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Suggestions for Stocking Fish Ponds in Madras*

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Introduction: Very frequently the questions "How many fish can a pond hold?" or "How many fingerlings of *Catla*, *Labeo*, *Etroplus*, *Mirror*, *Carp*, *Chanos*, etc., can one stock in a pond?" are posed; but satisfactory answers for them have not been received. Although definite data have been worked out for similar American and European fish ponds, there does not seem to be any agreed answer to these questions for tropical waters. Worthington (1943) states in this connection "……But productivity of fish should be capable of even greater development on account of the higher water temperatures and lack of winter. Thus there may be a big future for fish farming in the colonies in ponds specially constructed for the purpose, properly managed and manured. For intensive fish farming in warm climates, we have the outstanding example of the Chinese who see to it that every square yard of water produced a crop of fish. Before such a new industry is started in countries where opportunities for fish ponds are extensive, intensive research work is necessary in order to bring to bear our knowledge of productivity in water, of manuring, and of the life histories of difierent species of fish". Our knowledge about the bionomics of the inland fishes of the Madras State is fairly extensive and therefore it is possible at this stage to arrive at a uniform and standard method of computation per unit area or volume of water for stocking South Indian ponds with fingerlings of various kinds.

Basis of computation: Fish production may be expressed in weight of fish per unit volume of water or as number of fish or weight of fish per acre of water. From a study of the physical, chemical and biological conditions in a pond, it will be seen that the region of biological productivity is usually confined to the top, i. e., the region of photosynthesis or the depth to which the sun's rays can penetrate; and that the bottom region is the zone of biological reduction where the inorganic nutrients required for biological productivity in the upper zone, are being manufactured. Apparently therefore, the depth of water has little effect on the amount of fish that a given pond area can support. So, weight of fish per acre of water surface would appear to be a more accurate measure than weight of fish per unit volume of water. Thus a given area of water will support only a certain weight of fish; and

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productivity of fish is, therefore, more nearly related to its area than to its volume. Hora (1943) has also stated that the number of fish that can be stocked in a given pond depends upon the nourishing power of the water and surface area in contact with air.

Looking thus at the same problem from another angle, fish productivity in a pond depends not on its size but on its nourishing power as stated above. It is not correct to assume that the more small fish added to a water the greater would be the harvest. A pond yields best results according to Hora (*loc. cit.*), when it is stocked according to the nature and amount of natural food contained in it or artificial food that can be supplied to fish. If a body of water can feed only 1000 pounds of fish to the acre it does not make any difference where 1 lakh or 5 lakhs of fingerlings begin life there each year, as the end result will be the same, namely, 1000 pounds per acre. Only that number of fish will grow up that the food supply will support.

Types of waters: There are however different kinds of waters. In order to produce a good fishery a pond must be stocked with the proper kinds and numbers of fish. If a piece of natural water contains a permanent bloom of one or several species of alga, as in the case of a temple tank, it should be stocked with such fishes like the Katla (*Catla catla*), Milk-fish (*Chanos chanos*), Mrigal (*Cirrhina mrigala*), Mirror Carp (*Cyprinus carpio*) and Labeos (*Labeo spp.*), that will feed mainly on them; and if on the other hand, the zoo-plankton predominates in the water, then it should be stocked with such fishes as *Thynnichthys sandkhol*, *Osteochilus thomassi*, *Barbus hexagonolepis* and *Barbus carnaticus*. Species of *Labeo Etroplus suratensis*, and *Cyprinus carpio* which feed on debris at the bottom and margin should also be stocked in the economy of pond culture.

Fish associations: The problem of rearing fishes in different types of waters is therefore varied. Naturally, the estimated yield of fish that can be expected in a given piece of natural water will also vary with the species of fish selected for stocking and the nature of the available food. If the fish stocked is a feeder, to a large extent, on phytoplankton, highest production of about 1000 lbs. per acre of water surface can be realised; if they feed on animalcules mainly only half the amount can be expected; and if they are carnivorous and feed on other fish, only about 200 pounds per acre can be expected in temperate waters (Swingle and Smith, 1941). But as biological productivity is nearly twice or thrice that in the temperate region, the above rate of production can be safely doubled, especially in the first case. Our knowledge of the productivity of the waters of this State confirms this. Any pond contains also plenty of detritus or decomposed or dead organic matter upon which certain other types of fishes can feed. Further, different fishes feed at different

levels and have a selected habit of feeding. One of the problems of Fish Farm Management is therefore to work out the combination of species that will produce the maximum yield of edible fish for each type of pond. So a pond should be stocked with surface feeders, column feeders and bottom feeders to get maximum production. As a general rule, it is advisable to stock a pond with 50% of fingerlings of surface feeders, 25% of column feeders and with 25% of bottom feeders.

Growth rate of fish in different types of waters: Before suggesting the formula for estimating the number of fingerlings which can be stocked in a pond, it is necessary to know (i) the rate of growth of fishes suitable for stocking in inland waters of Madras (Table I,) and (ii) types of ponds commonly met with and the nature of fish-food available in them and annual yield of fish in pounds per acre (Table II). The data given in these two tables are based on our own observations made on various departmental and public waters of this State. With the help of the above information, the number of fingerlings, which should be stocked in a pond can be easily estimated.

TABLE I

Showing food Preferences, nature of feeding, growth and mortality of common freshwater fishes of Madras.

Kind of fish	Food preferences	Nature of feeding	Normal growth attained at the end of 1st year			% likely of mortality the during first year
			Length in inches	Weight lbs.	oz.	
Catla catla	Phytoplankton and macro-vegetation.	Surface & colum	15—18	2	0	10
Laebo fimbriatus	do.	Bottom & column	12—15	1	0	10
Labeo rohita	do.	do.	15—18	1	8	10
Labeo calbasu	do.	do.	12—14	1	0	10
Labeo kontius	do.	do.	9—12	0	12	30
Cirrhina mrigala	Phytoplankton	Surface & column.	15—18	1	8	10
Cirrhina cirrhosa	do.	do.	10—12	0	12	30
Cirrhina reba	do.	Column & bottom.	8—10	0	4	20
Thynnichthys sandkhol	Zoo & phyto-plankton	Column	9—12	0	12	30
Osteochilus thomassi	do.	do.	9—12	0	12	30
Barbus carnaticus	do.	do.	6—8	0	4	20
Barbus hexagonolepis	do.	do.	6—8	0	4	20
Chanos chanos	Phytoplankton	Surface	15—18	1	0	10
Etroplus suratensis	Algae & zooplankton	Colomn & bottom	4—5	0	4	20
Ciprinus carpio	Phytoplankton & macro-vegetation	Colomn & & bottom	12—18	1	8	10
Osphromenus gorami	Macroveget-ation.	do.	9—10	1	0	10

TABLE II

Showing classification of ponds in Madras State.

Pond type.	Nature of food organisms.	Colour of water.	P. H..	Nature of pond bottom.	Average yield of fish per acre (lbs.)
I	Permanent bloom of a blue-green alga, like *Microcystis, Anabaena* or *Oscillatoria.*	Greenish	>8·0	Black rotting organic matter.	2000
II	Abundant macrophytic vegetation *Hydrilla, Vallisneria, Potomogeton,* water-lilies, etc.	Colourless	7·5–8·5	do.	1000
III	Abundance of zooplankton and few plant organisms.	Brownish	7·0	do.	500
IV	Clear throughout with an occasional algal bloom.	Clear	6·5–7·5	Brownish	300
V	Few phyto and zooplankton.	Clear	6·5–7·5	sandy	200

Number of fingerlings to be stocked: From a careful inspection of any pond, it is possible to determine to which of these five types it belongs. Table II gives us a rough indication of the total annual weight of fish which that pond is likely to produce: and Table I gives the annual increase in weight of different kinds of fish at the end of one year and also the percentage of mortality of the fish. From a consideration of the two data and by applying the following formula (Macan *et al*, 1942), one can easily calculate the number of fingerlings with which the pond should be stocked

$$\text{No. of fingerlings to be introduced} = \frac{\text{Total expected weight of fish crop (Table II)}}{\text{Annual increase in weight of individual fish (Table I)}} \times \text{\% mortality (Table I)}$$

Applying the above formula, a tank measuring 1 acre can be stocked with fingerlings of the various species as detailed in Table III.

TABLE III

Showing number of fingerlings per acre of waterspread to be stocked in different types of waters. (The figures are corrected to the nearest ten.)

Kind of fish	No. of fingerlings be to stocked.				
	Type I	Type II	Type III	Type IV	Type V
Catla catla	1100	550	280	170	110
Labeo fimbriatus	2200	1100	550	330	220
Labeo rohita	1480	740	370	220	150
Labeo calbasu	2200	1100	550	330	220

Kind of fish	No. of fingerlings be to stocked.				
	Type I	Type II	Type III	Type IV	Type V
Labeo kontii	3470	1740	870	520	350
Cirrhina mrigala	1480	740	370	220	150
Cirrhina cirrhosa	3470	1740	870	520	350
Cirrhina reba	9600	4800	2400	1440	960
Thynnichthys sandkho	3470	1740	870	520	350
Osteochilus thomassi	3470	1740	870	520	350
Barbus carnaticus	9600	4800	2400	1440	960
Barbus hexagonolepis	9600	4800	2400	1440	960
Chanos chanos	2200	1100	550	330	220
Etroplus suratensis	9600	4800	2400	1440	960
Cyprinus carpio	1480	740	370	220	150
Osphromenus gorami	2200	1000	550	330	220

Conclusion : One of the principal problems in raising fish in ponds is the management of the population so that the maximum number reach a desirable table size each year. As already stated, since a pond can support only the weight of fish for which food is available, it can support either a large number of very small fish or a smaller number of large fish in each acre of water. The former condition results in very poor fishing; the latter gives good fishing. It is very important, therefore, to stock a a pond with the correct number of fish that would utilise efficiently the food available. Further, it is necessary that periodic cropping should also be associated with stocking, if one should get full value of the pond. It is hoped that the suggestions given in this article would be of help to the practical fish farmer.

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