

The Common Carp (*Cyprinus carpio* L.) in Norway

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Kålås, S. & Johansen, R. 1995. The Common Carp (*Cyprinus carpio* L.) in Norway. - Fauna norv. Ser. A 16: 19-28.

Attempts have been made to introduce common carp (*Cyprinus carpio* L.) to at least 35 sites in Norway during the last 250 years up to 1992. At least twelve introductions occurred before 1930, but the populations were believed to be extinct in the sixties and seventies. However, natural reproduction has occurred in three of these populations during the last hundred years. Common carp have also been introduced during the last decades and is now found in about 30 lakes and ponds in southern Norway. The origin of most of the earlier introductions was Germany. Later introductions from Sweden are known and further spreading from Norwegian populations has occurred. Common carp and crucian carp (*Carassius carassius*) hybridize in the two lakes in Norway where they occur together.

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INTRODUCTION

The common carp (*Cyprinus carpio* L.) was probably the first fish species to be subject to wide scale transfers and introductions (Welcomme 1988). This carp species is believed to have originated in eastern Asia (see McCrimmon 1968), but is today spread to most of the world (Welcomme 1988). Several attempts have been made to introduce common carp (hereafter called carp) to Norway during the last 250 years (Pontoppidan 1753, Collett 1875, 1905, Huitfeldt-Kaas 1918, Senstad 1962, L'Abée-Lund 1992), but its present status is uncertain. In the sixties and seventies the carp populations were believed to be extinct (Jensen 1968, Sømme & Jensen 1970, Jensen 1985). It was suggested that the climate in Norway was too cold for carp breeding or development of roe and fry (Sømme & Jensen 1970, Jensen 1985), but during the eighties catches of carp from Norwegian lakes have been reported (Pethon 1985, L'Abée-Lund 1992). Carp has also

reproduced naturally in a farm pond in south-eastern Norway during the last thirty years (Borgstrøm et al. 1989), and has later been introduced to several lakes in the eastern part of Norway (L'Abée-Lund 1992).

The aim of this work is to give an updated review of available information on carp in Norway. We present a historical review on carp introductions in Norway and show its present geographical distribution. We also present some additional information on the biology of carp in Norway.

MATERIAL AND METHODS

This review is based on literature on both natural and cultural history available through the Norwegian University library system (BIBSYS). We have also been in contact with historians, keepers and other persons at various Norwegian institutions, and also persons living near carp sites. Collections at Norwegian

University museums were also checked but the collections contained very few carps and offered no new information about introductions and distribution of carp in Norway. More detailed information may be available in official historical archives in hand-written manuscripts, but investigations of these would be very time-consuming and would probably add little information.

Several sources were used when making the survey of the present distribution of carp in Norway. One of the authors (R. Johansen) have the position as co-editor of the fish record list in the wildlife magazine "Villmarksliv" and has thereby received much valuable information about carp sites and carp caught in Norway during the latest years. Information was also given by pond owners, anglers, senior executive officers at county freshwater resource managements, scientists at Norwegian research institutions and others. In most cases we examined potential sites by angling, and in one case by gillnet fishing. When sites were not controlled by ourselves catches were confirmed with photographs. The information is collected during the period 1987-93.

A problem when making this survey is that crucian carp (*Carassius carassius*) often are called carp in Norway (Huitfeldt-Kaas 1917, 1918, Senstad 1962). In many cases reports of carp were in fact crucian carp. We have only included populations where identification of common carp was confirmed.

Length of fish is measured as total body length (mm) and weight as total body weight (kg). When studying hybrids, species and hybrids are identified following Smitt (1895) and Berg (1962). Opercular bones were used for age determination.

Names of lakes are not always given. In some cases because lake or pond owners wish the

location of the lake to remain unknown. Another reason is to avoid uncontrolled spread of carp.

THE HISTORY OF CARP INTRODUCTIONS IN NORWAY

The Swedish bishop Olaus Magnus (1555) stated that carp did not occur naturally in Nordic lake systems. He mentioned fish culture ponds, but did not specify the species in culture. Remnants of a cyprinid fish dated to the early sixteenth century was found in remains of a fish pond in Trondheim. No sure species identification could be done, but the fish was either a carp or a crucian carp (Nordeide & Hufthammer 1993). This is the first known presence of exotic fishes in Norway. The exact time of the first carp introduction to Norway is thus not known. However, it seems unlikely that many attempts of introductions were done before 1600. In Denmark carp breeding is not documented earlier than 1560 (Otterstrøm 1914), and when carp ponds were built by the Kalmar castle in Sweden in 1572, foreign craftsmen were used, and carp were brought in from Germany (Bernström 1981). This indicates that the knowledge of carp and carp breeding was scarce in the Nordic countries at this time, and it also point out the time when the knowledge started to spread. The knowledge has spread fast since carp breeding was well established in Denmark around 1600 (Otterstrøm 1914). It has been speculated that carp has been introduced earlier by monks and held in monasteries in the Nordic countries (Krøyer 1846-53, Huitfeldt-Kaas 1918, Wollebæk 1924, Sømme & Jensen 1970), but no documentation of this was found in the literature.

The bishop Erik Pontoppidan (1753) gives the first information of carp introductions to Norway. He states that carp is a fish not

belonging to the Norwegian fauna and is therefore very rare. He also writes that a friend of his had imported carp from Germany to an unnamed lake near Bergen, western Norway. This introduction was not looked upon as a success because the offspring of the introduced carp grew slowly.

More than one hundred years later Collett (1875) describes two sites with carp in the first edition of his book about the Norwegian fish fauna. The first is at the farm Milde south of Bergen where he states that carp undoubtedly was introduced already at the end of the 18th century. He later adjusted the estimated time of this introduction to about 1850 (Collett 1905). The second site mentioned by Collett (1875) is Farsund, southern Norway, where he states that carp was introduced just a few years before he wrote his book. Both Milde and Farsund are also mentioned by Løberg (1864), so the fish must have been introduced before 1864. Collett (1875) also mentions an introduction of carp and tench (*Tinca tinca* L.) from Denmark to a pond at Næs Jernverk near Tvedestrand, southern Norway early in the 19th century (probably 1815, P. Pethon pers. comm.), but this population went extinct after a few years. In later editions of Collett's reports on the Norwegian fishes more carp sites are mentioned. According to Collett (1905) a fair number of young carp were introduced from Germany to Sjaaens water reservoir and a small pond at Skåtøy near Kragerø in 1898. During the first six years the carp thrived. They reproduced several times, and individuals measuring approximately 40 cm were observed in 1904. The carp stock at these sites consisted of both the mirror and the scaled variety (Collett 1905). Sjaaen water reservoir was drained ca.1970, and during the draining process most of the carp were moved to a nearby lake (J. Christophersen pers. comm.). We have not found any updated documentation regarding the population at Skåtøy. An introduction to Jarlsberg Hovedgaard in

1898 is also mentioned by Collett (1905) but this introduction failed as just one living carp was found two years later.

Huitfeldt-Kaas (1918) mentions three sites with carp in Norway in his classical work on the distribution and immigration of the freshwater fishes in Norway. One new site is included. This is the Nygårds park pond in Bergen where carp was introduced in 1901. This population was founded by carp from a fish breeding institution in Berneuchen (which at that time was situated in Germany, but is now situated in Poland). Five hundred carp and one hundred ide (*Leuciscus idus*) of a type with red colouration, also named golden orfe, were ordered, but 204 of the carp and 46 of the golden orfe died during the transport (Anonymous 1901). The carp population in the Nygårds park pond went extinct during the winter 1926 or 27, due to very dry and cold weather (Senstad 1962). In addition to this population Huitfeldt-Kaas (1918) included the Milde and Sjaaen populations referring to Collett, but the Farsund population and the Skåtøy pond population were not mentioned.

Carp and golden orfe were introduced to a pond by the house "Stamerhuset" at Paradis near Bergen at about the same time as they were introduced to the Nygårds park, and a population of carp lived in this pond until ca.1970 when the pond was filled in (Ludvig von Tangen-Kjær, pers. comm.). It is likely that these carp had the same origin and maybe resulted from the same introduction as the carp in the Nygårds park pond.

Another introduction occurred probably at about the same time in a pond near Tønsberg, Vestfold county. The site consisted originally of five ponds, which were dug during the period 1865-84 (Johnsen 1954). One of the reservoirs was filled in the 1950-ies. We do not know exactly when carp was introduced to the reservoirs, but we know that 100 small carp of

German origin were introduced to a pond in the Tønsberg district in 1898 (Collett 1905). Although we can not be sure, these carp are probably ancestors of the populations in the ponds. Local people have told us that the carp was rather abundant in all of the ponds during the fifties, sixties and early seventies, and it was popular to feed the carp with bread crust.

In 1914 fish was transported from the Nygårds park pond to Lake Skårsvatn 50 km east of Bergen (Soldal & Soldal 1976). The Nygårds park pond contained at that time still both carp and golden orfe in addition to crucian carp, and all these fish species may potentially have been brought by to Lake Skårsvatn. Crucian carp and golden orfe are found in Lake Skårsvatn today. In addition cyprinid fishes with barbels have been observed in the lake. A fish with barbels weighing 3.5 kg was caught in the early sixties (Å. Soldal, pers. comm.). This must have been a carp or a crucian carp x carp hybrid.

A new introduction occurred in eastern Norway in 1927 when the local fishery inspector Joakim Harstad introduced carp to Lake Sems vann, in Asker municipality (Senstad 1962). These carp originated from Aneboda in Sweden. A 10 kg carp was netted in this lake in the second half of the fifties (Sømme & Jensen 1970). This may have been one of the carps introduced in 1927 or a descendant of this population. It is not known whether carp is still found in this lake.

After World War Two, carp was introduced to Alnsjøen near Oslo (Andersen 1990). There is little information available about this population, but it probably went extinct in the mid-seventies.

In 1956 carp was introduced from Aneboda, Sweden, to a pond at Nedre Stomner, Østfold County (Ø. Grimstad, pers. comm.). This population has later founded most of the present carp populations in Norway.

A strange incident from the sixties is the catch of a carp in the sea in Osterfjord near Vikanes 35 km north east of Bergen in July 1962 (Sigbjørn Urdal, pers. comm.). No freshwater localities with carp is known in the vicinity from where this individual can have migrated, and this episode will probably remain as a mystery. The carp is preserved and kept at the Museum of Zoology, University of Bergen.

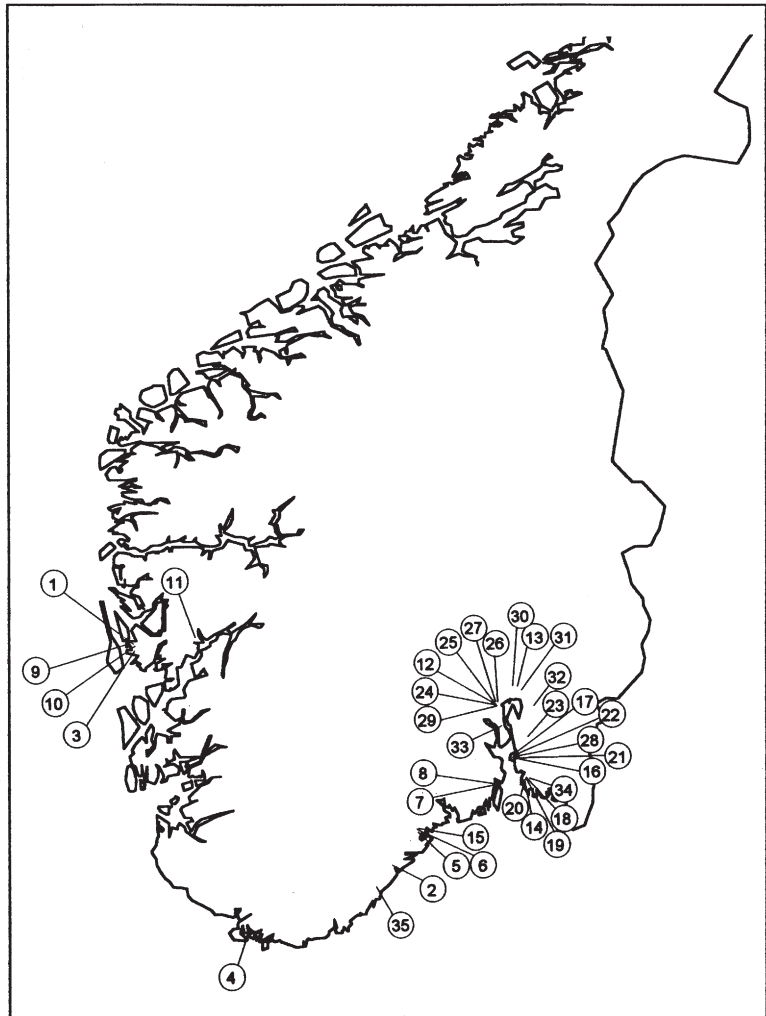
The literature from after the second world war up to 1980 include few new reports on carp in Norway. No new introductions are mentioned and the old sites reported by Huitfeldt-Kaas (1918) were repeated as possible sites of carp (Rustad 1958) or it was assumed that the earlier mentioned carp populations were extinct (Jensen 1968). The next part of this study shows that this view was wrong. Carp were introduced to many new sites during the 70-ies but this was not registered by authors of fish literature.

THE PRESENT DISTRIBUTION OF CARP IN NORWAY

We know 35 lakes/ponds where carp was introduced during the last 250 years up to 1992 (**Table 1, Figure 1**). In 1992 carp was further introduced to eight lakes and in 1993 to one lake. The information about these sites was given on the condition that no information about these sites should be published. We therefore do not include data from 1992 and 1993 in this study. According to reported catches of carp in the period 1988 to 1992, carp were present in about 20 lakes/ponds in Norway early in 1992 (**Table 1**). In addition there are a few localities where there may be carp, but this is not confirmed by observations during the latest years.

All carp populations are found in the southern part of Norway, and most of them in the south-eastern part (**Figure 1**). The northern-

Figure 1
Schematic outline of southern Norway indicating localities where common carp has been introduced. Localities are numbered in chronological order and refer to table 1.



most is the population in Lake Mildevatn ($60^{\circ}15' \text{ N } 05^{\circ}15' \text{ E}$). Three of the carp populations are old and carp has been present for more than ninety years. The oldest population is the one in Lake Mildevatn where carp has been present for at least 150 years. The populations in Farsund and Tønsberg has been present for about 130 and 100 years, respectively (**Table 1**). This clearly shows that carp has been able to reproduce naturally in Norwegian lakes often enough to keep up populations during the last 150 years. We therefore reject the view by Sømme and

Jensen (1970) that the Norwegian climate is too cold for carp reproduction. We can also reject the hypothesis that the carp populations known from the old Norwegian fishing literature have gone extinct (Sømme & Jensen 1970, Jensen 1985). Three of the five populations mentioned by Løberg (1864), Collett (1875) and Huitfeldt-Kaas (1918) are still found, two of them at the original site.

Carp is extinct in about 14 of 22 lakes in southern Norway where carp was introduced before 1975, but in 3 of the cases the extinct-

Table 1. Introductions of common carp to Norway from 1740 to 1992 presented in chronological order.

Locality	Municipality, County	Year	Origin	Type	Status today	Reference
1 Unknown	Bergen, Hordaland	ca. 1740	Germany		unknown	Pontoppidan 1753
2 Nes Jærnverk	Tvedestrand, Aust-Agder	ca. 1815		scale	extinct ca. 1820	Collett 1875, 1905; P. Pethon, Pers. comm.
3 Mildevaen	Bergen, Hordaland	ca. 1850			few in number, hybridize with <i>C. carassius</i>	Løberg 1864; Collett 1875, 1905; Huitfeldt-Kaas 1918; own obs.
4 Mosvolljønna	Farsund, Vest-Agder	< 1864		scale	dense population	Løberg 1864; Collett 1875; own obs.
5 Sjaen	Kragerø, Telemark	1898	Germany	scale	lake was drained in 1970	Collett 1905
6 pond, Skåføy	Kragerø, Telemark	1898	Germany	scale	probably extinct	Collett 1905
7 Jantsberg Hovedgaard	Tønsberg, Vestfold	1898		mirror	introduction failed	Collett 1905
8 ponds	Tønsberg, Vestfold	1898?			few in number	Johnsen 1954; own obs.
9 pond, Nygårdsparken	Bergen, Hordaland	1901	Berneuchen, Poland		Extinct winter 1926 or 27	Huitfeldt-Kaas 1918; Senslad 1962
10 pond, Stamerhuset	Bergen, Hordaland	ca. 1900	Nygårdsparken?	scale	Pond filled in ca. 1970	L. von Tangen-Kjær, Pers. comm.
11 Skårsvann	Kvam, Hordaland	1914	Nygårdsparken		Unknown	Soldal and Soldal 1976; Å. Soldal pers. comm.
12 Semsvann	Asker, Akershus	1927	Aneboda, Sweden		probably extinct	Senslad 1962
13 Almsjøen	Oslo	ca. 1950			probably extinct	Andersen 1990
14 Nedre Stømmer	Råde, Østfold	1956	Aneboda, Sweden	scale, mirror	dense population	Borgstrøm et al. 1989; Ø. Grimstad pers. comm.; Own obs.
15 small lake	Kragerø, Telemark	1970	Sjaen	scale	few in number, hybridize with <i>C. carassius</i>	J. Christophersen pers. comm.; own obs.
16 Kase, Jeløya	Moss, Østfold	ca. 1970		koi	few in number	own obs.
17 Skallerød, Jeløya	Moss, Østfold	1974	Nedre Stømmer	scale	dense population	D.Dolmen Pers. comm.; own obs.
18 Sandaker	Råde, Østfold	ca. 1975	Nedre Stømmer	scale	probably extinct 1986	D.Dolmen Pers. comm.; own obs.
19 Sogn	Råde, Østfold	ca. 1975	Nedre Stømmer	scale	probably extinct 1986	D.Dolmen Pers. comm.; own obs.
20 Tomb	Råde, Østfold	ca. 1975	Nedre Stømmer	scale	pond filled in	D.Dolmen Pers. comm.; own obs.
21 Alby, Jeløya	Moss, Østfold	ca. 1975	Nedre Stømmer	scale	carp observed 1990	J. Christophersen Pers. comm.; own obs.
22 two ponds, Jeløya	Moss, Østfold	ca. 1985	Nedre Stømmer	scale	unknown	own obs.
23 farm pond	Hobøl, Østfold	ca. 1985	aquarium	koi	unknown	own obs.
24 Østensdammene	Asker, Akershus	ca. 1986	aquarium	scale	extinct 1991?	own obs.
25 Slupengdammen	Asker, Akershus	1989	Skallerød	scale	unknown	own obs.
26 Syverstaddammen	Asker, Akershus	1989	Skallerød	scale	few in number	own obs.
27 Torstaddammen	Asker, Akershus	1989	Skallerød	scale	unknown	own obs.
28 Økerød, Jeløya	Moss, Østfold	1990	Nedre Stømmer	scale	dense population, reproduces F.E. Lerdalen Pers. comm.; own obs.	
29 Toklistrand	Asker, Akershus	1990	Nedre Stømmer	scale	few in number	own obs.
30 Gjernstufjern	Oslo	1990	Nedre Stømmer	scale		
31 Ulstrudvann	Oslo	1990	Nedre Stømmer/Kragerø	scale	unknown	own obs.
32 Vesletjern	Lørenskog, Akershus	1990	Nedre Stømmer	scale	unknown	own obs.
33 Isdam, Stemmeslad	Røyken, Buskerud	1990	Nedre Stømmer	scale	unknown	own obs.
34 Sarpebakken	Råde, Østfold	1990	Nedre Stømmer	scale	unknown	own obs.
35 Skoletjern	Arendal, Aust-Agder	1991	Mosvoll	scale	unknown	own obs.

tion was due to drainage of pond. Then about 40 % of the introductions were successful. However, it is difficult to estimate the success of introductions of fish through a survey like this one. Lakes with successful introduction will be more reported than lakes where introduction fail. The ratio of successful introduction is therefore prone to be overestimated.

The exact origins of many of the carp populations in Norway are unknown. However, it seems as if Germany was the origin of the earliest introductions. As mentioned above, carp has later been introduced from Aneboda, Sweden, to two localities, and one of these sites (Nedre Stomner) have founded most of the present populations in Norway. Carp has been spread from this site directly or indirectly to at least 16 lakes or ponds in Norway (Table 1).

Almost all Norwegian carp populations consist of individuals of the common scaled variety. Mirror carp have only been observed at two sites (Tønsberg and Nedre Stomner) (Table 1). A few populations of koi carp are also known (Table 1). With one exception, these are results of occasional stockings done by aquarists, and we are not sure whether any of these populations still exist.

HYBRIDIZATION

In Lake Mildevatn and one lake near Kragerø hybrids between common carp and crucian carp are found. These hybrids are intermediate with regards to most external morphological characters. Externally they are most easily identified by having thin or rudimentary barbels. Fish caught in Lake Mildevatn suspected to be hybrids were all confirmed by analysing pharyngeal teeth. Hybrids found in Lake Mildevatn had an average length of 385 mm (sd = 49 mm, n = 23; average age 10.8 years, sd = 3.45, n = 23) while crucian carp had an

average length of 235 mm (sd = 29 mm, n = 229; average age 11.7 years, sd = 3.57, n = 207). The only carp caught in the lake had a length of 618 mm, a weight of 2.78 kg and was 16 years old.

When Sjaaen water reservoir was drained and the carp were moved to another lake in the Kragerø area, the new site already contained crucian carp. During the last 20-25 years, the carp and crucian carp have hybridized. Most of the catches made by anglers the last five years have been hybrids and crucian carp. A few carp between 5 and 9.25 kg have also been caught, and these individuals are probably from the original stocking back in 1970. The largest individual, weighing 9.25 kilos, was caught by an angler in early May 1994, and was a common scaled carp. Most of the hybrids have been between 2 and 4 kg. The crucian carp have been between 0.8 and 1.4 kg, which is well beyond the usual maximum size of this species in Norway.

Hybrids are normally infertile. The production of such hybrids is therefore negative for the individual which invest in infertile offspring and for recruitment in populations. The consequences for a species living on the edge of its physiological range is even more serious since it is already hard to produce offspring. Nevertheless, carp has managed to keep up a population in a lake with crucian carp for at least 150 years in Lake Mildevatn.

The findings of crucian carp x common carp hybrids in Lake Mildevatn and the lake near Kragerø are not surprising since common carp and crucian carp hybridize wherever these species are found together (Berg 1962). Hybrids between cyprinid species are common. Until now findings of five different cyprinid hybrids from Norway have been published (Pethon 1985), but there are probably more.

CARP AS A SPECIES IN THE NORWEGIAN FAUNA

We believe that the southern part of Norway is the northern border of natural carp reproduction, due to climatic causes. This is probably the main reason why most populations are rather sparse. An increase in the average temperature in Norway would probably influence carp reproduction, and increase carp abundance in the lakes where it is introduced. We doubt that carp are able to reproduce every year in Norwegian lakes. Their long lifespan is therefore a trait that increase the probability of experiencing years when reproduction is possible. We therefore conclude that long lifespan of individuals increase the chances to maintain a population of a species on the edge of its physiological range, if egg development and juvenile survival is the problem.

Introduction of carp to North-America have had negative effects on lake communities. The carp has destroyed the vegetation and made water more turbid by digging in the bottom substrate for food, and thereby destroyed habitats for the original fish species (King & Hunt 1967, McCrimmon 1968). Digging and digestive activity by carp may also increase eutrophication in lakes (Lamarra 1975). In Australia and Europe, however, habitat destruction is not found to be of major importance (Crivelli 1983, Fletcher et al. 1985). Large carp are found to cause the worst effect on habitats (Crivelli 1983), and since carp found in Norway generally are small sized and populations are sparse, habitat destruction is probably not a problem in Norway.

For angling enthusiasts carp is an exciting game fish. It grows to a large size, is rather difficult to catch and it fights very hard. Fishing for carp is therefore an exciting sport, and today carp is a very popular species among European anglers (Moyle 1984, Johansen 1993). As carp is a rare species in

Norway, Norwegian anglers has traditionally not been interested in carp, but during the eighties the interest has increased among anglers in southern Norway. This explains the increased spread of carp to lakes and ponds in the south-eastern part of Norway in recent years. We warn against uncontrolled spread of carp. Increased competition and destruction of the original fish community, destruction of habitats and introduction of parasites and pathogens may be the effect of introducing a new species to a lake (Welcomme 1988). Because of these potentially negative influences on ecosystems, introduction of fish is illegal in Norway. In the case of further spread of carp, each case should be considered thoroughly by Norwegian authorities to avoid unwanted effects on natural communities.

ACKNOWLEDGEMENTS

Inge Solberg helped with the mapping of carp sites early in this study. The following persons gave valuable information on one or more existing or historic carp sites: Bjarne Aas, Rolf Berge, Reidar Borgstrøm, Jon Christophersen, Dag Dolmen, Rune Fjellvang, Øivind Grimstad, Ingar Heum, Tom Ole Holth, Pete Knight, Finn Erik Lerdalen, Per Pethon, Tor J. Samuelsen, Chr. Senstad, Bjørn Swanstrøm and Asbjørn Vøllestad. Thanks to John Atle Kålås, Harald Lura, Harald Sægrov, Kurt Urdal and two anonymous reviewers who gave valuable comments on various drafts of this manuscript.

SAMANDRAG

Karpe (*Cyprinus carpio* L.) i Noreg

Karpe (*Cyprinus carpio* L.) er ein aust-asia-tisk art som i dag er spreidd over nesten heile verda. Vi kjenner til i alt 35 forsøk på å setje ut karpe i Noreg i løpet av dei siste 250 år fram til 1992. Tolv av desse utsetjingane skjedde før 1930, men på seksti og syttitalet trudde ein at desse bestandane var utdøydd. Vår undersøking viser at tre bestandar av karpe har formert seg naturleg i norske innsjøar dei siste hundre år. Karpe finst no i omlag 30 innsjøar/dammar i sør-Noreg. Karpe vart opprinneleg introdusert frå Tyskland og Sverige, og den har seinare vorte spreidd vidare frå etablerte norske bestandar. I dei to norske innsjøane med både karpe og karuss (*Carassius carassius*) formerer dei seg saman og dannar hybridar.

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