

# CURRENT SCIENCE

Vol. XII]

JUNE 1943

[No. 6

	PAGE		PAGE
<i>Paddy-Cultivation cum Fish-Culture.</i> SUNDER LAL HORA ..	169	<i>Dr. C. G. Pandit, O.B.E.</i> ..	181
<i>The Economic Aspects of State Geological Surveys.</i> BY CYRIL S. FOX ..	173	<i>Dr. J. J. Rudra, M.B.E.</i> ..	182
<i>Scientific Discovery.</i> ..	175	<i>Diwan Bahadur Dr. K. R. Ramanathan</i> ..	182
<i>The Origin of the "Rohr" or Anhydrous Sodium Sulphate Beds below the Salt Pans at Didwana.</i> BY E. SPENCER ...	176	<i>Letters to the Editor</i> ..	183
<i>Nephridia of Earthworms.</i> B. P. ..	180	<i>Reviews</i> ..	190
<i>Sir Cyril S. Fox, Kt.</i> ..	181	<i>Centenaries—</i>	
		<i>Gill David (1843-1914)</i> ..	193
		<i>Science Notes and News</i> ..	193
		<i>Errata</i> ..	196

## PADDY-CULTIVATION CUM FISH-CULTURE

SIR F. A. NICHOLSON,<sup>1</sup> in his 'Note on Fisheries in Japan', described how Japan was utilising its paddy fields for the culture of carps. He observed:

"The distribution of fry is gratis and is for a special purpose; in Japan it is customary in suitable localities to place young carp when one or two inches long, in the paddy fields in June when irrigation begins; by October, say four clear months, when the paddy is cut these have grown to 8 or 10 inches and are quite marketable; the rapidity of growth is due to the warmth, excellent feeding on minute crustacæ such as copepods, larvæ, etc., in the fields, from which, of course, they are kept from escaping by bamboo gratings. Should the water in the fields fail, the ryot digs a small pit in one corner in which the fish can survive till more water comes down. The rearing of the fish in the fields is said to improve the produce of the paddy since the fish destroy many insects injurious to the plant." (Pp. 86-87.)

He further observed:

"On the subject of the growth of carp in paddy fields Prof. Mitsukuri says that in a single village the agricultural society (a point worth noting) represents the whole village, utilises 250 acres of paddy fields each year for this by-product, and annually breeds 25 million fry to be sold and raised in surrounding villages. He mentions another case where a vast area is irrigated (as in Egypt) by inundation, and the culture of carp in this area, though in its infancy, realised in 1902 no less than Rs. 72,000." (P. 87.)

In making suggestions for the improvement of fisheries in India, Nicholson (pp. 100-101) regarded paddy fields as suitable grounds for fish culture, especially in the deltas where the water-supply is

almost unfailing. Thus vast areas of Bengal are particularly suited for the simultaneous cultivation of paddy and the culture of carps.

In considering the question of paddy cum carp culture, it is essential to remember that though the yield from individual fields may not be great, the aggregate produce would run into several millions of pounds. This experiment can be conducted at practically no cost except that of obtaining the fry, while if villages do so on an extensive scale on co-operative basis, thereby reducing the individual expenses, the income from this by-product would be considerable. Mitter<sup>2</sup> has calculated that if the acreage in Bengal under rice crop (2,292,100 acres) and jute crop (2,310,300 acres), which require water almost all the time during the season, were to be utilized for the culture of fishes and if the average yield from the fishery were to be calculated at a modest sum of Rs. 10 per acre an annual additional income of nearly 5 crores of rupees could be derived from these sources.

In his popular note on 'Carp-Growing in Germany', Nicholson<sup>3</sup> made reference to this subject again and suggested the culture of carps in the vast areas covered by paddy fields in Madras.

Though references to the great possibilities of paddy cultivation cum carp culture are contained in the writings of several later writers<sup>4</sup> on Indian fisheries, no one appears to have recorded this practice from



any part of India. It is a matter of great pleasure, therefore, to report that in parts of the Sundarbans use is being made, though at present to a very limited extent, of the paddy fields and khals in the Abad areas for the culture of common Indian carps. Before describing the practice as prevailing at present, it is necessary to say a few words about the genesis of the Abad areas.

It has long been realised that detritic action has given rise to a network of deep creeks in many areas in South Bengal, particularly in the Sundarbans. In view of the heavy rainfall and the rise and fall of the spring tides in these regions, a network of deep khals is developed for the draining of the receding waters. In the process of colonisation, it is necessary to make embankments right round the area to be colonised so as to prevent the salt-water flooding the land. For this purpose a number of creeks are also dammed across by massive bunds (embankments). These creeks are sometimes over 25 feet deep, 100-200 feet broad, and several miles long, and by putting in sluices at the river end they are used as drainage canals for the embanked areas. Certain low parts of the embanked land are flooded with salt water and the young of river fish are taken in and allowed to grow for 8 to 9 months till they attain a marketable size. Then about November-December, the fishery is dewatered and the fish are either trapped or netted. Gradually when the higher lands in the embanked portions lose a part of their salinity through the action of the rains, and this happens in two or three years' time, they are put under paddy cultivation. So at one stage the *khals* with brackish waters are used for the cultivation of salt-water fishes while the neighbouring fields properly embanked are used for paddy cultivation. With the salt-water fisheries there is always a danger to the embankment, for snakes, eels, crabs, etc., cause immense damage by tunnelling through them. To avoid this heavy loss month after month, the brackish water fisheries are usually discarded and more lasting embankments are put up for the collection of fresh water. Not very long ago these creeks or drainage canals were not utilised in any way though the fields alongside them were used for the cultivation of paddy.

I am informed that about fifteen years ago, Babu Priyanath Sao of Suryapur, now

living in Gurguria, while on a visit to Midnapur, where the carp fry are available in abundance, happened to purchase eight annas worth of very young fry and brought them to his place in the Sundarbans in a small pot. These he liberated in a small pond near his homestead and when the fry attained a size of about two inches, he transplanted them into another larger pond. These were liberated in the month of Asar and Sraban (July and August); when ten months later, he caught those fishes, to his great surprise Catla had attained a size of about seven seers, and Rohu about five seers.<sup>5</sup> This encouraged him very much and the news spread all over the neighbouring Abads and the people then thought of seriously taking up carp culture as a profitable proposition in their creeks alongside the paddy fields. Now these fish are cultured in several of the creeks and it has been reported that they have bred naturally in some of these canals. However, the dealers in carp fry now go from Abad to Abad during the stocking season and the people are taking to carp culture as a subsidiary means of making some extra money. It is a pity that the evil practice of stocking fishery areas with very young fry is also prevalent in these Abads and in some cases, therefore, the results are not very satisfactory. For the present only tanks and ponds are generally stocked but in certain cases these are connected with paddy fields during the season so the fishes roam about over vast areas.

The breeding of carps in these estuarine parts of Bengal may seem rather strange, because from the information so far available carps have only been known to breed in large rivers with swift currents during floods when the neighbouring paddy fields are covered with flood-waters and the brood fishes leave rivers and enter the shallow and warm waters.<sup>6</sup> As indicated above, the deep creeks in the cultivated areas in the Sundarbans and the high lands where the paddy fields are situated, provide an exact parallel to the conditions which prevail in the artificial breeding grounds of carp in places like Midnapore<sup>7</sup> and Chittagong.<sup>8</sup> There is every probability, therefore, that the carps may have bred in these parts, though it has not definitely been ascertained so far.

From the rate of growth and the ease with which these fishes have been cultured in



these parts, it seems evident that there is a great possibility of developing carp culture in the Abads. As it is a relatively new venture in these parts, it is essential to organise it along proper lines. In the first place, it must be made clear to all pisciculturists to stock their tanks only with fry of reasonable size so as to avoid the introduction of predaceous fishes, such as Boal, Saul, Chital, Phaloi and others. It was brought to my notice that in one of the tanks, where inadvertently a Boal had been introduced, out of about 15 seers of fingerlings only thirty carps were netted, while a Boal of about 4 to 5 feet long was also taken from the tank. This explained the cause of failure of this crop of carps.

With regard to the rapid growth of fish in these waters, it must be remembered that in the beginning, when the water is slightly brackish, there are plenty of shrimps, prawns and abundance of planktonic organisms, and Catla and Rohu feeding on them grow at a fairly rapid rate. When the water becomes almost fresh, then vegetation appears which consists of water-lilies, Samna grass and various types of Jhanjis and Panas. However, the growth of the fishes is not to be ascribed only to the abundance of food but also to the long runs they have in the creeks and the adjoining paddy fields which generally swarm with microscopic life. Thus in the Sundarban Abads we have extremely favourable conditions for paddy cum carp culture.

At the time of paddy harvesting it is necessary to dewater the paddy fields and at this time either the fishes are marketed or they are allowed to congregate into the deeper channels or the creeks referred to above. After the paddy is harvested, the dry season having commenced, the lands are left fallow for the cattle to graze on while in suitable areas vegetables or other short-term crops are raised.<sup>9</sup> On the rush of monsoon all cattle refuse in these dry portions is carried into the deeper channels and provides manure for the growth of fishes. In pisciculture it has been found necessary to allow piscicultural areas to dry up and as noted above in these Abads this is almost a necessity at the time of harvesting paddy. It will thus be seen that most ideal conditions exist in these Abad areas for the cultivation of paddy and the culture of carps simultaneously.

Attention may here be directed to the practice of prawn culture in paddy fields

along the Malabar Coast in North Travancore.<sup>10</sup> The paddy fields adjoining the backwaters and at a somewhat higher level are cultivated only once in the year from July to October when the water in them is fresh. The paddy is harvested by about the end of September and then the same fields are used for the culture of prawns. The flooding caused by the October-November rains is often allowed to keep the backwaters in direct communications with the paddy fields, but after the monsoon and with the lowering of the water-level the communications are restricted and during high tides brackish water, along with the young of prawns, is allowed to get in freely through sluice gates in the embankments into the paddy fields. By judicious manipulation fresh water is drained out occasionally and brackish water taken for some months into the paddy fields so the salinity of the water in the paddy fields goes on raising. The fishing for the prawns starts after two to three months of stocking (end of December or early in January) and lasts for several months. The rains of the south-west monsoon wash out the salinity from the fields and make them suitable once again for paddy cultivation by about July.

In places where "Bhasa Bada" fisheries in the Sundarbans adjoin paddy fields or fresh-water canals, mullets and prawns, especially Bagda Chingri, are allowed access into fields and canals for they are known to fatten well under fresh-water conditions usually in the second year of their growth.

Mr. H. S. Majumdar, Agricultural Officer, Gosaba (24-Parganas), has kindly made the following suggestions from his practical experience.

In suggesting the cultivation of fish along with paddy, attention may also be paid to the following important factors:—

- (i) Owing to the continuous movements of the fishes, planted in the paddy fields, the tillering action would be increased due to disturbance of the mud and the weeds. As is well known, Carps eat Jhanjis, other soft weeds and the insects which drop from the crops due to their movements or by the breeze.
- (ii) The paddy crops benefit from the excreta of fishes, which serves as manure.
- (iii) Due to the sound from the paddy crop caused by the movement of



the plants and by the breeze; fishes run about which is healthy for their growth.

If the fish thus reared as a by-product are sold in the month of October, that is, after four months of cultivation, at least fifteen times profit on the purchase value would be made. But if the fish are transferred to a big pond, or if trenches are dug around the paddy fields and the fish preserved in them for a longer period, much greater profit could be made.

The cost of digging trenches in the Abad areas is negligible in comparison with the benefit that would be derived from stocking fish in them. The earth excavated for making these trenches would serve the purpose of making strong bunds. These bunds can be utilized for high land crops, vegetables and other trees which would provide the cultivators with another means of earning and also control the water in the fields which would be helpful for cultivation of crops and fishes.

The trenches could be utilized as reservoirs for the irrigation of vegetable and paddy crops, when necessary. They can also be used to drain out water from the fields, if required, and would not allow the field rats, cattle or thieves to enter the fields and cause damage to the paddy crops.

These trenches would serve as places of retreat for the fishes, and can also be used for the cultivation of deep-water 'Aus' and 'Aman' paddy.

The bunds would prevent the wasted away silt to get deposited in the trenches. The bottom mud from the trenches would serve as a good manure for paddy fields.

The trenches if covered by bamboo shades, may be used as support for the creeper vegetable plants, such as kumra, cucumber, etc.

The poor cultivators may take advantage of these suggestions by mutual co-operation if they find it hard to do it individually.

In a recent communication, Dr. Herbert H. Brown, Director of Fisheries Investigations, British West Indies, made the following interesting observations on the possibilities of fish-culture along with agricultural crops in British Guiana:

"In British Guiana, the intensely cultivated alluvial coast lands under sugar and rice are irrigated by a complicated system of canals and trenches; for every square mile of cane cultivation there exist 16 miles of irrigation canals 40 feet wide, 4 miles of drainage canals also 40 feet wide and 45 miles of 4 feet drains.

Flood fallowing for periods of six months to a year is a standard practice, and this and the rice padi fields afford further considerable acreage under water and entire mechanical control. These canals are assiduously fished and when a flood-fallowed field is drained there is often a general scramble for the fish left stranded. My suggestion is that these areas under water could be made much more productive by stocking with fingerlings of indigenous fish reared in hatcheries in order to supplement the natural rate of reproduction, and to meet the heavy fishing load. This would be coupled with management of the fishing load by such measures as temporary closures and control of gear. There is a brief description of this canal system in the *Agricultural Journal of British Guiana*, Volume 9, No. 4, pp. 201-202, December 1938.

"Although the culture of fish on these lands should be profitable, I put forward these suggestions for stocking and fishery management not only from a revenue-producing standpoint but in the interests of public welfare, with the object of making available significant amounts of animal protein to labouring populations whose diets are generally deemed to be deficient in animal protein. At least 40 per cent. of this population are immigrants or their descendants from India."

It will thus be seen that under the stress of war and with a view to "Grow More Food", all suitable water areas are being stocked to make them much more productive. It is hoped that in India also this aspect of fish culture will receive due consideration at the hands of the agricultural and fisheries authorities.

SUNDER LAL HORA.

1. Nicholson, F. A., *Bull. Madras Fish. Deptt.*, 1907, 2, 86, 87, 100, 101.
2. Mitter S. C., *A Recovery Plan for Bengal*, 1934 Calcutta, 243.
3. Nicholson F. A., *Bull. Madras Fish Deptt.*, 1917, 11, 158.
4. Gupta, K. G., *Reports on the Results of Enquiry into the Fisheries of Bengal and into Fishery Matters in Europe and America* 1908, Calcutta, 102.
- Director of Fisheries, Madras, "Pisciculture", *The Allahabad Farmer*, 1933 7, 13.
5. Mitter, S. C., *A Recovery Plan for Bengal*, 1934, Calcutta, 243.
6. Mazumdar, C. H., *Financial Times*, 1939, December, 4.
7. This would seem incredible, for in an average good tank Catla grows to a seer and a quarter and Rohu to somewhat less than a seer in the course of a year. However, extensive and careful enquiries made in the Abad show that the rate of growth reported by Babu Priyanath Sao is not improbable. I had a tank netted at Gurguria where Pona fry had been liberated about four months earlier and found that Catla had within that short period attained a weight of  $1\frac{1}{4}$  seer and Rohu about  $\frac{7}{8}$  seer.
8. Khan, Hamid, *Jour. Bom. Nat. Hist. Soc.*, 1942, 53, 416-27.
9. Das, B., *Proc. Ind. Assoc. Cult. Sci.*, 1917 3, 6 21.
10. Ghose, A., and Ghosh, N., *Bull. Dept. Fish. Bengal*, 1922, 18, 3-8.
11. Mazumdar, C. H., *Science and Culture*, 1940, 5, 735-38.
12. The raising of short term agricultural crops alternately with fish culture is considered very desirable by a number of authorities, such as Prasad, B., *Bull. Deptt. Fisheries, Bengal and Bihar and Orissa*, 1919 13, 4.
13. Lal, Chaman, *The Modern Review*, December 1942, 472.
14. Panikkar, N. K., *Journ. Bom. Nat. Hist. Soc.*, 1937, 39, 343-53.