume XVIII, No. 3).

Laufer points out that the cormorant is a cosmopolite, spread virtually world-wide, so all nations had the same opportunity but that only a few utilised it. The Chinese are the only ones who have

fully domesticated the cormorant while the cormorants used in Japan are only partially domesticated.

Laufer also writes that the first European who described fishing with cormorants in any detail was Friar Odoric of Pordenone and ascertains, following a careful examination of the European literature from Odoric until today (1931, my note), that: “Few of these works add anything of significance to our knowledge with some exceptions Fortune and Fauvel. The rest are mainly copies of predecessors”.

Laufer writes that fishing with cormorants in Europe was practised as a transient sport until the end of the 1500s or the start of the 1600s when it made an appearance at almost the same time at the English and French courts.

England’s King James I was very fond of fishing with cormorants. John Wood was appointed “master of the royal cormorants” in 1618, and it was decided to construct cormorant ponds in Westminster. In 1609, fishing with cormorants was demonstrated to King Louis XIII at Fontainebleau.

(my note: An interesting memorandum in the context is the name of master of the hawks (or master falconer) (**“Hunting, Sporting and Gaming Establishment: The Buckhounds 1660-1837**) contains a detail: 1664, 28 June, Leeke, R. (Cormorant Keeper) and 1689, 3 May, Volinge, B. Cormorant keeper 1689-?1702)

Laufer also refers to Harting (1883) and thinks that the sport was first made known in Europe by the Dutch at the start of the 1500s as well as that “Freeman... reports two instances of cormorants having been brought to England from Holland where they were trained”.

...

The fact that English birds were previously used in both England and in Holland, “but it is absolutely impossible that they fished in the same way as in China since the Chinese birds were fully domesticated “while their European cousins were never domesticated, just trained to hunt fish”. ...

Fishing with cormorants was limited to Holland, England and France. No attempt was made in either Germany or Scandinavia to train cormorants. Olaus Magnus (History of the Goths, Swedes and Vandals, 1558)... briefly describes the cormorant under the name of “water crow” or “eel rook”, but does not allude to fishing with cormorants”.

Regarding the systematics/taxonomy of Cormorants, Laufer writes:

The cormorant of China does not constitute, as was formerly assumed, a species of its own, being paraded under such hard names as *Hydrocorax sinensis* Viellot, or *Pelecanus sinensis* Latham or *Phalacrocorax sinensis*. According to Armand David (Les oiseaux de la Chine, p 532) and other ornithologists, the Chinese cormorant is identical with that of Europe, and must simply be termed *Phalacrocorax carbo* Schr. Swinhoe. The species is diffused as far north as Kamchatka, and is very common along the entire coast of China and on lakes and rivers in the interior of the country, as well as in Mongolia. Moreover, this species is widely distributed along the Atlantic coast of North and South America, in South Greenland, Iceland, the Faroe Islands, Europe, Asia, Africa, Australia, and New Zealand.

According to Laufer, there were significant differences between China and Japan. He writes the following⁶:

Japanese terminology U ..*Phalacrocorax carbo*

⁶ Translator’s note: this is what I assume was meant by the Swedish.

P. cappillatus

P. pelagicus

P. bicristatus

P. carbo hanedae Kuroda

...

During the daytime the birds gather on islands; at night they roost in trees of forests. The ordure of the birds is poisonous, and the trees on which for a long time they have perched will decay.

...cormorant fishing is distributed in China over a vast stretch of the territory... the birds have been truly domesticated and bred in captivity, with the result that hundreds of birds can be easily be transported from one locality to another... ..in Japan fishing is restricted to certain localities,... for one species, the ayu .. always recruited from wild stocks... no active trade...could develop.

Laufer also ascertains that: “The wild cormorant is not difficult to tame... and Harting (1883) quotes... “His heart is very near to his stomach”.

According to Laufer, the cormorants used in China were fully domesticated. They bred in captivity and only rarely was new blood introduced from wild-caught birds, special establishments do business with breeding birds and selling or leasing them to fishermen. The value of a bird amounted to “ten taels (ounces of silver)”.

Friar Odoric of Pordenone describes the “free fishing method” (Chinese, my note) which requires a long period of domestication. The birds were released without being driven and immediately began to dive and catch large amounts of fish that they placed in baskets of their own free will, being equipped with rings around their neck and bands in the boat after having finished fishing.

The Japanese method of catching young birds in their resting places, which have their wings clipped, are equipped with hoods and sent to Gifu...

According to Laufer, people in Japan were “constantly concerned that they might escape and put pressure on the birds to an unnecessary extent”. The Japanese fishing with cormorants was more of a religious ritual (sacred bird) and aimed at capturing just one type of fish, the Ayu (*Plecoglossus altivelis*).

Interesting in this context is a history of art essay: “**Fishing with cormorants: a note on Vittore Carpaccio’s Hunting on the lagoon - Critical Essay**” (Knauer, E.R., 2003) which analyses a painting that is probably dated to the early 1490s that very probably depicts fishing with trained cormorants outside Venice. The painting also shows some “free cormorants” sitting on poles. The painting shows that cormorants were used for fishing in Italy as early as during the 1400s - 1500s and was a popular sport in renaissance Venice and possibly as early as during the 1300s. The essay asks how this fishing method could have been developed in such far apart areas as China and Europe. One possible answer is the contacts between Venice and China that go back to the 1200s and 1300s and were facilitated by “pax mongolica”. This essay also indicates that Marc Polo did not mention fishing with cormorants from his travels in China but Fransican monk Odorico Matiussi (Odoric of Pordenone), 1263-1331, did.

A reference is also made to a painting by Pietro Longhi (1702-85) which is usually called “Duck Hunters on the Lagoon”, dated to around 1760, that depicts a “well-dressed gentleman” being rowed on the water aiming a bow and arrow using “terracotta balls” using principally the same

method as on Carpaccio's "Hunting on the Lagoon". Other paintings by Longhi from the same environment show seabird hunting but the hunters then use firearms/rifles. It seems as though fishing with trained cormorants may have gone on in the Venice area way into the 1700s.

Comments

What? (method and biological unit)

Both fishing methods and biological units were introduced into Europe.

The fishing methods were very different. In Japan, tethered flocks of wild-caught, semi-domesticated cormorants were used for ritual fishing of one single species, the Ayu. In China on the other hand, fully domesticated animals, hatched and bred in captivity, were trained to swim freely and hunt fish and bring them to the boat. There even seem to have been major method differences in Europe. In Venice's lakes, an Italian variant of the Chinese form of fishing was developed while the method in North-Western Europe, at least during the 1800s, was more reminiscent of traditional hunting with falcons from the hand.

Biological unit

From Japan *Palacrocorax carbo* is mentioned as well as *P. cappillatus*, *P. pelagicus*, *P. bicristatus* and *P. carbo hanedae* Kuroda.

The following from China are mentioned: "the fishing cormorant of China (*Phalacrocorax sinensis*), *Hydrocorax sinensis* Viellot, or *Pelecanus sinensis* Latham or *Phalacrocorax sinensis*".

There are details of the introduction to North-Western Europe of trained cormorants from China, probably *P.c. sinensis*. The details on fishing with cormorants in Italy from Olaus Magnus in (1555) is probably *P.c. sinensis* (Bernström, 2008). There are no details of the introduction of *P.c. sinensis* to Italy from Asia via the trade routes in the eastern Mediterranean Sea, but there are details on the introduction of trained cormorants from England to Italy, although unclear as to whether it was *P.c. sinensis* or *P.c. carbo*.

Where? and When?

According to several sources, fishing with cormorants has taken place in Japan since the 500s and in China since the 900s. In Europe, the method of fishing with cormorants was first known in Italy sometime during the 1200-1300s and, somewhat later, at the start of the 1500s, in Holland, England and France.

In Europe, it was a popular sport in aristocratic circles, particularly at the end of the 1500s and during the 1600s, but the interest declined during the 1700s.

The sport saw a new brief upturn during the latter half of the 1800s, particularly in England.

A few questions and a possible scenario

Many questions have been raised by the above details.

What sort of cormorants were used and where from and when did they come to Europe?

The cormorants that were used in each area seem to be *P. capillatus* in Japan and *P.c. sinensis* in China, and in Europe possibly both *P.c. sinensis* and *P.c. carbo*, something that needs further clarification.

It is strange that cormorants, if they were common in Europe during the 1600s, were so desirable and expensive that princes engaged in cormorant theft. Was it because they were trained, was it *P.c. sinensis* or *P.c. carbo* and were they wild-caught in Europe (like in England) or introduced from outside?

It is unclear as to how common *P.c. sinensis* was in North-Western Europe before the 1500s and what effect the *P.c. sinensis* that were introduced to Holland from China may have had on an indigenous population. During the following centuries, the sport had a certain scope in Continental Europe and England. The interest went in waves but fell during the 1700s.

Trained/domesticated *P.c. sinensis* may have escaped or been released and established itself in some locations in the Netherlands. A certain spreading is also definitely likely to have occurred to the neighbouring areas in Germany. Blumenbach, who was the first to describe the cormorant variety that existed in Holland/Germany as a separate species in 1798 must have known about both the introduction and the origin when he gave it the name of *Pelecanus Sinensis* (later *P. c. sinensis*), “the pelican from China”.

This opens up an exciting cultural-historical/biological research area that ought to be able to shed a great deal of light on “the chinese cormorant” in Europe. Interesting study materials should be available in abundance in art museums and libraries.

8. Introgression and hybridisation

During the most recent decades, several details have been published on introgression between *P.c. carbo* and *P.c. sinensis* from breeding sites in England and Western France.

The concept of “introgression” has been used in different senses and for different phenomena, for both spatial introgression, individuals from *P.c. carbo* and *P.c. sinensis* breeding in the same colonies, and for genetic introgression, individuals from *P.c. carbo* pairing with individuals from *P.c. sinensis* and thus hybridising.

The essay “**Problèmes Biogéographiques, Écologiques et Taxonomyques Posés pairs le Grand Cormoran *Phalacrocorax carbo***” (Marion, L. 1983 Rev. Ecol. (Terre Vie), vol. 38,) attempts to ascertain subspecies belonging, *P.c. carbo* or *P.c. sinensis*, among cormorants breeding in Western France on the basis of morphology, biogeography and ecology. Some conclusions are that it is not possible to definitely distinguish *P.c. carbo* from *P.c. sinensis* simply from the adult birds’ plumage, and that the immigrants to Grand-Lieu in France probably come from the Netherlands and not from the British Isles, and are thus probably *P.c. sinensis*.

The reasons given for the conclusions are:

1. that the breeding habitat (in France, my note) is like that in the Netherlands
2. that there is a clear difference between the subspecies’ habitat preference for both the breeding and overwintering areas
3. since 1967, the inflow of overwintering cormorants to French inland waters coincides with the increase in Holland and Denmark.
4. (sic)

To summarise, it is thought that available “data supports the hypothesis of different racial preference for a given habitat between *carbo* and *sinensis*. It must not involve a genetic determinism for such a habitat preference. The same result can be achieved with a learning process, such as a traditional preference for the habitat where the adult birds have hatched and grown up”. (note: my poor translation)

In the essay entitled “**Racial identity of Cormorants *Phalacrocorax carbo* breeding at the Abberton Reservoir colony, Essex**” (Sellers, R.M. 1993, Seabird 15: 45-52), Sellers writes:

...
The racial identity of Cormorants *Phalacrocorax carbo* breeding at a recently founded tree-nesting colony at Abberton reservoir, Essex was assessed by comparison with birds at two breeding colonies in the Netherlands (birds of the continental race *P.c. sinensis*) and at several colonies in Wales and Scotland (birds of nominate race *P.c. carbo*). The two races differ in several respects and based primarily on the gloss to the plumage, the whiteness of the head, the size of the white thigh patches and the shape of the gular pouch, together with the evidence from ringing, it is concluded that the birds breeding at Abberton in 1989/90 were more likely to have originated from the British Isles than the continent.

...
Cormorants of the N. Atlantic race usually breed on cliff ledges, rocky stacks and islets (Cramp & Simmons 1977) but tree nesting is not unknown. Thus in Ireland Macdonald (1987) recorded that 14 % of the colonies (11 of 77) surveyed in 1985 and 1986 were in trees and there were formerly tree-nesting colonies in Norfolk (Seago, 1967), Suffolk

(Pyan, 1962), Pembrokeshire (Lockey et al, 1949) and Scotland (Baxter & Rintoul 1953), as well as an unsuccessful attempt in Kent 1947 (Gregory, 1948).

A frequently quoted essay that is considered to verify that hybridisation occurred between *P.c. carbo* and *P.c. sinensis* is “**Population introgression and differentiation in the Great Cormorant *Phalacrocorax carbo* in Europe**” (Goostrey et al 1998, Molecular Ecology Vol 7 no. 3). (note: only the **Abstract** was available to me)

There, you read that “Multivariate analyses indicated that these inland colonies (south-east England, my note) were not comprised solely of *P.c. sinensis*, but that both subspecies were living sympatrically and were probably hybridizing”.

The essay “**The subspecific origin of the inland breeding colonies of the cormorant *Phalacrocorax carbo* in Britain**” (Winney et al 2001, Heredity Jan 2001 vol. 86, number 1) shows analyses of mtDNA in feather, tissue and blood samples to ascertain “the subspecific origin of two recently established breeding colonies”.

Discussion

Three distinct groupings were found: Scotland – Norway (SN), England Wales- Iles the Causey (WE), and the rest of Continental Europe (CE).

....

Within Europe, there now appears to be an overlap in range, with the two subspecies becoming sympatric in what were previously thought to be separate wintering ranges of *P.c. sinensis* and the French coastal populations of *P.c. carbo* (Marion 1995).

...

The simplest hypothesis that can be drawn from these two sets of molecular data is that male *P.c. sinensis* initially colonized Britain and established inland breeding colonies, for example at Abberton, where they bred with WE females.

...

At present it is not possible to discriminate

...

Further work must be undertaken to establish whether the two subspecies hybridize or mate assortitatively within Britain...

An essay entitled “**Further European integration: Mixed sub-species colonies of Great Cormorants *Phalacrocorax carbo* in Britain- colony establishment, diet and implication for Fisheries management**” (Carss et al 2002 Ardea 90(1): 23-41) gives the question of possible hybridisation further clarification through studies of colony size, food, etc.

...

Inland colonies of Great Cormorants *Phalacrocorax carbo* in Britain contain individuals of both European subspecies the Atlantic Great Cormorant *P.c. carbo* and the Continental Great Cormorant *P.c. sinensis*. Not only are the two breeding together, they are probably hybridising.

... We speculate on the implication of inland mixed subspecies Great Cormorant colonies in Britain for the future management of both Great Cormorants and Fisheries.

...

The racial origin of tree-nesting Great Cormorants in Britain has been the subject of speculation but DNA analysis indicated that they have a considerable *sinensis* component with both sub-species living sympatrically with some level of introgression/hybridisation between the two (Goostrey et al., 1998).

Discussion

... Inland colony formation in Britain is still a relatively new phenomenon... (2) further genetic investigations into the sub-species composition of inland colonies and the levels of introgression...

The rapid expansion of cormorants at inland locations in England in recent decades has been the subject of a doctoral thesis, "**Colonisation and range expansion of inland breeding Great Cormorants *Phalacrocorax carbo* in England**" (Newson, S.E. 2000. Thesis, University of Bristol).

One part of the thesis discusses *P. carbo* in detail as an invasive species:

The biology of invasive species

Biological invasion occurs when a species arrives at a new area beyond its natural range and establishes a viable population. These species, often termed invasive species, may increase their range naturally or recently, more commonly, through introduction or modification of the species environment by humans (reviews in Elton 1958, Williamson 1996).

....

An invasive species: the Great Cormorant

...

The origins of the two sub-species in Europe are unknown, although fossil records show that Great Cormorants were present in The Netherlands at least 4-6 thousand years ago (Clason & Brinkhuizen 1978) and probably colonised Western Europe 8-9 thousand years ago (Hansen 1984). The sub-specific distribution from this time to the 20th century is poorly known, but apparently complicated, with shifting subspecies distributions (Ericson & Carraquilla 1997). However, the little available evidence suggests that population levels of *P.c. sinensis* at least were kept low and distribution restricted most likely through habitat loss and persecution by humans (Van Eerden & Gregersen 1995).

....

General discussion

.... While the theory of invasion biology has advanced through computing and analytical techniques, for many species such as Great Cormorants, basic natural history is still lacking.

In order to further clarify any hybridisation between *P.c. sinensis* and *P.c. carbo*, the above researcher was contacted, who gave the following response (Newson, S.E. (2002, pers. com.):

Work carried out at Nottingham University showed that *P.c. sinensis* and *P.c. carbo* are at least as genetically distinct as Hooded and Carrion Crow (*Corvus corone*) although further than that, their results could not prove or disapprove full species status of the two subspecies.

....

So in answer to your question are the two subspecies “melting together”, if they were full subspecies, England and (possibly parts of France) could be classes as hybrid zones and as my thesis suggests, in inland England we are in a period of change. As far as I know, presumed *sinensis* has not been observed in coastal colonies.

In the essay entitled **Sub-specific differentiation and distribution of Great Cormorants *Phalacrocorax carbo* in Europe** (Newson et al, 2004 Ardea 92(1): 3-10), biometrical methods were used (primarily the “gular pouch” from skinned examples) in order to establish subspecies belonging

- together with bill height and -length possible to establish the majority’s subspecies belonging.....
- of 261 Great Cormorants shot in England during the winters of 97-98 and 98-99, 66 % were *P.c. carbo* and 34 % *P.c. sinensis*. .. “this suggests that *P.c. carbo* is currently the predominating sub-species inland in England during the winter”.

Discussion

In this study we assume that cormorants belong clearly to one or other of the two subspecies- However, hybridisation between the two subspecies of Great Cormorant has been demonstrated at inland colonies in England through recent molecular studies (Goostery et al 1998; Winney et al 2001) although the level of hybridisation occurring and the influence of this on Great Cormorant biometrics is unknown.

...

Whilst the inland breeding, predominantly *P.c. sinensis* population is increasing rapidly, the coastal *P.c. carbo* population is relatively vulnerable to years of poor breeding or survival (Newson, 2000), and parts of its range, such as north-east Scotland, long-term population decline is occurring (Budworth unpubl.data).

...

The findings of this paper now allow for a long-term and cost-effective monitoring of subspecies occurrence and population development in the UK, as well as in other European countries where the two sub-species may occur. This will be important for improving our current understanding of the dynamics and possible introgression of the two sub-species, and for assessing differences in diet, energy consumption, habitat use and distribution.

The question of the genetic status and immigration history of the subspecies of *P. carbo* occurring in Europe as recently been clarified in great detail by the essay **“Ecological segregation and population structuring of the Cormorant *Phalacrocorax carbo* in Europe, in relation**

to recent introgression of continental and marine subspecies”. (Marion, L. et al, 2006 Evolutionary Ecology 20:193-216).

The essay describes the distribution and spreading of the two subspecies in Europe. *P.c. carbo* is spread in many small colonies along the Atlantic coast. In 1970, *P.c. sinensis* occurred only in a dozen relatively large colonies in its core area in Holland and Denmark as well as secondarily also in Germany, Poland, Sweden and Hungary. General protection in 1970 led to a major geographical expansion to France and England in 1981 and Italy in 1985 and, from 5 300 pairs in 1970 to 102 000 pairs in 1995.

A genetic study of the relation between the different subspecies of Great Cormorant in Europe states that it can be divided into three parts: a “Continental” *P.c. sinensis* and a “marine” one that can in turn be divided up into two units, a western (“Western Europe”) *P.c. carbo* as well as a more northerly (Norway) *P.c. norvegicus* that is believed to be closely related to the Japanese cormorant *P. capillatus*. The northern variety’s close relationship to *P. capillatus* is explained by the fact that it probably originates from the eastern Siberian coast, which is similar to the division to which the ice age led for other species like the brown bear (*Ursus arctos*).

Of interest is the information that analyses of material from the Mediterranean Sea (Santa Caterina on Sardinia):

...seemed to be mainly a relict *P.c. carbo* colony (unfortunately destroyed recently, S.Volponi com. pers.).

...

Although the Sardinian population is located within the current distribution area of *P.c. sinensis*, it is marine and existed prior to the recent extension of *P.c. sinensis* to Italy, and was thus considered in the literature as *P.c. carbo*.

The discussion produces several interesting thoughts about the time of the separation between *P. carbo*’s subspecies and it suggests a possible scenario for their spread in Europe after the last ice age.

We do not know when *P.c. carbo* and *P.c. sinensis* diverged from one another, nor when the species itself diverged from other Phalacrocoracidae since this family appeared at least 30 million years ago. If we assume an average mtDNA substitution rate of about 20 %/Myr for the control region (see Methods), the divergence could have occurred 290 000 years ago if we consider the overall divergence of 5.76 % observed in the present study, that is to say in the Pleistocene, a period where speciation events occurred in many taxa (Zink and Slowinski, 1995), well before the recent glaciations.

...

However, if we consider the ecological traits of the two subspecies, their separation probably occurred during the Wurm, when the European part of the *P.c. sinensis* population probably found a refuge in the Danube Basin while *P.c. carbo* did on the Atlantic coasts and maybe in the Mediterranean sea (as shown by the relict Sardinian population), both subspecies expanding towards the north when the ice cap retracted. For instance, according to Ericson and Carrasquilla (1997), Cormorants that bred in Sweden from about- 12 000 years BP until the late Mediaeval (1500 AD) were presumed to be *P.c. carbo* from the size of their skeleton (or *P.c. norvegicus*?). Precisely when the subspecies *P.c. sinensis* immigrated into the Baltic is unknown but it must have occurred sometime between 1500 and 1800 AD.

Comments

What?

The concept of introgression is used in both a spatial and a genetic sense.

In England and Western France, the distribution of *P.c. carbo* and *P.c. sinensis* overlap while overwintering since the 1990s and this is also the case for individuals from *P.c. carbo* and *P.c. sinensis* breeding in tree colonies.

According to some details, *P. carbo* in Europe today consists of three units; *P.c. sinensis* and *P.c. carbo* as well as perhaps *P.c. norvegicus*.

Where? and When?

A separation between *P.c. sinensis* and *P.c. carbo* can either have occurred around 290 000 years ago, i.e. long before the last ice age, or during the last ice age when *P.c. sinensis* may have found a refuge in the Danube delta and *P.c. carbo* along the Atlantic coast and possibly in the Mediterranean Sea.

Regarding the immigration of *P.c. sinensis* into the Baltic Sea area this is presumed to have taken place sometime between 1500 and 1800 (the details are based on Ericson et al, 1997, my note).

Hybrid zones are not uncommon between related species with neighbouring distribution areas. It seems strange that hybridisation between *P.c. carbo* and *P.c. sinensis* did not occur until during the 1990s if the distribution areas were close or overlapping following the last ice age or since “immemorial times”.

The question on hybridisation between *P.c. carbo* and *P.c. sinensis* cannot be considered to have been finally settled, but may involve a genetic risk for the *P.c. carbo* that breeds in the British Isles and France and for the *P.c. carbo* or *P.c. norvegicus* that breeds in Norway.

9. Indigenous or alien, naturally occurring or introduced

The environmental policy and nature conservation have over recent decades focused all the more on questions concerning biodiversity, threatened species and environments as well as the threat from alien species. National red lists, Species databanks, action programmes, environmental policy measures and rules and regulations to preserve threatened species have held a prominent position in the environmental debate. At the same time as a number of measures being taken to protect indigenous species, intensive work is ongoing to prevent the spreading of **alien species**, which has given rise to a special discipline called **invasion biology**. The Swedish Environmental Protection Agency has the main responsibility for preventing the undesirable spreading of alien species in Sweden.

From a biological and legal point of view, it is of the utmost importance to clarify the category in which an organism should be placed and there are still many uncertainties where concept formation and definitions are concerned.

An organism is either **indigenous** or **alien**.

Other concepts that are sometimes used as synonyms for indigenous or alien and sometimes as clarification supplements are **naturally occurring** or **introduced**. These are **exclusive categories** - an organism is either indigenous or alien, naturally occurring or introduced.

A report from The Swedish Board of Fisheries “**Invasion Biology: a Baltic Fish Experience**” (Almquist, G. Finfo 2007:4) gives a detailed description of the field and the different concepts used. Among the suggestions is that instead of “introduced species”, use a more general concept like “**non-indigenous species**” (NIS). An NIS is considered to be **invasive** when it starts to commonly occur in the recipient region and has a negative effect on the indigenous biota (my note and translation). Additional concept definitions, etc. can be read on a large number of organisations’ websites, e.g. www.frammandearter.se, www.biodiv.se, **The information centres for the Gulf of Bothnia, the Baltic Proper and the North Sea**, The North European and Baltic Network on Invasive Alien Species (NOBANIS), (tematea.org).

In order to be meaningful the above categories must be defined on the basis of **What?**, **Where?** and **When?**

What is alien?

An early essay on the subject, “**Biological invasion or greater diversity?**” (Hägerhäll Aniansson, B., 1999 Fauna and Flora 94:2), contains a definition of the concept **alien**:

This refers to species, subspecies, populations, provenances or genetic material that have not naturally occurred in Sweden during historical times (the past 900 years) but that, through some form of human help, intentionally or unintentionally have moved here to an area outside the organism’s natural distribution area.

... Neither indigenous nor alien means any valuation in the sense of being better or worse.

In a Report from The Swedish Environmental Protection Agency, “**Spreading of alien populations in Sweden**” (REPORT 5475 Laikre et al, 2005) you can read the following:

A species according to CBD’s definition (Article 8h in the Convention on biodiversity, my note) also includes lower taxonomic units and genetically distinct groupings that may occur within a species. Alien species are therefore made up of both species that do not occur naturally within a geographical area and of genetically alien populations of species that occur naturally within an area.

...

There are evidently risks that the spreading of alien populations may affect the biodiversity at gene level in “recipient” natural populations. Such an effect may lead to loss and change of biodiversity primarily at gene level, but in the long run also at “higher” levels (species and ecosystem level).

...

...hybridisation between transplanted and “natural” individuals occur and such hybridisation leads to the breakdown of genetic adaptations to local environment conditions.

It should be added that the concept of **population** may have a very different meaning from the genetically defined “local population” mentioned in the “biological species concept” (Mayr, 2004) to a more practical meaning that simply indicates the individuals that exist within a more or less arbitrary geographical area, sometimes administrative as a nation or an organisation of nations like the EU.

Where is an organism alien?

An organism can be alien in an administrative or biogeographical area.

Neither the discipline of biology nor organisms take into account administrative borders; laws and regulations, on the contrary, apply only within geographically delimited administrative areas.

The EU’s Bird Directive covers all Member States and national rules and regulations are “subordinate” to those of the EU. Both Sweden and the EU are bound to comply with international Conventions.

EU enlargement also means an enlargement of the EU’s flora and fauna and, reasonably speaking, a reconsideration of which organisms should be considered to be alien or indigenous. The status of the organisms in the individual Member States should on the other hand not be affected in the same way. Organisms that are alien in Sweden or in various parts of Sweden do not need to be alien in other EU States and organisms that are indigenous in places like Greece can be alien in Sweden.

Another difficulty is defining and drawing relevant delimitations of the biogeographical areas. A relatively well-delimited biogeographical area can be the Baltic Sea, including the drainage area and within Sweden’s borders the “eastern archipelago”, from Örskär in the north to Kråkelund in the south.

When is an organism indigenous or alien?

There is no clear-cut answer to the question When?

There is no obvious retrospective time limit for that which is “original”, but there is sometimes a delimitation between prehistoric and historic time. For Sweden, “indigenous” then means species, subspecies, populations or genes that have occurred in Sweden since prehistoric times (since at least the start of the middle ages around 900 years ago) and that have naturally spread to an area. According to the Convention on biodiversity on the other hand, time limits are not important - a species that comes under the definition of an alien species is alien, irrespective of whether it came here 1 000 years ago or earlier in the year. (www.frammandearter.se)

The Swedish Board of Fisheries draws the line for “alien” far later than that since Swedish flora and fauna “has continuously changed since the last ice age and is relatively young, a limit is often in practice drawn at the year 1850, and species that have come to the country since then are considered to be alien”. The **Species Databank** also decided in 2005 when revising its red list (species that are threatened with extinction in Sweden) that species that have been introduced into Sweden since 1850 will not be included on the list.

On the other hand, according to the **Convention on biodiversity**, time limits are unimportant - a species that comes under the definition of alien species is alien, irrespective of whether it came here 1 000 years ago or earlier in the year. Nor does it need to concern migrations between countries, across actual national borders. If a species has not been able to move from one area to another within the same country by its own effort, but can move with the help of humans, this is considered to be the introduction of an alien species into the new area. (Laikre et al, 2005)

One example of the handling of an alien introduced organism

One species that is categorised as alien in “Sweden and Europe” is the American Ruddy Duck (*Oxyura jamaicensis*) and The Swedish Environmental Protection Agency writes (www.naturvardsverket.se):

...

International bird protection organisations have therefore agreed that it is urgent for all American Ruddy Ducks in Europe to be destroyed.

...

The species is an alien bird in Sweden and Europe. Sweden’s affiliation to the International Convention on Biodiversity means that we have undertaken to control, eradicate or prevent the introduction of the alien species that threaten indigenous ecosystem living environments or species.

The Swedish Ornithological Society (SOF) has accepted this, which is justified by:

...that it hybridises with and out-competes a European indigenous species of Ruddy Duck (*Oxyura leucocephala*), simply called “kopparand” [Ruddy Duck] in Swedish. This

Ruddy Duck is very much threatened with extinction and intensive work is therefore ongoing to eradicate the alien American duck.

Hunting to protect species was quite rightly permitted all year round against the American Ruddy Duck as of this year. It is probably the first time in Europe that people have agreed on an eradication battle against an introduced animal species that is threatening the indigenous fauna. The SOF encourages hunting of the American Ruddy Duck and ornithologists who observe individual American Ruddy Ducks to report this to the municipality or county council since this introduced species of duck has become a threat to the acutely threatened European Ruddy Duck.

Comments

What?

According to the CBD's definition (Article 8h of the Convention on biodiversity, my note), a species also includes lower taxonomic units and genetically distinct groupings that may occur within a species. *P.c. sinensis* may for good reasons be considered to be such a unit.

Where? and When?

The cormorant issue makes topical the existing problems of delimiting and handling changes to the administrative and biogeographical areas in time and space.

P.c. sinensis would very likely be designated as an alien organism in Sweden in the 1800s.

10. The cormorant in the EU's rules and regulations

The EU's legislation is superior to that of the Member States and the EU's handling of the cormorant issue is therefore of considerable national interest, particularly bearing in mind the EU's enlargement and the way in which indigenous and alien species must be classified and handled in new and old member countries. Of particular significance is the EU's Bird Directive that sets stringent requirements for the Member States.

The “**Action Plan for the handling of the cormorant population in the landscape**” (www.ls.alan.fi) describes it as follows:

In the EU's “Bird Directive” (79/409/EEC) in the 1995 wording, the Lesser Great Cormorant race is included in Annex 1 to the Directive, which means that in order to safeguard the species' continued population, “special measures need to be taken to safeguard the protection and continued population of the species within the Union”. In the Commission's Directive 97/49/EC of 29 July 1997, the Lesser Great Cormorant race is removed from Annex 1 on the grounds that “the bird subspecies *Phalacrocorax carbo sinensis* (Lesser Great Cormorant) has achieved a favourable preservation status”. On the other hand, the Lesser Great Cormorant is not moved to Annex II of the Directive, which would, for example, mean that regular hunting could be introduced, and the Great Cormorant is not mentioned in any other way, which means that it is also “automatically” covered by Article 4 of the Bird Directive in which requirements are set regarding the overwintering area for species that breed outside the Union's borders but that overwinter within them.

Regarding “the guidelines on the management of cormorants”, the Swedish Hunters' Association (2000) writes the following in “**Referral concerning the proposals for the “Management plan for the Lesser Great Cormorant - Great Cormorant”**” on the “legal conditions” in Sweden:

With Sweden's accession to the EU, the option of general hunting of cormorants ceased as of 1 January 1995. As a consequence of the powerful increase in cormorants in recent years, discussions are taking place within the EU on the options and consequences of introducing the Lesser Great Cormorant to Annex 2a or 2b of the Bird Directive, which would permit general hunting. Since 1997, the Lesser Great Cormorant has been omitted from Annex 1 of the Directive, which means that there is now no obligation to establish special protection areas (SPA) for the species.

(it was *P. c. sinensis* that was listed in Annex I of the EU's Directive (79/409), my note.)

Comments

What?

In its rules and regulations, the EU can handle biological units, taxon and categories of different ranks, in the cormorant issue both *P. carbo* and *P.c. sinensis*, as well as introduce special rules concerning subspecies as for *P.c. sinensis*. However, in the documents from the EU and others that concern cormorants, the handling of name, taxon, etc. is often inconsistent and **category and rank errors** are common occurrences.

Where?

From when “the European Community” (EEC) was formed in 1957, the EC (1965) and then the EU (1993) has undergone considerable geographical enlargement and thereby so has the EU’s mandate, which in 2008 covers 27 countries and a major part of the Continent of Europe.

When?

Before 1979, the EU’s rules and regulations (note: e.g. EC) included only *P. carbo* and thereafter both *P. carbo* and *P.c. sinensis*, and after 1997 only *P. carbo*. The rules on *P.c. sinensis* established by the EU in 1979 and 1997 also came to include Sweden’s territory as of 1995.

The EU’s handling of “the cormorant” raises primarily two questions:

On what scientific grounds was the decision made to introduce *Phalacrocorax carbo sinensis* to Annex 1 of “**Council Directive 79/409/EEC of April 1979 on the conservation of wild birds**” as well as in 1997 to remove this taxon from the list?

Which taxon is indigenous and alien in the EU and what does the EU enlargement mean as regards the content of the concepts and application thereof in the Member States?

11. A few pan-European cormorant projects

The cormorant issue is now very much a European matter and several projects, primarily to reduce conflicts regarding the Lesser Great Cormorant and various utilisation interests, have been ongoing since the mid 1990s.

Participants in the projects are primarily researchers who are interested in cormorants and representatives of different authorities plus, to a lesser extent, representatives of the fisheries and other user interests.

Wetlands International Cormorant Research Group CRG

CRG was formed in 1993 in order to facilitate the comparison of knowledge on ecology and biology among the different cormorant species around the world. CRG issues a Cormorant Research Group Bulletin. In a **Position Statement** (1993), CRG writes about "Populations, status and trends:

1. Cormorant populations have expanded greatly during the last 10-15 years from levels that were previously held low by man. There is still strong population growth in some areas, especially in the northern parts of the European range of *P.c. sinensis*, and the beginning of (possible) sharp population increases are evident in central European areas also, such as Lithuania and Bulgaria.
2. In 1992, the European breeding populations were estimated at 105 000 pair for *P.c. sinensis* and 45 000 pairs for *P.c. carbo*. This is the first European wide estimate for *P.c. sinensis*, whose north-central European population alone rose from 40 000 pairs in 1988 to 77 000 pairs in 1992, a 93 % increase. Census data for *P.c. carbo* from the same period are less complete, but the population increased by less than 20 % during this time.
3. The most important breeding areas for both sub-species lie in the northwestern Europe. Denmark and The Netherlands together support more than 50 % of breeding *P.c. sinensis* in Europe, whilst Norway and Great Britain are the primary breeding areas for *P.c. carbo*.

In connection with the CRG's work, a group of researchers began to draw up an "**Action Plan for the Management of the Great Cormorant in the African-Eurasian Region**" that would be established during **1997**. The intention was for the plan to primarily concern *P.c. sinensis* and the conflicts linked with the subspecies. Those responsible for the formulation of the plan were researchers from the Netherlands and Denmark but, following internal objections, various perceptions of the main direction, etc., (the German government and the EIFAC were particularly critical), it has achieved no noteworthy impact (see REDCAFE below).

Between 2002 and 2004, a project called **REDCAFE** (Reducing the conflict between Cormorants and Fisheries on a pan-European scale) was ongoing, which was a "concerted action funded by the European Union".

A final report, “**Report of a Concerted Action funded by the European Union**” (Study contract no. Q5CA-2000-31387REDCAFE (2002): Reducing the conflict Lesser Great Cormorants and Fisheries on a pan-European scale. Carss, D.N. ed.) states the following:

1.1 Pan-European Great Cormorant populations

Two subspecies of Great Cormorant (hereafter “Cormorant”) occur in Europe: the “Atlantic” subspecies *Phalacrocorax carbo carbo* and the “Continental” subspecies *P.c. sinensis*.

... Although there are no estimates for *sinensis* populations during 19th century or the first half of the 20th, it is likely that numbers in the remainder of Europe had declined to an unprecedented level of around 800 breeding pairs in the Netherlands in the early 1960s: Thereafter, numbers have increased dramatically to over 150,000 pairs throughout the region in 1995 (van Eerden & Gregersen 1995) and it is likely that the species is now more numerous than ever before.

....

The geographical range of these populations has also expanded with Cormorants returning to some areas after a long absence whilst also moving into areas previously never occupied. Recent DNA studies have shown one consequence of such population increases and associated range expansion. *Sinensis* birds are breeding in inland colonies in the UK, living sympatrically, and probably hybridising, with *carbo* populations there (Goostrey et al. 1998).

....

The reason for such expansion are unclear but possible causal factors include a “non-limiting food supply” (i.e. populations are not limited by lack of food), protection of breeding sites and reduction in persecution throughout Europe (van Eerden & Gregersen 1995, Bregnballe & Gregersen 1997).

The explanation for the rapid expansion of *P.c. sinensis* is given as being the human impact on the landscape, etc. as well as greater protection (EEC Directive 79/409 as well as the Berne, Bonn and Ramsar Conventions).

It is laconically ascertained that: “(The) Action plan for the Management of the Great Cormorant in the African-Eurasian Region, (is) largely ignored by the Range States”.

The two *P.c. sinensis* “core areas” and expansion direction are shown in the Figure and quotations below”:

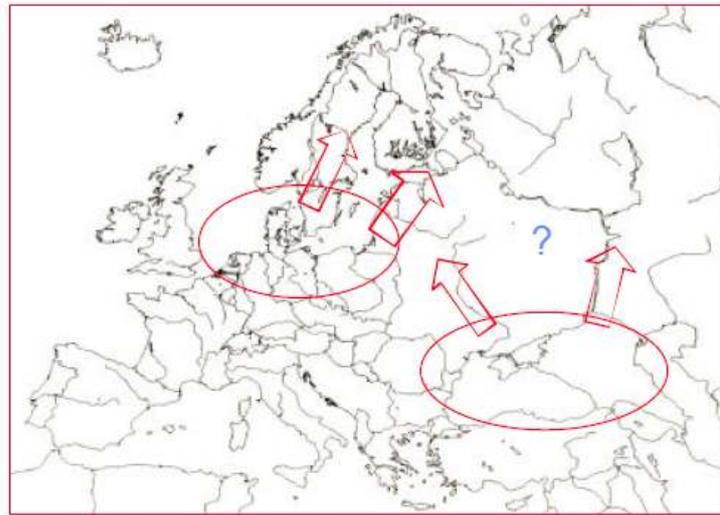


Figure 4.1 Core areas of Cormorant (*sinensis*) distribution in Europe with current direction of expansion (arrows).

Fig. 4.1 Core areas of Cormorant

4.3.2...

In Europe, one core Cormorant area includes the Netherlands, Denmark, Germany and Poland. From this core area Cormorants have expanded into Baltic countries, Sweden and less into central Europe and Great Britain. A second core area exists in Romania, Ukraine and southern Russia. The Cormorant is a migratory species that winters in the Mediterranean and the Black Sea but also at northerly latitudes.

...

4.5.3

Old strongholds seem to be at their limit and numbers here are stable or even in decline. There has been a considerable geographic expansion to previously unused areas in Europe. Especially into areas in the Baltic, the Finnish Gulf and Sweden (see Figure 3.6) there have been recent increases in the number of colonies and the number of Cormorants. A second core area of distribution is in Eastern Europe, around the Black Sea (Romania, Ukraine). ... Cormorant numbers are increasing here too and new colony foundation is occurring inland in Ukraine and Russia.

REDCAFE has been followed up by a project partly financed by the EU, called **INTERCAFE** (Interdisciplinary Initiative to Reduce Pan-European Cormorant-Fisheries Conflicts), “a four year 2004-2008, pan European COST Action”.

The plans and activities of INTERCAFE are described in a report: “**INTERCAFE: Conserving Biodiversity- Interdisciplinary Initiative to Reduce pan-European Cormorant-Fisheries Conflicts, Proposal for a new COST action 2004-2008**” (Carss, D.N. prop. 2004)

The following is written regarding REDCAFE:

One of the most important aspects of REDCAFES work, in relation to the provision of management solutions for cormorant-Fisheries conflicts, was to show clearly that such conflicts are complex in terms of their biology but that social and economic issues are equally important: these conflicts are sometimes as much human: human ones as they are human: wildlife ones.

Where the expansion of *P.c. sinensis* in Europe is concerned, the following quotation from the report is of particular interest:

The reason for such increase and expansion are unclear but populations are not limited by lack of food or nest sites, and protective legislation (particularly EEC Directive 79/409 on the Conservation of Wild Birds) has been an extremely important factor. ...considered to be a success for biodiversity conservation....

...

The wide geographic range of European cormorant populations and their wintering migration patterns require investigation and monitoring at the continental scale. Similarly cormorant conservation legislation is defined at the EU level but implemented nationally or regionally.

...

(1) Develop databases detailing both the size and location of European cormorant breeding colonies.....

WG1 (working group 1): Ecological database and analyses

... ecology of cormorants at the continental level

...temporal and spatial distribution

...predictions of future distribution

...via electronic databases...

In year 4, the electronic database will be ready and publicly available to “local people, NGO’s, scientists...” (September 2008, my note and translation).

In recent decades, the **European Inland Fisheries Advisory Commission (EIFAC)** has noted the cormorant issue in many different contexts.

In 2007, a Workshop was held in Germany with participants from 13 Member States, including Sweden. The report from the meeting (**EIFAC/OP41**) shows an overview of the current status of the “Great Cormorant” in each country. Common to most of the States is a strong increase over the past two decades.

An overview report ascertains that:

The number of breeding birds from the *P.c. sinensis* "Western subpopulation" has increased from 9 900 (1970) to 217 000 (2000). The *P.c. sinensis* "eastern subpopulation" has increased to 226 000 and *P.c. carbo* to an estimated 78 000 in the year 2000. Conclusions are therefore that, among other things, we need a "European Cormorant Management Plan (ECPM)" as well as that "There is a need to explore the consequences of moving the cormorant to the status of Annex II, 2 of the EU Birds Directive 79/409/EEC (nonprotected species).

The **Tematea project** (www.tematea.org), a cooperation between the UNEP (United Nations Environment Programme) and the IUCN (the International Union for Conservation of Nature) that compares information on Conventions relating to biodiversity to facilitate national applications, also contains a module that particularly covers **Invasive Alien Species (IAS)**. The "Great Cormorant" issue can be handled therein with the following conclusions and recommendations:

Recommendation 4.1

Conservation and management of cormorants in the African-Eurasian region
"Acknowledging that in the African-Eurasian region:

...

(c) The population trend of the Great Cormorant subspecies *Phalacrocorax carbo carbo* is overall to be increasing.

(d) The population trend of the Great Cormorant subspecies *Phalacrocorax carbo sinensis* is increasing strongly both in numbers and range; Acknowledging that,

...

(c) Persecution of *Phalacrocorax carbo sinensis* and *Phalacrocorax carbo carbo* in its breeding colonies in some countries

...

1 Recommends.....

(IV) Genetic analysis in order to confirm the existence of the two sub-species and the different populations of Great Cormorant and to define current range:...

...

Annex

...

There are two subspecies of the Great Cormorant normally recognized in Europe. The nominate subspecies *carbo* has an estimated total population of at least 45 000 pairs with an increasing trend, and the subspecies *sinensis* an estimated total population of at least 150 000 pairs with a strongly increasing trend (1992 estimates). Increases are also apparent in winter quarters.

Comments

The pan-European cormorant projects that have been ongoing for the past two decades have principally been aimed at **preserving** *P.c. sinensis* and, to an even greater extent, reducing **the conflicts** between *P.c. sinensis* and other interests, fishing, etc. EIFAC on the other hand is looking for measures in a “European Cormorant Management Plan” (ECPM).

What?

In the majority of projects, cormorant means *P. carbo* and then primarily *P.c. sinensis*. There is emphasis on the importance of treating *P.c. sinensis* as a unit as well as that *P.c. sinensis* consists of two separate populations. In one case there is a call for an analysis of the genetics and distribution of *P.c. sinensis* and *P.c. carbo*.

Where? and When?

Detailed information has been compiled on the expansion of *P.c. sinensis* in Europe in recent decades, but amazingly little has thus far been produced by the projects that can shed light on the earlier distribution history of *P.c. sinensis* in Europe. The final report that, according to the plans, will be made publicly available from INTERCAFE’s WG1 in September 2008 (not yet available, my note) will contain details on “temporal and spatial distribution” and “predictions of future distribution” of *P.c. sinensis* may perhaps change this.

12. Discussion, conclusions and proposals for measures

Discussion

There are some particular questions that can be asked regarding “the cormorant” in Europe.

Does the fact that *the cormorant* has dispersed and increased in numbers in Sweden and the rest of the EU mark success for the **preservation work** or is *the cormorant* an **alien** organism in the Swedish fauna and in major parts of the EU?

Put in this way, the questions are impossible to answer but if the available details on “the cormorant” in Europe are filtered through the questions What? Where? and When?, it is possible to form a clearer picture although many pieces of the puzzle are still missing.

Is it *P. carbo* or *P.c. sinensis* that is the relevant biological unit? If the concept of **the cormorant** is replaced by *P.c. sinensis*, the questions are still difficult but become possible to handle.

Is it a mark of success for the **preservation work** that *P.c. sinensis* has spread and increased in numbers in Sweden and the rest of the EU or is *P.c. sinensis* an **alien** organism in the Swedish fauna and in large parts of the EU?

Is it of significance to which category and rank a taxon like *P.c. sinensis* is assigned? When it was first noticed that there was a slightly more green-looking variety of “Great Cormorant” in Europe, it was described by Blumenbach in 1798 as a species (typological) and called *Pelecanus Sinensis*, “The pelican from China”. Throughout the 1800, perceptions changed regarding the rank and name and the taxon is currently considered to be a subspecies, *P.c. sinensis*, but with the misleading name of “Lesser Great Cormorant”. The name used by Brehm in **The Life of Animals**, for *Phalacrocorax sinensis*, the “**Chinese cormorant**”, appears to contain more information.

The extremely rapid expansion of *P.c. sinensis* over large parts of Europe follows a pattern that is similar to the one noted for various “**invasive non-indigenous species**”.

The most important reasons for the big expansion of *P.c. sinensis* in Sweden and Europe in recent decades is explained by eutrophication and improved protection, but can also be explained by an surplus of suitable nesting and breeding environments as well as the lack of natural enemies in the parts of Europe to which *P.c. sinensis* has dispersed in recent decades. *P.c. sinensis* prefers to breed in colonies (critical mass) in trees on islands where there are no predators like the Pine Marten (*Martes martes*), a common combination particularly in Sweden’s eastern archipelago and the Archipelago Sea. The way in which *P.c. sinensis* should be categorised is not just a biological question but is also of substantial economic and legal significance. If the Swedish State and the EU have formulated rules and made decisions based on inadequate scientific grounds, people that suffered economic loss should be able to demand compensation and this should also lead to the reconsideration of laws and rules and regulations within Sweden and the EU.

The distribution history of *P.c. sinensis* in Europe and Sweden, a synopsis

The historical distribution of *P.c. sinensis* as a breeding bird in Europe is still to a large extent unclear.

A find of relics av *P.c. sinensis* that are around 3 000 years old from Bulgaria indicate a “prehistoric” occurrence by the Black Sea.

The subfossil of *P. carbo* from Sweden that has been further analysed has proven to be *P.c. carbo*, which indicates that *P.c. sinensis* did not occur in the Baltic Sea area during prehistoric times.

The subfossil of *P. carbo* also found in the Netherlands is very probably *P.c. carbo*. If this is the case, there are no details of breeding of *P.c. sinensis* in North-Western Europe before 1400.

During the 1500s, *P.c. sinensis* was introduced to Holland from China, and details on breedings of *P.c. sinensis* in Holland during the 1500s – 1600s may be examples of escapees. This ought to be possible to clarify by genetic and cultural-historical examinations as well as analyses of subfossils.

In his 1798 description of the Chinese pelican *Pelecanus Sinensis* (later *P.c. sinensis*), Blumenbach indicates China as the type location.

The first geographical wave of distribution of *P.c. sinensis* during the 1700s and the 1800s started from a core area in Holland with neighbouring countries.

There is no evidence that *P.c. sinensis* bred in Sweden before 1800. Thereafter, breeding was ascertained for a period in Skåne and Blekinge but not after 1909. This lasted until 1948 before *P.c. sinensis* again bred in Sweden, this time in Kalmarsund.

Following a long period of very low growth in Europe during the 50s, 60s and 70s, an increase and spreading of *P.c. sinensis* began to which there are few equivalents within the bird world.

The process of introgression as described from England and Western France after 1990 is bewildering if both *P.c. carbo* and *P.c. sinensis* had existed with their neighbouring distribution area in large parts of Europe “since ancient times”. If a comprehensive hybridisation between *P.c. sinensis* and *P.c. carbo* has occurred, there is an obvious risk of genetic contamination of *P.c. carbo*, which should bring about reconsideration of the EU’s Bird Directive.

Conclusions

The chinese cormorant *Phalacrocorax carbo sinensis* Blumenbach 1798 should biologically and administratively be treated as a separate biological unit within the EU and the distribution history of the taxon in Western Palearktis needs further clarification.

Different conclusions can be drawn regarding the taxon depending on administrative or biogeographical level.

Available details indicate that:

Phalacrocorax carbo sinensis is an alien, in some cases introduced, invasive organism in several of the EU's Member States.

Phalacrocorax carbo sinensis was an alien invasive organism in **Sweden** (Skåne and Blekinge) in 1800.

Phalacrocorax carbo sinensis is an alien invasive organism in **Sweden's eastern archipelago**, from Örskär in the north to Kråkelund in the south.

A few proposals for measures

A large number of measures can be taken by the EU as well as by each Member State.

The EU must draw up scientifically well-founded definitions of the concepts of indigenous, alien, naturally occurring, introduced as well as invasive, which must be applied in each individual Member State as well as throughout the EU.

Compile and analyse the existing details of subfossils of *P. carbo* in Europe on the basis of "**Pleistocene Birds of the Palearctic: A Catalogue**" (Tyrberg, T. 1998 Nuttal Publication, No. 27) in order to clarify the prehistoric distribution of *P.c. sinensis*.

Compile and analyse the "Great Cormorant" finds in museum collections based on site and time. There are more than 100 examples in the Natural History Museum in Gothenburg alone.

Compile and analyse finds of parasites on *P.c. sinensis* as indicators.

Compile and analyse the cultural-historical details that are available on "cormorants" in art, literature, place names, etc.

The Swedish Environmental Protection Agency in Sweden must draw up scientifically and historically well-founded plans to facilitate a scientifically correct national handling of the cormorant issue; a "**Preservation plan for *Phalacrocorax carbo carbo* L. 1758**" as well as an "**Action plan for *Phalacrocorax carbo sinensis* Blumenbach 1798**".

The EU must revise the process and the scientific basis that led to the decision to introduce *Phalacrocorax carbo sinensis* in Annex 1 into "Council Directive 79/409/EEC of April 1979 on the conservation of wild birds" as well as the decision in 1997 to remove this taxon from the list.

The chinese cormorant *Phalacrocorax carbo sinensis* Blumenbach 1798, an alien bird
by Christer Olburs 2008-10-15

A few final words

More light will be shed on the chinese cormorant's *Phalacrocorax carbo sinensis* Blumenbach 1798 historical distribution in Europe.