Koi

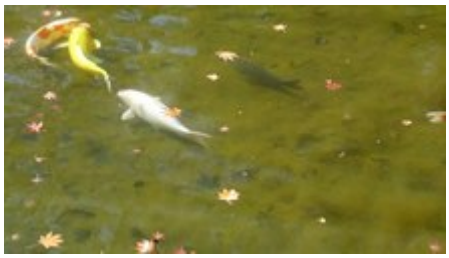
Koi (鯉, English: /ˈkɔɪ/, Japanese: [koˈi]) or more specifically ***nishikigoi*** (錦鯉, Japanese: [ɲiɕiˈgoi], literally "brocaded carp"), are colored varieties of the Amur carp (*Cyprinus rubrofuscus*) that are kept for decorative purposes in outdoor koi ponds or water gardens.

Koi is an informal name for the colored variants of *C. rubrofuscus* kept for ornamental purposes. There are many varieties of ornamental koi, originating from breeding that began in Niigata, Japan in the early 19th century.[1][2][3] Several varieties are recognized by the Japanese, distinguished by coloration, patterning, and scalation. Some of the major colors are white, black, red, orange, yellow, blue, and cream. The most popular category of koi is the *Gosanke*, which is made up of the *Kohaku*, *Taisho Sanshoku*, and *Showa Sanshoku* varieties.

Koi

Conservation status
Domesticated
Scientific classification
Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii
Order: Cypriniformes
Family: Cyprinidae
Genus: Cyprinus
Species: *Cyprinus rubrofuscus*
Variety: ***Cyprinus rubrofuscus* "koi"**
Binomial name
Cyprinus rubrofuscus Lacépède, 1803

Contents



Play media

Several koi swim around in a pond in Japan. (video)

History

Carp are a large group of fish originally found in Central Europe and Asia. Various carp species were originally domesticated in East Asia, where they were used as food fish. Carp are coldwater fish, and their ability to survive and adapt to many climates and water conditions

allowed the domesticated species to be propagated to many new locations, including Japan. Natural color mutations of these carp would have occurred across all populations. Carp were first bred for color mutations in China more than a thousand years ago, where selective breeding of the Prussian carp (*Carassius gibelio*) led to the development of the goldfish (*Carassius auratus*).[4]

The Amur carp (*Cyprinus rubrofuscus*), a member of the cyprinid family species complex native to East Asia. Amur carp were previously identified as a subspecies of the common carp (as *C. c. haematopterus*), but recent authorities treat it as a separate species under the name *C. rubrofuscus*.[5] Amur carp have been aquacultured as a food fish at least as long ago as the fifth century BC in China. Jin Dynasty (fourth century AD) texts mentioned carp of various colors.[6][7] The oldest record on colored carp in Japan is found in the Japanese history book *Nihon Shoki* (Chronicles of Japan) completed in 720. According to the *Nihon shoki*, it is recorded that Emperor Keikō praised colored carp in a pond in the Mino region in 94 and that Emperor Suiko saw them in the garden of Soga no Umako's residence in 620.[8][9]

The systematic breeding of ornamental koi in Japan began in Ojiya and Yamakoshi in the Niigata Prefecture (located on the northeastern coast of Honshu) in the 1820s. Selective breeding gave rise first to red carp, then to pale blue *Asagi* and white, red, and yellow *Bekkou*. The *Sarasa* variety, with a red on white pattern, was created around 1830. Later, a yellow-based *Ki uturi* variety was born. From this original handful of koi varieties, all other Nishikigoi varieties were bred, with the exception of the Ogon variety (single-colored, metallic koi), which was developed relatively recently.[1][3]

The outside world was unaware of the development of color variations in Japanese koi until 1914, when the Niigata koi were exhibited at an annual exposition in Tokyo. From that time, interest in koi spread throughout Japan. The number of varieties continued to grow, and repeated crossbreeding gave rise to more flashy varieties, such as *Kōhaku* , *Taishō Sanshoku* and *Shōwa Sanshoku*.[10]

The hobby of keeping koi eventually spread worldwide. They are sold in many pet aquarium shops, with higher-quality fish available from specialist dealers.[11][12] Collecting koi has become a social hobby. Passionate hobbyists join clubs, share their knowledge and help each other with their koi.[13] In particular, since the 21st century, some wealthy Chinese have imported large quantities of koi from Niigata in Japan, and the price of high-quality carp has soared. In 2018, one carp was bought by a Chinese for about $2 million, the highest price ever. There are also cases in which purchased carp are bred in China and sold to foreign countries, and many breeds are spreading all over the world.[14][15]

Etymology

The words "koi" and "nishikigoi" come from the Japanese words 鯉 (carp), and 錦鯉 (brocaded carp), respectively. In Japanese, "koi" is a homophone for 恋, another word that means "affection" or "love", so koi are symbols of love and friendship in Japan.

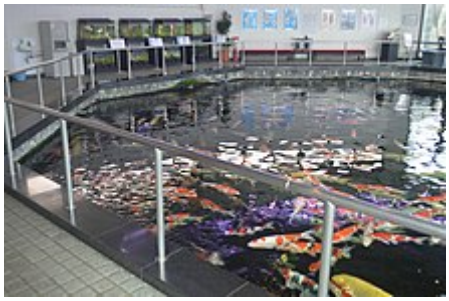
Colored ornamental carp were originally called *Irokoi* (色鯉) meaning colored carp, *Hanakoi* (花鯉) meaning floral carp, and *Moyōkoi* (模様鯉) meaning patterned carp. There are various theories as to how these words came to be disused, in favor of *Nishikigoi* (錦鯉), which is used today. One theory holds that, during World War II, the words *Irokoi* and *Hanakoi* (which can have sexual meanings) were changed to *Nishikigoi* because they were not suitable for the social situation of war. Another theory is that *Nisikigoi*, which was the original name for the popular Taisho Sanshoku variety, gradually became the term used for all ornamental koi.[3]

Taxonomy

In the past, koi were commonly believed to have been bred from the common carp (*Cyprinus carpio*). Extensive hybridization between different populations, coupled with widespread translocations, have muddled the historical zoogeography of the common carp and its relatives. Traditionally, Amur carp (*C. rubrofuscus*) were considered a subspecies of the common carp, often under the scientific name *C. carpio haematopterus*. However, they differ in meristics from the common carp of Europe and Western Asia,[5] leading recent authorities to recognize them as a separate species, *C. rubrofuscus* (*C. c. haematopterus* being a junior synonym).[16][17] Although one study of mitochondrial DNA (mtDNA) was unable to find a clear genetic structure matching the geographic populations (possibly because of translocation of carp from separate regions),[18] others based on mtDNA, microsatellite DNA and genomic DNA found a clear separation between the European/West Asian population and the East Asian population, with koi belonging in the latter.[19][20][21] Consequently, recent authorities have suggested that the ancestral species of the koi is *C. rubrofuscus* (syn. *C. c. haematopterus*) or at least an East Asian carp species instead of *C. carpio*.[5][22] Regardless, a taxonomic review of *Cyprinus* carp from eastern and southeastern Asia may be necessary, as the genetic variations do not fully match the currently recognized species pattern,[20] with one study of mtDNA suggesting that koi are close to the Southeast Asian carp, but not necessarily the Chinese.[23]

Varieties

According to *Zen Nippon Airinkai*, a group that leads the breeding and dissemination of koi in Japan, there are more than 100 varieties of koi created through breeding, and each variety is classified into 16 groups.[24] Koi varieties are distinguished by coloration, patterning, and scalation. Some of the major colors are white, black, red, yellow, blue, and cream. Although the possible colors are virtually limitless, breeders have identified and named a number of specific categories. The most notable category is *Gosanke*, which is made up of the *Kōhaku*, *Taishō Sanshoku*, and *Shōwa Sanshoku* varieties.



The Ojiya no Sato Museum in Niigata Prefecture, Japan, is the only museum in the world that exhibits both varieties of living koi and data that show the history of their breeding.[2]

New koi varieties are still being actively developed.[25] Ghost koi developed in the 1980s have become very popular in the United Kingdom; they are a hybrid of wild carp and Ogon koi, and are distinguished by their metallic scales. Butterfly koi (also known as longfin koi, or dragon carp), also developed in the 1980s, are notable for their long and flowing fins. They are hybrids of koi with Asian carp. Butterfly koi and ghost koi are considered by some to be not true *nishikigoi*.

The major named varieties include:[24]

- *Kōhaku* (紅白) is a white-skinned koi, with large red markings on the top. The name means "red and white"; *kohaku* was the one of the first ornamental variety to be established in Japan (late 19th century).[26]
- *Taishō Sanshoku* (or *Taishō Sanke)* (大正三色) is very similar to the *kohaku*, except for the addition of small black markings called *sumi* (墨). This variety was first exhibited in 1914 by the koi breeder Gonzo Hiroi, during the reign of the Taishō Emperor. In the United States, the name is often abbreviated to just "Sanke". The *kanji*, 三色, may be read as either *sanshoku* or as *sanke* (from its earlier name 三毛).
- *Shōwa Sanshoku* (or *Showa Sanke*) (昭和三色) is a black koi with red (*hi* 緋) and white (*shiroji* 白地) markings. The first *Showa Sanke* was exhibited in 1927, during the reign of the Shōwa Emperor. In America, the name is often abbreviated to just "Showa". The amount of *shiroji* on

Showa Sanke has increased in modern times (*Kindai Showa* 近代昭和), to the point that it can be difficult to distinguish from *Taisho Sanke*. The *kanji*, 三色, may be read as either *sanshoku* or as *sanke.*

- *Bekko* (鼈甲、べっ甲) is a white-, red-, or yellow-skinned koi with black markings *sumi* (墨). The Japanese name means "tortoise shell", and is commonly written as 鼈甲. The white, red, and yellow varieties are called *Shiro Bekko* (白), *Aka Bekko* (赤) and *Ki Bekko* (黄), respectively. It may be confused with the *Utsuri*.
- *Utsurimono* (写り物) is a black koi with white, red, or yellow markings, in a zebra color pattern. The oldest attested form is the yellow form, called "black and yellow markings" (黒黄斑, *Kuro ki madara*) in the 19th century, but renamed *Ki Utsuri* (黄写り) by Elizaburo Hoshino, an early 20th-century koi breeder. The red and white versions are called *Hi Utsuri* (緋写り) and *Shiro Utsuri* (白写り) (piebald color morph), respectively. The word *utsuri* means to print (the black markings are reminiscent of ink stains). Genetically, it is the same as *Showa*, but lacking either red pigment (*Shiro Utsuri*) or white pigment (*Hi Utsuri*/*Ki Utsuri*).
- *Asagi* (浅黄) koi is light blue above and usually red below, but also occasionally pale yellow or cream, generally below the lateral line and on the cheeks. The Japanese name means pale greenish-blue, spring onion color, or indigo.
- '*Shūsui* (秋翠) means "autumn green"; the *Shūsui* was created in 1910 by Yoshigoro Akiyama（秋山　吉五郎, by crossing Japanese *Asagi* with German mirror carp. The fish has no scales, except for a single line of large mirror scales dorsally, extending from head to tail. The most common type of *Shūsui* has a pale, sky-blue/gray color above the lateral line and red or orange (and very, very rarely bright yellow) below the lateral line and on the cheeks.
- *Koromo* (衣) is a white fish with a *Kohaku*-style pattern with blue or black-edged scales only over the *hi* pattern. This variety first arose in the 1950s as a cross between a *Kohaku* and an *Asagi*. The most commonly encountered *Koromo* is an *Ai Goromo*, which is colored like a *Kohaku*, except each of the scales within the red patches has a blue or black edge to it. Less common is the *Budo-Goromo*, which has a darker (burgundy) *hi* overlay that gives it the appearance of bunches of grapes. Very rarely seen is the *Tsumi-Goromo*, which is similar to *Budo-Goromo*, but the *hi* pattern is such a dark burgundy that it appears nearly black.
- *Kawarimono* (変わり物) is a "catch-all" term for koi that cannot be put into one of the other categories. This is a competition category, and many new varieties of koi compete in this one category. It is also known as *kawarigoi* (変わり鯉).
- *Goshiki* (五色) is a dark koi with red (*Kōhaku* style) *hi* pattern. The Japanese name means "five colors". It appears similar to an *Asagi*, with little or no *hi* below the lateral line and a *Kōhaku Hi* pattern over reticulated (fishnet pattern) scales. The base color can range from nearly black to very pale, sky blue.
- *Hikari-mujiimono* (光無地もの) is a variety of which the whole body is one color and the body is shiny, and it is called differently depending on the color.
- *Hikari-moyomono* (光模様もの) is a koi with colored markings over a metallic base or in two metallic colors.
- *Hikari-utsurimono* (光写りもの) is a cross between *utsurimono* series and *Ōgon*.
- *Kinginrin* (金銀鱗) is a koi with metallic (glittering, metal-flake-appearing) scales. The name translates into English as "gold and silver scales"; it is often abbreviated to *Ginrin*. *Ginrin* versions of almost all other varieties of koi occur, and they are fashionable. Their sparkling, glittering scales contrast to the smooth, even, metallic skin and scales seen in the *Ogon*

varieties. Recently, these characteristics have been combined to create the new *ginrin Ogon* varieties.

- *Tanchō* (丹頂) is any koi with a solitary red patch on its head. The fish may be a *Tanchō Shōwa*, *Tanchō Sanke*, or even *Tanchō Goshiki*. It is named for the Japanese red-crowned crane (*Grus japonensis*), which also has a red spot on its head.
- *Chagoi* (茶鯉), "tea-colored", this koi can range in color from pale olive-drab green or brown to copper or bronze and more recently, darker, subdued orange shades. Famous for its docile, friendly personality and large size, it is considered a sign of good luck among koi keepers.
- *Ōgon* (黄金) is a metallic koi of one color only (*hikarimono* 光者). The most commonly encountered colors are gold, platinum, and orange. Cream specimens are very rare. *Ogon* compete in the *Kawarimono* category and the Japanese name means "gold". The variety was created by Sawata Aoki in 1946 from wild carp he caught in 1921.
- *Kumonryū* (九紋竜)' （literally "nine tattooed dragons" is a black *doitsu*-scaled fish with curling white markings. The patterns are thought to be reminiscent of Japanese ink paintings of dragons. They famously change color with the seasons. *Kumonryu* compete in the *Kawarimono* category.
- *Ochiba* (落葉) is a light blue/gray koi with copper, bronze, or yellow (*Kohaku*-style) pattern, reminiscent of autumn leaves on water. The Japanese name means "fallen leaves".
- *Kikokuryū* (輝黒竜, literally "sparkle" or "glitter black dragon") is a metallic-skinned version of the *Kumonryu*.
- *Kin-Kikokuryū* (金輝黒竜, literally "gold sparkle black dragon" or "gold glitter black dragon") is a metallic-skinned version of the *Kumonryu* with a *Kohaku*-style *hi* pattern developed by Mr. Seiki Igarashi of Ojiya City. At least six different genetic subvarieties of this general variety are seen.
- Ghost koi (人面魚 ·じんめんぎょ), a hybrid of *Ogon* and wild carp with metallic scales, is considered by some to be not *nishikigoi*.
- Butterfly koi (鰭長錦鯉 ·ひれながにしきごい) is a hybrid of koi and Asian carp with long flowing fins. Various colorations depend on the koi stock used to cross. It also is considered by some to not be *nishikigoi*.
- *Doitsu-goi* (ドイツ鯉) originated by crossbreeding numerous different established varieties with "scaleless" German carp (generally, fish with only a single line of scales along each side of the dorsal fin). Also written as 独逸鯉, four main types of *Doitsu* scale patterns exist. The most common type (referred to above) has a row of scales beginning at the front of the dorsal fin and ending at the end of the dorsal fin (along both sides of the fin). The second type has a row of scales beginning where the head meets the shoulder and running the entire length of the fish (along both sides). The third type is the same as the second, with the addition of a line of (often quite large) scales running along the lateral line (along the side) of the fish, also referred to as "mirror koi". The fourth (and rarest) type is referred to as "armor koi" and is completely (or nearly) covered with very large scales that resemble plates of armor. It also is called *Kagami-goi* (鏡鯉、カガミゴイ), or mirror carp (ミラーカープ).

Kohaku

Taishō Sanke

Showa Sanke

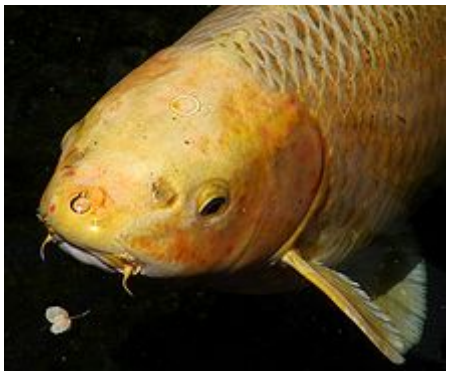
Asagi

Bekko

Gin Rin Showa

Differences from goldfish

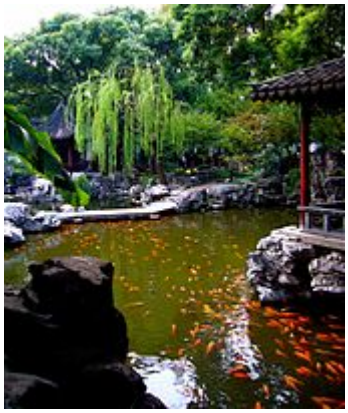
Goldfish (金魚) were developed in China more than a thousand years ago by selectively breeding Prussian carp for color mutations. By the Song dynasty (960–1279), yellow, orange, white, and red-and-white colorations had been developed. Goldfish (*Carassius auratus*) and Prussian carp (*Carassius gibelio*) are now considered different species. Goldfish were introduced to Japan in the 16th century and to Europe in the 17th century.[4] On the other hand, most ornamental koi breeds currently distributed worldwide originate from Amur carp (*Cyprinus rubrofuscus*) bred in Japan in the first half of the 19th century. Koi are domesticated Amur carp that are selected or culled for color; they are not a different species, but a subspecies, and will revert to the original coloration within a few generations if allowed to breed freely.



Koi have prominent barbels on the lip that are not visible in goldfish.

In general, goldfish tend to be smaller than koi, and have a greater variety of body shapes and fin and tail configurations. Goldfish usually only grow to about 35 centimetres (14 in).[27] Koi can grow up to about 100 centimetres (39 in) in length; on average they also grow about 2 centimetres (0.79 in) per month.[28] Koi varieties tend to have a common body shape, but have a greater variety of coloration and color patterns. They also have prominent barbels on the lip. Some goldfish varieties, such as the common goldfish, comet goldfish, and shubunkin, have body shapes and coloration that are similar to koi, and can be difficult to tell apart from koi when immature. Goldfish and koi can interbreed; however, as they were developed from different species of carp, their offspring are sterile.[29][30]

Health, maintenance, and longevity



Koi in Yu Garden, Shanghai

The Amur carp is a hardy fish, and koi retain that durability. Koi are coldwater fish, but benefit from being kept in the 15–25 °C (59–77 °F) range, and do not react well to long, cold, winter temperatures; their immune systems are very weak below 10 °C. Koi ponds usually have a metre or more of depth in areas of the world that become warm during the summer, whereas in areas that have harsher winters, ponds generally have a minimum of 1.5 m (5 ft). Specific pond construction has been evolved by koi keepers intent on raising show-quality koi.

The bright colors of koi put them at a severe disadvantage against predators; a white-skinned *Kohaku* is a visual dinner bell against the dark green of a pond. Herons, kingfishers, otters, raccoons, mink, cats, foxes, badgers, and hedgehogs are all capable of emptying a pond of its fish. A well-designed outdoor pond has areas too deep for herons to stand, overhangs high enough above the water that mammals cannot reach in, and shade trees overhead to block the view of aerial passers-by. It may prove necessary to string nets or wires above the surface. A pond usually includes a pump and filtration system to keep the water clear.

Koi are an omnivorous fish. They eat a wide variety of foods, including peas, lettuce, and watermelon. Koi food is designed not only to be nutritionally balanced, but also to float so as to encourage them to come to the surface. When they are eating, koi can be checked for parasites and ulcers. Naturally, koi are bottom feeders with a mouth configuration adapted for that. Some koi have a tendency to eat mostly from the bottom, so food producers create a mixed sinking and floating combination food. Koi recognize the persons feeding them and gather around them at feeding times. They can be trained to take food from one's hand. In the winter, their digestive systems slow nearly to a halt, and they eat very little, perhaps no more than nibbles of algae from the bottom. Feeding is not recommended when the water temperature drops below 10 °C (50 °F).[31][32] Care should be taken by hobbyists that proper oxygenation, pH stabilization, and off-gassing occur over the winter in small ponds, so they do not perish. Their appetites do not come back until the water becomes warm in the spring.

Koi have been reported to achieve ages of 100–200 years.[33] One famous scarlet koi named "Hanako" was owned by several individuals, the last of whom was Komei Koshihara. In July 1974, a study of the growth rings of one of the koi's scales reported that Hanako was 226 years old.[34] Some sources give an accepted age for the species at little more than 50 years.[35][36]

Disease

Koi are very hardy. With proper care, they resist many of the parasites that affect more sensitive tropical fish species, such as *Trichodina*, *Epistylis*, and *Ichthyophthirius multifiliis* infections. Water pH is important for maintaining koi's health.[37] Water changes help reduce the risk of diseases and keep koi from being stressed. Two of the biggest health concerns among koi breeders are the koi herpes virus (KHV) and rhabdovirus carpio, which causes spring viraemia of carp (SVC). No treatment is known for either disease. Some koi farms in Israel use the KV3 vaccine, developed by Prof. M. Kotler from the Hebrew University of Jerusalem and produced by Kovax, to immunise fish against KHV. Israel is currently the only country in the world to vaccinate koi against the KHV. The vaccine is injected into the fish when they are under one year old, and is accentuated by using an ultraviolet light. The vaccine has a 90% success rate[38] and when immunized, the fish cannot succumb to a KHV outbreak and neither can the immunised koi pass KHV onto other fish in a pond.[39] Only biosecurity measures such as prompt detection, isolation, and disinfection of tanks and equipment can prevent the spread of the disease and limit the loss of fish stock. In 2002, spring viraemia struck an ornamental koi farm in Kernersville, North Carolina, and required complete depopulation of the ponds and a lengthy quarantine period. For a while after this, some koi farmers in neighboring states stopped importing fish for fear of infecting their own stocks.[40][41]

Breeding

When koi naturally breed on their own they tend to spawn in the spring and summer seasons. The male will start following the female, swimming right behind her and nudging her. After the female koi releases her eggs they sink to the bottom of the pond and stay there. A sticky outer shell around the egg helps keep it in place so it does not float around. Although the female can produce many spawns, many of the fry do not survive due to being eaten by others. On average if the egg survives around 4–7 days the fry will be hatched from the egg.[42]

Feeding the koi

Like most fish, koi reproduce through spawning in which a female lays a vast number of eggs and one or more males fertilize them. Nurturing the resulting offspring (referred to as "fry") is a tricky and tedious job, usually done only by professionals. Although a koi breeder may carefully select the parents they wish based on their desired characteristics, the resulting fry nonetheless exhibit a wide range of color and quality.

Koi produce thousands of offspring from a single spawning. However, unlike cattle, purebred dogs, or more relevantly, goldfish, the large majority of these offspring, even from the best champion-grade koi, are not acceptable as *nishikigoi* (they have no interesting colors) or may even be genetically defective. These unacceptable offspring are culled at various stages of development based on the breeder's expert eye and closely guarded trade techniques. Culled fry are usually destroyed or used as feeder fish (mostly used for feeding arowana due to the belief that it will enhance its color), while older culls, within their first year between 3 and 6 inches long (also called *tosai*), are often sold as lower-grade, pond-quality koi.

The semi-randomized result of the koi's reproductive process has both advantages and disadvantages for the breeder. While it requires diligent oversight to narrow down the favorable result that the breeder wants, it also makes possible the development of new varieties of koi within relatively few generations.

In the wild

Koi have been accidentally or deliberately released into the wild in every continent except Antarctica. They quickly revert to the natural coloration of an Amur carp within a few generations. In many areas, they are considered an invasive species and a pest. In the state of Queensland in Australia, they are considered noxious fish.[43]

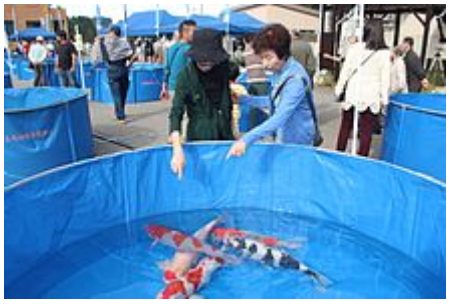
Various colors of koi feeding in a pond in Qingxiu Mountain, Nanning, China

Koi greatly increase the turbidity of the water because they are constantly stirring up the substrate. This makes waterways unattractive, reduces the abundance of aquatic plants, and can render the water unsuitable for swimming or drinking, even by livestock. In some countries, koi have caused so much damage to waterways that vast amounts of money and effort have been spent trying to eradicate them, largely unsuccessfully.[44]

In many areas of North America, koi are introduced into the artificial "water hazards" and ponds on golf courses to keep water-borne insect larvae under control through predation.

In common culture

In Japan, the koi is a symbol of luck, prosperity, and good fortune, and also of perseverance in the face of adversity.[45] Ornamental koi are symbolic of Japanese culture and are closely associated with the country's national identity.[46]



61st Nagaoka Koi Show at Yamakoshi Branch Office, Nagaoka, Niigata Prefecture, Japan

Since the late 20th century, the keeping of koi in outdoor water gardens has become popular among the more affluent Chinese. Koi ponds are now found in Chinese communities around the world, and the number of people who keep koi imported from Niigata, has been increasing. In addition, there are increasing numbers of Japanese koi bred in China that are sold domestically and exported to foreign countries.[14][15]

Koi are also popular in many countries in the equatorial region, where outdoor water gardens are popular.[47] In Sri Lanka, interior courtyards most often have one or several fish ponds dedicated to koi.[48]

See also

- Culture of Japan
- Japanese aesthetics
- Japanese white crucian carp

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Further reading

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- David Twigg (2001). *How to Keep Koi*. New York: Howell Book House. ISBN 978-0-7645-6242-6.
- Nicholas Saint-Erne (2010). *Advanced Koi Care*. Glendale, AZ: Erne Enterprises. ISBN 978-1-59247-400-4.

External links

- Feature article on treating sick fish, especially koi, "Surgery to Scale," *Cosmos Magazine* (https://web.archive.org/web/20060920140711/http://www.cosmosmagazine.com/node/100)
- Koi in the NIWA Atlas (https://www.niwa.co.nz/our-science/freshwater/tools/fishatlas/species/koi_carp)