AMERICAN FISHES IN ITALY

By Giuseppe Besana

President Lariana Section, Lombardy Society of Fisheries and Aquiculture

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[Translated from the German.]

REARING IN ARTIFICIAL PONDS.

In the small ponds of the Piscicoltura Borghi at Varano-Borghi, opened in 1907, were produced at first mostly fry and yearling fishes for stocking purposes. But as the plants were without results, the ponds were increased in number and the rearing of table fishes was undertaken, including attempts to cultivate American trouts and salmon, namely, *Salmo irideus*, *Oncorhynchus tschawytscha*, and *Salvelinus fontinalis*. Experiments were made also with *Salmo clarkii*, crossing it with the rainbow trout.

Of these fishes, at the present time only the rainbow trout is being cultivated. The quinnat grew extraordinarily fast during the first year and without losses, reaching a size for table use during that one year; but the flesh was not yet firm nor of good flavor. The growth was still good during the second year, but in the third year there remained but very few of the fish, and they were thin and for the most part died during the period of spawning. The quinnat presented another disadvantage during the second year, being so delicate that when fished out to be transferred to other ponds, in spite of the great care taken, a great number of them died. The brook trout grew very well during the first year, markedly less during the second year, still less during the third, while the mortality continually increased. Compared with the European salmonoids the best results were obtained with the rainbow trout. In the second summer these trout reached the size of table fishes, weighing 150 to 200 grams, and the flesh had a good flavor. They endure transportation well, and readily take artificial food. We know of no other salmonoids so well adapted to culture in ponds. The few experiments in crossing the *irideus* with the *clarkii* trout did not encourge further effort, as the growth of the hybrid is far inferior to that of *irideus*.

PLANTS IN LAKE MANATE.

The area of this lake is 240 hectares; greatest depth, 37 meters; plankton abundant; vegetation scant; maximum temperature of water, 8° C. at the bottom, 24° C. at the surface; minimum temperature, 8° C. at the bottom, 0° C. at the surface. The native fishes of this lake are, in the order of their abundance, river perch, tench, roach, pike, bleak, eel, and burbot. Tables I, II, III, and IV show the plants of the introduced fishes and the catch. Table V gives the catch for 1907.

TABLE I.—RAINBOW TROUT (SALMO IRIDEUS).

Year.	Size or age of fish planted.	Number planted.	Number caught.	Weight of catch.
				Kilograms.
1897	Fishes 2 years old	800		
1898	Small fry	4,130		
1899	Yearlings	8,618		
1899	Fry 2 months old	676	5	9.700
1900	Fry 2 months old	1,400		
1901	Yearlings	300	7	9,800
1901	Fishes weighing 400 grams each	21		
1902	Fry 2 months old	4,500		
1903	Small fry	10,000		
1904	Small fry	10,000		
	Total	40,445	12	19,500

TABLE II.—BROOK TROUT (SALVELINUS FONTINALIS).

Year.	Size or age of fish planted.	Number planted.	Number caught.	Weight of catch.
				Kilograms.
1903	Fry 2 months old	2,240		
1903	Yearlings	80		
1903	Fish weighing 200 grams each	150		
1904	Small fry	2,500	19	5.200
1905	Yearlings	518		
	Total	5,488	19	5.200

TABLE III.—BLACK BASS (MICROPTERUS SALMOIDES).

Year.	Size or age of fish planted.	Number planted.	Number caught.	Weight of catch.
				Kilograms.
1897	Yearlings	500		
1897	Fish 2 years old	86		
1897	Fish 3 years old	6		
1899			30	11.80
1901			76	78.20
1902			226	217.10
1903			163	196.70
1904			372	284.50
1905			343	246.80
1906			803	368.20
1907			241	147.40
	Total	592	2,254	1,550.70

TABLE IV.—SUNFISH (LEPOMIS AURITUS).

Year.	Number of fish planted.	Average weight when planted.	Weight of catch.
		Grams.	*Kilograms.*
1901	140	30	----------
1901	66	45	----------
1902	91	50	----------
1903	----------	----------	120.80
1904	----------	----------	164.60
1905	----------	----------	249.20
1906	----------	----------	300.10
1907	----------	----------	302.70
Total	297	----------	1,137.40

TABLE V.—TOTAL CATCH IN LAKE MANATE IN 1907.

Species.	Number.	Weight.
		Kilograms.
Tench (Tinca vulgaris)	618	706.70
River perch (Perca fluviatilis)	----------	562.80
Small eels (Anguilla vulgaris)	107	22.60
Large eels (Anguilla vulgaris)	24	14.70
Pike (Esox lucius)	53	46.50
Bleak (Alburnus alborella)	----------	302.70
Sunfish (Lepomis auritus)	----------	302.70
Black bass (Micropterus salmoides)	241	147.40
Burbot (Lota vulgaris)	4	1.10
Total	----------	2,107.20

Failures were noticeable with the salmonoids. I must add, however, that I have had similarly negative results with European salmonoids. It was only in the beginning of this year that there were caught 100 *Coregonus maræne*, weighing from 0.50 to 2 kilograms. Fry of this species had been introduced, and a large individual was seen only here and there. No fry had been planted in the lake for four years, and the smaller fishes which were caught, weighing 800 grams, must have been bred from fishes that had spawned in the lake.

The sunfish did not increase greatly in this lake; the catches are insignificant and have never exceeded 300 kilograms yearly, i. e., somewhat over 1 kilogram per hectare.

I had built great hope on the black bass. Young *Micropterus* were seen everywhere during the first years. The first catch was made only four years after their introduction, and it increased to 368 kilograms. During the last year, however, it fell to one-half of this quantity, and the present year will show still poorer results. When the black bass was introduced there were quantities of bleak in the lake, and this fish was not caught at all. At the present time it has entirely disappeared.

Lake Manate yields at present, as formerly, 3,000 to 5,000 kilograms of fish yearly. No benefit was derived from the introduction of new species of fishes,

but perhaps even some disadvantage. *Micropterus*, which bring a higher price, have disappeared, as have also the river perch and the pike, probably on account of a lack of small fishes for food. The tench and the roach (*Leuciscus erythrophtalmus*) are the only ones that remain.

How to provide new food is the present difficult problem, which, after the failure with the sunfish, will scarcely find easy solution with present experience.

PLANTS IN LAKE VARANO.

Area of this lake, 360 hectares; greatest depth, 7 meters; much plankton, very rich vegetation; maximum temperature of the water, 24° C. at the surface, 24° C. at the bottom; minimum temperature, 0° C. at the surface, 6° C. at the bottom.

The species of fish contained in the lake are, in the order of their abundance, sunfish, river perch, tench, bleak, black bass, eel, zander, mirror carp, and pike. The sunfish and black bass, also the zander and the carp, were introduced in this lake.

The results obtained with the American fishes here are marvelous, especially with the sunfish, as two other lakes communicating with Lake Varano are overstocked with sunfish. It is scarcely possible to notice any effect on the other kinds of fishes, except that the pike has grown scarcer and the bleak has disappeared. The river perch is much fatter and grows much more rapidly than before.

The plants of introduced fishes, together with subsequent catches, are shown in tables VI and VII. The yearly output of fish of all kinds, amounting, formerly to 170 tons, has increased to 300 and more tons. Table VIII gives the total catch for 1907, which is exceedingly good, amounting to almost 90 kilograms per hectare.

TABLE VI.—SUNFISH (LEPOMIS AURITUS).

[Eighty-three 3-year old brood fishes introduced in 1900.]

Year.	Weight of catch.
	Kilograms.
1901	682.5
1902	1,919.5
1903	5,845.9
1904	5,958.4
1905	7,456.9
1906	5,990.7
1907	12,811.4
Total	40,665.3

TABLE VII.—BLACK BASS (MICROPTERUS SALMOIDES).

Year.	Fish introduced.			Number caught.	Weight of catch.
	Number.	Size or age.	Average weight.		
			Grams.		*Kilograms.*
1900	8	Brood fish	560		
1900	1,000	Small fry			
1901	21	Brood fish	860		
1902	6	Brood fish	500		
1903				859	657.50
1904				3,193	2,204.90
1905				2,183	1,387.30
1906				8,941	2,987.20
1907				5,896	2,345.70
Total				21,872	9,582.60

TABLE VIII.—TOTAL CATCH IN LAKE VARANO IN 1907.

Species.	Number.	Weight.
		Kilograms.
Tench (Tinca vulgaris)	2,801	3,634.70
River perch (Perca fluviatilis)		7,568.10
Small eels (Anguilla vulgaris)	1,066	280.50
Large eels (Anguilla vulgaris)	894	457.30
Pike (Esox lucius)	224	232.10
Bleak (Alburnus alborella)		2,626.60
Sunfish (Lepomis auritus)		12,811.40
Black bass (Micropterus salmoides)	5,896	2,345.70
Carp (Cyprinus carpio)	52	280.30
Zander (Lucioperca sandra)	219	407.70
Total		30,644.40

I was criticised for introducing the sunfish, but I believe that I do not deserve it. The sunfish is of much better flavor than the ordinary bleak. Delicious steaks can be cut out of the larger of them, and the fish bring a good price where better known. They are also a very good food for the carnivorous fishes in the lake. They increase in an extraordinary manner in shallow lakes and must be fished out diligently. They do not reach any importance in deeper lakes and in consequence can not have any effect. In lakes where there are no salmonoids the sunfish should be an excellent item of popular food. The average weight of the fish caught is 100 grams, which is reached in three years, but we have caught individuals weighing 400 grams. Another advantage is that except when the lake is frozen it is always possible to catch more or less sunfish, a thing which is of great importance to the fisherman. The long spawning season, lasting from May until the middle of August, offers the advantage that, as the sunfish do not grow during the winter, there is present through almost the entire year a quantity of small fishes to constitute a food for the predatory species. If the sunfish now and then eats other small fry, it does not consume dangerously great quantities. That it does not eat spawn is well established. The fish should be of great value in Italy in swampy waters, where it thrives

very well and can stand great heat and great cold. While Lake Manate, which is of far greater depth, produced only a little more than 1 kilogram per hectare, the shallow Lake Varano with its swampy bottom produced 35 kilograms of sunfish per hectare during the past year.

The black bass also flourished in this lake (table VII), yielding somewhat less than 10 kilograms per hectare. The fishing is very irregular and uncertain, however, some 100 kilograms being caught one day, while on the next not one fish may be found. The black bass can be transported safely alive. Its flesh is boneless and very palatable, but its plump shape and big head make its sale difficult. There is much around the head that can be eaten, but most people prefer the zander. The growth of the black bass is markedly greater than that of the river perch. While the latter seldom reaches 1 kilogram and this in some eight or nine years, the black bass reaches this weight in three years. It increased in number considerably during the first years, but later, when there were many large individuals, these ate up many of the smaller of their species. It has no effect whatever on the other fishes in the lake, except *Alburnus alborella*, which it has eaten up entirely. I certainly prefer the zander, but it can not be introduced into all waters, while the black bass will thrive anywhere.

I have also introduced the black bass in small lakes with great success and at a small cost. In order to make this success lasting, however, it is necessary to introduce the sunfish at the same time. The small bleak is soon eaten up by the black bass, the sunfish alone, on account of its enormously prolific propagation, being able to withstand and keep ahead of this terrible devourer.

On account of the defective organization on the part of our government in respect to fisheries, it is impossible for me to report on the introduction of rainbow trout in public waters, or on catfish, black bass, and sunfish in other lakes. It may be seen, however, from the above reports, that great advantages may be reaped from the introduction of these and other American fishes.