Research Journal of Recent Sciences _____ ISSN 2277-2502
Vol. 3**(ISC-2013),** 82-86 **(2014)** *Res. J. Recent. Sci.*

The Relationship between Physico-chemical Characteristics and Fish Production of Mod sagar Reservoir of Jhabua District, MP, India

Shinde Deepak and Ningwal Uday Singh
Department of Zoology, Govt. Post Graduate College, Dhar–454001, INDIA

Available online at: www.isca.in, www.isca.me
Received 21st December 2013, revised 4th February 2014, accepted 19th February 2014

Abstract

The effect of physico-chemical parameters on fish production was investigated in Mod sagar reservoir of Jhabua District (M.P.) India. The physico-chemical parameters investigated were temperature=17.1-32°C, transparency=19 cm-62 cm, pH=7.6–8.8, DO=3.0-10.9 mg/1, BOD=0.66-48.34, Total alkalinity=168-290 mg/l, TDS=180-330 mg/I. hardness=162 mg/l to 222 mg/l. Calcium=18.0-33.2 mg/l, chloride=22-36 mg/l, phosphate = 0.25-1.26 mg/l and nitrate = 0.23 - 0.98 mg/l. The main aim of this study was to establish relationship between Physico-chemical Characteristics and fish production of the reservoir.

Keywords: Mod sagar, fish production, Jhabua, physico-chemical parameters.

Introduction

Physico-chemical condition of water has direct impact on survival, growth, reproduction and distribution of fishes. Any adverse environmental condition affects the life of fishes. In fact, whole of the aquatic life in any water body is governed by the interaction of a number of physical and chemical conditions[1]. Gross physico-chemical characteristics of Indian reservoirs have been reported by several workers[2,3,4,5,6,7,8,9 and 10]. Pond habitats can easily be manipulated by controlling the water characteristics for an optimum environment yielding high level fish production. This study therefore focuses on: i. Estimation of some physcio-chemical parameters. ii. Suitability of pond water for fish production (Figure 1, 2 and 3 to be inserted here)

Figure-1
Location map of Jhabua District

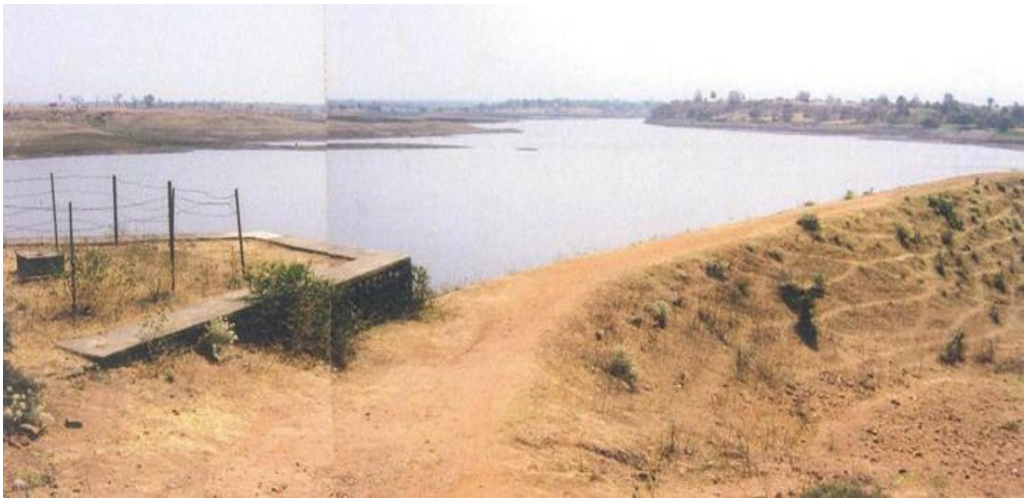

Figure-2
Panoramic view of Mod sagar reservoir of Jhabua District

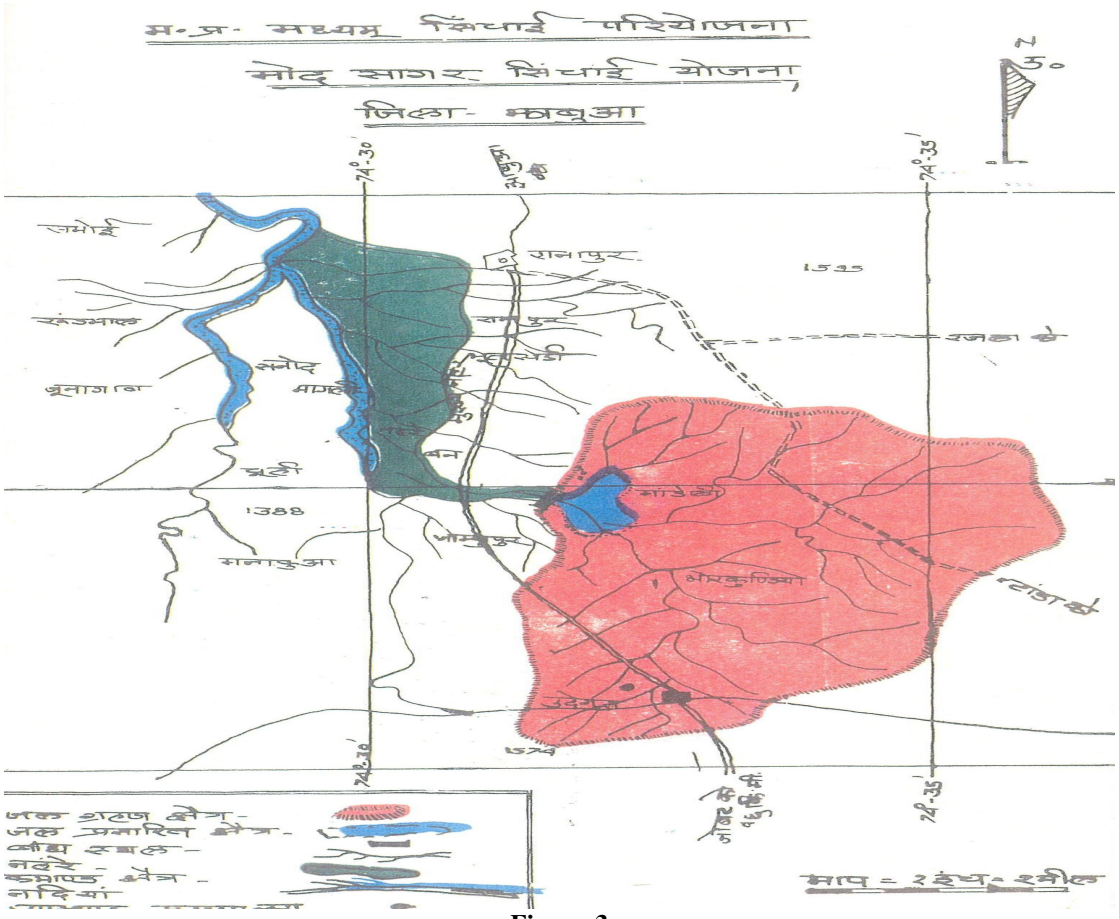

Figure-3
Project map of Mod sagar reservoir

Material and Methods

Mod sagar is an important fresh water reservoir of Jhabua District and is managed by fishery department. The dam is constructed on river Mod, a tributary of river Anas which is a main river of Jhabua District (latitude 22^{o}-34'-42" and longitude 74^{o}-31'-45") and is mainly used for fish culture, irrigation and drinking water supply. The study was conducted seasonally for

a period of three years from Jan. 2005 to Dec. 2007 at the reservoir. The water samples from six selected study sites were collected seasonally in clear pre-sterilized polythene bottles. Various Physical and chemical parameters like temperature, pH, TDS, Alkalinity, chloride, Hardness, BOD and DO etc were estimated as per standard methods[11].

Results and Discussion

The various physico-chemical parameters recorded for Mod sagar were favourable for fish culture and were within the standard range already documented.

Average surface water temperature recorded was 17.1 – 32.0°C agreed with the ranges suggested and documented earlier by some authors for freshwaters [5,12,13].

Transparency values ranged from 19 cm to 62 cm. were similar to values documented by various authors like Hassan, Adebisi, Egberongbe, Ugwumba and Ugwumba[14,15,16,17]. This shows that the pond waters contain adequate nutrients hence, it is fairly turbid**[17].**

The average pH values recorded was between 7.6 and 8.8. This range was within the pH range of 6.5 - 9.0 documented by Jhingran and Banerji as values most suitable for maximum fish production[5,18]. Tolerable pH range for most fish is 05-09[19].

Dissolved Oxygen (DO) recorded with higher ranges of 5.4-10.4 mg/l fell within the ranges documented by APHA for good water quality on fish culture[11]. This is because oxidation coverts poisonous compounds to useful material. It also encourages good feeding, food utilization and high stocking density of fish eggs, larvae and adults[20]**.**

BOD values ranged between 3.2 and 5.65 mg/l and found according to the values documented by APHA hence, suitable for fish production[11].

The average range of total alkalinity recorded was 168 – 290 mg/l which is agreed with the range values documented by Alikunhi hence, suitable for fish production[19].

The TDS value of the reservoir water varied between 180 and 330 mg/l. A maximum value of 400 mg/l of TDS is permissible for a diverse fish population[21]. TDS concentration below 200 mg/l promoted even healthier spawning conditions. Hence, it can be concluded that water of Mod sagar provides intermediate condition for fish production.

The hardness value of Mod sagar ranged from 162 to 222 mg/l. According to Jhingran the most suitable hardness value for fish is 40-200 ppm and does not require additional liming[5]. This proves that the water of Mod sagar is most suitable for the growth and production of fish.

The Calcium contents fluctuated between 18.0 and 33.2 mg/l. Mod sagar reservoir can be classified as 'rich' as the average calcium contents of the water are more than 25 mg/l[22]. According to Jhingran soft water lakes are generally poorer in their aquatic flora and fauna[5]. Water of Mod sagar is slightly harder which is favourable for good flora and fauna of the reservoir including fish.

Chloride contents of the reservoir ranged between 22 and 36 mg/l. Fresh water normally contains 8.3 mg of Chloride per liter[23]. The higher range of Chloride concentration of Mod sagar indicates that the water is slightly polluted and is not favorable for fish in general.

Phosphate values ranged between 0.25 and 1.26 mg/l. Total phosphate/ phosphorus recommended for rivers and streams is 0.1 mg/l[24,25]. Lack of Phosphate is often the chief cause of poor productivity of water. Natural waters having a phosphorous content more than 0.2 ppm Po_4 are likely to be quite productive[5]. Hence, it can be concluded that Mod sagar having Phosphate range between 0.25 and 1.26 mg/l is quite productive.

The nitrate values of the reservoir water ranged between 0.23 mg/l and 0.98 mg/l. Nitrate-nitrogen levels below 90 mg/L seem to have no effect on warm-water fish[24,25]. The nitrate contents of Mod sagar, which are well within the standard permissible limits of WHO and IS (10500), indicate its pollution free and good water quality status for fish production[26,27]. The relationship between fish yield and water parameters showed that no parameter can be singled out in relation to fish growth and health. However, five of these parameters (i e. temperature, DO, transparency, pH and alkalinity) must be kept at optimal level to guarantee high fish yield. The high temperature recorded might have resulted in better feeding and food conversion for the fish. This, according to Lin temperature range of 27 and 32°C allow tropical fish to eat more and grow faster**[28]**. Water transparency is inversely proportional to the abundance of most plankton; hence an increase in plankton will reduce transparency of water. But it will avail ample food availability to fish for high productivity as reported[29].

An approximate estimation of the average fish production from Indian reservoirs is only 6.7 Kg. /ha[30]. It is estimated to be 6.2 Kg./ha and 39.0 Kg./ha. in Tungabhadra and Mettur respectively[5]. During presents study the average annual fish production in Mod sagar, with 82.50 ha water area available for fish culture, recorded was 40.31 Kg/ hectares which is far greater than those of the other Indian reservoirs.

Conclusion

From the above discussion it can be concluded that the most of the physico-chemical characteristics of Mod sagar not only provide favourable conditions but also gave average requirement for growth, survival and production of fish. (Table 1: to be inserted here)

Table-1
Table showing observed and recommended range of Physico-chemical parameters of Mod sagar for Fish production along with inferences

S.no.	Parameters	Units	Observed Range	Best suitable (Recommended) range	Inference
1	Water Temperature	Degree Celcius	17.1 - 32.0	25.0 - 31.0 [5]	Suitable for Fish production
2	pH		7.6 - 8.8	(1). 6.5 - 7.5 [18] (2). 6.5 - 9.5 [5,13]	Suitable for Fish production
3	Transparency	cm	19 - 62	0.45 - 0.57 cm [14,15]	Water contains adequate nutrients suitable for Fish production
4	Dissolved Oxygen	mg/l	5.4 - 10.4	above 5.0 mg/l [11]	Suitable for Fish production
5	TDS	mg/l	180 - 330	upto 400 mg/l [22]	Suitable for Fish production
6	BOD		3.2 - 5.65	upto 5.0 mg/l [11]	Water is Pollution free and in favour of good fish production
7	Alkalinity	mg/l	168 - 290	above 100 ppm [21]	Suitable for Fish production
8	Hardness	mg/l	162 - 222	40 - 200 ppm [5]	most Suitable for Fish production
9	Calcium	mg/l	18.0 - 33.2	More than 25 mg/l [23]	Mod sagar can be classified as rich and favourable for Fish production.
10	Chloride	mg/l	22 - 36	upto 8.3 mg/l [24]	Water is slighly polluted. Not favourable for fish
11	Phosphate	mg/l	0.25 - 1.26	more than 0.2 ppm.5	Water is quite productive.
12	Nitrate	mg/l	0.28 - 0.98	*Below 90 mg/L.* [19,25]	Water does not have any effect on warm-water fish

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