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Assessment the present fish catch composition from Nanak Sagar reservoir of Uttarakhand

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Abstract

The commercial fishing in Nanak Sagar reservoir is carried out using traditional types of gears viz. gill net, triangular net, drag net, hooks and lines, cast net and rod and line. From the gear, the gill net was most commonly used to harvest the fishes. The fish fauna of Nanak Sagar reservoir mainly consists of a rich assemblage of forage fishes, residual cat fishes, minor carps, exotic carps and some amount of major carps. Among fishes, *Gadusia chapra* with mean annual contribution of 44.14% was the most dominant fish species in the catches. *Labeo gonius* with a contribution of 15.95% was another quantitatively dominant species during the study period. Among Indian major carps *Cirrhinus mrigala* was the most abundant. The Cat fishes and minor carps were also present in appreciable numbers in the fishery of the Nanak Sagar reservoir. Maximum and minimum fish catch was obtained in the month of February, 2017 and September, 2016 respectively.

Keywords: Nanak Sagar, gill net, *Gadusia chapra*, *Cirrhinus mrigala*

Introduction

Food *vis-a-vis* nutritional security has assumed great significance due to increase in human population in the country. In context of food, fish being a cheapest source of animal protein can form the foundation for nutritional security and bridge the gap in protein requirement. The cultivable land is reducing fast due to rapid urbanization. Reservoirs have played a vital role in terms of fish production of over one million tons against the manifold production potential if the resource is managed scientifically. During the year 2015-16, the total fish production from the inland sector is 7.21 million tonnes ^[1] with appreciable contribution from reservoirs. The reservoirs in India are located under divergent geo-climatic, morphometric and edaphic environments. The Ministry of Agriculture, Government of India has classified reservoirs as small (<1000 ha), medium (1,000 to 5,000 ha) and large (>5000 ha) for the purpose of fisheries management ^[2]. The water area under large, medium and small reservoirs is spread over 3.15 million ha in the country. The estimated cumulative areas are 1485557, 527541 and 1140268 ha for small, medium and large reservoirs, respectively ^[3]. The achievement of potential fish production from reservoirs may provide 1.0 million tonnes of fish annually in the country ^[4]. The State of Uttarakhand is endowed with amply of freshwater resources in the form of rivers, lakes, reservoirs etc. The Tarai region of the state has many small and medium sized reservoirs like Dhaura, Haripura, Baigul, Baur, Tumaria, Nanak Sagar and Sarda Sagar ^[5]. These water bodies support valuable fish diversity. The proper understanding of ecosystem of these reservoirs is necessary for developing roadmap for fisheries development. The reservoirs are mainly used for irrigation, hydropower generation and for fish production. The average fish production rate in the reservoirs of Uttarakhand is about 25 kg/ha which can be increased up to 200 kg/ha by proper scientific fisheries management ^[5]. The Nanak Sagar reservoir is located near the Town Sitarganj across the river Deoha, with a catchment area of 570 km². The reservoir is located at 28^o, 57', 20'' N latitude and 79^o, 50', 34'' E, longitude with an altitude of 200 meter (m). The designed total capacity of the reservoir was 209.80 Million Cubic Meter at elevation level 215.19 m or Full Reservoir Level (F.R.L) and dead storage capacity was 9.25 M m³ at elevation level 207.26 m or Dead Storage Level (D.S.L). Among the above reservoirs, Nanak Sagar is the largest one with the total water surface area of 4600 ha ^[6]. The study will help in assessing the current status on fish catch composition in Nanak Sagar, providing necessary ideas for improving the fisheries management in the reservoir.

Materials and Methods

The present study was carried out from September, 2016 to March, 2017. In the present study fish specimens were obtained from landing centre preserved in 5% formalin and identified in the laboratory at College of Fisheries Science, Pantnagar [7-9]. For the purpose of study, monthly fish catch data was collected from ten randomly selected boats and from the fishermen involved in landing centre of Nanak Sagar reservoir.

Results and Discussion

Fish Catch composition

The annual fish catch of Nanak Sagar reservoir (calculated from the data of experimental fishing & Department of Fisheries, Government of Uttarakhand) is given here. The total seven months catch of 2,20,867.42 kg was obtained in the Nanak Sagar reservoir. The maximum catch was recorded during the month of March, 2017. The catch composition of Nanak Sagar reservoir was dominated by *Gadusia chapra*, *Labeo gonius* and *Notopterus notopterus*. The average fish production of Nanak Sagar reservoir during study period was calculated as 45.07 kg/ha from seven months catch data. The fish catch presented here is based on catch obtained from the net. If a species did not represent in the catch that does not always indicate its absence from the reservoir. There is a certain degree of probability that they may or may not be caught in the net. The monthly sampling for fish catch composition was made using fishing boats each has one fisherman which operated the standard gill net (size 50x 2m, mesh size from 1.5-7.5 cm). The data of fish catch and population density was recorded from ten boats that were selected randomly. A total of 22 genera of 30 fish species comprising of Indian major carps, minor carps, cat fishes, weed fishes and other fishes were recorded from Nanaksagar reservoir during the investigation period. The Indian major carps were represented by *Catla catla*, *Labeo rohita*, *L. calbasu* and *C. mrigala*, medium carps by *Labeo gonius*, *Labeo dyocheilus*, *L. bata* and *Cirrhinus reba*, cat fishes/ other carnivorous fishes by *Mystus spp.*, *Wallago attu*, *Channa spp.*, *Heteropneustes fossilis*, *Notopterus notopterus*, *Mastacembelus spp.* and weed fishes by *Tilapia*, *Oxygaster spp.*, *puntius spp.*, *Gadusia chapra*, *Xenentodon canicila*, *Chanda spp.*, *Salmostoma bacaila* and *Glassogobius giuris*. The catch of *Catla catla* varied from 9 to 50 fish/ boat and highest catch was observed during the month of March, 2017 with average of 26 fish/ boat. The weight of *Labeo rohita* ranged between 175- 6000 g. The population density of *Labeo rohita* varied from 0- 175 fish/ boat being highest during the month of March, 2017 with an average of 39 fish/ boat. The weight range was between 350- 2700 g. The catch of *Cirrhinus mrigala* varied from 0- 36 fish/ boat having maximum catch obtaining during the month of February, 2017 with an average of 18 fish/ boat. Its weight varied from 250- 3500 g. The population density of *Labeo calbasu* ranged between 0- 50 fish/ boat, the maximum range of this species catch varied from 250-2000 g. The minor carps were represented by *C. reba*, *L. dyocheilus*, *L. bata* and *L. gonius* of which *L. gonius* was the most dominant fish species of minor carps found in these reservoir. The catch of *L.gonius* (weight ranged from 150 to 1450 g/ fish) ranged between 0 to 179 fish/ boat, Maximum catch was obtained during March, 2017 with an average of 106 fish/ boat. The population density of *L.bata* (with weight range between 250 to 950 g/ fish) varied from 0 to 14 fish/ boat and the highest catch identified in the month of February with an average of 8 fish/

boat. This fish was frequently observed in the catch. The catch of *C. reba* varied from 10 to 392 fish/ boat. The weight of *C.reba* ranged from 150- 320 g/ fish and maximum catch obtained during the month of December, 2016 with an average of 134 fish/ boat. The catfishes/ carnivorous fishes recorded during the investigation period were *Heteropneustes fossilis*, *Wallago attu*, *Mystus spp.*, *Channa spp*, *Notopterus notopterus* and *Mastacembelus spp.* The population density of *Wallago attu* ranged between 0 to 16 fish/ boat with weight gain of 50- 4500 g. Highest catch was identified during the month of February, 2017 with an average of 8 fish/ boat. The density of *Mystus spp* (weight ranged from 85 to 4500 g/ fish) varied from 0 to 69 fish/ boat with highest catch identified during the month of March, 2017 averaging of 30 fish/ boat. *Channa spp* obtained during investigation period were *C. punctatus*, *C. striatus*, *C. marulius* and *C. gachua*. The population of this genera fluctuated from 0 to 105 fish/ boat, maximum catch gained during the month of February, 2017 with an average value of 24 fish/ boat and the weight of this species varied from 50 to 6000 g. The population of *N. notopterus* fluctuated between 0 to 195 fish/ boat having highest catch during the month of January, 2017 with an average of 95 fish/ boat and the weight range of 80- 425 g. The population density of other fishes of this group was negligible. Weed fishes were represented by *Gadusia chapra*, *Xenentodon canicila*, *Puntius spp.*, *Oxygaster spp.*, *Chanda spp.*, *Salmostoma bacaila*, *Tilapia spp.*, and *Glassogobius giuris*. *Gadusia chapra* was dominant in Nanaksagar reservoir and its catch fluctuated from 0 to 495 fish/ boat with average of 189 fish/ boat, maximum catch was obtained during the month of February, 2017, with weight ranging from 25- 50 g/ fish. The *Puntius spp.* (weight range from 20 to 365 g) was represented by four species viz. *P.sarana*, *P. sophore*, *P.chola* and *P. ticto*. The population density varied from 0 to 240 fish/ boat (Highest catch gained during the month of February, 2017 with average value of 50 fish/ boat). The other species of this group was observed occasionally. The commercial fishing in Nanaksagar reservoir is carried out mostly from September to June, using traditional types of gears viz. gill net, triangular net, drag net, hooks and lines, cast net and rod and line. From the gear, the gill net was most commonly used to harvest the fishes. The fishing methods are designed to suit the local condition and the availability of different fishes in the reservoir. The gill nets of different sizes were effectively used during the periods of sufficient water level to comprise most of the valuable fish species viz. major carps, cat fishes and some weed fishes. Simultaneously, the hooks and lines were also used. Drag nets were frequently used during May and June in shallow areas with maximum catch efficiency. The majority of fishes trapped by the drag net were weed fishes (*Salmostoma bachaila*, *Oxygaster spp.*, *Puntius spp.*, *Xenentodon canicila*, *Glassogobius giuris*, *Chanda nama* and *Gadusia chapra*). Comprehensive account of inland fishing gears and methods have been given by [10]. The gill nets with mesh size of 40, 50, and 70 mm were found to be more effective for commercial fishing in Tungbhadra, Govindsagar and Hirakund reservoirs [11]. According to [12] in Dhaura reservoir, gill nets of larger mesh sizes (> 50 mm) were used to catch the commonly occurring commercial fishes viz. cat fishes, carps and some weed fishes. Similar patterns of use of gill nets (50-75mm mesh size) have been observed in Nanak Sagar reservoir. According to [3, 5] the importance of reservoir management practices such as maintenance of fish stock in closed areas as per seasonal requirement, control of mesh size, and restrictions of fishing gears for obtaining high fish

yield. Regulation of the mesh size have been, widely practiced for controlling the minimum commercial size of various fishes. According to [8] minimum mesh size permitted for gill nets should not be less than 30 mm. Also [13] reported that capture of major carps of less than 15cm in length was prohibited in rivers, tanks and reservoirs.

Individual and group wise fish catch composition in percentage (Based on body mass)

The fish fauna of Nanaksagar reservoir mainly consists of a rich assemblage of forage fishes, residual cat fishes, minor carps, exotic carps and some amount of major carps. Clupeids, feather backs, murrels, cyprinids and silurids constitute the main commercial fishery of the reservoir. The fish catch data are categorized into five groups viz.: (1) Major carps, (2) Exotic carps, (3) Minor carps, (4) Cat fishes/ Carnivorous and (5) Weed fishes. The percent composition during the 7 months study was Major carps (9.15%), Exotic carps (0.76%), Minor carps (21.26%), Cat fishes+ Murrels/ Carnivorous (9.92%) and Weed fishes (56.9%) presented in (Fig. 1). The quantitatively important fishes included *Gadusia chapra*, *Cirrhinus reba*, *Labeo gonius*, *Notopterus notopterus*, *Puntius arana*, *Cirrhinus mrigala*, *Mystus* (3 spp.), and *Channa* (2 spp). Also [14] recorded a large population of weed fishes (53.8%) in Nanaksagar reservoir. According to [12] the weed fish share in Dhaura reservoir varied between 42.1 to 56.6%. The highest catch of weed fishes during winter in Nanak Sagar reservoir may be due to low temperature in which these fishes become more inactive and caught easily.

Species-wise percent composition of fish community (By number)

Percent composition of different fish species in Nanak Sagar reservoir is presented in (Fig. 2-13). In this reservoir, the *C. reba* and *G. chapra* contributed maximum share from 17.26% (January, 2017) to 32.4% (September, 2016) and 9.15% (March, 2017) to 31.76% (February, 2017), respectively. The highest contribution of other fishes was consisted by *L. gonius* (17.96% in March, 2017), *N. notopterus* (14.5% in December, 2016), *C. catla* (4.4% in February, 2017), *L. rohita* (6.61% in February, 2017), *C. mrigala* (3.02% in January, 2017), *W. attu* (1.95% in September, 2016), *M. singhala* (4.23% in March), *Channa spp.* (6.42% in September, 2016), *Puntius spp.* (8.47% in March, 2017), *L. calbasu* (5.86% in September, 2017), *Chanda spp.* (2.03% in March, 2017), *S. bacaila* (2.44% in January, 2017), *X. canicila* (3.89% in March, 2017), *Glossogobius giuris* (2.15% in January, 2017), *H. fossilis* (1.18% in March, 2017), *Mastacembalus spp.* (1.17% in March, 2017), *G. carp* (1.19% in March, 2017), *C. carpio* (1.86% in March, 2017), *L. bata* (1.34% in January, 2017). The weed fishes shared a high percentage during the month of February and March, 2017. The fishes like *L. calbasu*, *L. bata*, *Glossogobius giuris* and *Xenentodon canicila* were not observed at all during study period which shared a good percentage during past. The fish fauna of Nanaksagar reservoir mainly consist of a rich assemblage of forage fishes, residual cat fishes, minor carps, some amount of major carps and exotic carps. Thus fish catch in this reservoir is concentrated over only few species. *Cirrhinus reba* and *Labeo gonius* is the most important component of this reservoir which contributed 17.26 to 32.4% and 8.1 to 17.96% in Nanaksagar reservoir to the total catch by number. Similar results were observed by [15]. Another important contributor of fish catch (by number) of this reservoir is weed fishes ranging between 19.26 to 53.76% occupied during the study period.

Similar observations were obtained by [15].

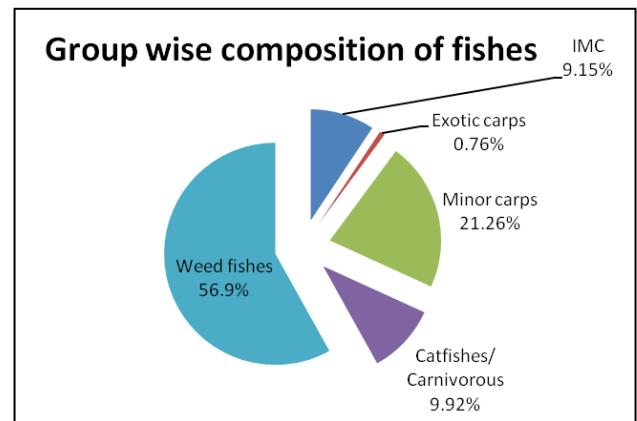


Fig 1: Group wise composition of fishes in Nanaksagar

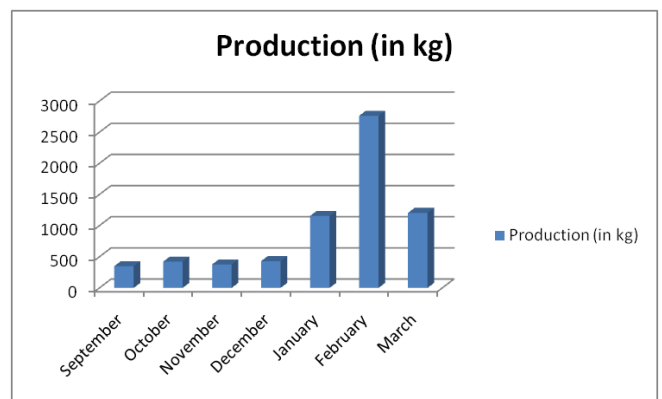


Fig 2: Monthly catch variation of *Catla catla* in Nanaksagar

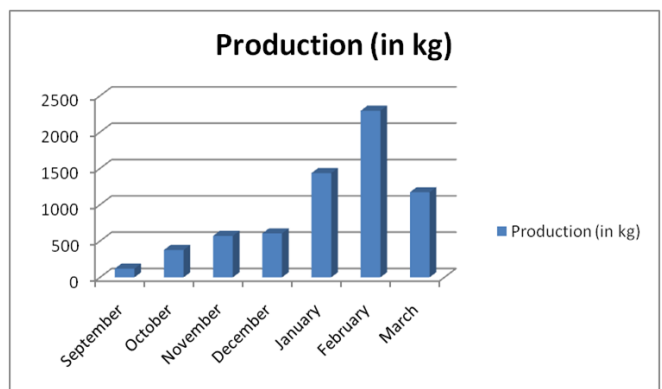


Fig 3: Monthly catch variation of *Labeo rohita* in Nanaksagar

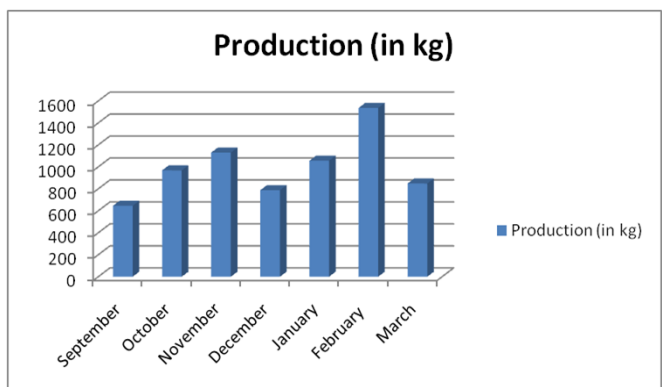


Fig 4: Monthly catch variation of *Cirrhinus mrigala* in Nanaksagar

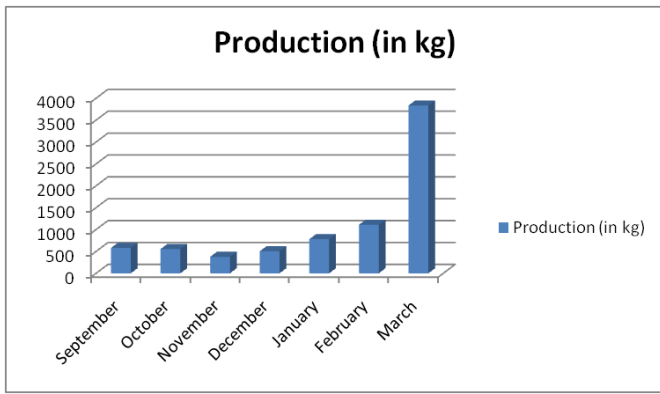


Fig 5: Monthly catch variation of *Labeo calbasu* in Nanaksagar

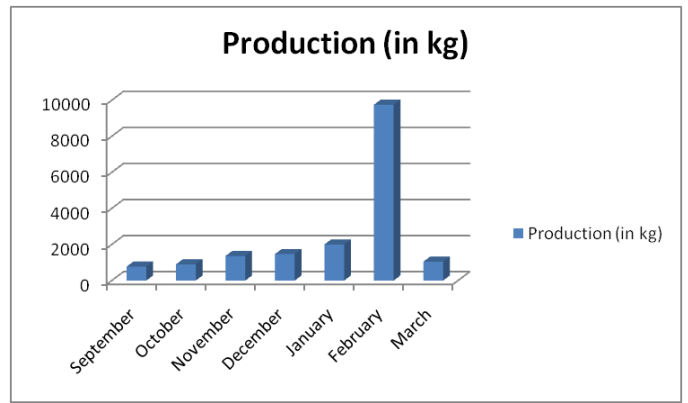


Fig 9: Monthly catch variation of *Mystus seenghala* in Nanaksagar

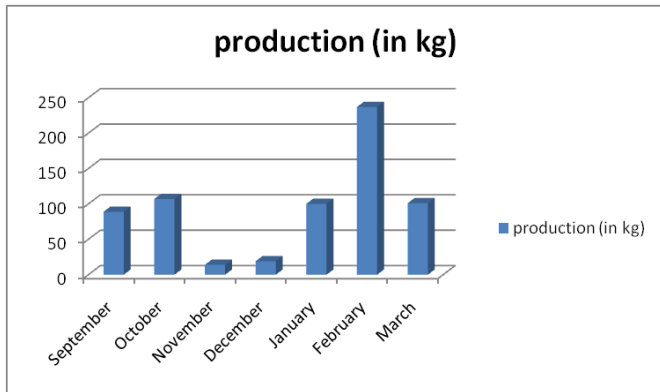


Fig 6: Monthly catch variation of *Cyprinus carpio* in Nanaksagar

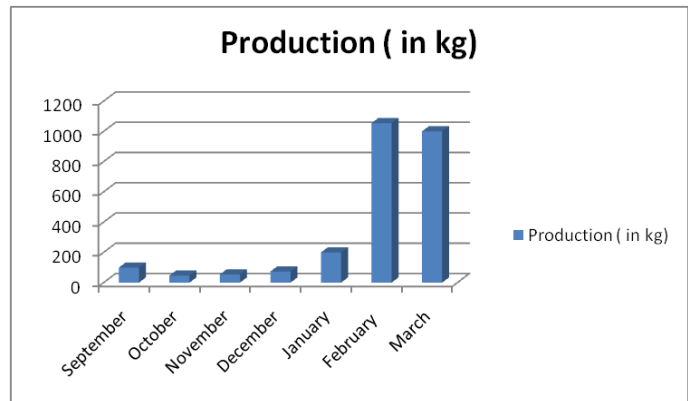


Fig 10: Monthly catch variation of *Channa striatus* in Nanaksagar

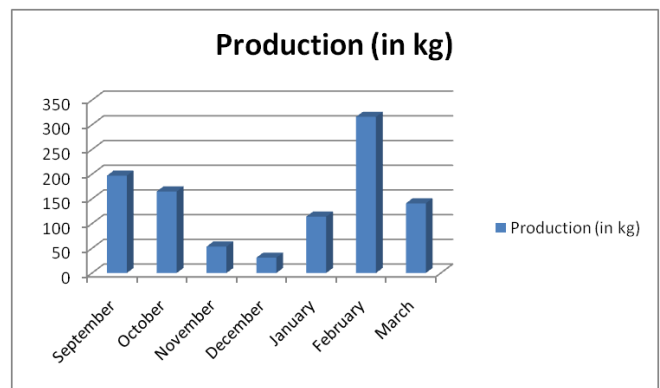


Fig 7: Monthly catch variation of *Ctenopharyngodon idella* in Nanaksagar

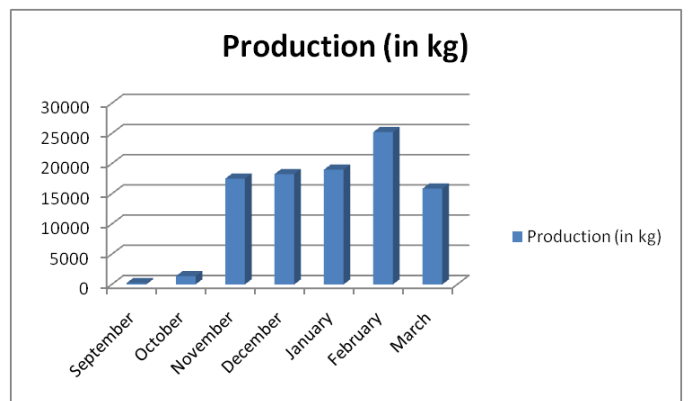


Fig 11: Monthly catch variation of *Gadusia chapra* in Nanaksagar

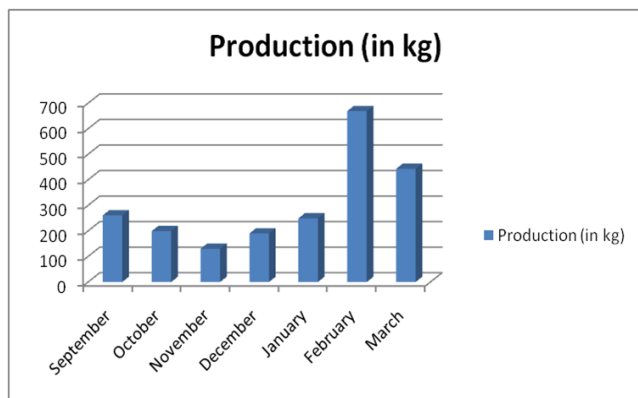


Fig 8: Monthly catch variation of *Wallago attu* in Nanaksagar

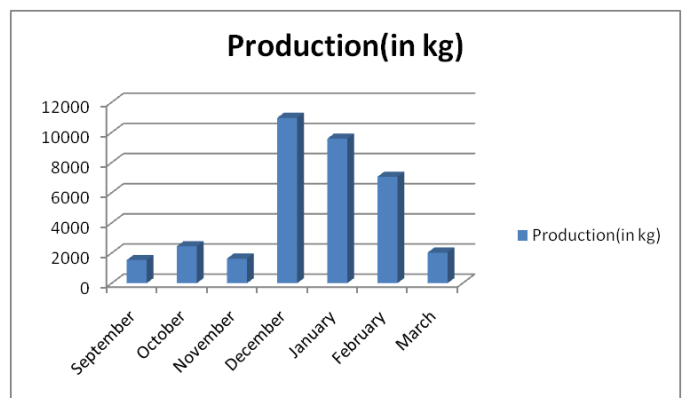


Fig 12: Monthly catch variation of *Labeo gonius* in Nanaksagar

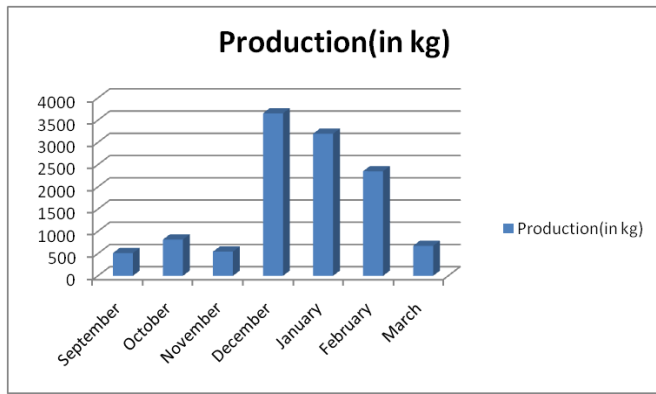


Fig 13: Monthly catch variation of *Notopterus notopterosus* in Nanaksagar

Conclusion

The fish production of reservoir was low due to many problems such as over population of weed fishes and Cat fishes, decrease in water depth due to excessive sedimentation, excessive macrophytic vegetation, poor stocking of commercially valuable fishes, illegal fishing during breeding season, poaching etc. The present study provides information on the status on catch composition of Nanak Sagar reservoir. The present fish production from the reservoir could be increased through proper management or culture based capture fisheries practices.

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