

104.—THE ENEMIES OF POND CULTURE IN CENTRAL EUROPE.***By Dr. BERTHOLD BENECKE.**

In Central Europe the only mammals which commit depredations in fish ponds are the water-shrew and the otter.

The water-shrew (*Sorex fodiens* Pall.) is a pretty little animal, measuring 10 to 12 centimeters [about 4 inches] in length, including the tail, which is 5 to 7 centimeters [about 2½ inches] long. Its thick and soft fur is black on the back and sides, and whitish or grayish on the throat, breast, and belly. The snout is somewhat elongated, and can easily be moved in different directions. The helix of the ear is small; and when diving under the water, the animal can turn it over, so as to close the opening of the ear. The feet are bordered all round with bristles, which spread out in the water and form a good oar. Below the tail there is a keel-shaped row of long hairs. The water-shrew is very common in nearly all the waters of Europe, and lives in mouse-holes, or in burrows which it makes, and which have several openings, one of which is invariably below the water. It is an expert swimmer and diver, and eats insects, worms, and any other small animals which it can overpower. As it is exceedingly voracious, it becomes very dangerous to the spawn and young fry of fish; but it even attacks large fish, to which it clings like a leech and eats their eyes and brain. In hatching establishments especially it can do a great deal of harm by destroying the eggs and young fish, and also cause great injury in ponds and ditches, if found in large numbers. Hatching establishments must be protected against them by carefully stopping up all holes in the walls and the floor. The water-shrew can easily be caught in the neighborhood of the ponds in mouse-traps baited with pieces of fish or roe.

The otter (*Lutra vulgaris* Erxl.) is a strong kind of marten with a flat head, a blunt snout, short round ears, and strong low legs, with webbed toes; the fur is exceedingly thick and smooth, dark brown on the top, and grayish-brown below. The body measures 80 to 100 centimeters [about 3 feet] in length, including a tail 40 centimeters [about 15 inches] long. The otter lives along rivers and lakes whose shores are covered with trees or bushes. It lives in burrows which it makes, or in old fox-holes, which have several entrances, one of which always opens under the water. It is a skilful swimmer and diver, lives on fish and crustaceans, and becomes very injurious by the circumstance that in

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brooks and ponds where it finds plenty to eat it eats only a small piece of every fish it catches, then lets the fish go, and hunts for another. The presence of an otter can easily be ascertained by its tracks, which are recognizable by the distinct impression of the webbed feet, and by its excrements, generally deposited on flat stones, and containing scales, fish-bones, shells of crustaceans, and remnants of water-beetles. Its presence is also generally indicated by half-eaten fish lying on the shores.

Small ponds can easily be protected against otters by wire fences about 50 centimeters [20 inches] high and extending the same distance below the ground. As soon as there are indications of otters near large ponds, the whole neighborhood should be carefully searched, and when positive traces of otter have been found, steel-traps should be set, especially near the place where the otters regularly come ashore.

Among the birds the principal enemies of pond culture are the kingfisher, the heron, the duck, and the diver. Sea-eagles, gulls, and cormorants are found only near very large ponds or lakes; and we need not mention them here.

The kingfisher (*Alcedo ispida* L.) is a very beautiful bird with brilliant plumage, 16 or 17 centimeters long [about 6½ inches], with a long, straight, and sharply-pointed beak, and short tail. The upper part of the head and neck have a dark greenish-black color, with narrow, close sea-blue bands. The shoulders and wings are dark sea-green, the back has a beautiful blue color, and breast and belly are cinnamon-colored. From the root of the beak a cinnamon-colored, and below it a dark sea-blue streak extends below the eye as far as the shoulder. The throat has a yellowish-red color, the beak is black, and the root of the lower part of the beak and feet are bright red. The kingfisher is not gregarious, but lives alone near brooks, rivers, and ponds, where, changing about between some favorite places, it hides as much as possible, sitting on poles, stones, or overhanging branches close to the surface of the water, and watches for its prey. Frequently it may be seen darting over the water, swift as an arrow, and plunging into it head foremost, soon to return, carrying in its bill its prey. Its food consists principally of small fish and crustaceans, and also of large insects. According to Brehm, the kingfisher on the average devours every day ten or twelve small fish, each about as long as a man's finger. It therefore becomes very dangerous in trout brooks and ponds, especially as it is by no means so rare a bird as is generally supposed, but is found in considerable numbers near brooks containing fish. Max von dem Borne, of Berneuchen, has during fourteen years caught upward of seven hundred kingfishers near his ponds. As the kingfisher is in the habit of sitting on stones or stakes projecting a little above the surface of the water, it is easily caught in small steel-traps on whose prong a small piece of wood is placed, inviting it to rest. When caught, it flutters about and falls into the water, with the trap, where it is soon drowned.

The heron (*Ardea cinerea* L.) has a length of 1 meter [about 40 inches], and measures 170 centimeters [about 5½ feet] from tip to tip of its wings. It has an ashy-gray color, a white forehead, grayish neck, and dark sides. A streak running from the eye to the back of the neck, three long feathers on the back of the neck, a triple row of spots on the front part of the neck, and the long feathers of the wings, are black; the beak is straw-colored, and the legs brownish-black. It is found in the neighborhood of shallow waters, where it roosts and has its nest on high trees. They are frequently so numerous that hundreds of roosts are found close together. The heron is very shy and cautious, and fishes by daytime or during light nights standing or wading in the water. It prefers fish measuring about 20 centimeters [8 inches] in length.

As the herons are very injurious, the regulations prescribe that they must be killed and their roosts destroyed in the Government forests. But as in spite of these measures the number of herons is surprisingly large in many places, owners of ponds must endeavor to get rid of them as fast as possible by setting steel-traps baited with fish, or by laying fish poisoned with strychnine in places frequented by herons.

Ducks, both wild and tame, are very fond of fish spawn and young fry. They should, therefore, not be allowed on spawning and raising ponds, while in ponds where larger fish are kept they can do little or no harm.

Two varieties of the diver (the *Podiceps cristatus* L. and the *Podiceps minor* Lath.) are frequently found in considerable numbers on large ponds. The *Podiceps cristatus* is 95 centimeters [about 3 feet] long, of a shining blackish-brown color on the back and a pure white on the breast and belly. The sides are rust-colored with grayish spots; the cheeks, throat, and a large spot on the wing are white; the beak is pale red, the eye red, the foot horn-colored. Round the neck there is a collar of brown feathers, and on the head there is a top-knot in two parts, which can be raised. The *Podiceps minor* is only 25 centimeters [about 10 inches] long, of a shining blackish-brown color on the back, and below grayish with occasional dark spots. The throat is blackish; the head, sides, and front of the neck are brownish-red; the eye is reddish-brown; the beak yellowish-green at the root, and black at the point. Both varieties are nearly always in the water; they dive often and long, and fly but rarely. The *Podiceps cristatus* lives principally on small fish; while the *Podiceps minor*, according to some statements, prefers worms, snails, &c. It is very difficult to shoot these birds, because they are exceedingly cautious and are rapid divers; but it is easy to find their rudely constructed nests in reed thickets close to the surface of the water, and take their greenish eggs, which have a very fine flavor.

Among reptiles which live on fish, we may mention the swamp-turtle (*Emys europæa* L.), and the two varieties of snakes, the *Tropidonotus natrix* L. and the *Tropidonotus tessellatus* L., but they are so rare in our ponds that they cannot do much harm.

Among the *Amphibia* only the green water-frog (*Rana esculenta* L.) is dangerous to fish ponds. In some places it is found in very large numbers, and does a great deal of harm, not only by depriving the fish of their food in the way of insects, worms, &c., but also by devouring large quantities of small fish sporting about in the shallow water. In large ponds pike may be employed advantageously in destroying frogs; while the spawn of frogs and tadpoles is eagerly devoured by trout and carp. Spawning and raising ponds should, if possible, be protected against frogs by being fenced in with wire screens. Frogs which have hid, before the pond was fenced in, are easily caught in tubs placed in the ground near the edge of the pond; when jumping about they fall into these tubs, and are then thrown as food to the pike or trout. Frog spawn found in small ponds should be carefully removed with rakes, and thrown as food into ponds containing older fish.

Among the insects, two varieties of the water-beetle, the *Dytiscus marginalis* Sturm, and the *Acilius sulcatus* L., are particularly dangerous for fish, as both the beetles and their larvæ completely devour fish spawn and little fish measuring several inches in length, while they will eat deep holes into larger fish.

Another insect, the *Notonecta glauca* L., is found in some ponds in incredible quantities, and with its sharp prong, with which it also stings human beings so as to cause considerable pain, it kills a great many young fish, and sucks them. These hurtful insects may occasionally be caught in large quantities with muslin bag-nets. Pounded and kneaded into a dough with fine flour, they can very suitably be employed as fish-food. It is easy to destroy these insects on a large scale by scattering quicklime over the bottom of the pond after the water has been let off.

A large number of crustaceans are occasionally found on fish as parasites, without, however, inflicting any serious injury. There are only two varieties, which, when found in large numbers, do considerable damage in our ponds, namely, the *Lernæocera cyprinacea* L. and the *Argulus foliaceus* L.

When quite young, the *Lernæocera cyprinacea* resembles the sand-flea. After spawning the female changes, when it has firmly attached itself to the body of a fish, into a worm-shaped tube, 1 to 2 centimeters [about one-half inch] long, at the front part of which four horn-like excrescences develop, for adhering to the gills or penetrating between the scales of fish, and frequently they enter deep into the body of the fish; at the back part of the dirty-green body the numerous eggs are carried in two small, long bags, till they are ready to issue. *Lernæocera* is often found in enormous numbers on crucians, frequently also on carp, but rarely on other fish. By moving the hard excrescences referred to above, it causes gatherings in the skin of the fish, which gradually increase in size, soon assume a very disgusting appearance, and worry the fish very much. As it is impossible, in cases where the *Lernæocera*.

by its great numbers, does serious harm, to free each fish from these parasites, it is best to prevent their further increase by draining the infected ponds, and to sell the fish before the gatherings in their skin have become large, and to scatter a great quantity of lime over the bottom of the pond.

The *Argulus foliaceus* is round, pressed flat in the form of a shield, 4 to 6 millimeters [about $\frac{1}{4}$ inch] long, with a long sucking-prong, two strong sucking-disks with stems close to it, a pair of climbing legs with strong claws, and four pairs of webbed feet with stiff bristles. It has a dirty greenish-gray color, frequently swims about in the water in a lively manner, and occasionally attacks young fish in such numbers as to cover their entire surface, causing their death. The best means of destroying them is to scatter lime in the ponds.

Still greater than the number of crustaceans living on fish is the number of worms living on and in fish as parasites. But, as a general rule, they do not do much harm, with the exception of the *Piscicola geometra* L. This grows to the length of 2 or 3 centimeters [about 1 inch]. The broad sucking-disks, located at the front and back part of the body, protrude distinctly from the thread-shaped body, which is only 1 to 2 millimeters [about $\frac{1}{8}$ inch] broad, and of a greenish or yellowish-gray color with darker bands. By means of these sucking-disks this worm moves about in the manner of some caterpillars, while in the water it swims about rapidly with a meandering motion. In ponds which contain many of these worms the fish may be seen swimming about wildly, covered with hundreds of these worms all over their bodies, principally, however, round the fins, gills, eyes, and mouth. By rubbing against the bottom and the banks, the fish try to rid themselves of these parasites; they grow lean, and frequently perish in large numbers. The best means of destroying these worms is likewise to scatter lime in the pond. By putting the fish for a short time in a solution of water and 1 per cent of common salt, they can be freed from these parasites and again be placed in fresh water.

Some plants likewise occasionally become hurtful in ponds. Reeds, rushes, and other high aquatic plants should not be allowed to grow too luxuriantly in the ponds. Sometimes green algæ make their appearance in such enormous quantity as seriously to impede the movements of the young fish, by forming a net-work between other aquatic plants. Sometimes also these algæ cover a great portion of the surface of the pond with a yellowish-green slimy mass. They can easily be removed with a rake.

Lower forms of algæ, of the varieties *Nostochaceæ*, *Oscillariæ*, and *Chroococcaceæ*, occasionally produce by their astonishingly rapid growth the so-called "water-bloom" (*Wasserblüte*), and transform the water into a blue-green mass resembling oil. Sometimes this "water-bloom" causes the death of all the fish in a pond; in other cases only certain varieties die, and frequently the fish are not at all affected by it. So

far no experiments have been made with the view to ascertain which of the algæ forming the "water-bloom" exercise an injurious influence on fish. It is, therefore, very desirable that careful observation should be made in this respect.

The *Saprolegniae*, a low variety of fungus, which are injurious to fish eggs, are also frequently found in ponds on full-grown fish. They probably adhere only to sore places on the fish, and, spreading more and more, frequently cover large portions of the body of the fish with a thick slimy cover of a whitish color. This disease has been especially noticed in fish kept in small basins, and often destroys a great many fish; but even when in a state of freedom in open waters fish are frequently attacked by this epidemic, and in the English rivers the salmon frequently die of this disease by thousands. The purer and cooler the water is, and the more air it contains, the less will it favor the growth of these fungi. A healthy vegetation of green aquatic plants prevents their spreading all over a pond.

Fish which have been attacked by these fungi may be cured, unless very large portions of the body have become affected, by placing them for a short while in a solution of water and 1 per cent of salt, or by rubbing the sore places with a solution of water containing a higher percentage of salt.

As enemies of pond culture we may finally mention various diseases, which are known by a variety of names, but of whose causes and nature we are as yet almost entirely ignorant, and in respect to which we need much accurate and painstaking observation.

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105.—FISHERY INDUSTRIES OF THE ISLAND OF HOKKAIDO, JAPAN.

By K. ITO.

INTRODUCTORY REMARKS.

The island of Hokkaido, in Japan, formerly known as Yesso, is situated immediately north of Nippon or Hondo, and separated from it by the Strait of Tsugaru. It lies between latitude $41^{\circ} 21'$ and $45^{\circ} 30'$ north, and has an area of 5,109 square ris (1 ri=2.5 miles). This island has remained, for a long time, as a wild territory, roamed over by Ainos, an aboriginal race; and it is not more than twenty years since the Japanese Government took up the effort for its colonization.

The only industry carried on by Japanese in this island previous to that time was fishing; and even in present days this constitutes one of the most important industries of the island. It is, however, to be remarked that the fisheries are confined to in-shore work, and the method pursued in curing fish caught is yet very primitive. Hitherto