RESERVOIR FISHERIES DEVELOPMENT

IN

HIMACHAL PRADESH

DIRECTORATE OF FISHERIES,

HIMACHAL PRADESH, BILASPUR.

Foreword

Reservoirs viz. Gobind Sagar, Pong (Maharana Pratap Sagar), Chamera, Ranjeet Sagar and Kol Dam of Himachal Pradesh with mean water spread of **43,785** ha constitute an important fishery resource of the State. The developments of fisheries on scientific lines in these ecotypes have shown its tremendous potential for food production and generating employment. In view of series of management measures taken by the State Fisheries Department, a total of **13909.62** tonnes of fish was harvested from Gobind Sagar and Pong (Maharana Pratap Sagar), during **(2006-07 to 2016-17).** This has also helped in providing viable vocation to over **5,500** fishermen families, constituting about 20% of dam's oustees on sustained basis. During **2015-16** alone a total of **1144.882** tonnes of fish valued Rs. **1093.73** lakhs was harvested by **6098** fishermen from state reservoirs. The department's income from state reservoirs during a single year alone (**2016-17**) was Rs. **174.10** lakhs. Further, while Gobind Sagar is maintaining a unique distinction of **highest per hectare fish production** (over **48 to 149 kg/ha.**) for over one decade, the Pong Reservoir fishermen are getting **highest per unit price** of their catch at landing sites (Rs. **41-250**/ kg.) in the country. In view of these two characteristic features while the fishermen of Gobind Sagar have benefited by continuous increase in total catch over the years, the fishermen of Pong reservoir got benefited by steep increase in the price of the harvest. The fish fauna of both these water bodies differ widely, while Gobind Sagar is exclusively ***carp reservoir***, the Pong Reservoir is predominantly a ***catfish reservoir***.

The success story of these two reservoirs is mainly attributed to the strict observance of fishing rules and initiation of number of fishermen welfare schemes which include risk fund, accidental insurance and fishing closed season assistance schemes etc. Notwithstanding, the State Government is determined to increase the unit area fish production further both in Gobind Sagar and Pong Reservoir by the end of next plan period. In addition, growth of three other reservoirs namely Chamera, Ranjeet Sagar and Kol Dam will be at priority for the Department.

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MORPHOMETRIC FEATURES OF GOBIND SAGAR & PONG RESERVOIR, HIMACHAL PRADESH

Sr. No.	FEATURES	GOBIND SAGAR RESERVOIR	PONG RESERVOIR
	GENERAL		
1.	Location (districts)	Bilaspur	Kangra
2.	Name of the river	Sutlej	Beas
3.	Water source	snow melt & monsoon run off	snow melt & monsoon run off
4.	Dam	Concrete Straight gravity type	Earthen
5.	Height (m)	226.0	132.59
6.	Location height (m above MSL)	560.0	435.86
7.	Year of commissioning	1959	1974
8.	Geographical ordinates	31°25"N	32°05"N
9.	Purpose	Multipurpose	Multipurpose
10.	Catchment area (Sq. Km)	56980	12562
	THE LAKE		
11.	Waterspread area at FRL (ha)	16867	24529
12.	Waterspread area at DSL (ha)	5063	14312
13.	Average Waterspread area (ha)	10000	14600
14.	Mean Depth (m)	55.0	75.0
15.	Total Length(Km)	168.0	41.8
16.	Widest Stretch (Km)	6.0	19.0
17.	Shoreline development index	12.26	560.0
18.	Volume development index	4.04	
19.	Annual water level fluctuation (m)	450-507	384-433
20.	Max. Water level fluctuation (m)	70.0	117.0
21.	Gross storage capacity (mill.cub.m)	9868	8570
22.	Live storage capacity (mill.cub.m)	7771	7771
23.	Inflow (mill.cub.m.)	4.4-8.0(mill.cusec)	8215-13134
24.	Outflow (mill.cub.m.)	4.9-7.0(mill.cusec)	6855-13641

RESERVOIR FISHERIES STATISTICS OF HIMACHAL PRADESH

Sr. No.	Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Number of fishermen co-operatives	36	39	43	43	45	45	49	49	52	59
2.	Membership	5450	5994	6269	6235	6369	6567	6973	6844	7549	8399
3.	Active fishermen	3209	3586	3881	4069	4385	4549	4975	5023	5472	6098
4.	Number of gillnet License	5149	5676	6123	6448	7067	7265	7891	7915	8700	9766
5.	Quantity of fish catch (tonnes)	1147.28	1314.78	1515.27	956.18	925.69	1575.10	1830.22	1562.12	1293.35	1144.48
6.	Value of catch (in lakhs)	574.99	643.12	841.90	587.50	716.74	1083.16	1300.70	1449.65	1218.24	11.67

DEVELOPMENT OF RESERVOIR FISHERIES IN HIMACHAL PRADESH

An Overview

Since Independence, harnessing the State's various rivers for power generation and irrigation has been the main focus of development activities in the State of Himachal Pradesh. This has resulted in the emergence of number of river valley projects with the primary objectives of sorting river water for irrigation, power generation and other activities. One of the direct results of these projects is the creation of several manmade water bodies dotted virtually throughout the length and breadth in the state. The man-made lakes hold tremendous potential for inland fisheries development and offer ample scope for fish yield optimization through adoption of suitable management measures, recognized long back. The major water bodies created so far include Gobind Sagar, Pong, Chamera and some part of Ranjit Sagar Dam, the smaller reservoirs in view of their drawdown character could not be harnessed for fish production. Another water body measuring 1300 hectare has been emerged as a result of construction of Kol dam on river Sutlej. During 2013-14, the fish production from large reservoirs was of the order of 1562.12 tonnes valued Rs. 1449.65 lakh. The fishing activities provided full time direct and indirect vocation to over 5000 fishermen families mainly up rooted due to the completion of these river valley projects. The sustained fishery activities clearly demonstrated the potential of providing viable jobs through fishing and other fishery related activities. This obviously, required undertaking of series of management measures by the State Government.

The biogenic potential of the reservoirs was evaluated under All India Coordinated Project initiated by Indian Council of Agriculture and Research (I.C.A.R.). The project attempted to delve into all determinants of reservoir productivity including climate, morphometric and edaphic variables and dynamics of biotic communities of the reservoir ecosystem. Consequently limnology was added as a mould to cast location specific management strategy for reservoirs. Application of these norms resulted in a remunerable increase in fish field. A three pronged strategy comprising selection of appropriate mesh size of the fishing gear, increased efforts and stocking support has paid rich dividend in Gobind Sagar; where the annual fish has increased from meager 25 kg to 149 kg/ha in the last two decades. As a sequel to increased productivity the fishing operation in reservoir also became remunerative enough to sustain fisherman who toiled in open waters. Taking the apprehension that low catches might lead to occupational shift in favour of other vocations efforts were made to enhance productivity in these reservoirs.

Though, essentially a combination of fluviatile and lacustrine systems, the reservoirs reveal a certain characteristics of its own, the two characters co-exist in reservoirs depending upon the temporal and spatial variation of certain habitat

variables. In general the lotic sector of the reservoirs sustains a fluviatile biocoenos whereas the lentic zone and bays of reservoir harbor pelagic fauna. During monsoons due to heavy inflow of water, a considerable part of the standing crop of biotic communities at the lower trophic disturbs the natural primary community succession. The sudden level fluctuation also affects the benthos by exposing or submerging the substrate. All these factors obviously affect the seasonal fluctuation in the centers of the reservoirs. Since at micro–level, each ecosystem differs widely in limno-chemical aspects as such for convenience sake, each reservoir is being discussed separately.

GOBIND SAGAR RESERVOIR

Built due to damming of river Sutlej, the Gobind Sagar Reservoir came into existence during mid sixties. The pristine stream of river Sutlej harbored 51 species of fish including *exotic trout, snow trout* and several species of hill stream fishes. Mostly these species were unique due to sub–temperate climate and the zoogeographic affiliation to the Himalayan region. The upper reaches of Sutlej and its tributaries were particularly rich in *Tor putitora, Labeo dyocheilus, L.dero and Schizothorax* species. The available species belong to nine families.

FAMILY CYPRINIDAE

Barilius bendelisis, B. vagra, B. barila, B.modestus, Oxygaster bacaila, Rasbora daniconius, Carassius auratus, Cirrhinus reba, C. mrigala, Crossocheilus latius latius, Catla catla, Labeo dero, L. dyocheilus, L. bata, L. calbasu, L. rohita, Cyprinus carpio var.communis, C. carpio var nudus, C.carpio var specularis, Schizothorax richardsonii, S. plagiostomus, Ctenopharyngodon idella, Hypophthalmicthys molitrix, Tor putitora, Garra gotyla gotyla, G. lanita , Puntius sarana, P.tioto, P.chola and P.sophore.

FAMILY COBITIDAE

Biota Dario, B. dayi, B. bindi, B. lohachata , Noemacheilus botia, N. rupicola, N. monatanus, N. kangrae and N. horai.

FAMILY BAGRIDAE

Mystus seenghala and M. aor

FAMILY SCHILBEIDAE

Clupisoma garua

FAMILY SISRIDAE

Glyptothorax pectinopterus and G. cavia

FAMILY BELONIDA

Xenentondon cancila

FAMILY OPHIOCEPHALIDAE

Channa gachua and C. punctatus

FAMILY MASTACEMBELIDAE

Mastacembalus armatus armatus

FAMILY SALMONIDAE

Salmo trutta fario

Following are commercially important fish in order of their abundance:
SILVER CARP *(Hypophthalmicthys molitrix),* ***CATLA*** *(Catla catla),* ***MIRROR CARP*** *(Cyprinus carpio),* ***MRIGAL*** *(Cirrhina mrigala),* ***MAHSEER*** *(Tor putitora),* ***ROHU*** *(Labeo rohita),* ***GID/BATA*** *(Labeo dero),* ***SINGHARA*** *(Mystus seenghala),* ***GRASS CARP*** *(Ctenopharyngodon idella),* ***KALBANS****(Labeo calbasu)*

INDIGENOUS CARPS :

A perusal of indigenous carps composition from years 2006-07 to 2016-17 indicates that their proportion increased till the year 2012-13 where after it declined each year. In 2012-13 it increased to 210.20 tonnes. All the four Indian major carps viz. *L. rohita, C. mrigala, C. catla and L. calbasu* are present in the reservoir. *L. rohita* a commercially highly valued fish has undergone fluctuation in the catches since 2006-07 and for the last ten years (2007-08 to 2016-17) maintaining a range from 2.7-13.981 tonnes each year. *L. rohita* composition shows a decline from the year 2006-07 upto 2011-12 whereafter it shows a constant rise in the catches till 2015-16 with maximum catch of 18.54 tonnes. *C. mrigala* has shown increase in last five years upto 32 tonnes a year from just 1.2 ton in 2008-09. *L. calbasu* however, failed to establish in the reservoir and quantitatively ranged between 0.2-2.57 tonnes each year. *C. catla* has almost maintained a steady position in the reservoir. Despite being opined by many workers that *silver carp* would eclipse *C. catla* , the fact is far from truth. While during 2006-07, 36.27 tonnes of *C. catla* was harvested from the reservoir, the production during 2016-17 was 28.876 tonnes accounting an increase of 120 tonnes. The yearly average during the last eleven years was 72.62 tonnes.

DEPARTMENTAL INCOME FROM GOBIND SAGAR RESERVOIR (in Lakh)

PARTICULARS	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
COMPENSATION	1.2	1.4	1.27	1.6	1.4	1.4	1.55	1.33	1.30	1.30
FISH AUCTIONED	0.5	0.4	0.3	0.2	0.4	0.6	0.5	0.11	0.083	0.092
LICENCE FEE	1	1.2	1.3	1.3	1.4	1.6	1.83	2.03	2.32	2.23
ROYALTY	47	66	71.0	47.0	50	105.3	127	99.16	82.18	75.00
OTHERS	0.09	0.18	----	0.51	0.41	0.52	0.54	1.86	0.53	0.64
TOTAL REVENUE	49.79	69.18	73.87	50.61	53.61	109.42	131.42	104.50	86.41	79.62

YEAR WISE SEED STOCKING IN GOBIND SAGAR RESERVOIR, HIMACHAL PRADESH

Particulars	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
MIRROR CARP										
Quantity of Seed Stocked (In lac)	5.45	6.90	5.44	1.8	5.225	1.6	4.49	2.955	4.309	10.090
Fish Harvested (In Tonnes)	220.0	189.0	215.34	190.93	169.4	136.72	141.94	129.667	136.596	122.829
INDIAN MAJOR CARP										
Quantity of Seed Stocked (In lac)	78.56	24.58	30.748	60.617	38.325	101.2	130.438	83.758	108.850	138.760
Fish Harvested (In Tonnes)	77.5	36.5	77.14	137.3	145.2	209.58	141.2	86.12	72.314	57.355

MINOR CARPS :

The minor carps in the reservoir are represented mainly by hill stream species *L. dero, L. dyocheilus, L. bata, C. reba and Puntius sarana*. The percentage composition of these fishes increased in the reservoir till 2011-12 and thereafter they started to decline. But catch during 2011-12 was 27.3 tonnes and 2014-15 was 28 tonnes with a slight increase as compared to previous years when catch was just 4-9 tonnes which is virtually insignificant. *L.dero* constituted almost 2% of the total catch thus indicating a rise in population of minor carps in the reservoir.

EXOTIC CARPS :

The three Chinese carps viz. *silver, Grass and Common carps* constitute the exotic fauna of the reservoir. The cumulative percentage of these three carps has decreased from 91.57 % to 85.10 % from 2008-09 to 2015-16 with *silver carp* alone contributing as high as 76.70 % of the total production during 2013-14. In terms of weight, exotic carps production was 8398.27 tonnes (57.49%) out of total production of 10425.36 tonnes from 2006-07 to 2016-17. *Silver carp* got an inadvertent entry in the reservoir during 1971 by inundation of one of the fish farms of the department when 47 *silver carp* specimen ranging from 290 - 530 mm were washed out. This species started appearing in the catches during 1977 - 78 and specimens of 300 mm size appeared in 1976. During 1977 there was substantial catch of 10 tonnes of *silver carp*, although this accounted only 1.4 % of the total reservoir landings. In view of congenial water qualities, wide feeding spectrum and high fecundity, the *silver carp* continued to proliferate and during 2016-17 the landing reached to a level of 506.128 tonnes. The maximum landings were recorded from lentic sector of the reservoir where the water was comparatively warm. The *grass carp* , however failed to establish in the reservoir presumably due to absence of weeds and the productivity ranged from meager 3.3 tonnes only in 2004-05 to 6.81 tonnes in 2016-17.

Mirror carp contributed significantly among the fish catches of Gobind Sagar. The fish established well as indicated by its composition in the total landing. Regular stocking is being carried out by the department for sustained production of the species. However, being bereft of weeds, which serve as substrate for sticking of mirror carp eggs, auto stocking has not been observed in the reservoir. The landing of mirror carp ranges from 136.7 to 219.7 tonnes in years 2006-07 to 2015-16.

YEAR WISE LANDING (In Tonnes) FROM GOBIND SAGAR RESERVOIR, HIMACHAL PRADESH

FISH SPECIES	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	TOTAL
L. rohita	16.4	6.9	3.4	2.7	7.0	13.2	16.3	11.64	18.54	**13.881**	**109.961**
%	2.1	0.7	0.3	0.4	1.1	1.1	1.09	1.1	2.16	**1.85**	**11.9**
C. catla	58.5	28.3	67.5	126.9	112.5	170.8	93.09	46.98	28.25	**28.876**	**761.696**
%	7.6	2.7	6.2	19.2	18.1	14.1	6.24	4.4	3.29	**3.83**	**85.66**
C. mrigala	2.5	1.2	6.1	7.6	25.6	25.6	31.781	27.5	25.53	**14.498**	**167.909**
%	0.3	0.1	0.6	1.1	4.1	2.1	2.13	2.6	2.97	**1.92**	**17.92**
L. calbasu	0.9	0.7	0.3	0.2	0.4	0.6	1.01	1.03	2.57	**1.738**	**9.448**
%	0.1	0.07	0.03	0.03	0.06	0.05	0.07	0.1	0.30	**0.24**	**1.05**
C. carpio	219.7	188.9	215.3	190.9	169.4	136.7	141.94	129.67	136.60	**122.829**	**1651.939**
%	28.6	18.4	19.7	28.8	27.3	11.3	9.51	12.2	15.91	**16.30**	**188.02**
H. molitrix	419.4	742.7	737.3	279.8	239.4	821.1	1144.34	772.4	585.29	**506.128**	**6247.858**
%	54.5	72.2	67.6	42.3	38.6	67.7	76.7	72.8	68.15	**67.17**	**627.72**
C. idellus	10.8	9.6	10.7	7.3	7.4	5.7	8.237	11.47	8.48	**6.808**	**86.495**
%	1.4	0.9	0.9	1.1	1.2	0.5	0.55	1.1	0.99	**0.90**	**9.54**
L. dero	4.1	8.6	7.3	19.8	27.3	13	28.99	28.10	12.45	**4.792**	**154.432**
%	0.5	0.8	0.7	3.0	4.4	1.1	1.94	2.6	1.45	**0.64**	**17.13**
T. putitora	26.5	30.0	29.1	18.8	22.7	14	13.976	20.09	31.78	**37.057**	**244.003**
%	3.4	2.9	2.7	2.8	3.7	1.2	0.94	1.9	3.70	**4.92**	**28.16**
M. seenghala	10.1	11.3	13.6	8.0	8.8	11.8	12.524	12.16	8.97	**8.943**	**106.197**
%	1.3	1.1	1.2	1.2	1.4	1	0.84	1.1	1.04	**1.19**	**11.37**
OTHERS	0	0	0	0	0	0.3	------	-------	0.325	**7.889**	**8.214**
%	0	0	0	0	0	------	------	-------	0.04	**1.04**	**1.08**
TOTAL FISH	**769.13**	**1028.4**	**1090.9**	**662.12**	**620.76**	**1212.7**	**1492.17**	**1061.04**	**858.782**	**753.539**	**9549.541**

CARNIVORE FISHES :

The major carnivore fishes encountered in Gobind Sagar reservoir are *Mahseer* and *M. seenghala*. During last ten years the cumulative percentage was 3.60 %. The highly voracious *M. seenghala* has kept a low profile in the catches reflected in catch structure. The low proportion of catfish has indeed helped in fast propagation of carps despite the absence of ideal habitat for spawning. *T. putitora* which used to form a dominant fishery of Sutlej river prior to impoundment has markedly declined. The catches have fluctuated between 14.0 – 32.00 tonnes for the last ten years, the lowest 13.98 ton being during 2013-14. The major factors attributed to decline in mahseer catches are (i) denial of migration for breeding, (ii) large scale killing of juvenile specimens and (iii) absence of insects and weed fauna in water body which forms the preferred food for mahseer. However, the department has taken action by amending the Fisheries Act and raising the allowable size for catching fish from 30 to 50 cm. so that specimen over one kg could only be caught.

AVERAGE WEIGHT OF MAJOR SPECIES :

A review of the fluctuation of major species being caught in the reservoir for the last ten years (2007-08 to 2016-17) indicates that among carps the average weight o f *L. rohita , C. catla, C. mrigala and L. calbasu* has ranged from 1.4 to 3.96 , 2.3 to 7.42 , 1.0 to 2.88 and 0.8 to 0.6 kg respectively. Among exotic carps the average size of *Silver carp* and *Mirror carp* ranged between 2.2 to 3.96 and 0.9 to 1.1 respectively for the same period. As far as carnivores are concerned, *M. seenghala* ranged between 1.1 – 1.4 kg. In case of *Mahseer* the average size has varied with a narrow limit of 1.2 to 1.9 kg for the last ten years (2007-08 to 2016-17).

FISH YIELD CATCH EFFORTS :

The fish yield from reservoir has ranged from 48.5 to 149.22 kg/ha for the last ten years (2006-07 to 2015-16). The highest was recorded during 2013-14 (149.2 tonnes) while lowest during 2006-07 (48.5 tonnes). In fact starting from 2006-07 when an all time low landings were recorded there is a constant rise in production each year reaching to a level of 1492.174 tonnes during 2013-14. The major reason attributed to persistent increase in catch are strict conservation, imposition of closed season, providing better quality subsidized nets to fishermen and intimation of fishermen welfare schemes.

REVENUE :

The revenue earned by the Fisheries Department from Gobind Sagar Reservoir falls under four categories.

1. Royalty @ 15 % of the price of the fish caught.
2. License fee charged annually from all fishermen belonging to various fisheries Co-operative Societies @ Rs. 50/- each.
3. Fines realized from the poachers for conducting illegal fishing or other offences indicated in the Fishery rules.
4. Auction and sale of confiscated fish incorporates the revenue realized by the department during various years

SPECIES INTRODUCTION :

Prior to construction of dam , the cold water of upper reaches of river Satluj used to harbor 51 species of fish of which *T. putitora , L. dero , L. Dyocheilus* and *Schizotharacids* were the dominant ones. The main question which confronted the policy makers during early stages of fisheries development in the impoundment was whether the resident indigenous species of Satluj would be able to effectively populate in the lacustrine condition of the reservoir or whether new species are to be to utilize the new habitat.

It was a general consensus among the leading limnologists that none of the indigenous rheophilic species would be able to offer viable commercial fishery and it was recommended that the reservoir should be stocked with Indian and exotic carps. Taking this into consideration the State Fisheries Department stocked 3500 gravid spawners and 0.5 million fingerlings of Indian major carps ranging from 100 – 150 mm during 1966 – 71. By 1969 Indian major carp established themselves in the reservoir and started breeding. The stocking in subsequent years continued mainly with mirror carp seed. A number of fish farms were set up in the State for this purpose with the main goal of producing the seed and their transplantation in the reservoir.

FLUCTUATION IN AVERAGE WEIGHT OF MAJOR SPECIES FROM GOBIND SAGAR RESERVOIR, HIMACHAL PRADESH.

FISH VARIETY	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
C.catla	9.7	10.8	2.3	2.8	4	6.2	7.3	7.64	7.72	7.14
L. rohita	1.8	2.0	2.0	1.7	1.6	1.5	1.4	1.4	1.55	1.91
C. mrigala	1.8	1.7	1.4	1.3	1.0	1.1	1.1	1.1	1.16	1.37
L. calbasu	0.8	0.8	0.8	0.9	1.0	0.9	1.04	1.04	1.03	1.04
C. carpio	0.9	0.9	1.1	1.1	1.0	1.0	0.9	0.9	0.88	1.02
T. putitora	1.4	1.2	1.4	1.5	1.5	1.9	1.7	1.53	1.50	1.59
L. dero	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.26	0.27
H. molitrix	3.0	3.3	3.5	3.9	2.4	2.2	2.44	2.8	2.94	3.30
M.seenghala	1.3	1.2	1.2	1.4	1.1	1.1	1.2	1.3	1.26	1.42
C. idellus	6.3	7.3	7.9	8.5	7.0	6.7	5.4	4.01	6.07	7.98
Misc.	---	---	---	---	---	0.08	---	-----	0.28	0.14

INVENTORY DATA ON FISHERMEN, GEAR & CRAFT FROM GOBIND SAGAR RESERVOIR, HIMACHAL PRADESH

PARTICULARS	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
No. of Fishermen Societies	18	21	25	24	26	27	30	32	32	33
Membership	2746	3211	3308	3148	3029	3213	3379	3200	3788	3831
No. of working Fishermen	1412	1737	1831	1902	1943	2105	2372	2426	2550	2741
Gill Net License	1600	2013	2075	2166	2229	2390	2685	2721	2856	3052
Rod and Line License	504	495	539	529	819	970	1227	1347	2232	1765
No. of Boats used	918	1042	1098	1236	1263	1473	1541	1650	1785	-
Boats per fishermen	0.65	0.6	0.6	0.65	0.65	0.7	0.65	0.68	0.7	-

PER KG. RATE OF FISH BEING PAID TO FISHERMEN IN PONG RESERVOIR , HIMACHAL PRADESH

PARTICULARS	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Summer (Rs.)	41-62	53-70	54-81	62-91	71-134	75-90	86-144	93-153	94-153	96-153
Winter (Rs.)	56-89	67-96	70-130	81-165	130-226	105-165	115-212	123-212	130-212	132-213

RESERVOIR MANAGEMENT :

During the first phase of reservoir development in 1964 – 75, the Department issued licenses @ Rs. 10/- per gill net and fishermen were free to dispose their catch as they wished. Thus, however, failed to develop a commercial fishing of appropriate size and hardly benefited the fishermen. During 1976, a fishing policy was formulated and implemented. As a first step fishermen were organized under Fisheries Co–operative Societies. The fish caught by the fishermen was now brought to the fixed landing centres for handing over to the Fish Federation, an apex body entrusted solely for the sale of fish. The Federation was free to sell the fish either at their own retail outlets or to the contractors. This Federation, an intermediary body between the societies and contractors, was made fully responsible for making payment to the fishermen at the rate fixed each year during the beginning of the year. The department's role was also made specific. Fish Federation was dissolved in year 2007 thereafter rates of fish were fixed by open auctioning of fish cooperative societies. Seed stocking, conservation, watch and ward, implementation of Fisheries Act/Rule, monitoring of catches, initiation of welfare schemes, providing subsidy and arranging loan were made as the major responsibility of the department.

FISHERMEN AND THEIR ORGANISATION :

At present there are 2550 fishermen recruited from 5000 oustees settled near the reservoir. This accounts for approximately 20% of the total fishermen population. Prior to the impoundment of a subsistence fishery of inconsequential nature existed in the rivers and streams, but with the formation of the reservoir the lucrative fishery started attracting a large number of fishermen and other oustees who lost their property with the emergence of the reservoir. The local fishermen who used to fish in shallow rivers and streams with primitive gears found them ineffective in the deeper waters of reservoir. The fisheries department then initiated training in the use of deep water fishing gear and boats. The income of fishermen operating in the reservoir inspired other oustees of various communities to adopt fishing as a profession and in 1978 the total number of fishermen was 1280. Besides direct employment to approximately 2000 families, the state provided livelihood to about 1000 additional families engaging in helping the fishermen carrying / transportation, packing of fish, fishing crafts/gears repair, sale of fish etc.

The fishermen on Gobind Sagar are full time licensed fishermen and member of Co-operative Societies and have their own boats. On an average50% of the fishermen have some education. Fishermen have boats, usually of size 16ft X 3 ft X 2 ft, costing approximately Rs. 20,000.00. The fishermen use mainly nylon gill nets. Each fisherman has on average 3-4 gill nets of 100 to 140 mm sizes which last about 1-2 years.

REMARKS :

The Gobind Sagar offers a classical example of exploiting the large reservoirs created in view of completion of river valley project for job generation and production of high quality animal protein i.e. fish. For the last ten years there is a continuous increase in the fish production. The reservoir has in fact created a history of maintaining highest per unit fish production in large reservoirs for the last two decades in the country. This could be made possible by adopting a sound management and development policy which inter alia include formulation and implementation of Fisheries Act, regular stocking, providing assistance to fishermen for pursuance of fishing equipment, strict enforcement of closed season and mesh size regulations etc. In addition two fibre glass motor boats were purchased for patrolling in Gobind Sagar and Pong reservoirs for effective conservation of fisheries resources of the state. As per available figures during the last 13 years a total of 9280.48 tonnes fish was harvested from Gobind Sagar Reservoir. Further 2550 direct and 3500 indirect jobs were made available in view of theses fishing operation. Further during the last ten years, there is constant increase in fish catches, value of fish, per unit price of fish leasing period of fishermen, total number of fishermen fishing in reservoir, in monthly income of fishermen and revenue of the department.

PONG RESERVOIR

Impounded across river Beas the Pong Reservoir with a catchment area of 12,561 sq. km and mean water spread of 15,662 ha. came into existence during 1975. Trial fishing was resorted by the department soon after its filling but during initial years the catches were dominated by rheophlyic species belonging to family *Salmonidae, Cyprinidae, Cobitidae, and Sisoridae* etc. However in new tremendous biogenic capacity of the reservoir and systemic seed stocking undertaken by the department over a number of years with Indian carps and mirror carps the catch structure of the reservoir was altered and carps started accounting as high as 50 – 60% of the catches. During 2014-15 the per hectare yield of reservoir was 30.25 Kg per ha. with cat fishes, carp accounting 56.3 % and 43.7 % of the landing. The limnological studies of the reservoir have shown a positive curvilinear relationship between standing crop approximately total alkalinity. The hypsographic curves indicated inverse relationship between volume of water and fish production.

As stated the commercial fishing in the reservoir was initiated soon after its emergence. The total catch during the 1st year of fishing operation was 98 tonnes and increased progressively attaining a peak of 473.83 tonnes during 2014-15, fluctuating with a range of 280 – 473.83 tonnes .

FISH STOCK COMPOSITION:-

A total of 27 species (sub-species, varieties) belonging to six families have been encountered in the Pong reservoir.

FAMILY CYPRINIDAE

Barilius bendelisis, B. Vagra, Cirrhinus mrigala, Crossochelus latius, Catla catla, Labeo dero, L. bata, L. rohita, Cyprinus carpio, Schizothoraax richardosnii, Tor putitora, Puntius ticto, P.sarana and *Hypophthalmicthys molitrix.*

FAMILY COBITIDAE

Biota birdi and *Noemacheilus kangrae*

FAMILY BAGRIDAE

Mystus aor, M. seenghala, Bagarius bagarius and *Wallago attu.*

FAMILY SISORDAE

Glyptothorax pectinopterus and *G. gharwali*

FAMILY CHANNIDAE

Channa marulius, C.straitus and *C.cephalus*

FAMILY MASTACEMBELIDAE

Mastacembalus armatus armatus

FAMILY SALMONIDAE

Salmo trutta fario

Following are commercially important fish in order of their abundance:

SINGHARA *(Mystus seenghala),* ***SILVER CARP*** *(Hypophthalmicthys molitrix),* ***CATLA*** *(Catla catla),* ***MIRROR CARP*** *(Cyprinus carpio),* ***MAHSEER*** *(Tor putitora),* ***MRIGAL*** *(Cirrhina mrigala),* ***ROHU*** *(Labeo rohita),* ***GID/BATA*** *(Labeo dero),* ***GRASS CARP*** *(Ctenopharyngodon idella),* ***KALBANS****(Labeo calbasu)*

TOTAL FISH CAUGHT, VALUE AND REVENUE FROM PONG RESERVOIR HIMACHAL PRADESH

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Total fish catch (in tones)	374.8	283.6	421.4	279.6	286	341	307.36	473.83	415.42	381.91
Value of fish (in lac)	260.53	201.63	369.2	267.28	373	369	431	764.65	654.54	590.35
Department Income in lac										
Royalty	39.1	30.23	55.38	40.09	55.91	55.32	64.66	114.7	98.32	84.63
License Fee	1.81	1.88	2.02	2.12	2.39	2.46	2.62	2.7	2.97	13.15
Fish auctioned & other fees realized	2.13	2.23	1.98	2.0	2.13	4.22	3.29	8.32	4.52	0
Total Revenue	**43.55**	**35.36**	**63.18**	**45.88**	**61.93**	**62**	**70.6**	**125.72**	**105.81**	**92.77**

FLUCTUATION IN AVERAGE WEIGHT (kg) OF MAJOR SPECIES FROM PONG RESERVOIR, HIMACHAL PRADESH

Fish species	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
M. seenghala	0.96	0.95	0.96	0.9	1.09	0.90	1.0	0.91	1.03	1.05
L. rohita	4.4	2.55	3.68	4.13	2.05	3.9	3.16	3.54	3.94	5.33
T. putitora	3.72	1.4	1.34	0.90	1.09	1.33	1.4	1.5	1.57	1.55
L. calbasu	2.95	1.3	1.40	1.74	1.22	1.94	1.13	1.9	2.44	2.45
H.molitrix	-	4.2	7.8	5.39	7.2	10.18	10.1	10.56	8.98	8.70
C . mrigala	2.95	1.3	1.4	1.74	1.22	1.83	1.4	1.55	2.47	2.71
W. attu	1.3	2.54	3.12	2.01	2.67	4.02	1.45	3.0	1.94	2.80
C. carpio	1.29	1.48	1.04	1.13	1.27	1.34	1.3	1.4	1.32	1.38
C. catla	7.06	7.8	5.76	8.04	4.9	7.0	5.5	7.4	8.78	8.97
Channa sp.	2.05	1.38	1.38	1.1	1.26	1.67	1.3	1.4	1.22	1.25
Misc.	0.16	0.38	0.40	0.36	0.23	0.25	0.43	0.43	0.43	0.41
Average weight	2.71	2.28	2.59	2.56	2.23	1.13	2.6	1.17	1.33	3.32

QUALITATIVE AND QUANTITATIVE FLUCTUATIONS:-

During 2006-07 the carps viz. *L.rohita, C. catla, C. mrigala, L. calabsu* and *C.carpio* accounted 14.17 % (44.1 tonnes) of the total catches while cat fishes viz. *M. seenghala , W. attu* accounted 68.54 % (213.3 tonnes) and mahseer 16 % (50.0 tonnes) . Against this during 2015-16 the percentage composition of *indigenous carps, cat fishes, mirror carp, T.putitora* and other was 28.23 % (117.28 tonnes), 60.10 % (249.67 tonnes) , 3.37 % (13.99 tonnes), 7.26 % (30.15 tonnes) , 0.24 % (1.0 tonnes) respectively.

Among the Indian major carps, *L. rohita* is the dominant fish encountered in the reservoir. The highest catch (63.78 tonnes) of this fish was encountered during 2015-16. For the last ten years 2006-07 to 2015-16 the catches have fluctuated from 8.4 – 63.78 tonnes. During 2014-15, landing of *L. rohita* was 60.74 tonnes. *C. catla* has always kept a low profile in the reservoir, the maximum catch of 10.1 tonnes was encountered during 2014-15. The catch during 2012-13 was 4.5 tonnes. *C. mrigala* has shown fluctuation in the catches. The highest catches (82.61 tonnes) of *C. mrigala* was in 2014-15. *L. calbasu* too used to account significantly in the reservoir during eighties the highest being 85 tonnes during 1982 – 83. The catch has constantly decreased with a catch of 1.57 tonnes in 2014-15 and almost negligible catch (0.1 tonnes) in 2007-08.

Pong reservoir may be categorized as a *Mystus* reservoir. The highest catch (324 tonnes) was recorded during 2004-05 accounting 75.5 % of the total catch. Wallago attu , however , has suffered a decline and was negligible in 2006-07 and 2007-08.

Mirror carp composition is quite errative in the reservoir presumably due to the fact that ideal breeding grounds are nonexistent in the water body. However regular stocking has helped in the revival of mirror carp fishery and from an all time low of 2 tonnes during 1992 – 93, the catches have increased to 14 tonnes during 2015-16.

Mahseer is a highly precious and sought after fish of the Pong. It's probably the only reservoir in the country which provide the opportunity of *Mahseer* angling. The catches of *Mahseer* in the reservoir has shown remarkably consistency during the past 14 years and landing have fluctuated between 24.60-50.00 tonnes. The highest catches of *mahseer* were recorded during 2006-07 (50 tonnes).

AVERAGE WEIGHT OF MAJOR SPECIES:-

An analysis of data for the last ten years (2006-07 to 2015-16) indicate that the average size of all species of Indian major carps have shown fluctuation in the water body. *L.rohita*, the principal fish has registered a range of 2.0 kg to 4.9 kg, the average during the last three years being 3.55 kg. Catla catches are more pronounced, the average size being 7.2 kg during the same period. *L. calbasu* have registered consistency in average weight during last ten years.

YEAR WISE LANDINGS (IN TONNES) FROM PONG RESERVOIR, HIMACHAL PRADESH

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	TOTAL
L. rohita	23	15.6	35.7	16.7	32.76	33.85	49.178	60.74	63.78	60.264	391.572
%	6.1	5.4	8.4	5.9	11.4	9.9	16.02	12.8	15.35	15.77	107.04
C.catla	2.6	1.3	7.0	4.6	4.33	4.5	6.155	10.40	7.73	8.432	57.047
%	0.7	0.4	1.6	1.6	1.5	1.3	2.0	2.2	1.86	2.20	15.36
C. mrigala	15.7	28.0	64.4	27.2	54.03	44.43	40.714	82.61	45.28	30.932	433.296
%	4.2	9.8	15.2	9.7	18.9	13	13.26	17.43	10.90	8.09	120.48
L. calbasu	0.1	0.2	0.4	0.2	0.80	0.5	2.389	1.57	0.49	0.130	6.779
%	0.02	0.07	0.09	0.07	0.28	0.14	0.78	0.33	0.12	0.03	1.93
C. carpio	13.4	13.0	24.8	24.2	21.40	15.71	17.129	19.53	13.99	18.914	182.073
%	2.7	4.6	5.8	8.6	7.5	4.6	5.58	4.12	3.37	4.95	51.82
C.marulius	2.3	1.9	3	2.3	4.68	2.63	2.353	3.46	3.32	0	25.943
%	0.6	0.6	0.7	0.8	1.6	0.8	0.77	0.73	0.80	0	7.4
T. putitora	48.0	27.5	38.3	42.6	39.20	37.77	24.591	27.81	30.15	28.343	344.264
%	12.7	9.6	9.0	15.2	13.7	11	8.0	5.87	7.26	7.42	99.75
M. seenghala	267.2	195.0	246.3	159.5	126.7	200.45	162.716	265.90	248.60	209.714	2082.08
%	71.0	69.0	58.0	57.0	44.0	58.7	53.00	56.1	59.8	54.91	581.51
W. attu	0.3	0.1	0.3	0.5	0.90	0.5	0.676	0.77	1.07	0.946	6.062
%	0.05	0.03	0.07	0.17	0.3	0.1	0.22	0.16	0.26	0.24	1.6
OTHERS	1.5	1.2	0.8	1.2	0.99	0.66	1.32	0.78	1.00	26.087	35.537
%	0.4	0.4	0.2	0.4	0.3	0.9	0.43	0.16	0.24	6.39	9.82
TOTAL	**374.1**	**283.8**	**421.0**	**280.0**	**285.79**	**341.0**	**307.0**	**473.84**	**415.42**	**381.91**	**3563.86**

C.mrigala and *L.calbasu* average weight for the last five years (2011-12 to 2015-16) was 1.7 kg and 1.73 kg respectively. *Mirror carp* however have shown consistency in average size during last few years. While during 2015-16, the total landing of *mirror carp* was 13.99 tonnes with average weight of 1.32 kg. *Mahseer* has kept a steady profile in terms of average size in the reservoir. For the last ten years the average size has ranged between 0.9 to 3.72 kg while the total landing have fluctuated between 27.5 to 50 tonnes during 2006-07 to 2015-16 and the average size of *mahseer* was 1.52 kg. The average size of other species encountered in the reservoir viz. *W. attu, Channa* species was 3.35 and 1.38 kg respectively. *M.seenghala* is prominent fish in the reservoir, its catches were of the range from 126.7 tonnes (2011-12) to 265.9 tonnes (2014-15). Average weight varied from 0.9 kg to 1.03 kg.

FISH YIELD , CATCH EFFORTS :-

An analysis of production figures for the last ten years indicates that there is consistency in yield rate, which works out to 22.3 kg/ha. The yield ranged between 18 to 30.57 kg/ha. The average yield during 2014-15 was 30.57 kg/ha.

REVENUE :-

While the fish landing of Pong reservoir have shown a consistency during the last decade, the value of fish caught has increased significantly mainly attributed to quality of the catch. The value of fish caught increased from 179.69 to 590.35 lac. During 2014-15 fish worth 764.65 lac was harvested from the reservoir.

As far as department revenue is concerned, the income of department has increased from meager 32.65 lac to 125.72 lac during the last decade. The revenue recorded during 2016-17 was 92.77 lac and the respective contribution by royalty, license fee, and fines etc. was 91.21 %, 3.32 % and 5.47 % respectively.

YEAR WISE SEED STOCKING IN PONG RESERVOIR, HIMACHAL PRADESH

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Quantity of Seed Stocked (in lac)	60.43	12.22	10.68	58.4	34.56	66.655	78.92	83.80	88.91	-
Value of seed stocked (in lac)	9.10	1.93	2.23	16.05	13.13	24.56	49.18	22.52	19.84	-
Fish Harvested (In Tonnes)	374.8	283.6	421.4	279.6	285.99	341	307.36	473.84	415.42	381.91
Value of Fish Harvested (In lac)	260.53	201.63	369.20	267.28	373.0	369.0	431.0	764.65	654.54	590.35

SEED STOCKING:-

Prior to the construction and completion of the reservoir, detailed study on ecology and fisheries of River Beas had never been done (Sehgal, 1998). However, Howel (1916) recorded *Oreinus sinnatus, S. richardsonii and Glyptosternum striatus* and three major fishes of river Beas recorded from Beas Kund to Largi - a stretch of approximately 150 km. Later. Singh (1982) listed *T. putitora, S. richardsonii, L.dero and W. attu* from Beas river. The creation of the reservoir while at one hand has created a perennial source of water body but on the other hand certain migratory species started competing to retain their position in the ecosystem. Of these species, three most important are the *Golden Mahseer* (*T. putitora*), *Snow trout* (*S. richardsonii*) and *L. dero*. The *Mahseer* which had its migratory run upto Sultanpur near Kullu has disappeared in this area. The other affected species are *S. richardsoni* and *L. dero*. While the former could not establish in the new environment, the later is struggling to retain its progeny in the reservoir.

The stocking programmes in Pong reservoir were initiated during 1974–75 when the first consignment of 1.30 lakhs fry of *mirror carp* were released. Since then a regular stocking programme has been undertaken. Stocking has been mainly confirmed to the seed of mirror carp and Indian major *L. rohita, C. catla and C*. *mrigala*. The seed of other species viz. *T. putitora , Schizothrax spp*. and L*. dero* could not made available due to absence of any large scale seed production technologies . The State Fisheries Department has set up or improvised four fish seed farms located near the reservoir site mainly kangra, Deoli and Nalagarh. In the year 2015-16 88.91 Lakh IMC seed was stocked in Pong Reservoir.

INVENTORY DATA ON FISHERMEN, GEAR & CRAFTS FROM PONG RESERVOIR, HIMACHAL PRADESH

Particulars	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
No. of Fishermen Societies	15	15	15	15	15	15	15	15	15	15
Membership	2597	2658	2825	2861	3114	3120	3356	3400	3493	3755
No. of working Fishermen	1711	1768	1952	2006	2276	2303	2455	2479	2741	2831
Gill Net Licenses issued per active fishermen	2	2	2	2	2	2	2	2	2	5662
No. of Boats used	756	760	835	848	910	825	835	840	1323	0
Boats per fishermen	0.44	0.43	0.43	0.42	0.40	0.36	0.34	0.34	0.48	0

RESERVOIR MANAGEMENT:-

With a view to enforce effective management and formulate a concerted approach of fisheries development in the reservoirs, a state level Reservoir Development Committee was set up during 1976. As a first step it was decided to bring all fishermen under a cooperative fold and only a member of cooperative societies be permitted to operate nets in the water body. Three societies with a total membership of 303 fishermen were registered during 1976. By 2015-16 the number of societies increased to fifteen with membership of 3493. An annual license fee of Rs. 50/- is levied on each gillnet of 80 m length. The department also charges 15 % royalty on the price of the fish caught by each fisherman. The permitted gears are gill nets and rods and line only.

For sale of fish the practice of appointing contractors by open auctioning at the beginning of each year was started. The fish caught by the fishermen are required to be brought to the fixed landing centers. The representatives of the contractors receive the fish at the fixed landing centers while the departmental staff charges the royalty and record the quantity of the catch species – wise. The contractors make weekly payment to the societies, besides keeping a lump sum or fixed deposit to be confiscated in the eventuality of any default. The societies make the payment to the fishermen after deducting a marginal commission (5.0 – 7.0 %) which varies between societies and fixed each year in the general meeting of the societies. To avoid conflict between the societies regarding the area of operation, the reservoir is divided into eight beats demarcated on the basis of area and productivity of water body apportioned for each society. Fishermen who are members of the cooperative societies are issued annual license through the cooperative societies by the respective Fisheries Officers of the landing centers at the beginning of each year.

FISHERMEN AND THEIR ORGANISATION:-

Presently there are 15 fishermen cooperative societies functioning in the reservoir. There are 2303 active fishermen recruited from 4000 oustees settled near the reservoir. This account for about 30.4 % of the total population of reservoir fishermen. Prior to the impoundment of the river Beas , a subsistence fishery of inconsequential nature existed in the river and adjoining streams and the average catch hardly exceeded 2-4 kg fishermen daily , but with the formation of the reservoir , a lucrative fishery started attracting large number of fishermen and the oustees who had no other viable means of livelihood . The fisheries department initiated training course for operating gears in the deeper waters for fishermen. This however, inspired a large number of oustees of various communities to adopt fishing as a profession. Besides direct employment to over 2303 fishermen, the fishing activities provide indirect job to over 1000 families engaged in helping fishermen , carrying / transportation , packing of fish , weaving and mending of gears , marketing etc.

The fishermen in Pong are mostly full time fishermen. On an average every fisherman has one boat, usually of size of 5.0 X 1.0 X 0.7 m, costing approximately Rs. 20,000/-. The fishermen normally use gill nets and varying from 80 – 140 mm mesh size. The minimum allowable mesh size for economically important species is fixed by the department.

Assuring highest prices of their product to the fishermen is one of the major concerns of the department. The efforts made on these lines helped the fishermen to ensure maximum price of their catch.

The fisheries department has initiated a number of welfare schemes for the benefit of fishermen. The department arranges procurement of these equipments to meet the needs of the users. A personal Accident Insurance Scheme has been initiated free of cost for each fishermen. Fishing is a hazardous job. There is every risk of life during heavy rains and storms. Keeping this in view, all active fishermen working in the reservoirs/riverine sector have been insured for Rs. **2,00,000**/- in case of death or permanent total disability. In case of partial permanent disability, a fisherman is insured for Rs. **1,00,000**/- and a cover of Rs. 10,000/- towards hospitalization expenses. The insurance premium is being shared by the Government of India & Government of Himachal Pradesh in 50:50 ratio.

A Risk Fund Scheme has also been initiated under which fishermen are compensated to the tune of 33% for losses such as blowing and sinking of boats or nets. Further, during the period of closed season (01, June – 01, August), a subsistence allowance of Rs. 1800 is paid under a Relief Scheme. For this the fishermen has to make a contribution on equal installments of Rs. 60 each for ten consecutive months of the fishing season.

REMARKS:-

The Pong Reservoir depicts a classical example of using reservoir for food production and generating employment avenues. Fisheries development in Pong Reservoir has helped in settlement and providing livelihood to families uprooted due to the impoundment. Though primarily formed for power generation and irrigation purpose, approximately **3875.61** tonnes of fish valued at Rs. **4460.87** lakhs was harvested from reservoir during the last ten years (2007-08 to 2016-17). The annual yield varied from 279.6 to **381.91** tonnes a year. Among the positive decisions taken by the management, the most important was to stock the reservoir with seed of Indian major carps. This helped in establishment of *C. mrigala*, contributing as high as 18.9 % during 2011-12. The amendment of State Fisheries Act, 1976 (Act No. 16), enforcement of mesh size regulation, organization of fishermen under the cooperative fold, imposition of closed season, settling of fishermen during the initial stage from outside the State, initiation of fishermen welfare scheme etc. were other well conceived measures which helped in

boosting the reservoir's fisheries activities and providing vocation to the displaced inhabitants of the reservoir. A study was made to correlate mean water temperature, area and volume of reservoir with fish production. While no consistent relationship could be discerned between temperature and fish production, a definite correlation existed between reservoirs volume/area and production. Analysis of data for the last ten years indicates that fish production was highest when the water level was 404 m and maximum water spread approximately 20000 ha. Against this, lowest production was recorded at the water level 395 m and an area of approximately 18000 ha.

The catch spectrum of the reservoir altered considerably during the course of years. During the initial years the catch was mainly dominated by *M. seenghala, T. putitora, L. dero, W. attu, C. mrigala* and *C. carpio*. While *L. rohita* has considerable degree of success in getting established in the reservoir, the same is not true of other species such as *C. catla C. mrigala* and *C. carpio*. The *mirror carp* catches increased each year reaching to the highest level of 24.8 tonnes during 2009-10 due to regular seed stocking by the department.The probable reasons attributed to non establishment of *mirror carp* naturally is absence of weed in the water body, dominance of predatory fish fauna and browsing habit of the species. The reason for non establishment of *Catla catla* defies explanation and requires detailed scientific study. The percentage composition by the number depict their trend over the years from 1982 – 83 to 1989 – 90. In the earlier years, after the formation of the reservoir the dominance of indigenous fishery is more pronounced. During 2016-17, *M. seenghala* was the most dominant fish (**54.5** %) followed by *L. rohita* (**15.77** %) *C. mrigal* (**8.09** %) , *Mahseer (**7.42** %),* , *Mirror carp* (**4.95** %) *C.marullius* (**2.20** %) and other (**7.06%).** However, *Wallagu attu and L.cabasu* was far from recognition and it formed hardly 0.1 % of the catch.

Subsequently, the catch spectrum altered widely owing to the effect of the dam, the establishment of exotic varieties, vagaries of monsoon and fluctuating water level of the reservoir. The stocking of L*. rohita* was initiated during 1974–75 and the species soon established, yielding 63.78 tonnes (15.35 % by weight) by 2015-16.

A remarkable feature of the reservoir is the establishment of carps despite dominance of carnivores like *M. seenghala , W. attu* and *T. putitora*. Cumulative percentage of carnivorous fishes was **62.68** during 2016-17 (**239.00.** tonnes). Compared to this, the percentage of herbivores was **36.42** during 2016-17 (**142.907** tonnes).

Maintaining a high sustained yield is the backbone of the reservoir fisheries management. The department while giving it a priority attention has carefully developed a monitoring system. At each landing center, fisheries officers, field assistants, sub– inspectors and helpers have been posted, who weigh the landed fish and species record is maintained. They also maintain strict surveillance on mesh sizes, apprehend poachers and take action against them. Further in view of a long shoreline, the surveillance of reservoir places a

great demand on the limited man power of the department. The situation becomes extremely acute during the closed season when fish are scarce in the markets and prices shoot up. The concentration of fish in the shallower areas for breeding makes them vulnerable to poaching. The department sets up a number of field camps during the closed season at such vulnerable points to control the poachers. The department has also set up flying squads in order to reinforce the surveillance. A conservation unit with a speed boat moves round the clock in the reservoir to protect the spawning grounds. In this way the department has been able to control the illegal fishing in the reservoir to a considerable extent. The Himachal Pradesh Government has enacted the Fisheries Act. 1976 and fishing during closed season has been made a cognizable offence, inviting imprisonment upto three years and fine upto Rs. 3000. Further the watch and ward staff has been given full power to seize fishing gears and to forfeit or confiscate fishing devices and fish.

CHAMERA RESERVOIR:

- Impounded across the river **Ravi** in the area of Chamba Distt of Himachal Pradesh in 1994.
- Dam is built at place named at Chohra, covering the villages Udipur, Saru, Bhanota , Tippri, Dugh, Taleru, Brangal Bhalehi, Sundla, Koti, Chandi largo, Mohal, Palehi, Chaklu, Rajnagar, Malan, Kyani, Folgate & Rajpura.
- Total water spread area of maximum 1500ha, & avarage800 ha, & depth of 123m.
- There are four fish Co-op society working at present named Rajnagar, Bhonota & Palehi.
- It is y shaped cliffed by hills on both sides.
- There are about 137 fishermen engaged in fishing in Chamera reservoir who are members of fish co-operative societies.
- Fish production is hampered by abrupt rise and fall of average water level and sometimes takes the shape of rivulet when the water level falls.

Following are the achievements in Chamera reservoir

Year	Fish caught (tonnes)	Value of fish caught (lac)	Total gill net licence (No.)	Revenue (lac)	Fisheries Cooperative Societies (No.)	Members (No.)	Licence holders (No.)	Illegal fishing cases (No.)
2009-10	2.89	1.56	144	0.413	3	136	98	73
2010-11	3.48	2.26	210	0.529	3	179	131	81
2011-12	4.04	3.17	214	0.664	3	179	130	68
2012-13	2.80	2.25	223	0.540	3	179	118	22
2013-14	2.82	2.58	240	0.56	3	179	120	28
2014-15	2.63	2.68	166	0.518	3	179	83	17
2015-16	3.24	3.43	274	0.729	4	203	137	19
2016-17	3.123	3.32	290	0.72	4	217	145	14

RANJEET SAGAR RESERVOIR:

- Impounded across the river Ravi in the area of Chamba Distt of Himachal Pradesh and it is divided into only one beat from village Chonka to Khairi, lahari Sandhara, Siharu, Chuhan, and Minhu.
- Ranjeet Sagar dam is declared a **"Wetland of national importance ".**
- Total water area is 9,615 hectare spread in three states (Punjab, J&K,H.P)
- The share of J&K, Punjab, and H.P. in the reservoir is 5600 ha, 3525ha and 490 ha respectively.
- There is only one Fisheries Co-operative Society of Fishermen engaged in Fishing .

Following are the achievements in Ranjeet Sagar reservoir

Year	Fish caught (tonnes)	Value of fish caught (lac)	Total licence (No.)	Revenue (lac)	Fisheries Cooperative Societies (No.)	Members (No.)	Licence holders (No.)	Illegal fishing cases (No.)
2010-11	11.41	3.99	60	0.693	1	47	30	63
2011-12	14.91	8.05	72	1.48	1	47	36	45
2012-13	18.34	11.63	46	1.9	1	55	23	13
2013-14	27.864	18.78	56	2.96	1	59	28	20
2014-15	24.62	21.43	70	3.34	1	65	35	16
2015-16	15.90	13.87	44	2.187	1	65	44	13
2016-17	4.338	3.91	82	0.69	1	65	41	15

Following are the achievements in Koldam reservoir

Year	Fish caught (tonnes)	Value of fish caught (lac)	Total licence (No.)	Revenue (lac)	Fisheries Cooperative Societies (No.)	Members (No.)	Licence holders (No.)	Illegal fishing cases (No.)
2016-17	1.974	1.38	340	0.65	6	531	340	4

MINIMUM ALLOWABLE SIZE FOR MAJOR COMMERCIAL SPECIES IN RESERVOIRS OF HIMACHAL PRADESH

1.	*L. rohita*	40 cm
2.	*C. catla*	45 cm
3.	*C. mrigala*	30 cm
4.	*C. carpio*	30 cm
5.	*H. molitrix*	45 cm
6.	*C. idellus*	45 cm
7.	*T. putitora*	50 cm
8.	*Schizothorax spp.*	40 cm