Evolution of Fisheries and Aquaculture in India

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Table 7. Present and projected area, fish production and input requirement for freshwater aquaculture in India

State	Total area(m ha)	Projected water area coverage(m ha)	Present Production (m t)	Projected fish production (m t)	Projected yield (t ha^{-1} yr^{-1})	Present Total Seed production (million fry)	Projected Seed production (million fry)	Projected feed requirement (000 t)
Andhra Pradesh	0.517	0.2	0.18	0.66	3.3	709	3020	1170
Assam	0.023	0.015	0.03	0.054	3.6	2547.54	222	93
Bihar	0.095	0.069	0.13	0.2	2.9	332.2	860	295
Goa	0.003	0.002	0.001	0.003	1.5	0.03	15	3
Gujarat	0.071	0.04	0.04	0.1	2.5	191.17	440	130
Haryana	0.01	0.009	0.026	0.054	6	200.73	212	116
Himachal Pradesh	0.001	0.001	0.002	0.001	1	23.1	5.6	1.75
Jammu & Kashmir	0.017	0.009	0.005	0.022	2.44	12.6	98	28
Karnataka	0.414	0.15	0.07	0.155	1.03	164.34	1240	85
Kerala	0.003	0.002	0.005	0.008	4	20.26	32	14.5
Madhya Pradesh	0.119	0.07	0.07	0.16	2.29	564.34	740	190
Maharashtra	0.05	0.03	0.04	0.06	2	293	320	65
Orissa	0.114	0.07	0.093	0.2	2.86	186.69	860	295
Punjab	0.007	0.007	0.026	0.044	6.29	44	172	96
Rajasthan	0.18	0.065	0.005	0.09	1.38	175	600	95
Tamil Nadu	0.224	0.1	0.08	0.16	1.6	467.43	1040	130
Uttar Pradesh	0.162	0.089	0.1	0.29	3.26	546.62	1160	460
West Bengal	0.276	0.22	0.58	0.96	4.36	8180	3800	1850
North-eastern region	0.072	0.05	0.028	0.09	1.8	334.78	520	85
Other States	0.001	0.001	0.001	0.001	1	14.52	6	2.25
Total	2.358	1.199	1.512	3.312	2.76	15 007.35	15 362.6	5204.5

(modified Gopakumar *et al*., 1999)

marked for its abandoned river beds (beels) supporting rich fishery. Catfishes and major and minor carps dominate the commercial catches of upper middle and lower stretches, while the commercial catch in lower-middle stretch is primarily composed of catfish and miscellaneous catch.

Table 8. Profile of various river systems in India

River system	Name of main Rivers	Approx. Length (km)	States
Himalayan or Extra- Peninsular rivers			
Ganga	Ganga	2525	Uttar Pradesh, Bihar, West Bengal
	Ramganga	569	Uttar Pradesh
	Gomti	940	Uttar Pradesh
	Ghagra	1080	Uttar Pradesh, Bihar
	Gandak	300	Bihar
	Kosi	492	Bihar
	Subarnarekha	395	Bihar, Orissa, West Bengal
	Yamuna	1376	Punjab, Haryana, Delhi, Uttar Pradesh
	Chambal	1080	Madhya Pradesh, Uttar Pradesh, Rajasthan
	Tons	264	Uttar Pradesh
	Son	784	Uttar Pradesh
	Ken	360	Madhya Pradesh
Brahmaputra	Brahmaputra, Dibang, Siang, Lohit, Manas, Buri Dihang, Dhansiri, Koppili	4000	Arunachal Pradesh, Assam, Nagaland, Sikkim, Manipur
Indus	Jhelum	400	Jammu & Kashmir
	Chenab	330	Jammu & Kashmir, Himachal Pradesh
	Beas	460	Himachal Pradesh, Punjab
	Sutlej		Himachal Pradesh, Punjab
	Ravi		Jammu & Kashmir, Himachal Pradesh, Punjab
Peninsular rivers			
East Coast	Mahanadi	851	Orissa, Madhya Pradesh
	Brahmani	799	Orissa, Bihar
	Godavari	1465	Maharashtra, Andhra Pradesh
	Krishna	1401	Maharashtra, Andhra Pradesh, Karnataka
	Cauvery	800	Karnataka, Tamil Nadu
	Pennar	597	Karnataka, Andhra Pradesh
	Bhima	861	Karnataka
West Coast	Narmada	1322	Maharashtra, Gujarat, Madhya Pradesh
	Tapti	720	Gujarat, Maharashtra
	Mahi	583	Gujarat
	Sabarmati	371	Gujarat, Rajasthan

Source: Jhingran, 1991; Rao, 1979; Sinha and Katiha, 2002 & Anon., 2000

In the case of the Indus river system, Indus and its tributaries in the upper and Beas and Sutlej in the lower reaches are important from Indian fisheries viewpoint. Its headwaters in the states of Kashmir, Himachal Pradesh and Punjab mainly harbour mahseer, snow trout, some cyprinids and exotic trouts. The rivers Beas and Sutlej contain indigenous carps and catfishes which are commercially exploited.

The Peninsular Rivers

The torrential and rain fed peninsular rivers have well defined stable courses. These include two river systems along the east and west coasts. The east coast river system has vast expanse of water in the states of Orissa, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. This river system with its four main constituent rivers, the Mahanadi, the Godavari, the Krishna and the Cauvery have a combined length of 6437 km and catchment area of 121 million ha. This system drains the entire peninsular India, east of western ghats in the west and south parts of central India. Besides its own fish fauna of several carps, catfishes, murrels and prawn, the system is repeatedly enriched by transplantation of Gangetic carps.

The combined length of rivers of the west coast river system and catchment area are 3380 km and 69.16 million ha. respectively. The Narmada and the Tapti are the longest rivers of this system along with 600 small rivers. Its rivers are distributed in the states of Gujarat, Maharashtra and Madhya Pradesh. The fish fauna of the system consists of carps, catfishes, mahseers, prawns etc.

The riverine resources have a major share in the inland capture fish production. In the past few decades the riverine ecosystem witnessed marked alterations due to serious human interventions in the form of water abstraction, dam construction, sedimentation and irrational fishing. These had discerningly disturbing effect on the natural riverine fish production which showed continuous declining trend. The studies made by the Central Inland Fisheries Research Institute, Barrackpore revealed that the average yield of major carps from the Ganga river system declined from 26.62 kg ha^{-1} $year^{-1}$ during1958-61 to 2.55 kg ha^{-1} $year^{-1}$ during 1989-95. The fishery of anadromous *Hilsa* have declined by 96% upstream of Farakka after construction of the Farakka barrage in 1974. The examples of Ganga river system may be cited to depict the status of fish production in all the rivers of India. The restoration of riverine fisheries would entail an integrated

approach encompassing the requirements of fisheries alongwith other uses of land and water.

Reservoirs

During post independence period, large number of river valley projects created a chain of impoundments which are highly conducive for fishery activities. These man made water bodies created by obstructing the surface flow by erecting a dam of any description on a river, stream or any water course are called reservoirs (Sugunan, 1995). These are generally classified into small (<1000 ha), medium (1000-5000 ha) and large (>5000 ha). The area under these water bodies is on a continuous increase by adopting more and more reservoirs for fisheries. At present the total reservoir area is 3.15 million ha (Table 9), out of which small reservoirs occupy 1.49 million ha followed by large (1.14 million ha) and medium (0.52 million ha) reservoirs. Among the states, maximum percentage area under reservoirs is in Madhya Pradesh (14.6) followed by Andhra Pradesh (14.5), Karnataka (13.8) and Tamil Nadu (11.3). Among different sized reservoirs, maximum annual production is from small reservoirs (49.9 kg ha^{-1}) followed by medium (12.3 kg ha^{-1}) and large (11.43 kg ha^{-1}) with an average of 20.13 kg ha^{-1} (Sugunan, 1995). Despite the amenability for fish production and a production potential in the range of 50-300 kg ha^{-1}, the present yield from reservoirs in India is very low. The large and medium reservoirs are generally managed as stocking cum capture fisheries resources. Management policies based on norms of stock manipulation through selective stocking and harvesting operations have been suggested to rectify the imbalances in species spectrum and to increase fish yield. For small reservoirs, culture based management is considered the best.

Floodplain wetlands

India has extensive floodplains in the form of oxbow lakes (mauns, beels, chaurs and jheels) especially in the states of Assam, Bihar and West Bengal (Table 10). These are shallow, nutrient rich water bodies formed due to change in course of the river. Some of these retain connection with the main river, atleast in monsoons, while others have lost it permanently (Sinha, 1997). Due to their high production potential these are adopted for aquaculture based capture fisheries. The areas having river connections can be exploited optimally by keeping the deeper central zones exclusively for capture fisheries and renovating the marginal pockets for culture fisheries.

Table 9. State and size-wise distribution of reservoirs in India

State	Size											
	Small reservoirs			Medium reservoirs			Large reservoirs			Total		
	Area (ha)	(% of total)	Yield (kg ha^{-1})	Area (ha)	(% of total)	Yield (kg ha^{-1})	Area (ha)	(% of total)	Yield (kg ha^{-1})	Area (ha)	(% of total)	Yield (kg ha^{-1})
Tamil Nadu	315941	21.27	48.50	19577	3.71	13.74	23222	2.04	12.66	358740	11.38	22.63
Karnataka	228657	15.39	—-	29078	5.51	—-	179556	15.75	—-	437291	13.87	—-
Madhya Pradesh	172575	11.62	47.26	169502	32.13	12.02	118307	10.38	14.53	460384	14.60	13.68
Andhra Pradesh	201927	13.58	188.00	66429	12.59	22.00	190151	16.68	16.80	458507	14.54	36.48
Maharashtra	119515	8.05	21.09	39481	7.48	11.83	115054	10.09	9.28	273750	8.68	10.21
Gujarat	84124	5.66	—-	57748	10.95	—-	144358	12.66	—-	286230	9.08	—-
Bihar	12461	0.84	3.91	12523	2.37	1.90	71711	6.29	0.11	96695	3.07	0.05
Orissa	66047	4.45	25.85	12748	2.42	12.76	119403	10.47	7.62	198198	6.29	9.72
Kerala	7975	0.54	53.50	15500	2.94	4.80	6160	0.54	—-	29635	0.94	23.37
Uttar Pradesh	218651	14.72	14.60	44993	8.53	7.17	71196	6.24	1.07	334840	10.62	4.68
Rajasthan	54231	3.65	46.43	49827	9.45	24.47	49386	4.33	5.30	153444	4.87	24.89
Himachal Pradesh	200	0.01	—-	—-	—-	—-	41364	3.63	35.55	41564	1.32	35.55
North-east	2239	0.15	—-	5835	1.11	—-	—-	—-	—-	8074	0.26	—-
Haryana	282	0.02	—-	—-	—-	—-	—-	—-	—-	282	0.01	—-
West Bengal	732	0.05	—-	4600	0.87	—-	10400	0.91	—-	15732	0.50	
Total	1485557	47.11*	49.90	527541	16.73*	12.30	1140268	36.16*	11.43	3153366	100.00	20.13

* percent of total area under reservoir in India

Source: Sugunan, 1995 & Sinha and Katiha, 2002

Table 10. The floodplain wetlands of India

State	River basin	Local name	Area (ha)
Arunachal Pradesh	Kameng, Subansiri, Siang, Dibang, Lohit, Dihang, Tira,	Beel	2500
Assam	Brahmaputra and Barak	Beel	100000
Bihar	Gandak and Kosi	Mauns and Chaurs	40000
Manipur	Iral, Imphal, Thoubal	Pat	16500
Meghalaya	Someshwari and Jinjiram	Beel	213
Tripura	Gumti	Beel	500
West Bengal	Ganga and Ichhamati	Beel	42500
Total			202213

Source: Sinha, 1997 & Sinha and Katiha, 2002

Brackishwater

The data on concentration and distribution of area, production and yield for brackishwater shrimp farms in different states for 1990-91 to 2002-03 is given below (Anon., 2001).

The area along the coastline of India suitable for shrimp culture was estimated at 1.19 million ha, out of which only 13.14% (0.156 million ha) was under farming during 2001-02 (Table 11). The area covered by shrimp farms in the coastal regulation zone (CRZ) along the entire coast line is almost same as 1997-98 due to the Supreme Court ban on new farms in the CRZ in December 1996. It allowed new farms which follow traditional culture practices (extensive/modified extensive). In order to ensure the implementation of directive of the Court, an Aquaculture Authority of India was set up with Headquarters at Chennai.

Out of the total area under shrimp culture the highest area is in Andhra Pradesh, followed by West Bengal, Kerala, Orissa, Karnataka and Tamil Nadu. The area under culture in other states was less than 1000 ha.

The estuarine capture fishery forms an important component of inland fisheries (Sinha, 1997). The open estuarine system includes Hoogly-Matlah and Mahanadi estuaries (Table 12). Godavari estuary is the main estuary of peninsular India, Chilka, Pulicat and Vembanad are the important brackishwater lagoons. These estuaries and lagoons are recognised as excellent sources for fish and prawn seed. The fisheries of the estuaries are considered as above the subsistence level. The average yield varies between 45 and 75 kg ha^{-1}.

Table 11 State wise area under shrimp farming in India (000ha)

State	Estimated potential area	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	2001-2002	2002-03
West Bengal	405.00	33.82	33.92	34.05	34.15	34.40	34.66	42.61	42.53	42.07	42.07	42.07	46.75	49.05
	(34.01)	(51.95)	(49.71)	(48.16)	(41.37)	(34.16)	(29.13)	(31.42)	(30.03)	(29.66)	(29.66)	(29.66)	(29.87)	(32.25)
Orissa	31.60	7.08	7.42	7.76	8.15	8.50	11.00	11.33	11.33	8.00	8.00	8.00	8.12	9.00
	(2.65)	(10.87)	(10.87)	(10.98)	(9.87)	(8.44)	(9.25)	(8.36)	(8.00)	(5.64)	(5.64)	(5.64)	(5.20)	(5.92)
Andhra Pradesh	150.00	6.00	8.10	9.50	19.50	34.50	50.00	60.25	66.29	71.00	71.00	71.00	79.60	71.42
	(12.60)	(9.22)	(11.87)	(13.44)	(23.62)	(34.26)	(42.02)	(44.43)	(46.82)	(50.06)	(50.07)	(50.07)	(50.86)	(46.96)
Tamil Nadu	56.00	0.25	0.48	0.53	1.05	2.00	2.88	0.64	0.67	1.09	1.09	1.09	2.48	3.63
	(4.70)	(0.38)	(0.70)	(0.75)	(1.27)	(1.99)	(2.42)	(0.47)	(0.47)	(0.77)	(0.77)	(0.77)	(1.58)	(2.38)
Pondicherry	0.80	N.A.	N.A.	N.A.	N.A.	N.A.	0.04	0.02	0.02	0.02	N.A.	N.A.	N.A.	N.A.
	(0.07)						(0.03)	(0.02)	(0.02)	(0.02)				
Kerala	65.00	13.00	13.15	13.40	13.86	14.10	14.66	14.66	14.60	14.71	14.71	14.71	14.70	13.68
	(5.46)	(19.97)	(19.27)	(18.95)	(16.79)	(14.00)	(12.32)	(10.81)	(10.31)	(10.37)	(10.37)	(10.37)	(9.40)	(9.00)
Karnataka	8.00	2.50	2.54	2.57	2.60	3.50	3.50	3.50	3.54	3.56	3.56	3.56	3.08	3.04
	(0.67)	(3.84)	(3.73)	(3.64)	(3.15)	(3.48)	(2.94)	(2.58)	(2.50)	(2.51)	(2.51)	(2.51)	(1.97)	(2.00)
Goa	18.50	0.53	0.53	0.55	0.58	0.60	0.65	0.68	0.65	0.65	0.65	0.65	0.93	0.93
	(1.55)	(0.81)	(0.77)	(0.78)	(0.70)	(0.60)	(0.55)	(0.50)	(0.46)	(0.46)	(0.46)	(0.46)	(0.59)	(0.61)
Maharashtra	80.00	1.80	1.87	1.98	2.18	2.40	0.72	0.93	0.97	0.43	0.43	0.43	0.30	0.46
	(6.72)	(2.77)	(2.74)	(2.80)	(2.64)	(2.38)	(0.60)	(0.69)	(0.69)	(0.30)	(0.30)	(0.30)	(0.19)	(0.30)
Gujarat	376.00	0.13	0.23	0.36	0.48	0.70	0.88	1.00	1.00	0.32	0.32	0.32	0.54	0.88
	(31.57)	(0.19)	(0.34)	(0.51)	(0.58)	(0.70)	(0.74)	(0.74)	(0.70)	(0.22)	(0.22)	(0.22)	(0.34)	(0.58)
Total	1190.90	65.09	68.23	70.70	82.54	100.70	118.98	135.61	141.59	141.84	141.82	141.82	156.50	152.08

The figures in parentheses represent the percentage of the total

Source: modified Anon., 2001, 2002 and Jose, 2003

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Inland ecosystems

The inland fishery waters can be categorised into aquacultural waters, rivers, reservoirs, floodplain wetlands and estuaries. The details of their expanse in different states, production and production potential, yield etc. (Sinha and Katiha, 2002) are summarised below.

Freshwater aquacultural water bodies or ponds

By virtue of its geographical situation in the monsoon belt, India is endowed with good rainfall and consequently extensive aquacultural water bodies. The inland aquacultural water resources in the form of ponds and tanks have been distributed almost all the states of India (Table 5). These bodies have over 2.85 million ha area with maximum in the state of Tamil Nadu (0.69 million ha) followed by Andhra Pradesh (0.52 million ha) and Karnataka (0.41 million ha). These states account for about 57% of aquacultural waters of the country.

Despite immense efforts for horizontal expansion of this industry, only 0.8 million ha area could be brought under scientific fish culture. In the early seventies, with World Bank assistance, Fish Farmers' Development Agency (FFDA) has been set up with the objectives of promotion of pond fish culture and adoption of modern aquacultural techniques to achieve high fish production. This agency has adopted over half of the area used for fish culture. The maximum percentage of area covered by FFDA was in the states of Punjab and Haryana where fish farmers were taking more than one crop. The productivity was also highest for Punjab at 4085 kg ha^{-1} $year^{-1}$ followed by Haryana at 3501 kg ha^{-1} yr^{-1}. The national average productivity from FFDA supported ponds has increased from 50 kg ha^{-1} yr^{-1} in 1974-75 to about 2135 kg ha^{-1} yr^{-1} in 1994-95. During IX plan, the stress was on strengthening the technical wings of FFDA to assist fish farmers to adopt various improved packages and practices of aquaculture. It also emphasized on expansion of prawn farming and setting up of medium sized fish feed units (Anon., 1996 a).

Despite immense efforts for horizontal expansion of this industry, only

Table 5. Aquacultural water bodies in India

State	Total area (million ha)		Covered area (000 ha)	% of state area covered	Production (t)	Yield (kg ha^{-1} year^{-1})
Andhra Pradesh	0.517	(18.13)	13.72	2.65	26074	1900
Arunachal Pradesh	0.001	(0.04)	0.16	16.40	180	1098
Assam	0.023	(0.81)	3.44	14.97	6368	1850
Bihar	0.095	(3.33)	22.31	23.49	47527	2130
Goa	0.003	(0.11)				
Gujarat	0.071	(2.49)	30.93	43.57	34027	1100
Haryana	0.01	(0.35)	18.57	185.70	65005	3501
Himachal Pradesh	0.001	(0.04)	0.26	26.30	658	2502
Jammu & Kashmir	0.017	(0.60)	1.56	9.15	2022	1300
Karnataka	0.414	(14.52)	21.70	5.24	31898	1470
Kerala	0.03	(1.05)	4.00	13.34	7202	1800
Madhya Pradesh	0.119	(4.17)	54.96	46.19	86292	1570
Maharashtra	0.05	(1.75)	11.31	22.63	6109	540
Manipur	0.005	(0.18)	1.79	35.82	2507	1400
Meghalaya	0.002	(0.07)	0.03	1.25	18	720
Mizoram	0.002	(0.07)	0.15	7.30	219	1500
Nagaland	0.05	(1.75)	1.16	2.33	1163	1000
Orissa	0.114	(4.00)	39.84	34.95	75698	1900
Punjab	0.007	(0.25)	12.15	173.57	49628	4085
Rajasthan	0.18	(6.31)	4.17	2.32	7211	1730
Sikkim			0.06		196	3500
Tamil Nadu	0.691	(24.23)	12.15	1.76	16521	1360
Tripura	0.012	(0.42)	3.33	27.78	6666	2000
Uttar Pradesh	0.162	(5.68)	69.21	42.72	138410	2000
West Bengal	0.276	(9.68)	98.78	35.79	296349	3000
Pondicherry			0.07		75	1119
Other States	0.003	(0.11)				
Total	2.852	(100.00)	425.82	14.93	908023	2135

Source: Anon., 1996a, b & Sinha and Katiha, 2002
The covered area, production and yield are under farms adopted by FFDA. Figures in parentheses represent percent of total area

one third of the total potential aquacultural water area could be brought under scientific fish culture. The untapped production potential can be harnessed through effective and intensive adoption of available technologies, transfer of technical know-how and provision for material inputs. Flexibility in areas of operation and scales of investments, and compatibility of freshwater aquaculture practices with other farming systems coupled with high potentials of eco-restoration have provided congenial environment to establish it as a fast growing activity. Considering its potential and impressive annual growth rate of over 6%, Government of India is also emphasizing on aquaculture development. The national freshwater aquaculture development plan has proposed to increase the area under

aquaculture to 1.2 million ha (Table 6), with average productivity of 2762 kg $ha^{-1}yr^{-1}$ (Gopakumar *et al*., 1999). To achieve this goal, suitable strategies for enhancement of area coverage and productivity are needed considering components of horizontal and vertical expansion in concurrence with the potential and problems of different states. In summary, to achieve the targeted fish production, an increment of 45.2% in area coverage and 50.9% in productivity is needed.

The state-wise distribution of area under ponds and tanks according to their production potential and projected productivity is summarized in Table 6. The increase in area under different production levels as a percentage of total projected area (1.2 million ha) shows 3.67% for 8 t $ha^{-1}yr^{-1}$, 0.50% for 6 t $ha^{-1}yr^{-1}$, 16.51% for 5 t $ha^{-1}yr^{-1}$, 34.33% for 3 t $ha^{-1}yr^{-1}$, 17.48% for 2 t $ha^{-1}yr^{-1}$, 19.17% for 1 t $ha^{-1}yr^{-1}$ and 8.34% for 0.5 t $ha^{-1}yr^{-1}$. The major emphasis is to have a yield of 3 t or less on area of 79%. It seems to be a viable and realistic proposition.

In addition to more land dedicated to ponds and tanks, an increase in fish production levels would require more seed and feed. The requirements are detailed in Table 7. At present 15007 million fry produced each year supply for both the culture and the culture-based fisheries. To reach the target production levels, almost the same amount of fry would be needed to supply for the culture fisheries alone (Katiha, 2000). The projected seed requirement could be supplied by new hatcheries in seed-deficit states and/ or imported from seed-surplus states. The projected area required for brood-stock management and seed rearing is 79950 ha, about 6.7% of the projected culture area in the country.

Rivers

The river systems of India may be classified into two major groups, namely, Himalayan or extra-peninsular rivers and peninsular rivers (Table 8). The general profile of these groups is mentioned below.

The Himalayan or Extra-Peninsular Rivers

Originating from the Himalayas to transverse great alluvial Indo-Gangetic plains, these snow and rainfed rivers are characterised by complicated flood regimes and seasonal variations in volume of flow. Descending on the plains, they become sluggish and inundate vast land area. These rivers may be categorised into three systems, the Ganga, the Brahmaputra and the Indus. The Ganga river system has a combined length of 12500 km and a catchment area of 97.6 million ha. The Ganga, Ghagra,

Table 6. Projected water spread ('000 ha) under different production levels

State	Production levels (t ha^{-1} $year^{-1}$)							
	8	6	5	3	2	1	0.5	Total
Andhra Pradesh	20		50.0	60.0		70.0		200.0
Assam			6.0	6.0	3.0			15.0
Bihar			10.0	30.0	30.0			70.0
Goa					1.5			1.5
Gujarat				20.0	20.0			40.0
Haryana	2.0	3.0	4.0					9.0
Himachal Pradesh				0.3	0.2			0.5
Jammu & Kashmir				4.0	5.0			9.0
Karnataka				10.0	20.0	50.0	70.0	150.0
Kerala			1.0	1.0				2.0
Madhya Pradesh				20.0	50.0			70.0
Maharashtra				10.0	10.0	10.0		30.0
Orissa			10.0	30.0	30.0			70.0
Punjab	2.0	3.0	2.0					7.0
Rajasthan			5.0	10.0		20.0	30.0	65.0
Tamil Nadu				20.0	20.0	60.0		100.0
Uttar Pradesh			10.0	80.0				90.0
West Bengal	20.0		100.0	100.0				220.0
North-east				10.0	20.0	20.0		50.0
Other States				0.5				0.5
Total	44.0	6.0	198.0	411.8	209.7	230.0	100.0	1199.5
% of total	3.67	0.50	16.51	34.33	17.48	19.17	8.34	100.00

Source: modified by Gopakumar *et al.,* 1999; Katiha and Bhatta, 2002

Gomti, Ramganga, Kosi, Gandak, Yamuna, Chambal, Sone and Tons are the major rivers of this system. These rivers are spread over most of the north Indian states (except the hilly states) to extend upto West Bengal through Bihar. In the upland waters of the system, commercial fisheries is virtually absent due to inaccessible terrain and other exploitation problems. The stretch of river Ganga from Haridwar to Lalgola is recognised as one of the richest source of capture fisheries in India, comprising highly priced major carps, *Hilsa* and catfishes. Mid September to June are peak months for fishing. During monsoon months the fishing activities are generally confined to riverbanks. The combined length of the Brahmaputra river system is 4023 km with catchment area of 51 million ha. Originating from Tibet the river flows through northern slopes of Himalayas to enter India at the north-east of Arunachal Pradesh. Brahmaputra has 918 km stretch in India, including 730 km in Assam alone. Its northern tributaries Subansiri, Kameng and Manas are large with steep, shallow-braided channels, whereas those on the southern bank, Buri Dihing, Dhansiri and Kopilli are deeper with meandering channels and low gradient. The Brahmaputra valley is