Public, Private or Cooperatives? The governance of Tawa reservoir fisheries, India

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Inland Fisheries Resources

Area under different water resources includes:

- **Rivers / Canals (195567 kms), Reservoirs (31.5 lakh ha)**
- **Tanks and Ponds (25.15 lakh ha)**
- **Flood Plain / Lakes & Derelict Water Bodies (9.98 lakh ha)**
- **Brackish Water (16.86 lakh ha)**

Area under reservoir in India is around 3.15 million ha. that includes:

- **19134 small size reservoirs with a total surface area of 1.48 million ha**
- **180 Medium sized reservoirs with a total surface area of 5. 27 million ha**
- **56 large reservoirs with a total area of 1.14 million ha.**

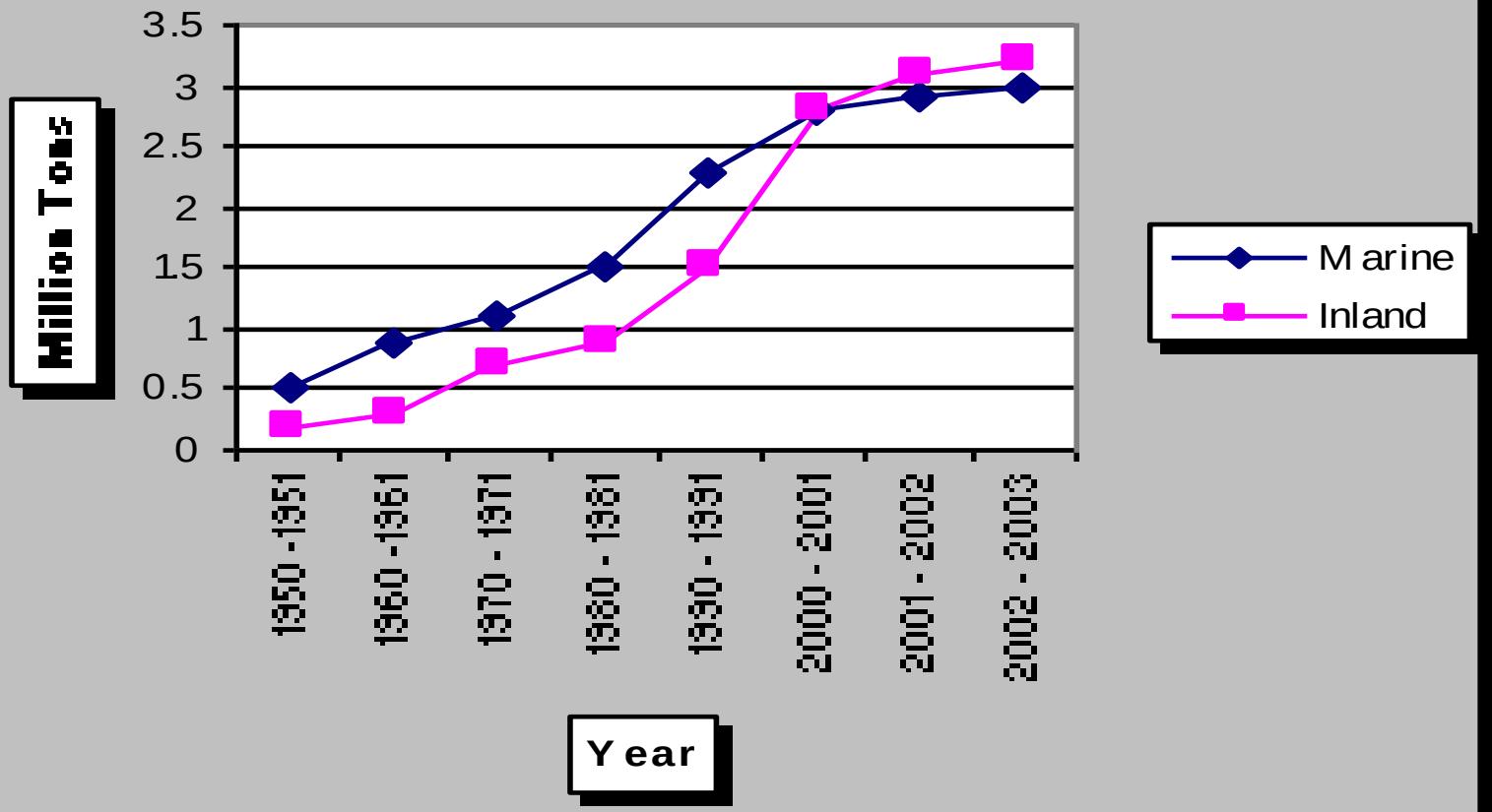
Important Facts About Fisheries Sector in India

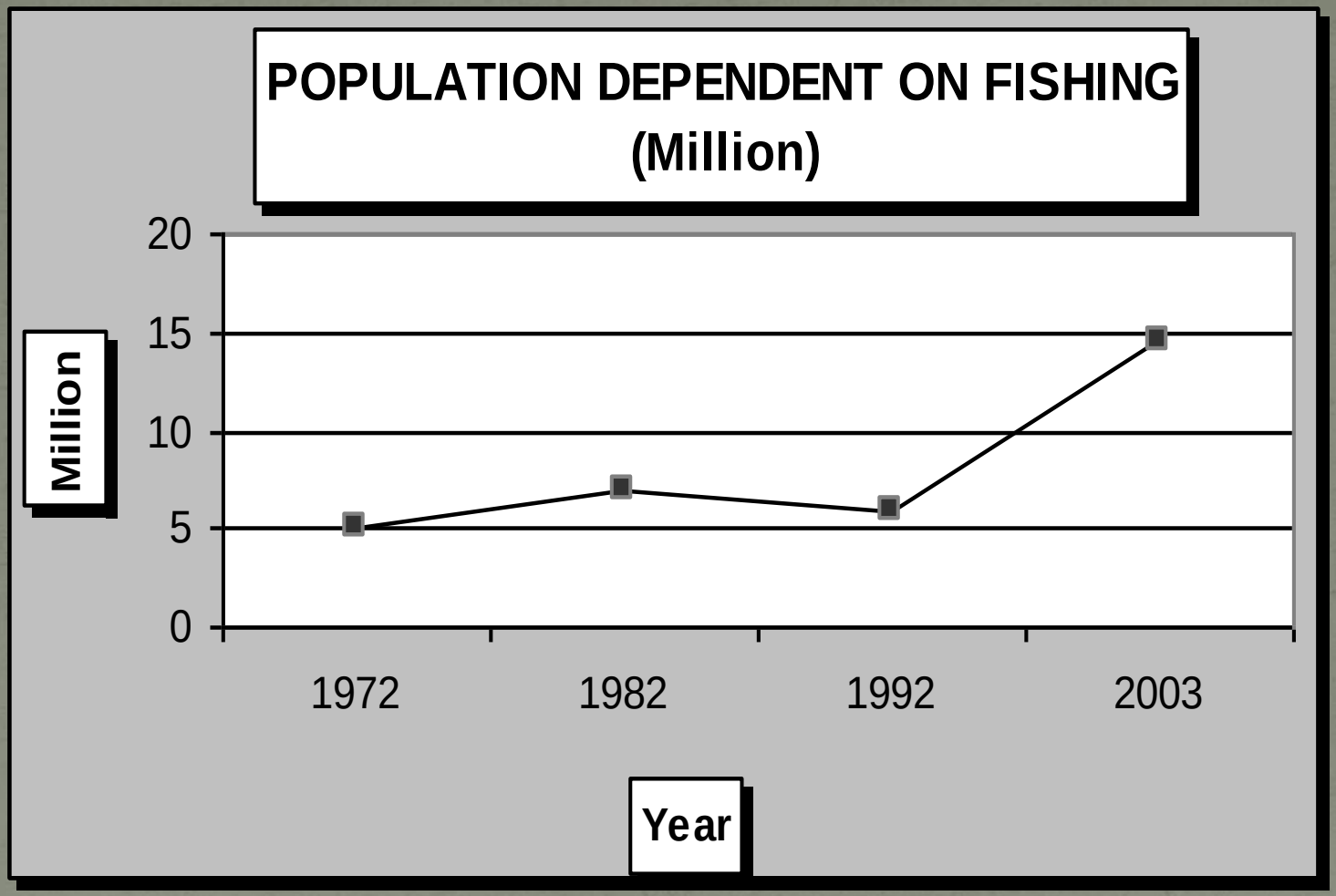
- India is the third largest producer of fish in the world and second largest producer in inland fishery sector (FAO, 1998)
- It provides employment to economically underprivileged population, particularly to the rural people. In the fishery sector alone, six million people including fisher folk and fish farmers are employed (Tenth plan documents 2002 - 2007, Planning Commission, GoI).
- Apart from contributing to the national economy, it provides - food and nutritional security. Fish serve as an important source of cheap animal protein, particularly for economically weaker sections of the society.

Overview of Fisheries Sector in India

- **Fishery sector contributes Rs. 19.555 corers to national income, which is 1.4 percent of the total Gross Domestic Product (GDP) in the year 2003.**
- **Fish production has increased with an annual growth rate of 4.1 percent during the last five decades.**
- **Drastic change in the composition of share in fish production from marine and inland sector: Up till 1990, marine sector had more share in fish production. However, from 1990 onwards the composition has substantially tilted towards inland sector.**

FISH PRODUCTION (MILLION TONS)




POPULATION DEPENDENT ON FISHING
(Million)
Million
20
15
10
5
0
1972
1982
1992
2003
Year

Estimated Demand Supply situation of fisheries in India (in 000' tones)

Year	Fish production (1)	Inland contribution (2)	Total Demand (3)	Domestic consumption (4)	Export (5)	Difference (3-1) (6)
2001	5909	2648 (44.81)	11030	5745	5285	5121
2002	6094	2739 (44.95)	11732	6065	5667	5638
2003	6279	2829 (45.05)	12548	6500	6048	6269
2004	6463	2920 (45.18)	13386	6955	6431	6923
2005	6648	3010 (45.28)	14127	7315	6812	7479

Note: Figures in the brackets are percentage share of inland fisheries to total fish production.

Source: Compiled from Bhattacharya (2002)

Yield variation in Reservoir Fisheries in India

Yield*	Small	Medium	Large	Total
Average	49.90	12.30	11.44	18.12
Standard Deviation	54.62	7.38	10.69	12.45
Coefficient of Variation	109.46	59.99	93.47	68.68
Maximum	188.00	24.47	35.55	36.48
Minimum	3.91	1.90	0.11	0.05

Note: * yield in kilogram per hectare per year

Source: Computed from Sinha and Katiha (2002)

Production Potential of Reservoirs

Category of reservoirs	Avg. fish yield (kg per ha)	Potential fish yield (kg per ha)
Small	49.90	100
Medium	12.30	75
Large	11.43	50

Source: Sugunan 1995

Bottlenecks in Reservoir Fisheries Growth

- Fisheries is not the Priority in Reservoirs case
- Lack of Skills in fishing
- External Problems Viz. Surrounded by forests of protected category
- CPR Nature of the resource

This demands an Institutional response that can lead to better management

Type of Institutions in Reservoir Fisheries Management

Type of Management	Characteristics
State Government	State fisheries department; manage all the reservoirs in the states.
Private institutions/ person / contractor	State fisheries department lease out the reservoirs to private contractors/ person for a period of time. Mean while it becomes a responsibility of that person to manage the resource.
Communities / Cooperatives	This is also called as collective actions. Groups of communities or people come forward for resource management
Co – management	In this responsibility of reservoir management is shared between the communities and state fisheries department.

On Choosing an Appropriate Institution

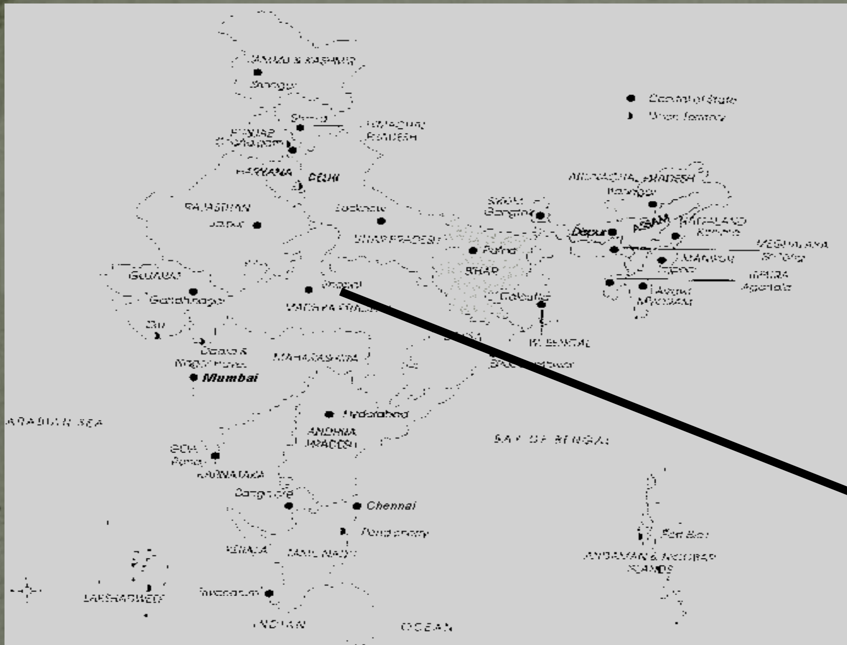
An Institutional arrangement that has little compromise on:

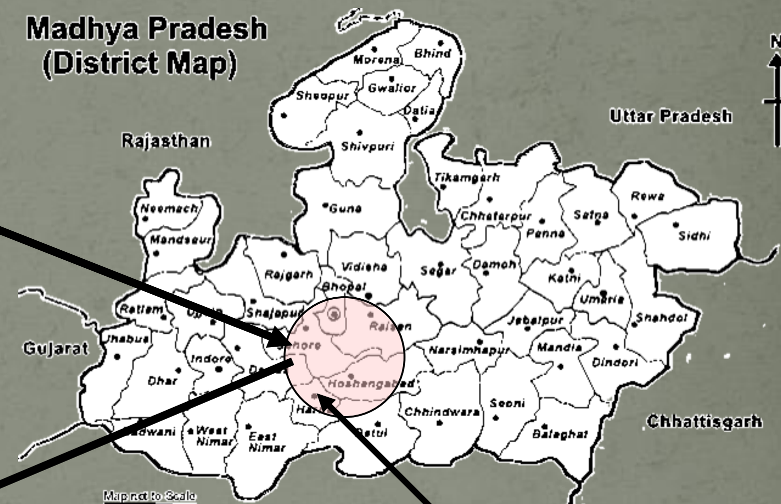
- Efficiency (*viz. Productivity as an immediate goal)*
- Equity *(viz. employment, livelihood and Welfare of the people dependent on this resource)*
- Ecological Sustainability (*viz. practices like fingerling dropping, use of gears etc.)*

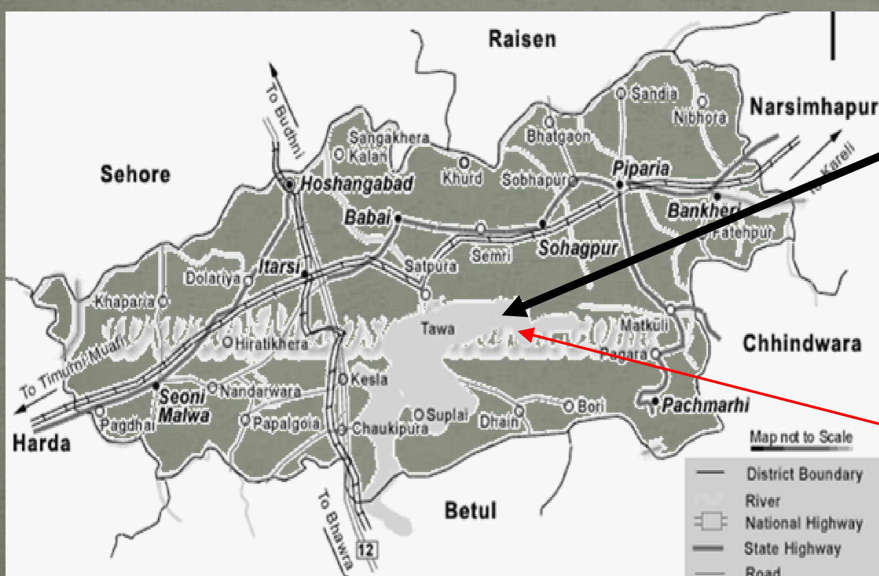
The Case of TAWA Reservoir

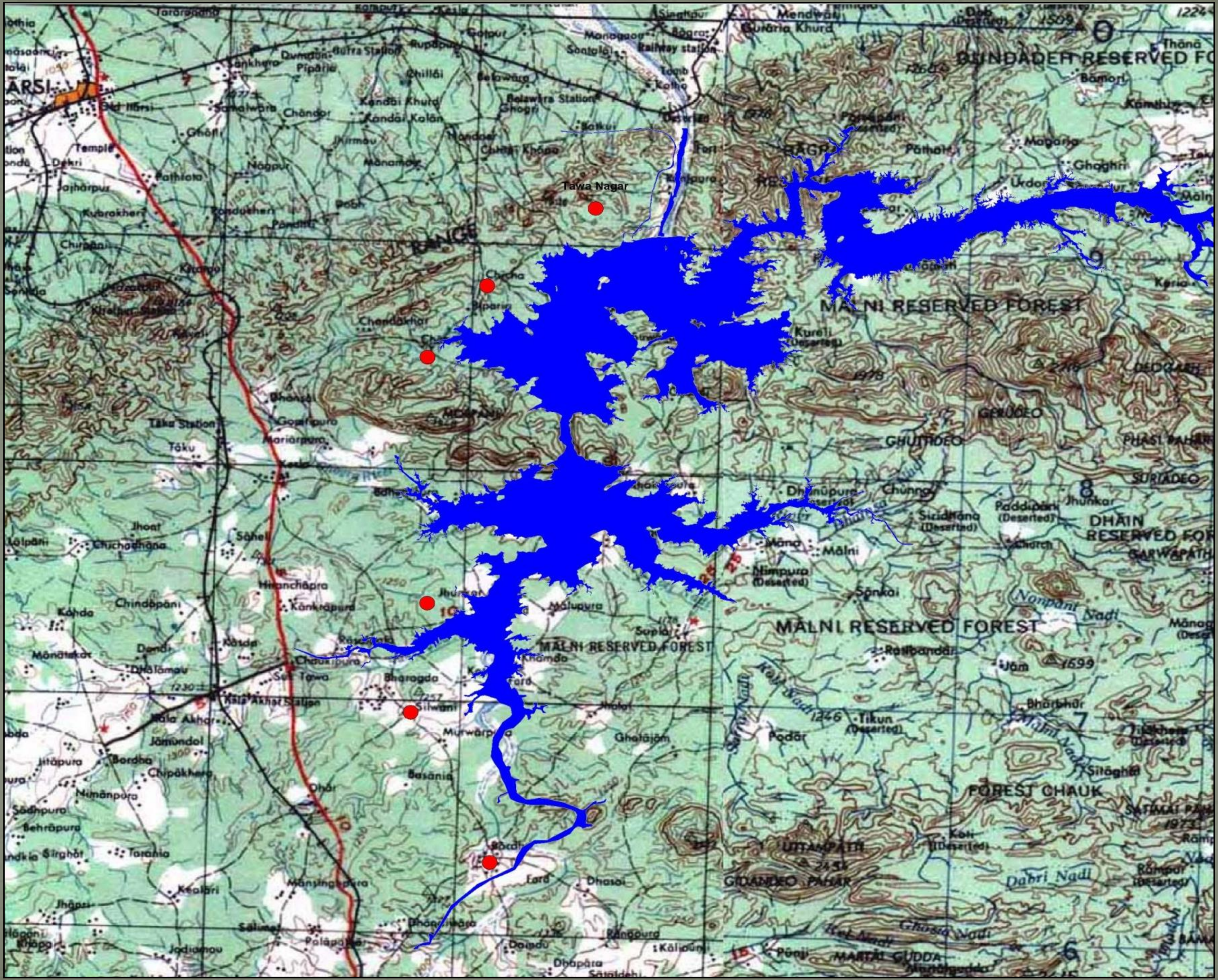
Why we Chose Tawa?

- Understanding Institutions is the Key to potential growth of reservoir fisheries.
- We were looking for a reservoir that has undergone different institutional regimes
- Tawa satisfies this condition.


Mumbai
Hyderabad
Chennai
BAY OF BENGAL
ARABIAN SEA
INDIAN
OCEAN


Madhya Pradesh
(District Map)
Rajasthan
Uttar Pradesh
Gujarat
Chhattisgarh
N
Morena
Bhind
Gwalior
Sheopur
Datia
Shivpuri
Guna
Tikamgarh
Chhatarpur
Neemuch
Mandsaur
Rajgarh
Vidisha
Bhopal
Sagar
Damoh
Panna
Satna
Rewa
Sidhi
Ratlam
Ujjain
Shajapur
Raisen
Katni
Umaria
Shahdol
Jhabua
Indore
Dewas
Sehore
Jabalpur
Narsimhapur
Mandla
Dindori
Dhar
Hoshangabad
Harda
Betul
Chhindwara
Seoni
Balaghat
West Nimar
East Nimar
Map not to Scale


Raisen
Narsimhapur
Sehore
Chhindwara
Harda
Betul
Sandia
Nibhora
Sangakhera Kalan
Bhatgaon
Hoshangabad
Khurd
Sobhapur
Piparia
Bankheri
Babai
Semri
Sohagpur
Fatehpur
Itarsi
Dolariya
Satpura
Khaparia
Tawa
Matkuli
Hiratikhera
Kesla
Pagara
Seoni Malwa
Nandarwara
Pachmarhi
Pagdhai
Papalgoia
Chaukipura
Suplai
Dhain
Bori
To Budhni
To Kareli
To Timurni Muari
To Bhawra
12
Map not to Scale
District Boundary
River
National Highway
State Highway
Road



Source: Terra server satellite image 1999 superimposed on Army map service (L.D.) U.S 1956

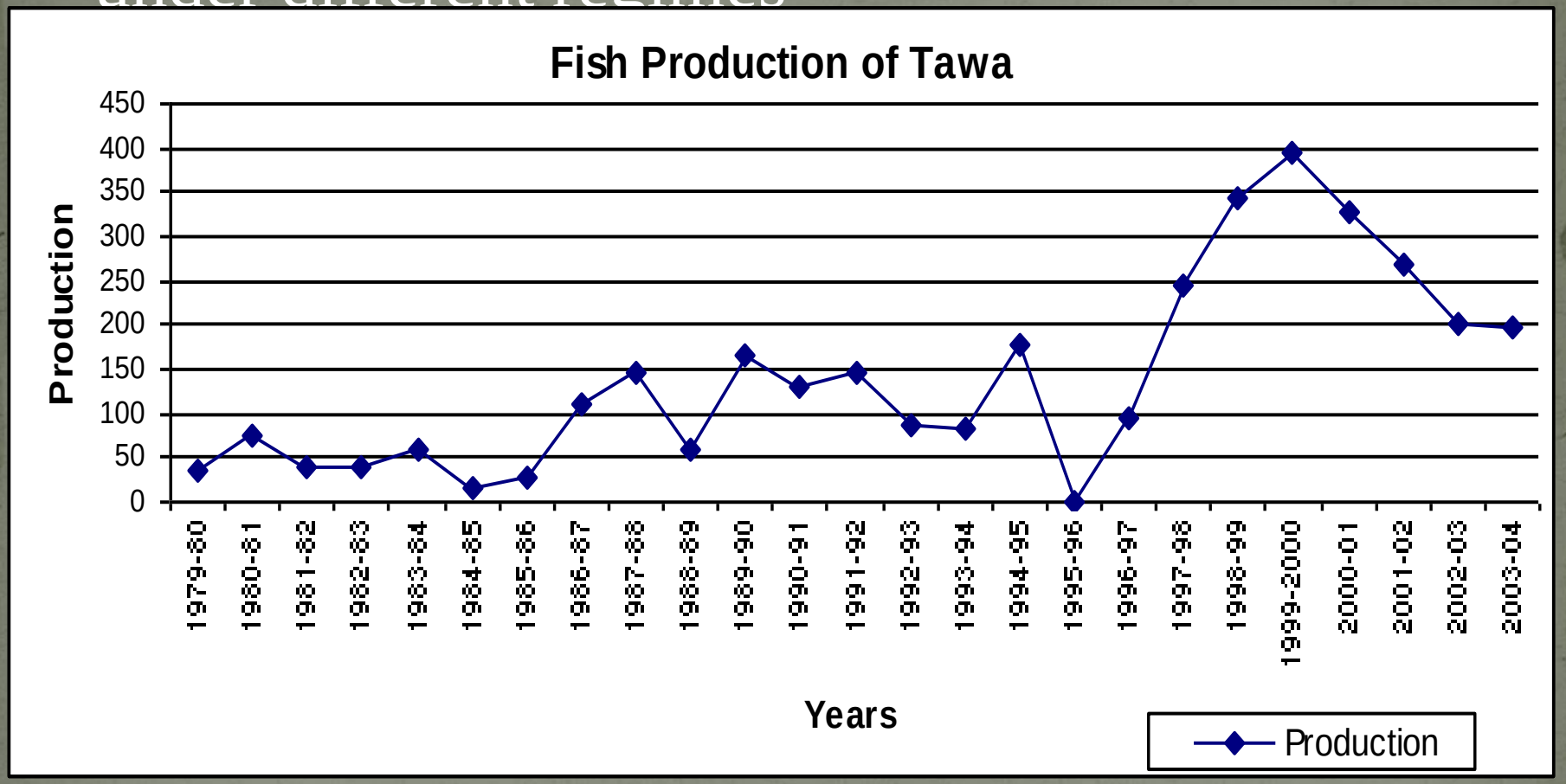
Brief Overview of Tawa

- Dam built on river Tawa a tributary of Narmada
- Construction started in 1956 and completed in 1974
- Fish production started in 1975
- Management was under fisheries department of state government, MPFDC, partial privatization in terms of lifting contract, private contractor, open access, cooperative.
- Majority of people involved in fishing are belong to Scheduled Tribe communities

Management Regimes in TAWA Reservoirs

Year	Tawa
1975-79	Fisheries Department
1979-89	MPFDC
1989-94	MPFDC (Lifting and Marketing Contract)
1994-95	Contractors
1995-96	Open Access
1996-2001	TMS
2001-2006	TMS (contract renewed)

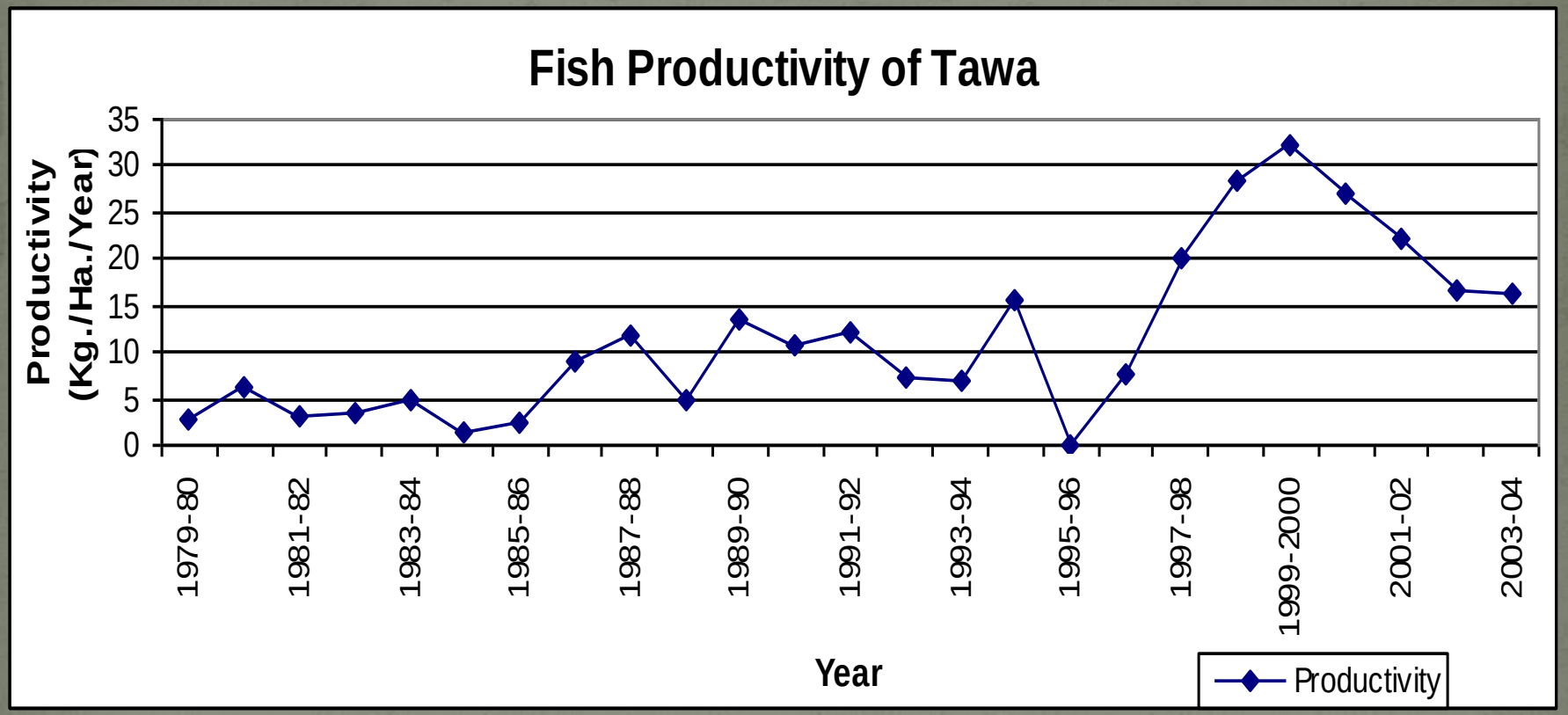
The Efficiency Angel: Fish *Production* in Tawa under different regimes



Note: Production in Metric Tonnes

Source: Sunil and Smita (1996) and Annual Reports of *Tawa Matsya Sangh*

Fish *Productivity* in Tawa under different regimes



$$Y_t = A \prod_{i=1}^{4} x_{it}^{\beta i} e_{it}$$

$$\ln Y_t = \alpha + \sum_{i=1}^{4} \beta_i \ln x_{it} + e_{it} \quad \text{where } \alpha = \ln A$$

$$\ln \hat{Y}_t = \alpha + \Sigma \beta_i \ln x_{it}$$

$$\ln Y_t - \ln \hat{Y}_t = e_{ti}$$

$$\ln \hat{Y}_{tMax} = (\alpha + e_{it\max}) + \Sigma \beta_i \ln x_{it}$$

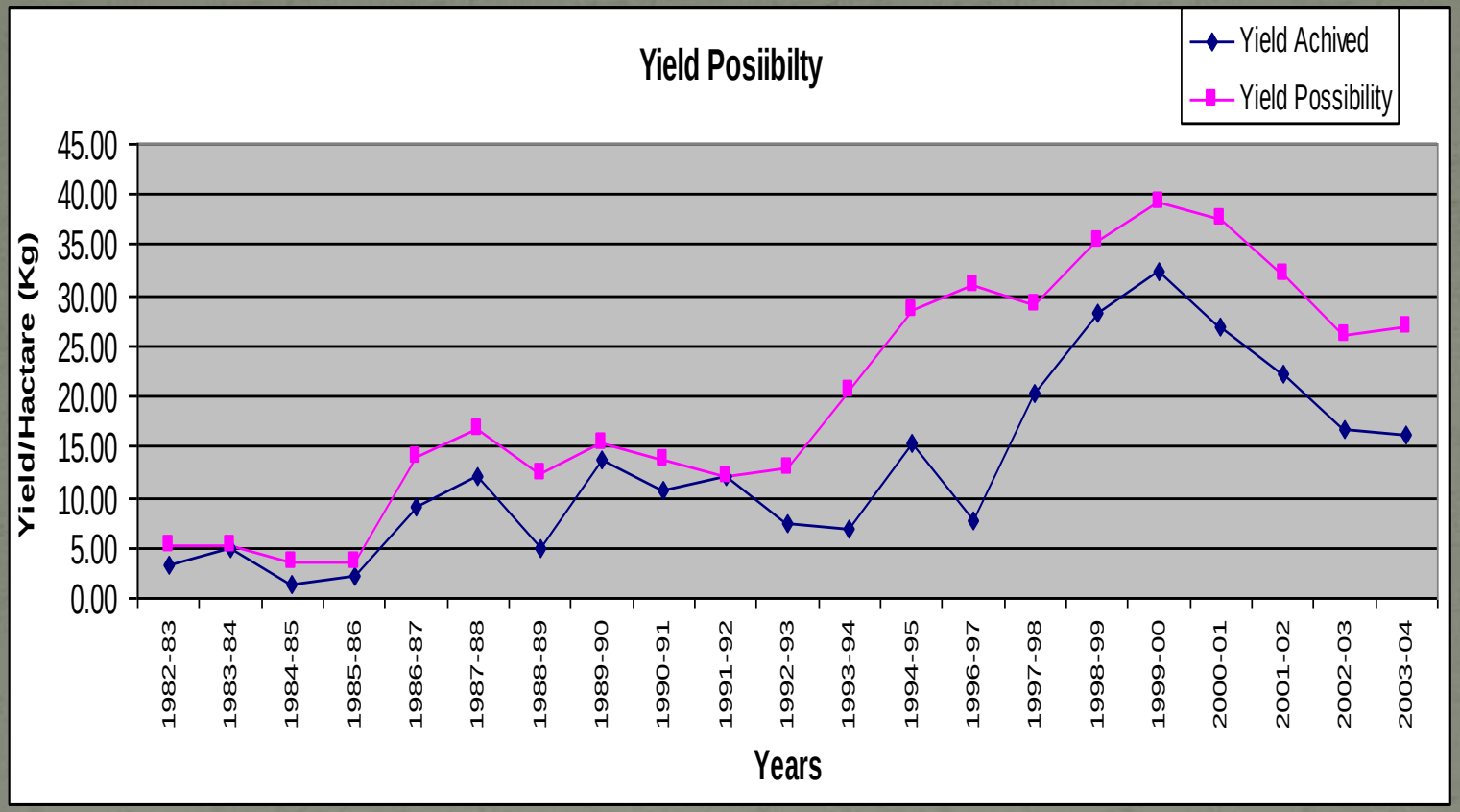
Factors determining productivity of regimes

	β- Coefficients	t-Stat
(Constant)	-2.668	-1.991***
LNFISHR – **β1**	1.212	4.112*
MPFDC – **β2**	-0.795	-2.030***
LCON – **β3**	-0.411	-1.697***
LNLAGSTR – **β4**	-0.120	-0.872

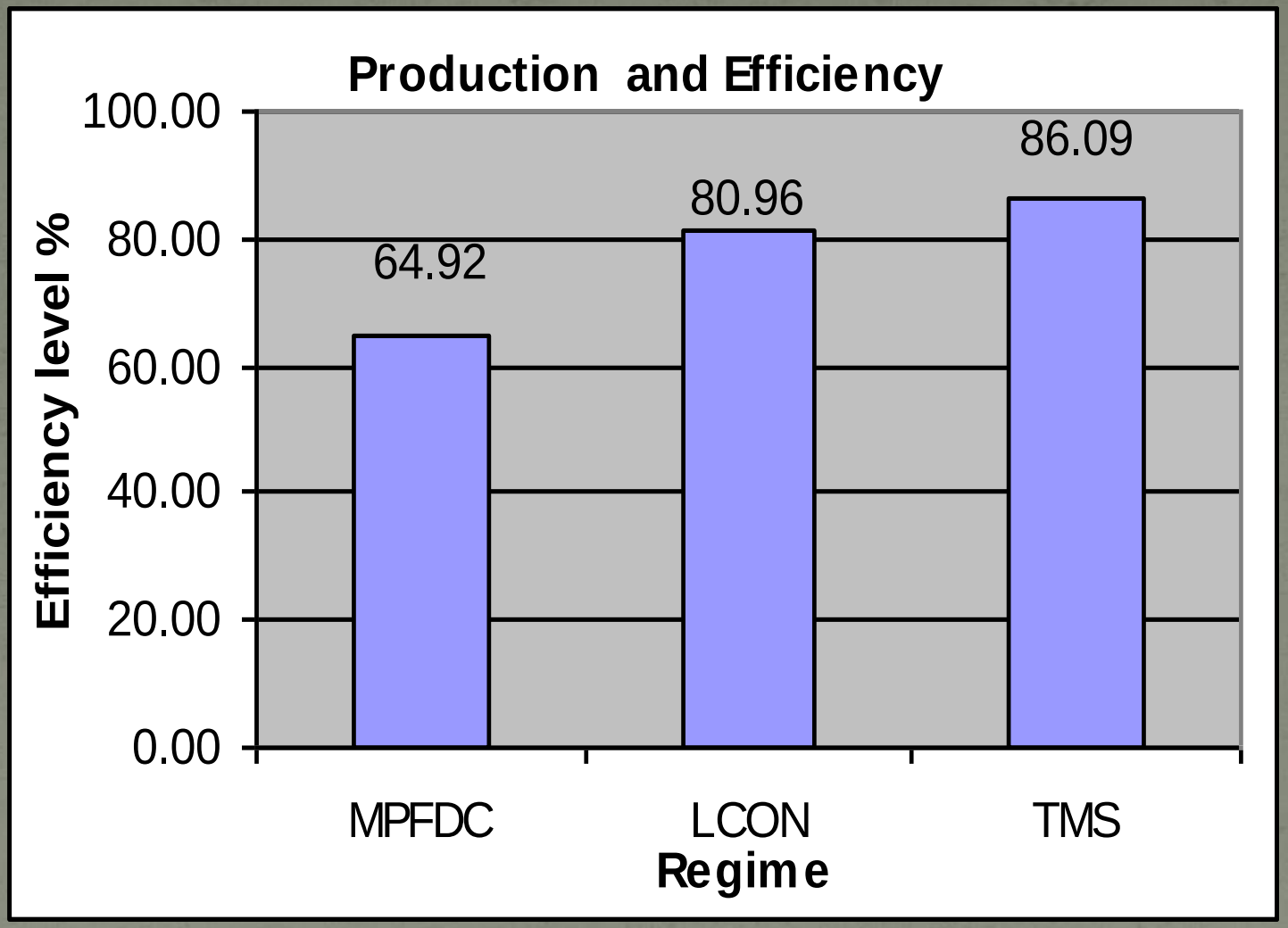
Adjusted R^2 = 0.79

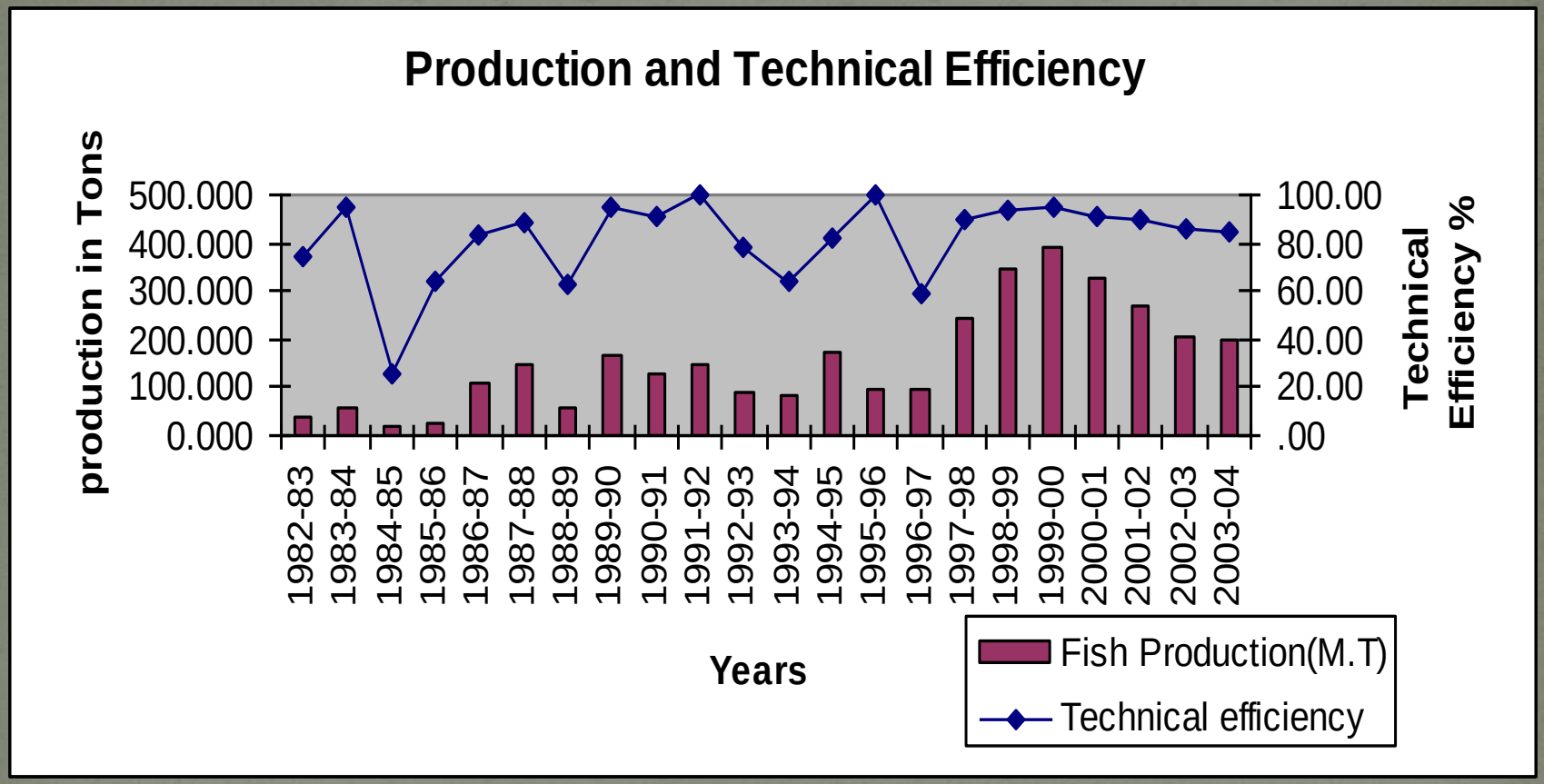
* = 1% level of significance, ***= 10% level of significance

Figure Productivity achieved and productivity Possibility



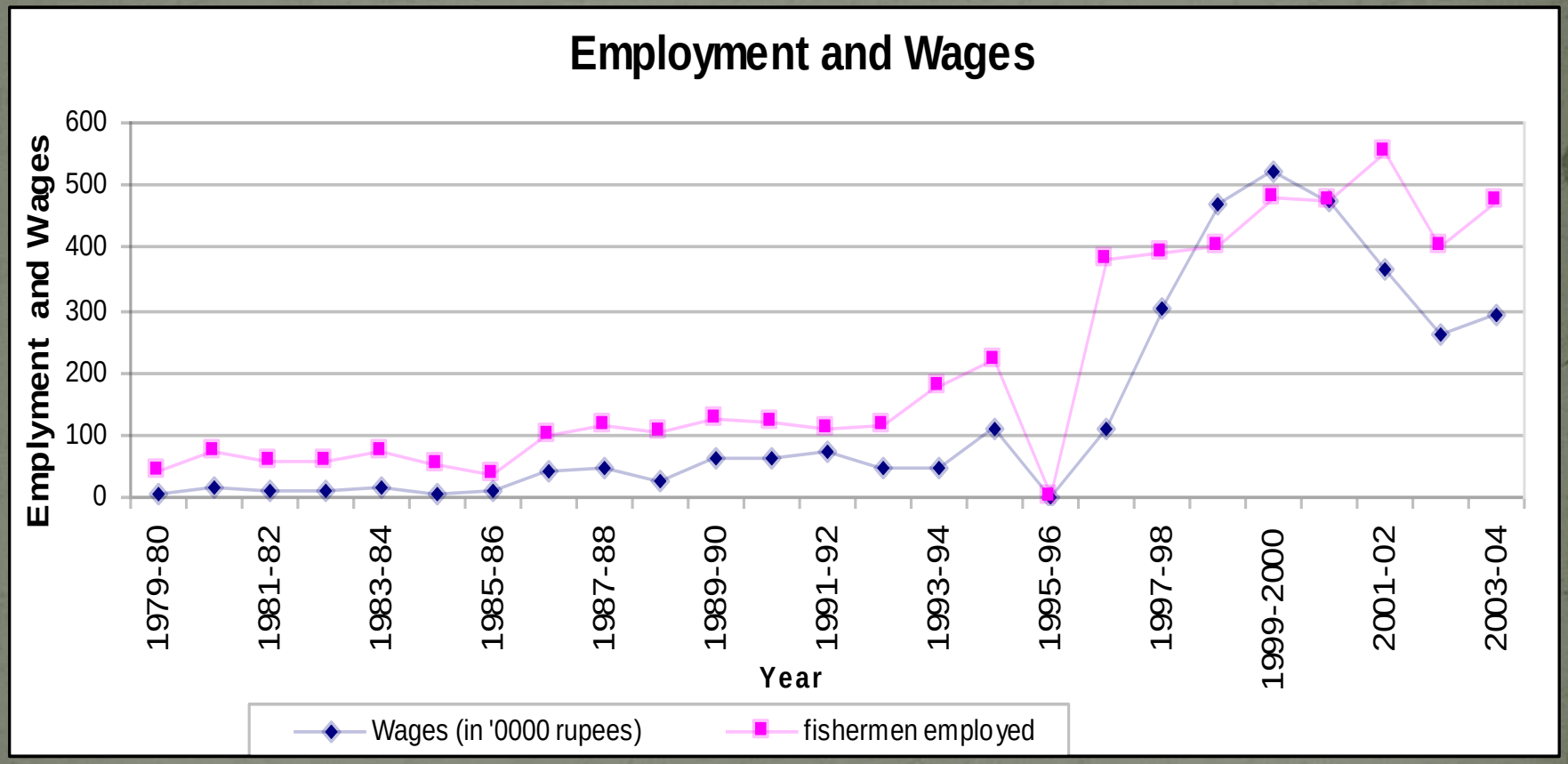
Note – 1995-96 was omitted due to lack of substantial data


Production and Efficiency
Efficiency level %
100.00
80.00
60.00
40.00
20.00
0.00
64.92
80.96
86.09
MPFDC
LCON
TMS
Regime


Production and Technical Efficiency
production in Tons
500.000
400.000
300.000
200.000
100.000
0.000
100.00
80.00
60.00
40.00
20.00
.00
Technical Efficiency %
1982-83
1983-84
1984-85
1985-86
1986-87
1987-88
1988-89
1989-90
1990-91
1991-92
1992-93
1993-94
1994-95
1995-96
1996-97
1997-98
1998-99
1999-00
2000-01
2001-02
2002-03
2003-04
Years
Fish Production(M.T)
Technical efficiency

The Equity Angle

Wages and Employment Scenario in Tawa from 1979-80 to 2003-04



Source: Sunil and Smita (1996) and Annual Reports of *Tawa Matsya Sangh*

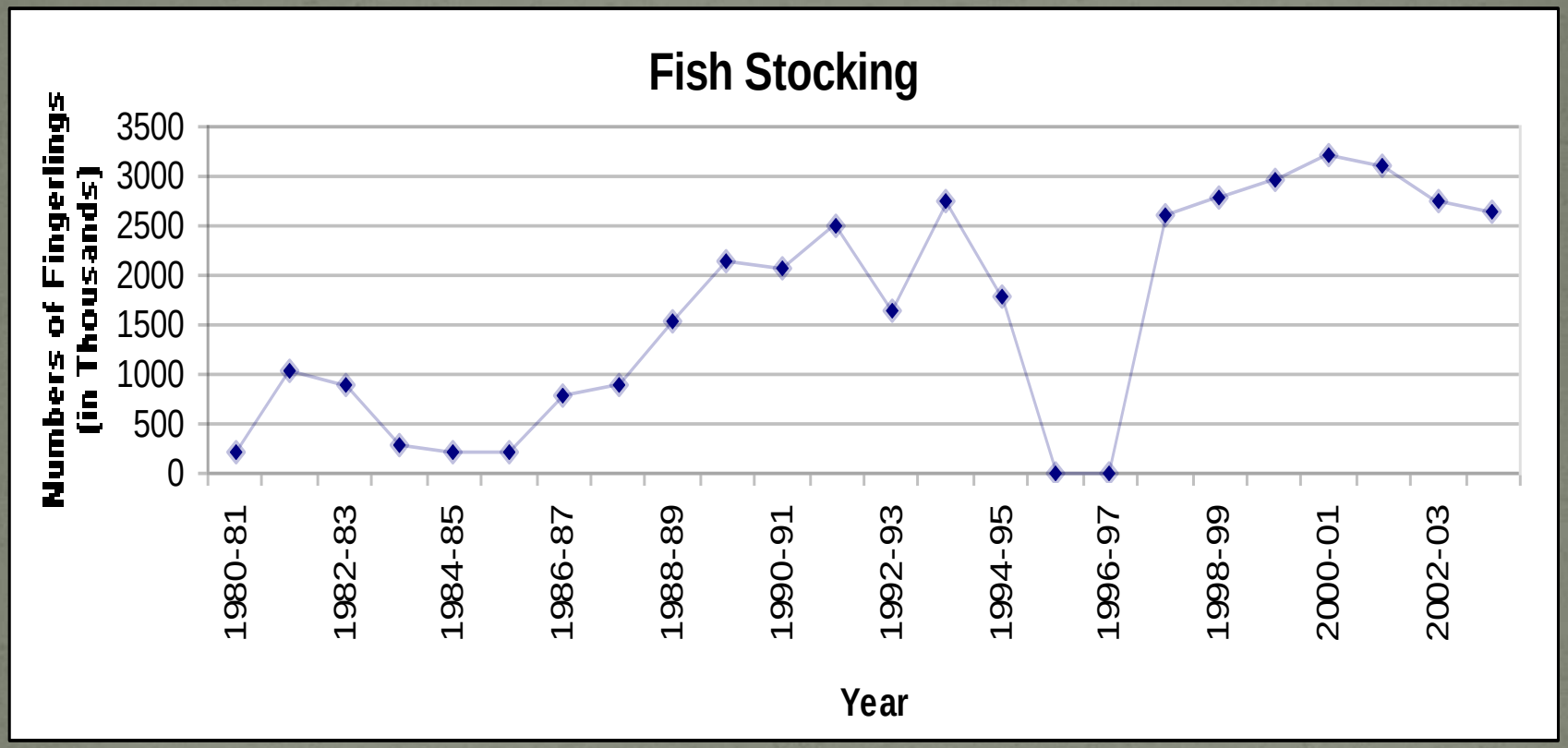
Income Scenario during TMS Regime

Year	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Income from Fish sell (Thousand rupees)	7756	9986	12535	11671	9721	7127	7440
Total Income of the Fisher folk (Thousand rupees)	3045	4715	5212	4746	3637	2664	2943
Royalty (Paid to Fish Federation) (Thousand rupees)	1180	1653	1887	1570	1291	970	940
Per Capita Per Day earning in Current Price (in rupees)	65.56	89.39	93.27	90.93	73.64	62.79	63.92

Source: Various Annual Reports of Tawa Matsya Sangh

Sustainability Angle

Stocking Scenario in Tawa from 1980-81 to 2003-04



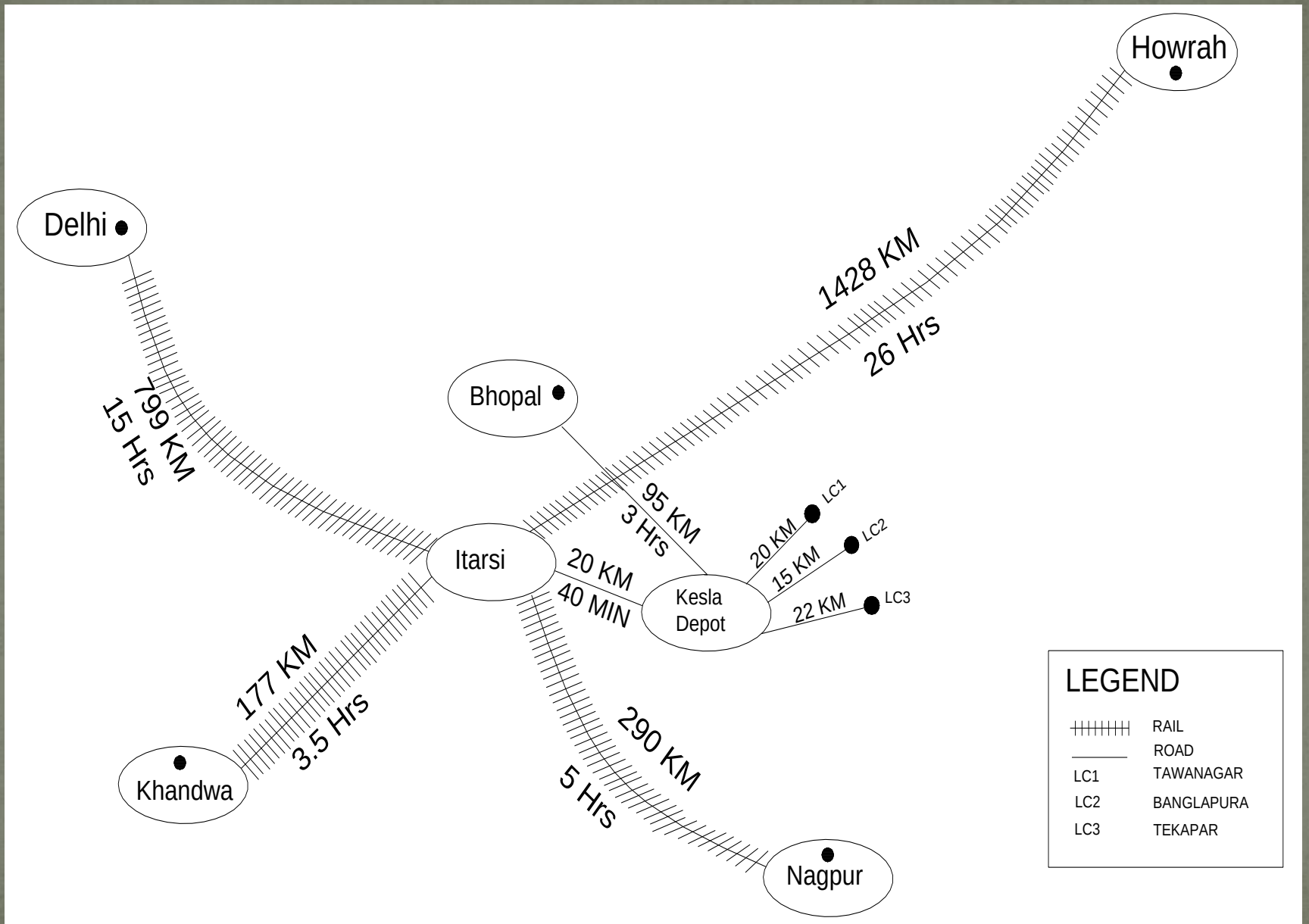
Source: Sunil and Smita (1996) and Annual Reports of *Tawa Matsya Sangh*

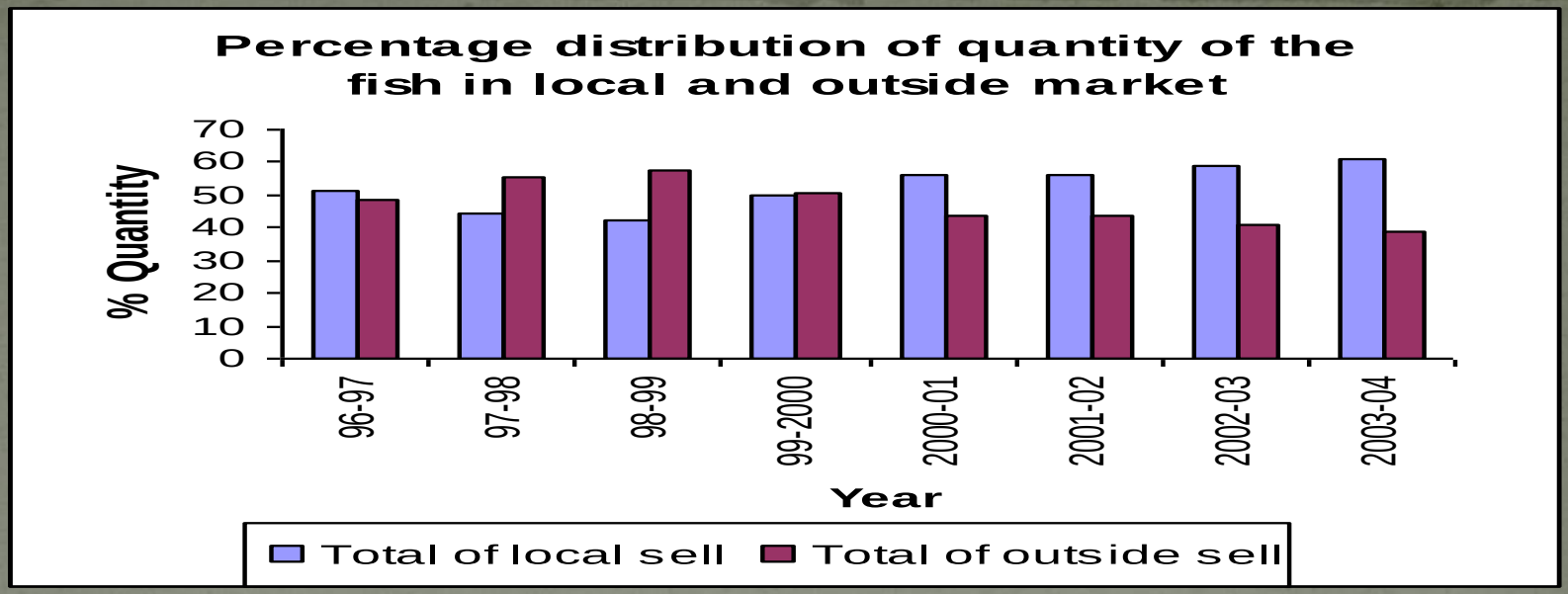
Other Sustainability Criteria

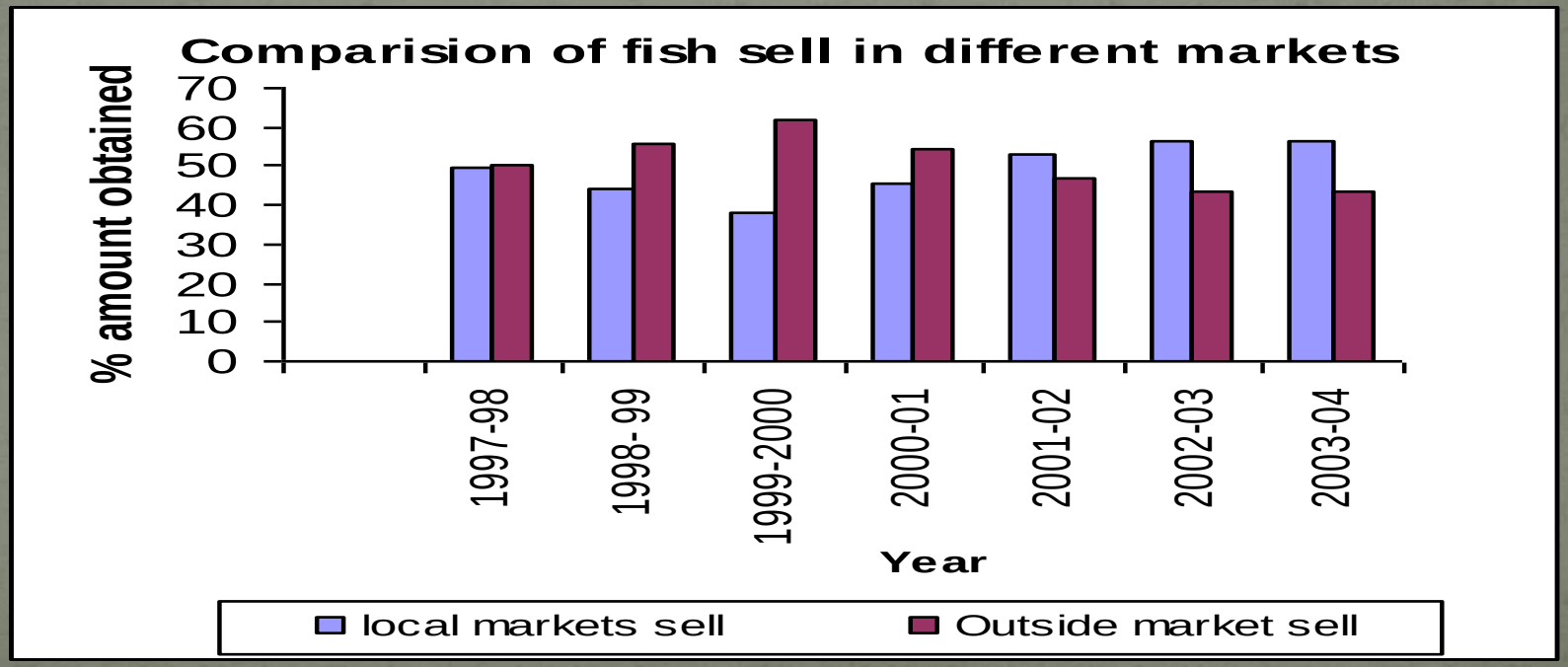
- Type of gear use (technology)
- Low cost monitoring (collective response)
- Reduced dependency on external sources for fingerlings (from 100 percent to 62 percent)

Weak links in Reservoir Fisheries Management

- Marketing: Distance from marketing sources, high transportation costs, other transaction costs in terms of ice box etc.
- Less than 50 percent realization of price to the fisher folk leading to the problems of *Moral Hazard*.
- Increasing and High overhead expenses (perpetuation of this problem during low production year)


Howrah
Delhi
1428 KM
26 Hrs
799 KM
15 Hrs
Bhopal
95 KM
3 Hrs
Itarsi
20 KM
40 MIN
Kesla
Depot
20 KM
LC1
15 KM
LC2
22 KM
LC3
177 KM
3.5 Hrs
Khandwa
290 KM
5 Hrs
Nagpur
LEGEND
RAIL
ROAD
LC1 TAWANAGAR
LC2 BANGLAPURA
LC3 TEKAPAR


Percentage distribution of quantity of the fish in local and outside market
% Quantity
70
60
50
40
30
20
10
0
96-97
97-98
98-99
99-2000
2000-01
2001-02
2002-03
2003-04
Year
Total of local sell
Total of outside sell


Comparision of fish sell in different markets
% amount obtained
70
60
50
40
30
20
10
0
1997-98
1998- 99
1999-2000
2000-01
2001-02
2002-03
2003-04
Year
local markets sell
Outside market sell

Threat Factors

- National Park and Sanctuary
- Water level in the reservoir
- Pollution (Industrial) in the Upper Catchments
- Tragedy of Commons (catching small fishes, monitoring problem (poaching)
- Moral Hazard (price factor)

To Conclude…

- Reservoir fisheries has high potential to grow
- Requires a comprehensive institutional response due to the nature of the resource
- Requirements of changes in policy views to priorities fisheries in multiple reservoir use
- Tawa is a classic case to understand different management regime
- Cooperative in Tawa seems to be a better system that we comprehended with our analysis
- Among the given regimes community regime seems to perform better than others. However, there are threats associated with marketing, moral hazard and protected area related issues that can jeopardize community management.