30.—PISCICULTURE IN ENGLAND.

By J. J. MANLEY, M. A.

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Pisciculture, as applied to both salt and fresh water fish, was well illustrated at the recent Fisheries Exhibition; and it is expected that an impetus will be given to its pursuit in this country, which has hitherto been somewhat backward in this matter, except as regards the artificial propagation of the *Salmonidæ* family. The culture and acclimatization of salt-water fish has made little progress among us, and foreign countries have left us far behind. The Romans, in the time of the empire, paid great attention to salt-water fish farming, rich men having extensive and elaborate vivaria for amusement sake and gastronomic pleasure, while others cultivated fish for profit. Arrangements were made for the fish to run into the vivaria from the sea and deposit their ova in them, and spawn was collected in the sea itself and brought into the vivaria to hatch. Exotic fish, also, were brought from long distances. But the artificial propagation of fish does not appear to have been practiced till the fifteenth century, and in this country not till within the last fifty years; and we are still without any recognized establishment or enterprise for the culture of sea fish. The United States Government is thus far ahead of our own, and the shad has been artificially disseminated in many districts, to say nothing of the success in other branches of pisciculture. Other Governments are following the example of the United States; and in England it is hoped that the establishment of a marine biological station, or stations, will lead before long to an extensive system of marine pisciculture and the acclimatization of foreign fish. The recent news from America, that the spat of the oyster has been successfully impregnated by artificial means, will give a further impetus to marine pisciculture.

In the matter of pisciculture in fresh water, other countries, notably France with its famous Huningue establishment, and Germany, are also in advance of us, notwithstanding many admirable private enterprises, such as those at Stormontfield, on the Tay, and of Sir J. Gibson Maitland, at Howietown. But there is no fear now that the culture of salmon and trout and their allies will not make continued progress, and it is already an established and remunerative industry. The culture of other and commoner kinds of fresh-water fish is another matter, and this, too, has, directly and indirectly, had fresh attention called to it by the Fisheries Exhibition; and it is to this branch of pisciculture the following remarks are directed.

The question seems to present three chief heads for consideration; the first, whether pisciculture applied to fresh water could be so carried

out in this country as to supply an amount of food which would be a sensible addition to our resources; the second, whether the fish food thus produced would be acceptable to our tastes; the third, whether pisciculture would pay commercially. As to the first point, there can be little doubt but that the supply of fresh-water fish of the ordinary kinds might be immensely increased by proper culture. By ordinary kinds are meant jack, carp, tench, roach, dace, perch, chub, gudgeon, bream, and eels; but the culture of the *Salmonidæ* family is not included, as it forms a distinct branch of this question, and may be considered as an established and remunerative industry. Pisciculture, as applied to the common fresh-water fish of different countries, is a very ancient art. It was successfully practiced by the Greeks and Romans, and probably by the Egyptians before them. It has been a branch of public industry among the Chinese for many centuries, and at the present time fresh-water fish form the cheapest and most plentiful food in that country. This is the case also to a very great extent in Japan, where, by the way, it is said that most fish are preferred in a raw to a cooked state. For many centuries the abbeys and monasteries in this country procured a large supply of fish food from their ponds and stews; and during the church fasts, which were many, and often of long duration, a large proportion of the population lived mainly on a diet of fresh-water fish. The monks, and country gentlemen too, in those days, must have had tolerably good ideas of pisciculture, as the different old books on the formation and management of fish ponds indicate, and it is certain that fish formed a very considerable portion of the food supply of the kingdom. With our improved knowledge of natural history, and especially of the method of expressing the ova from fish and artificially hatching them, whereby the increase of production is extended a thousand-fold, we could, doubtless, raise a very large stock of fish in our ponds and rivers. But considering the great increase in the population, it is more than doubtful whether the supply thus obtained would be any very appreciable addition to our food resources.

But though the supply of "coarse" or common fresh-water fish could be greatly increased, the acceptability of such fish as food to the mass of the population is very uncertain; indeed, the popular verdict seems decidedly against them, with few exceptions. They have all, more or less, a palpably muddy taste, and where this is not predominant they have but little more flavor than stewed blotting paper. Even trout, from many streams that could be named, are either insipid or partake to a great extent of the characteristic flavor of other fresh-water fish. Persons may be found, indeed, who will go into raptures over jack stuffed with the appropriate "pudding," or over carp and tench stewed *secundum artem*. Even roach, dace, barbel, and bream find advocates; but in this matter the *vox populi* is probably right, and it is more often the sauce or the stuffing which gains admirers than the fish themselves. It may be admitted that there is a vast difference in fresh-water fish,

and much depends on the way of cooking them. Thames fish have a decided superiority over most others, and the wives of Thames puntsmen and cooks at Thames-side hostelries seem to excel in the art of serving up the fish from their river. The secret chiefly lies in cleaning the fish as soon as possible after they are caught, and thoroughly drying them, when split open, in the sun and wind before cooking. Thames gudgeon, when properly cooked, are by no means bad eating, and are fairly entitled to the name of "fresh-water smelt." Thames perch, also, and jack, are certainly eatable; and a Thames trout is undeniably excellent, but he is a *rarissima avis*. Thames fish are, however, an exception. Those from other rivers are mostly inferior, while it is no exaggeration to say that fish from stagnant water, or from ponds and lakes which have only a slight stream running through them, can hardly be considered as coming within the category of acceptable food. Even enthusiastic anglers can hardly dare to advocate the culinary merits of fish from the Norfolk Broads. As a rule, the poor will not eat fresh-water fish, even when they can get them for nothing, or when *paterfamilias* brings home a basket of "coarse" fish of his own catching, pretends to like them himself, and his family eat them out of compliment to the catcher. When a pond or river is dragged, the owner, as a rule, can hardly find persons to carry away the carp, tench, and other such fish captured. As an instance of this, I once saw large heaps of fine roach, which had been netted out of the trout water round Wilton, lying on the banks and no one caring to come for them, though a general invitation to help themselves had been given to all the country side. There is little or no market for coarse fish in London, except at particular seasons, when the Jews will buy them, following some "tradition of the elders." But this is a poor testimony to their goodness, when we find that barbel is the most favorite fish among the Jews, whereas most Christians would agree that this fish is the most unpalatable one our waters produce.

It may be said that this popular estimate of fresh-water fish is all prejudice. Perhaps it is, to some slight extent. We know how prejudice militates against the use of Australian tinned meat. We know that a true Celt will not taste an eel, or a true Englishman a snail or a French edible frog. It would take many years of "raniculture" to make the latter an acceptable article of food. But it is not all prejudice in the matter of fresh-water fish. With the exception of trout, to which may be added gudgeon and perch from the Thames and some other rivers, and eels, which, like salmon, almost stand apart by themselves in this question, fresh-water fish have either a muddy or unpleasant flavor, or are simply tasteless; add to which, the abundance of large and small bones throughout them renders them still more unacceptable. Again, it might be alleged as a proof of present prejudice, that our forefathers, not only of the lower but the higher classes, ate and appreciated these fish. True, but this was partly because of the

cheapness of this poor food, and the scarcity of better, and partly owing to their want of good taste. This is not begging the question. The tastes of a nation travel forwards, so to speak, not backwards, and food which previous generations accepted is refused by those that follow them. This is a fact, however much as in certain respects it may be a subject of regret. Jack and carp can hardly be considered as generous dishes at modern, civic, or regal banquets, as they were of old, though I believe the latter fish is still served at Windsor Castle. But the Virginia water carp do not appear at the royal table till they have spent a considerable time in clear, sharply running water, arranged for the purpose in which they, to some extent, are freed of their muddy flavor. And, after all, this serving of the old Elizabethan stew must be more a matter of form and of keeping up old traditions, than based on any real appreciation it meets with. Of course, scientific pisciculture might improve the quality of our pond and river fish; and proper feeding, due cleansing of the ponds, a proper regulation of the number of fish in any given space, and a cleansing of those about to be used as food in stews of swiftly running water, according to the old custom, might do much to make the fish more palatable; but I cannot imagine that the time will ever recur when the old saying recorded by Izaak Walton, "He that hath bream in his pond hath always a welcome for his guest," will be true either in reference to the poor-eating fish named, or to the other ordinary inhabitants of our waters. We cannot expect by scientific culture to improve their breed as we have that of our flocks and herds. The salmon family and eels seem to be the only products of our fresh waters really worth cultivating from a food-supply point of view, or as ministering to the pleasures of gastronomists.

If pisciculture is destined to supply us with any appreciable increase of palatable fresh-water fish-food, it must be by the introduction of new species from other countries, and their acclimatization in our waters. Several such have been proposed as most suitable, and some have actually been introduced by way of experiment. For instance, the *Silurus glanis*, or "sheat-fish" of Central Europe, is thought by some as a very likely kind to thrive in our waters. It is excellent food, and grows rapidly, and to a great size. It was in reference to the enormous weight which this fish attains that a humorous contemporary suggested that, if naturalized in our rivers, it would show excellent sport when played with a chain cable attached to a crane, which should move on a tramway along the river's bank. The great lake trout of Switzerland has been successfully introduced into some of our waters, as so has the *Salmo fontinalis*, or American "brook trout." The black bass (*Grystes nigricans*) from the northern districts of America, and that from the southern and western, known by the name of *Gristes salmoides*, have also been found likely to suit our waters. The Marquis of Exeter has been very successful in the acclimatization of some species of black bass at Burleigh-house, and it is a fish which would probably thrive well in some of

the waters of the East Anglian broads and rivers, as suggested by Mr. Wilmot, the Canadian commissioner to the Fisheries Exhibition at South Kensington, on the occasion of a visit some few weeks ago to the Norfolk broads. The black bass is a fine sporting fish, and gastronomically to be commended. To these we may add, as suitable to some of our waters, the white-fish (*Coregonus albus*) of Canada, which is very prolific, and most excellent eating.

The third point for consideration is—would pisciculture pay? Even if our ordinary fresh-water fish were acceptable to consumers, it is doubtful whether the culture of them would commercially be successful. Under no circumstances could it be expected that they would be able to compete with salt-water fish in cheapness. The cost of cultivation would, probably, be greater than the advocates of pisciculture anticipate. Letting the water off ponds in succession, and cropping them with corn or vegetables, as proposed by the late Mr. Frank Buckland, and after the removal of the soil, would involve great labor and expense. Fish are but slowly growing creatures, unless supplied with abundance of food, and this represents a further outlay. During the summer months, Mr. Buckland suggested that putrefying flesh hung over the ponds would supply maggots, and that lob-worms might be gathered in the meadows after dark. But suitable flesh is not always obtainable, and for weeks in a drought not a lob-worm will show itself. The latter are often worth from a shilling to half-a-crown a quart for fish, in dry weather, along the Thames side; and are actually imported by thousands from Nottingham, where "vermiculture," or rather worm-gathering, is a recognized industry. The difficulty and expense of feeding the fish in the winter would be still greater. It certainly would not pay to supply them, as Mr. Buckland did his small fry of various kinds at South Kensington, with "chopped beef-steak and biscuits." Whether the quicker growth of foreign fish proposed for naturalization would cover the expenses attached to their culture, is a matter on which it is almost impossible to give an opinion. It would be satisfactory to think that careful calculations as to the whole matter would give good grounds for expecting that any system of pisciculture in fresh water would answer the expectations formed of it by its advocates. At all events they will be benefactors who can make two fish to live where only one lived before, and will, by the introduction of new species, develop the capacities of our now generally ill-stocked waters. As an encouragement to such, it may be noted that in Germany the scientific culture of carp in ponds is found to be remunerative, as in that country, and in some other districts on the continent, this fish is still specially popular as an article of food.

Perhaps the recent establishment of the National Fish-culture Association of Great Britain and Ireland, the honorary secretaries of which are Mr. R. B. Marston and Mr. W. Oldham Chambers, will do much toward the solution of the question. It is certainly one which may

fairly be taken up by scientific and philanthropic members of the community; and perhaps many of the general, and especially the angling, public will supply funds for the acquisition of some suitable water or waters for experiments in the way of pisciculture, not so much in the hopes of receiving a pecuniary return, at least for the present, as for the purpose of practically testing the possibility of improving our own fresh-water fish supply by cultivating the species already in our rivers, ponds, and lakes, or naturalizing new ones. Such an attempt would have the sympathy of a considerable public interested in the subject, and could not fail to elicit valuable information. It is hoped that the remarks here made will not be considered as discouraging to such an inquiry. Even apart from the question of fresh-water fish as contributing to our food supply, their multiplication for the sport of the angling fraternity is a matter well worth attention, as the facilities for rational and wholesome recreation are no mean elements towards the well being of a nation, and especially of its poorer classes.

31.—COMPOSITION OF SOME OF THE FOOD-FISHES.

By E. T. KENSINGTON, F. C. S.

[From a book entitled "Composition of foods, waters, minerals, manures, and miscellaneous substances, compiled by E. T. Kensington, F. C. S." London, 1877.]

I.—ROE OF SALMON (p. 24).

Lecithin	7.5
Cholesterin	2.2
Fat	4.5
Albumen	10.3
Nucleiu*	48.7
Protamine	28.8

II.—COMPOSITION OF CARP, TROUT, &c. (p. 24).

Constituents.	Carp.	Trout.
Water	80.00	80.5
Muscular fiber	12.00	11.1
Albumen and hœmatoglobulin	5.20	4.4
Alcohol extract	1.00	1.6
Water extract	1.70	0.2
Phosphate of lime, &c	.....	2.2

Fish.	Fibrin.	Oil.
Skate	97	2
Haddock	92	8
Herring	92	8
Salmon	78	22
Eels	44	56

*All albuminoid substance rich in phosphorus.