



Original Article

Effective Utilization of Water Bodies and Production Potential of Inland Fish in Kolhapur District of Maharashtra: A Geographical Study

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Manuscript ID:
RIGJAAR-2026-030216

ISSN: 2998-4459
Volume 3
Issue 2
Pp. 80-86
February 2026

Submitted: 09 Jan. 2026
Revised: 16 Jan. 2026
Accepted: 11 Feb. 2026
Published: 28 Feb. 2026

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Quick Response Code:



Web. <https://rlgjaar.com>



DOI:
10.5281/zenodo.20307448

DOI Link:
<https://doi.org/10.5281/zenodo.20307448>



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Abstract

This research examines the dynamics of inland fisheries in the Kolhapur District of Maharashtra over a decade (2013–14 to 2022–23), focusing on water resource utilization and its production potentiality. Using Agarwal's modified formula and the Gulland Model, the study identifies a significant transition toward total resource optimization, with the district-wide utilization rate reaching 100% in the final biennium. Analysis of production data reveals a persistent "yield gap," where actual per-hectare output consistently outperformed estimated potentials by three to fivefold, peaking at 709.87 kg/ha in 2021–22. However, the study also uncovers critical regional disparities; while tahsils like Panhala and Shirol demonstrate exceptional productivity, others like Radhanagari remain significant underperformers with utilization rates as low as 15.72%. Moreover, a recent deceleration in growth rates suggests that, the sector may be approaching a technical saturation point. These findings highlight the need for revised potentiality metrics and targeted policy interventions to address regional imbalances and sustain productivity through technological innovation.

Keywords: Inland Fisheries, Resource Utilization, Production Potentiality, Kolhapur District, Aquaculture Economics.

Introduction:

Fish farming plays an important role in generating employment for large scale population raising nutritional level, augmenting food supply and earning foreign exchange. Fishery sector in India has become an important component in Indian economy during the last six decades. Three fourth of the earth surface is covered by sea. Other water resources like reservoirs, rivers, canals, lakes, artificial tanks, pools, ponds etc. are in abundance on the earth. The area under the lakes and rivers fisheries and fish yield are increasing pisciculture technology is improving and fisheries becoming accepted as a branch of agriculture industry. Food problem is becoming serious with increasing population in India. There has been more or less or continuous imbalance in the food production between aggregate supply and demand for various types of food grains. In this situation, the fish production provides alternative food and high calories of protein for human being. The fish product which is coming from fisheries is a valuable item as a human nutrition and is gaining a greater recognition. Hence as a geographer this attempt has been made to study spatio temporal change and regional disparities in effective utilization, production potential and productivity patterns of inland fish production in Kolhapur district of Maharashtra.

The Region:

The Kolhapur district is located in the extreme southern part of Maharashtra state. It's latitudinal and longitudinal extension is 15° 73' and 17° 10' North latitude and 73° 40' and 74° 42' East longitude. Kolhapur district is surrounded by Sangli district to the North, Belgaum district of Karnataka state to the East and South and Ratanagiri and Sindhudurg district to the West.

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How to cite this article:

Gaikwad, V. D., & Gaikwad, S. V. (2026). Effective Utilization of Water Bodies and Production Potential of Inland Fish in Kolhapur District of Maharashtra: A Geographical Study. Royal International Global Journal of Advance and Applied Research, 3(2), 80–86. <https://doi.org/10.5281/zenodo.20307448>

The total area of Kolhapur district is 7685 sq. kilometer which is about 2.50 percent to the total area of the state supports population of 3,876,001 as per the census 2011. The region selected for present study is Kolhapur district, on the whole, is a part of the Deccan plateau with an average height of 600 meters from mean sea level. Kolhapur district is one of the developed fishing pockets of the south Maharashtra. The geographical setting, topography, climatic conditions, ecological and infrastructural factors have given good environment for fishing activity in the region. Fish farming is mainly concentrated along to the river Panchganga and its tributaries as well as large- and small-scale water bodies are in 12 tehsils in the district. The culture and capture both type of fisheries are practiced in the region. The Capture fishery is practiced in river water. The culture fishery is practiced in 668 shallow water bodies like tanks, dams and reservoirs and provides area of 4410 hectare for culture fishery in the region (2023). The river Panchaganaga, and its tributaries drain the entire region. Besides that, several tanks are constructed during the British regime numerous

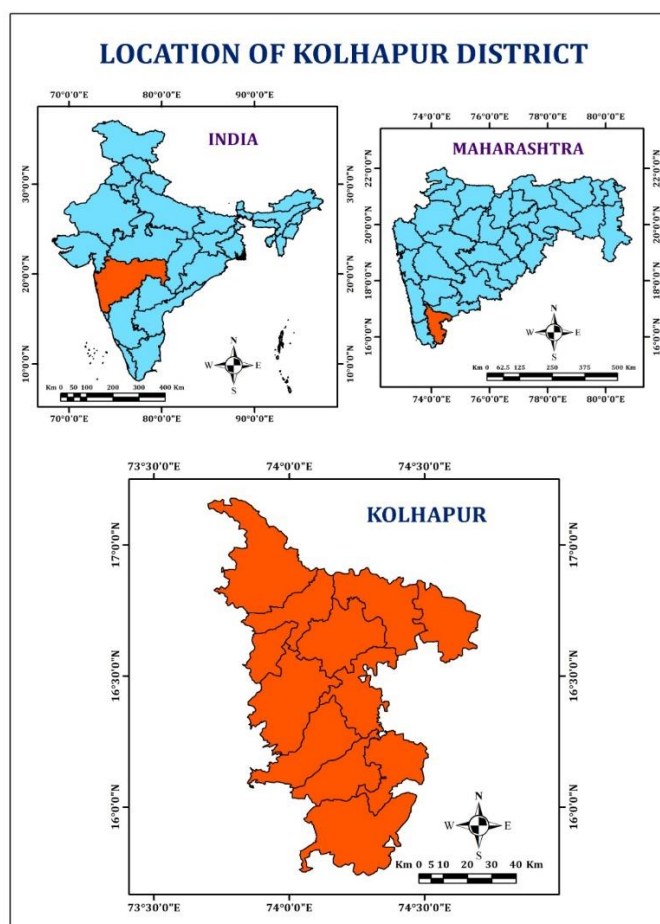
reservoirs are provide wide scope for fish farming in the study area.

Objectives: Objectives of the study are as under:

1. To analyze the effective utilization of water resources for different tehsils of the Kolhapur district of Maharashtra.
2. To study production potentiality and productivity of inland fish in the region under investigation.
3. To make valuable recommendations to increase area under fishing and also to increase fish production potential.

Data Base:

Present work is based on secondary data which is collected from Socio Economic Review and District Statistical Abstract of Kolhapur District record published by Department of Statistics, Government of Maharashtra through online mode on mahades.maharashtra.gov.in Thasil is considered as areal unit for understanding regional disparities. The secondary information related to the topic is also collected from Books, Thesis, Research papers and also from websites.



Source: <https://www.diva-gis.org/gdata>

Methodology:

Five-year average for area under water bodies, number of seed stocked and production of fish was calculated to analyze the spatial and temporal change. Effective utilization of water resources has been calculated by Agarwal's (1990) formula. The estimation of fish

production potentiality is calculated by Gulland Model (1974). The results derived are displayed by the Tables, Graphs and Maps. For the preparation based on data base of Diva GIS where as Q-GIS freeware software is used for preparation of Productivity maps.

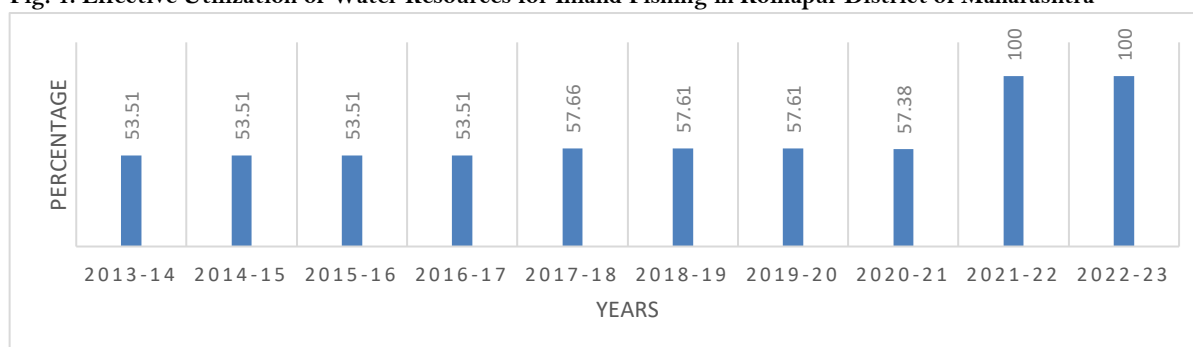
1. Effective Utilization of Water Resources:

Here, an attempt has been made to analyze the effective utilization of water resources for inland fishing in different tehsils of the Kolhapur district.

The effective utilization of water resources have been calculated by Agarwal's (1990) modified formula as below.

$$\text{Effective Utilization} = \frac{\text{Effective Surface water area Under Fish Stacking In Hectare in Component Areal Unit or Tehsil}}{\text{Of Water Resources Total Effective potential surface water area for fishing in Hectare in Component Areal Unit or Tehsil}} \times 100$$

Fig. 1: Effective Utilization of Water Resources for Inland Fishing in Kolhapur District of Maharashtra



Source: Data Compiled and Computed by Researcher: Base - Socio Economic review and District Statistical Abstract of Kolhapur 2013-14 to 2022-23.

The Effective Utilization of Water Resources for Inland Fishing in Kolhapur District of Maharashtra," illustrates a decade-long progression in resource management from 2013-14 to 2022-23. The data reveals three distinct phases of utilization efficiency. Initially, from 2013-14 to 2016-17, the utilization rate remained completely stagnant at 53.51%, indicating a period of fixed operational capacity. This was followed by a moderate improvement starting in 2017-18, where the rate climbed to and stabilized around 57.6% for four consecutive years. The

most significant development occurred in the final two years of the study, 2021-22 and 2022-23, where the district achieved a 100% utilization rate. This leap suggests a major shift in fisheries management, potentially due to the full integration of available water bodies into the production cycle, infrastructure upgrades, or policy interventions that successfully eliminated underutilization. For research purposes, this trend highlights Kolhapur's transition from a surplus-capacity state to a fully optimized inland fishing model.

Table: 1

Effective Utilization of Water Resources for Inland Fishing in Kolhapur District of Maharashtra

Sr. No.	Tahsils	Percentage of Effective Utilization of Water Resources 2013-14 to 2017-18	Percentage of Effective Utilization of Water Resources 2018-19 to 2022-23	Growth in Percent
1	Shahuwadi	100.00	100.00	0.00
2	Panhala	67.37	100.00	32.63
3	Hatkanangale	100.00	100.00	0.00
4	Shirol	100.00	100.00	0.00
5	Karveer	95.50	100.00	4.50
6	Gaganbbawada	92.81	100.00	7.19

7	Radhanagari	10.02	15.72	5.71
8	Kagal	96.20	100.00	3.80
9	Bhudargad	100.00	100.00	0.00
10	Ajara	100.00	100.00	0.00
11	Gadhinglaj	100.00	100.00	0.00
12	Chandgad	95.80	97.88	2.08
Average		54.35	68.71	14.35

Source: Data Compiled and Computed by Researcher: Base - Socio Economic review and District Statistical Abstract of Kolhapur 2013-14 to 2022-23

The table shows the comparative analysis of resource optimization of Kolhapur district during the period of 2013-14 to 2017-18 and 2018-19 to 2022-23. The data reveals a significant trend toward total resource optimization, as nine out of the twelve tahsils reached a 100% utilization rate by the second period. While regions like Shahuwadi, Hatkanangale, Shirol, Bhudargad, Ajara, and Gadhinglaj maintained perfect utilization throughout the decade, others showed marked improvement. Panhala demonstrated the most substantial growth, increasing its utilization from 67.37% to 100%, a 32.63% rise. Similarly, Karveer, Gaganbawada, and Kagal transitioned from high-partial utilization to full capacity, indicating successful regional interventions in inland fisheries management.

The tahsil Radhanagari stands out as a critical outlier with the lowest efficiency in the district. Although it

experienced a 5.71% growth, its effective utilization remains exceptionally low at 15.72% as of 2022-23. The tahsil Chandgad was also showed slight improvement but fell just short of full utilization at 97.88%. Overall, the district average for effective utilization increased from 54.35% to 68.71%, representing a total growth of 14.35%.

Production Potentiality:

The estimation of fish production or the production potentiality of the region is an important aspect to know the present status of productivity of the region under investigation.

Gulland Model (1974) has been employed for the estimation of production potentiality. Gulland has given simple model by relating the potential yield with the seed of fish stocked as below.

GullandModel (1974) Formula: $Y = KMB$

Where,

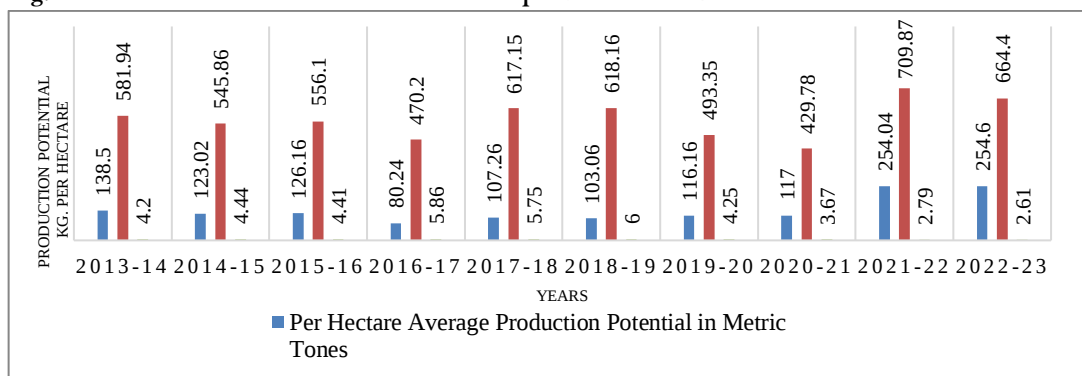
Y = Estimated total fish Yield in kg. for long term basis.

K= Proportionality Constant which is .4 (as accidental Mortality).

M = Is Natural Mortality co-efficient which is 0.25 for major carp group and .60 for catfish group.

B = Number of fish seed stocked.

Fig. 2: Inland Fish Production Potential in Kolhapur District of Maharashtra



Source: Data Compiled and Computed By Researcher: Base - Socio Economic review and District Statistical Abstract of Kolhapur 2013-14 to 2022-23

The inland fish production of Kolhapur District, for the period (2013–2023) shows a significant disparity between estimated potential and realized output. Throughout the study period, actual per hectare production was consistently and substantially outperformed the average production potential, suggesting that the district is operating at a high level of efficiency, likely due to the adoption of intensive aquaculture practices. A major shift is visible in the 2021–22

and 2022–23 cycles, where estimated potential more than doubled to approximately 254 kg/ha, coinciding with a record-high actual production peak of 709.87 kg/ha in 2021–22. However, despite these high yields, the actual growth rate (green bars) has entered a period of deceleration, declining from a peak of 6.0 in 2018–19 to its lowest point of 2.61 in 2022–23.

Table: 2

Regional Disparity of Inland Fish Production Potentiality in Kolhapur District of Maharashtra

Sr. No.	Tahsils	Kg. Per Hectare Average Production Potential	Actual Kg. Per Hectare Average Production for 2013-14 to 2017-18	Actual Growth in Kg. Per Hectare Production During 2013-14 to 2017-18
1	Shahuwadi	119.16	586.77	4.92
2	Panhala	207.02	3825.67	18.48
3	Hatkanangale	304.73	572.49	1.88
4	Shirol	161.61	629.46	3.90
5	Karveer	137.86	539.67	3.91
6	Gaganbbawada	98.44	501.88	5.10
7	Radhanagari	97.41	528.67	5.43
8	Kagal	150.16	564.25	3.76
9	Bhudargad	89.08	558.02	6.26
10	Ajara	122.15	516.46	4.23
11	Gadhinglaj	127.37	551.04	4.33
12	Chandgad	83.09	317.93	3.83
Average		114.89	555.41	4.83

Source: Data Compiled and Computed by Researcher: Base - Socio Economic review and District Statistical Abstract of Kolhapur 2013-14 to 2022-23

Table 2, reflects a comparative analysis of fisheries performance of Kolhapur district during the period 2013–14 to 2017–18. The data highlights a profound discrepancy between the estimated average production potential (114.89 kg/ha) and the actual average production (555.41 kg/ha), indicating that the district significantly exceeded traditional yield expectations by nearly fivefold. The

tahsil Panhala emerges as the most productive region by a substantial margin, recording an exceptional actual yield of 3825.67 kg/ha and the highest growth rate of 18.48. In contrast, Chandgad tahsil shows the lowest production levels at 317.93 kg/ha, while most other tahsils, such as Shahuwadi, Shirol, and Kagal, maintain a relatively consistent production range between 500 and 600 kg/ha.

Table: 3

Regional Disparity of Inland Fish Production Potentiality in Kolhapur District of Maharashtra

Sr. No.	Tahsils	Kg. Per Hectare Average Production Potential	Actual Kg. Per Hectare Average Production for 2018-19 to 2022-23	Actual Growth in Kg. Per Hectare Production During 2018-19 to 2022-23
1	Shahuwadi	149.66	559.43	3.74
2	Panhala	233.05	648.07	2.78
3	Hatkanangale	291.24	649.77	2.23
4	Shirol	398.86	806.82	2.02
5	Karveer	269.71	675.87	2.51
6	Gaganbbawada	158.32	624.86	3.95
7	Radhanagari	115.90	620.92	5.36
8	Kagal	277.88	633.53	2.28
9	Bhudargad	110.28	627.31	5.69
10	Ajara	155.47	615.27	3.96
11	Gadhinglaj	245.72	626.36	2.55
12	Chandgad	152.52	489.35	3.21
Average		166.54	580.14	3.48

Source: Data Compiled and Computed By Researcher: Base - Socio Economic review and District Statistical Abstract of Kolhapur 2013-14 to 2022-23

Table 3, presents a detailed comparative analysis of the region for the period 2018–19 to 2022–23. The data reveals a consistent trend where the actual average production (580.14 kg/ha) was significantly exceeded the average production potential (166.54 kg/ha), indicating a high level of resource optimization across the district. Shirol tahsil was emerged as the leading producer with an actual yield of 806.82 kg/ha, while Chandgad recorded the lowest at 489.35 kg/ha. Despite having a relatively low production potential of 110.28 kg/ha, Bhudargad achieved the highest growth rate during this period at 5.69, closely followed by Radhanagari tahsil at 5.36 kg/ha. The figures of the table highlight a narrowing of the production gap compared to previous years, yet significant regional disparities remain. While tahsils like Shirol and Karveer demonstrate high-volume output, the high growth rates in traditionally lower-potential areas like Bhudargad suggest a successful shift toward more intensive fishing practices.

Findings:

The perennial drainage helps to the irrigation projects and also for culture fishery in the ponds, tanks and reservoirs. The eastern part of the region has poor surface and ground water resources which needs to develop more water bodies to increase potential area for fish farming.

The physiography of the western part of the region supports for construction of the dams and reservoirs for effective utilization of water bodies for inland fish farming. Hence the western part of the region provides good location for natural water storages and also for fish farming.

The success of the fish farming totally depends on the proper stocking of the seeds in the tank at proper time with proper method of acclimatization.

Effective utilization of water shows that, more than 50 percent of the area is utilized for fish farming but actual water area in compare with the total geographical area in the region needs to give more attention to increase the utilization of water resources in full context. It is also observed that, most of the tahsils has moved toward a model of maximum resource efficiency, the stark disparity in Radhanagari identifies a specific area for targeted infrastructure development and further socio-economic investigation.

The production potential of the region as a whole was 555.41 kg. per hectare in the initial five year 2013-14 to 2017-18, which is increased up to 580.14 kg. per hectare during the next years 2018-19 to 2022-23. It is also observed that, the per hectare actual production of fish was 2 to 4 times more than the production potential. It shows that, the rate of natural and accidental mortality was negligible due to well climate, proper seeding, and intensive care taken by the fisherman's helps to growth of fish seeds in the region.

The trend of inland fish production potential indicates that, while Kolhapur has successfully maximized its resource utilization, the sector may be approaching a production plateau or facing diminishing marginal returns that require new technological interventions to overcome.

The actual yields in Kolhapur are consistently 3 to 4 times higher than estimated potentials, suggesting that

current "potentiality" metrics may need to be revised upward to reflect modern aquaculture capabilities and the district's effective management of its inland water resources.

The inland fish farming in the Kolhapur district is relatively developing in the western part of the region, whereas newly constructed tanks, ponds and reservoirs provide the large scope for fish farming in central and eastern part.

Recommendations:

1. It is recommended to stock the fish seeds in the morning or in the evening when water temperature is lower to avoid mortality.
2. For increasing per hectare production and production potential of the ponds and tanks it is suggested to feed by using supported food material like ground nut cake, cellulose and forage at certain time on a certain place. It is also recommended to fertilize the pond and tanks by organic manures and fertilizers as per requirement.
3. There is a need of proper training to increase the fertility of the water bodies and knowledge about fishing and marketing activity to the fishermen.
4. To overcome these difficulties Co-operative sector and Govt. as well should take initiative, which will bring a bright future to inland fish farming in the region.

Acknowledgment

I would like to express my sincere gratitude to all those who have contributed to the successful completion of this research paper on Effective Utilization of Water Bodies and Production Potential of Inland Fish in Kolhapur District of Maharashtra: A Geographical Study. I am deeply thankful to my institution for providing the academic support and necessary resources required for conducting this study.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

References:

1. A. Manjare and D. V. Muley (2016): "Comparative Study of Fish Diversity and fishery Potential of Perennial Tanks of Kolhapur District (Maharashtra)", www.biollifejournal.com, ISSN (online): 2320-4257, https://www.academia.edu/30453040/Comparative_Study_of_Fish_Diversity_and_fishery_Potential_of_Perennial_Tanks_of_Kolhapur_District_Maharashtra
2. Agrawal S. C. (1990): "Fishery Management", Ashish Publishing House, New Delhi.
3. Belsare S. G. (2002): Present Status of Fresh Water Prawn Farming in Maharashtra and India and Its Export, Training Notes, State level training on Advances in Freshwater Prawn farming, faculty of Fisheries, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Ratnagiri.
4. Govt. of Maharashtra (2012 to - 2022): "Socio Economic Review and District Statistical Abstract of Kolhapur District", [www.https://mahades.maharashtra.gov.in](https://mahades.maharashtra.gov.in)



5. Husain, M. (1999): Systematic Agricultural Geography, Rawat Publication, pp.90, 92, 99,102,104 and 108
6. Jitesh Vilas Keshave*, Ananthan P S and Asha Landge(2013):Fish Diversity and Productivity of Isapur Reservoir, Maharashtra State, International Journal of Biomedical And Advance Research, ISSN: 2229-3809 (Online), www.ssjournals.com
7. Katkar Ekanath. Rau (1987): "A Study of Development of Fisheries in Lakes and Rivers in and Around Kolhapur", Unpublished Ph. D. thesis Submitted to Shivaji University, Kolhapur.
8. Pawar C. T. (2005): "Reclamation of Degraded Soils: A Study on Economics of Fish Farming," The Indian Geographical journal 80(1), pp. 39 to 44 Published in 2006S.
9. Singh, Jabbir & Dhillan S. S. (1987): Agricultural Geography Tata Mc Graw, New Delhi, first Reprint
10. V. D. Gaikwad (2010): "Inland fish farming in upper Krishna basin of Maharashtra: A Geographical study", Unpublished Ph. D. thesis Submitted to Shivaji University, Kolhapur.