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Land and Water Characteristics Governing Inland Pond Fisheries in East Singhbhum District, Jharkhand: An Evidence Synthesis with Specific Implications for Potka Block

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Abstract

East Singhbhum, in south-eastern Jharkhand, combines high monsoonal rainfall with a dissected hard-rock plateau, extensive acidic soils and a large stock of rural ponds and tanks. This study synthesised official district, soil, groundwater and aquaculture sources to evaluate how these conditions shape inland pond-fishery development, with specific reference to Potka block. District land-resource mapping indicates strong spatial variation in slope, soil depth and runoff. Soil pH ranges from 4.1 to 7.6, and about 93% of the mapped district area is acidic; nearly 60% is affected by land degradation, predominantly water erosion. The 2025 groundwater assessment classifies Potka as Safe, with 3,822.5 hectare-metres of annual extractable groundwater, 492.9 hectare-metres of extraction and a 12.9% stage of groundwater extraction. However, monitoring shows pronounced seasonal water-level changes, while Potka groundwater samples vary substantially in electrical conductivity, hardness and major-ion composition. These results support a rainwater- and surface-storage-led aquaculture strategy rather than routine pond filling by groundwater. Existing perennial ponds on stable sites are the lowest-risk entry point for composite carp culture; seasonal ponds require shorter production cycles and earlier harvest. Site decisions should be based on measured pond depth, retention, catchment condition, bottom-soil pH, source-water chemistry and pollution pathways. The study concludes that Potka is suitable for expanded pond aquaculture only through pond-level verification, test-based liming, controlled stocking, catchment protection and seasonal water budgeting.

KEYWORDS

East Singhbhum; Potka; Inland aquaculture; Pond fisheries; Groundwater; Soil acidity

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Introduction

Pond aquaculture in plateau regions is governed by a practical interaction between catchment hydrology, pond geometry, bottom-soil condition, water chemistry and husbandry. A pond can receive abundant monsoon runoff and still perform poorly if the stored water is lost quickly, the bottom soil is strongly acidic, the inflow carries sediment or contaminants, or the standing fish biomass exceeds the oxygen-supporting capacity of the pond. This distinction is important in Jharkhand, where rainfall is concentrated in a few monsoon months and much of the terrain is underlain by hard rock [1-4].

East Singhbhum is situated on the eastern margin of the Chhotanagpur Plateau. The district covers about 3,533 km^2; roughly 53% is described by the district administration as residual hills and mountains composed mainly of granite, gneiss, schist and associated rocks. The Subarnarekha is the principal drainage axis, and annual rainfall is generally reported in the range of 1,200-1,400 mm, with the largest share occurring during the south-west monsoon [1]. Potka block lies in Dhalbhum subdivision and combines rainfed agriculture, village ponds and access to the Jamshedpur fish market. These features make it a plausible area for organized freshwater aquaculture, but they do not establish that every pond is suitable.

The study therefore asks a site-selection question rather than a production-potential question: which land and water characteristics in East Singhbhum are favorable or limiting for inland pond fisheries, and what do they imply for pond development in Potka? The objective was to synthesize the best available official and technical evidence, retain each dataset at its published spatial scale, and translate the findings into management implications that can be verified pond by pond.

Materials and methods

Evidence selection

This was a structured evidence synthesis; no new field experiment was conducted. Sources were included when they met at least one of three criteria: (i) they were official datasets or technical reports describing the geography, soils, groundwater resources or groundwater quality of East Singhbhum or Jharkhand; (ii) they provided Potka-specific observations; or (iii) they were recognised aquaculture manuals or peer-reviewed publications relevant to pond soil, liming, alkalinity, hardness, stocking or water-quality management [1-18].

The principal land sources were the East Singhbhum district profile and geographical description, the Jharkhand Space Applications Center (JSAC) district material, the 1:50,000 soil-resource map prepared by Indian Resources Information & Management Technologies Ltd. for JSAC, and the ICAR-NBSS&LUP/Birsa Agricultural University soil-acidity and fertility assessment [1-4]. Groundwater interpretation used the 2025 dynamic resource assessment, the 2024-25 and 2022-23 groundwater yearbooks, and groundwater-quality yearbooks containing Potka observations [5-9]. Aquaculture interpretation was checked against Department of Fisheries and ICAR-CIFA guidance, the FAO manual on fish culture in undrainable ponds, and peer-reviewed literature on pond soil, pH, alkalinity, hardness and liming [10-17]. Wetland information was used only to establish the wider presence of

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tanks and ponds in Jharkhand and East Singhbhum [18].

Source identification was undertaken as a targeted evidence search from 20 to 29 August 2026, followed by a reviewer-update check on 1 September 2026. Official repositories and institutional sources were searched first, including the East Singhbhum district portal, JSAC reports, the Central Ground Water Board publications repository, the Department of Fisheries, ICAR-CIFA and FAO. Targeted title/DOI searches were then used to verify peer-reviewed aquaculture literature. Search terms were combined as appropriate and included “East Singhbhum district profile”, “East Singhbhum soil resources map”, “East Singhbhum soil acidity”, “Jharkhand groundwater 2025”, “Jharkhand groundwater yearbook”, “Jharkhand groundwater quality”, “Potka groundwater”, “pond aquaculture pH alkalinity hardness”, “fish pond liming bottom soil” and “composite carp pond culture”. The process was designed as a structured, targeted evidence synthesis rather than an exhaustive systematic review.

Records were screened first for source authority and geographic relevance and then for direct usefulness to land-water or pond-aquaculture interpretation. Preference was given to primary government or institutional reports for district- and block-scale environmental data and to peer-reviewed or nationally recognized technical guidance for aquaculture management. Duplicate versions, unverified secondary summaries where a primary source was available, geographically ambiguous local claims and sources without a clear link to pond site selection or water/soil management were excluded. Where official series overlapped, the most recent applicable source was used for current status and older editions were retained only when needed for seasonal or temporal comparison. No meta-analysis was attempted because the included datasets differed substantially in purpose, scale, sampling design and reporting period.

Data handling and interpretation

Values were transcribed at their published scale and vintage. District soil statistics were not assigned to individual pond bottoms, block groundwater status was not used as a proxy for well yield, and groundwater samples were interpreted as possible source-water conditions rather than as pond-water chemistry. No statistical pooling was attempted because the datasets differ in purpose, sampling density, year and spatial denominator. Apparent inconsistencies between older land-resource boundaries and current groundwater assessment units were retained rather than mathematically harmonized without a common GIS boundary.

For aquaculture interpretation, each land-water attribute was considered through a source-pathway-response sequence. For example, a steep degraded catchment is a source; sediment-laden runoff is the pathway; reduced pond depth, turbidity and oxygen stress are possible responses. This approach was used to separate conditions that can be managed, such as acidic pond soil, from conditions that may justify

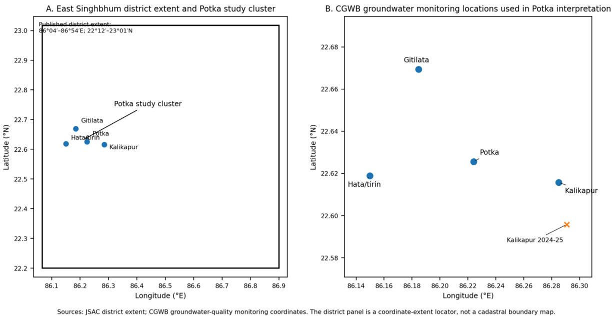

Figure 1. Study location and CGWB groundwater monitoring points used in the Potka interpretation. Panel A shows the published coordinate extent of East Singhbhum district and the Potka monitoring cluster; Panel B shows Hata/Tirin, Kalikapur, Potka and Gitilata monitoring locations from the 2023-2024 groundwater-quality dataset, together with the later Kalikapur monitoring point. The district panel is a coordinate-extent locator rather than a

rejecting a site, such as persistent contaminated inflow (Figure 1 and Table 1).

Table 1. Evidence base used in the synthesis.

Evidence	Scale / period	Use in this study	Main limitation
District administration and JSAC	East Singhbhum	Physiography, drainage, climate, broad soil setting	District-scale generalization
Soil resource map	1:50,000; historical layers	Slope, soil depth, runoff, hydrologic group, pond-catchment implications	Requires parcel verification
ICAR-NBSS&LUP/BAU soil assessment	East Singhbhum	Soil acidity, organic carbon and nutrient context	Agricultural soil, not pond-bottom sampling
CGWB resource and yearbooks	Jharkhand / East Singhbhum / Potka	Groundwater status and seasonal water-level context	Does not predict individual pond retention
CGWB quality yearbooks	Monitoring points, including Potka	Source-water chemistry and local variability	Sparse snapshots, not pond water
Aquaculture guidance and literature	Indian / international pond aquaculture	Interpretation of depth, stocking, pH, alkalinity, hardness and liming	Must be adapted to local pond conditions

Land and water setting

Physiography, geology and drainage

East Singhbhum is a dissected plateau rather than a uniform agricultural plain. The district administration reports elevations of about 700-3,100 ft (approximately 213-945 m) and a landscape of residual hills, uplands and intervening lower areas [1]. The soil-resource mapping further shows a mosaic of shallow, stony upland soils and deeper soils in gentler plains and valleys [3]. Such variation matters for ponds because the same rainfall produces different runoff, infiltration and erosion responses over short distances.

The geology is dominated by hard-rock formations, including granite, gneiss, schist, volcanic and metamorphic units [1-3]. In these settings groundwater storage is mainly associated with the weathered mantle and secondary fractures rather than a continuous porous aquifer. Pond siting therefore benefits from observing actual soil depth and retention history rather than assuming uniform seepage conditions across a village.

The drainage network converges towards the Subarnarekha and its tributaries [1,2]. Lower slopes and local depressions can intercept monsoon runoff efficiently, which is favorable for pond filling. The same process creates a management risk where catchments are steep or degraded: sediment, organic matter and contaminants can enter the pond during high-intensity rainfall, while inadequately protected

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overflow can erode bunds or allow fish to escape. The soil-resource report specifically recognizes farm ponds, low earthen dams and bandhara-type structures as part of water-harvesting strategy, while also emphasizing controlled spillways in higher-runoff settings [3].

Rainfall and seasonal water availability

Annual rainfall of 1,200-1,400 mm is favorable for freshwater pond recharge, but the rainfall regime is strongly seasonal [1]. The practical constraint is therefore not annual rainfall alone; it is the amount of water remaining after the monsoon. Storage volume, seepage, evaporation, irrigation withdrawals and catchment inflow determine whether a pond can carry a planned biomass through the dry season.

Groundwater monitoring illustrates the same seasonality. In the 2022-23 CGWB yearbook, the Potka monitoring station recorded depth to water of about 8.0 m below ground level (BGL) in May, 2.9 m in August, 3.96 m in November and 5.8 m in January. At Kalikapur, the corresponding values were about 3.1, 1.33, 1.64 and 2.7 m bgl [7]. These observations do not predict pond depth, but they demonstrate rapid monsoon recharge followed by post-monsoon recession. For fish farming, a dry-season water budget should therefore be prepared before stocking (Table 2).

Table 2. Illustrative seasonal groundwater observations in Potka block.

Monitoring location	May (m bgl)	August	November	January	Interpretation
Potka	8.00	2.90	3.96	5.80	Strong monsoon rise followed by recession
Kalikapur	3.10	1.33	1.64	2.70	Shallower water table but still seasonal

Soil characteristics relevant to pond fisheries

Soil reaction and fertility

Potka is broadly associated with red and yellow soils [2]. The district-scale ICAR-NBSS&LUP/BAU assessment measured soil pH from 4.1 to 7.6 and classified about 93% of the geographical area as acidic. Very strongly acidic soils formed the largest class; neutral and slightly alkaline soils occupied only a small fraction [4]. Because these are terrestrial agricultural-soil observations, they cannot be used as a pond-specific liming prescription. They do, however, make bottom-soil pH testing a necessary part of pond preparation.

The same assessment found available phosphorus to be low over most of the district, while organic carbon and available nitrogen were commonly medium to high [4]. In an aquaculture pond, these terrestrial patterns are modified by sediment deposition, fertilization, feed, organic matter accumulation and water exchange. For that reason, land-soil fertility should be treated as background context rather than transferred directly into fertilizer doses.

Pond productivity is influenced by the interaction between bottom-soil acidity and water alkalinity. Low-alkalinity water has limited buffering capacity, while acidic bottom soils can reduce nutrient availability. Conversely, adding lime where alkalinity is already adequate may provide little benefit and can complicate pH management. Aquaculture literature therefore supports measurement-based liming rather than a routine fixed dose [12,14-17].

Infiltration, runoff and erosion

Hydrologic soil groups C and D are widespread in the district soil-resource mapping [3]. Group C soils are characterized by relatively slow infiltration and moderately high runoff potential; group D soils have still lower infiltration and high runoff potential. For pond development, these conditions can be favorable for retaining surface water, but they increase the need for a protected inlet, sediment control and a safe overflow route.

The same mapping reports approximately 213,288 ha, close to 60% of East Singhbhum's geographical area, as affected by soil degradation, with water erosion and associated topsoil loss as dominant processes [3]. A pond below an eroding catchment can lose useful depth through siltation even when the pond embankment itself is sound. Catchment treatment - vegetation on vulnerable slopes, grassed bunds, diversion of dirty first flush where appropriate, and maintainable silt traps - should therefore be considered part of pond management rather than a separate land-conservation activity.

Groundwater resources and source-water quality

Potka groundwater status

The 2025 CGWB assessment classifies Potka as a Safe groundwater assessment unit. It reports an assessment-unit area of about 59,422 ha, a recharge-worthy area of about 45,817 ha, total annual recharge of 4,247.2 hectare-metres (ham), annual extractable groundwater of 3,822.5 ham, total annual extraction of 492.9 ham and a stage of groundwater extraction of 12.9%. Net future availability is reported at about 3,326.8 ham [5].

This classification is encouraging but should not be read as an instruction to maintain fish ponds by unrestricted pumping. In fractured hard-rock terrain, individual well yield and pumping cost can vary sharply, and aquaculture can require large volumes of water. A Safe block status is best used to support carefully planned supplementary or contingency water, after the yield and chemistry of the actual source have been tested (Table 3).

Table 3. Potka groundwater resource account, 2025.

Indicator	Published value	Aquaculture interpretation
Assessment-unit area	59,422 ha	Current CGWB denominator; not equivalent to pond-suitable land
Recharge-worthy area	45,817 ha	Regional recharge context
Total annual recharge	4,247.2 ham	Strongly influenced by monsoon recharge
Annual extractable groundwater	3,822.5 ham	Block-level resource after natural-discharge provision
Total annual extraction	492.9 ham	Used in stage-of-extraction calculation
Net future availability	3,326.8 ham	Planning signal, not a well-yield guarantee
Stage / category	12.9% / Safe	Supports selective supplementary use where justified

Local variation in groundwater chemistry

Potka groundwater chemistry is not uniform. The 2023-24 groundwater-quality dataset contains four Potka observations with pH values between 7.54 and 7.92, but substantially different mineralization. Electrical conductivity ranged from 866 to 2,779 µS/cm and calculated total dissolved solids from 563 to 1,806 mg/L. Kalikapur showed the highest sodium, bicarbonate, chloride and sulphate among the four locations [8]. A later Kalikapur observation in the 2024-25 quality yearbook again showed high mineralization, with EC about 2,509 µS/cm and total hardness about 816.5 mg/L as $CaCO_3$ [9].

The point is not that groundwater from Kalikapur is automatically unsuitable for fish culture. Rather, these records show that water from one borewell or village cannot be represented by a block average. Any groundwater intended as a major pond-fill or emergency source should

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be analyzed separately. At minimum, pH, EC/TDS, alkalinity, hardness, chloride, nitrate and iron should be checked; additional parameters should be added when mining, industrial, sewage or pesticide pathways are plausible (Table 4) [10-16].

Table 4. Available pre-monsoon groundwater chemistry at four Potka locations.

Location	pH	EC (µS/cm)	TDS (mg/L)	Hardness as $CaCO_3$	Na	HCO_3	Cl	NO_3	SO_4	F
Hata/Tirin	7.54	1,034	672	335	69	366	64	24	101	0.41
Kalikapur	7.82	2,779	1,806	450	423	1,049	192	23	227	0.38
Potka	7.92	1,045	679	475	22	384	114	0.54	46	0.25
Gitilata	7.76	866	563	300	46	262	75	0.35	82	0.36

Note: Except for pH and EC, values are reported in mg/L; total hardness is expressed as $CaCO_3$. These measurements describe groundwater source samples, not fish-pond water. Source: CGWB groundwater-quality yearbook [8].

Implications for pond aquaculture

Existing ponds as the preferred entry point

The wider Jharkhand wetland inventory confirms that tanks and ponds are an established component of the state's inland-water landscape, and East Singhbhum contains a substantial wetland area [18]. The available evidence, however, does not provide a current georeferenced inventory of all Potka ponds, nor does it establish their dry-season area, depth or ownership. For investment decisions, the pond - not the block - must therefore be the unit of verification.

Existing perennial ponds are generally a lower-risk starting point than new excavation because their water-retention history and flood behavior can be observed. The preferred site is a pond with secure use rights, a stable embankment, controllable inflow and overflow, a clean catchment, adequate dry-season depth and an accessible source of tested supplementary water. Seasonal ponds can still be productive, but the culture cycle must be matched to the period of water availability rather than extended by expensive pumping (Table 5).

Pond classes and management response

Table 5. Pond classes suggested by the land-water synthesis.

Pond condition	Appropriate fisheries use	Primary management requirement
Perennial pond with adequate dry-season depth	Composite carp grow-out; staggered or partial harvest	Baseline soil/water test, moderate stocking, oxygen and feed management
Pond retaining water for approximately 6-9 months	Short-duration carp grow-out or advanced fingerling production	Stock promptly after water stabilises; plan harvest before critical drawdown
Small seasonal pond	Nursery, fry-to-fingerling rearing or household-scale production	Short cycle, reliable seed timing and early harvest
Pond receiving strong upland runoff	Production only after hydraulic and catchment safeguards	Silt trap, protected inlet, screened spillway, vegetated bund and flood-escape control
Pond with unresolved polluted inflow or unsafe embankment	Not suitable for food-fish culture until corrected	Reject or rehabilitate; verify safety before stocking

Water depth, stocking and species choice

Indian composite carp culture is well aligned with the ecological and market setting of eastern India. Catla, rohu and mrigal use different feeding niches and are standard species in pond polyculture [10,11,13]. Official farmer guidance commonly treats about 1.5-2.5 m average water depth as appropriate for grow-out ponds and uses approximately 5,000 advanced fingerlings/ha as an indicative benchmark under adequately prepared and managed conditions [10,11]. These figures should not be applied mechanically in Potka. A shallower or strongly seasonal pond should begin with a lower biomass or a shorter crop.

The limiting variable is often oxygen-supporting capacity rather than pond surface area alone. Feed loading, temperature, phytoplankton density and decomposing organic matter can cause dawn dissolved oxygen to fall even when afternoon readings appear satisfactory. Stocking decisions should therefore consider effective water volume, expected late-season depth, feeding intensity and the operator's ability to monitor and respond to low oxygen [10-13].

Soil pH, alkalinity and liming

The district's strong acid-soil signal justifies routine measurement of pond-bottom pH, but not routine application of one lime dose. pH, acidity and alkalinity describe different aspects of water chemistry, and alkalinity is central to buffering pH in ponds [14,15]. Liming is most useful where bottom soil is acidic and/or water alkalinity is low; its requirement depends on soil properties and the neutralizing value of the liming material [12,14-17].

Published pond studies also show that agricultural limestone can raise water alkalinity and hardness and neutralize acidic surface sediment, but the response is site-specific [16]. For Potka, a practical sequence is to measure bottom-soil pH, pond alkalinity and product calcium-carbonate equivalent, then calculate the treatment under fisheries guidance. This is safer than repeating the previous year's dose without checking the present pond.

Pollution and mining context

East Singhbhum is both mineral-rich and industrialized [1]. That context requires an additional screening step for ponds receiving drainage from mine areas, industrial premises, road drains, waste sites or contaminated streams. Ordinary aquaculture parameters such as pH and dissolved oxygen cannot establish food safety in such settings. Where a plausible contamination pathway exists, water and sediment should be tested for the relevant metals or chemicals before fish are stocked or sold. Clear-looking water should not be treated as evidence of chemical safety.

Discussion

The evidence points to a qualified but substantial opportunity for pond fisheries in Potka. The area's monsoon rainfall, numerous rural water bodies and low block-level groundwater development provide a favorable resource context [1,5,18]. At the same time, the same

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landscape creates predictable constraints: acidic soils, high runoff, erosion, seasonal drawdown and local differences in groundwater chemistry [3-9]. The appropriate development model is therefore not a uniform input package but a pond-by-pond operating decision.

A useful distinction emerges between resource availability and production reliability. Potka's 12.9% groundwater extraction stage describes the block's groundwater account [5]; it does not guarantee that a particular pond will retain water or that a nearby borewell will yield sufficient water at acceptable cost and quality. Similarly, the district's 93% acid-soil statistic identifies a regional management concern [4], but it does not determine the lime dose for an individual pond. Both examples illustrate why planning data should be used for screening, while stocking and input decisions require field measurements.

The hydrologic setting also favours integration of aquaculture with catchment management. A pond that receives clean runoff from a protected catchment can provide fish production and local water storage. The same pond can lose capacity if erosion is not controlled. In this sense, pond rehabilitation, inlet and spillway design, sediment management and bund vegetation are production investments because they preserve the water volume on which fish biomass depends [3,13].

The source-water chemistry results deserve similar caution. The contrast between Gitilata and Kalikapur demonstrates heterogeneity, but four samples cannot define village-wide suitability [8]. Repeat sampling across seasons would improve confidence, especially for groundwater used as a major fill source. Future monitoring should pair source chemistry with pond depth, pumping hours, dissolved oxygen, feed use and growth so that water management can be linked to production rather than assessed as a separate environmental variable.

Pond-level decision framework for Potka

The synthesis supports a five-step pre-stocking sequence. First, confirm ownership or lease rights and competing water uses. Second, measure pond area, depth and dry-season retention and inspect the complete inflow and overflow path. Third, test bottom-soil pH, source-water chemistry and a filled-pond baseline. Fourth, screen for pollution, flood and structural hazards. Fifth, match species, stocking density and crop duration to the verified water volume and management capacity. A failure at an earlier step should not be compensated for by adding more seed, feed, fertiliser or lime.

For farmer practice, the minimum pond record should include a GPS point or polygon, full-supply and dry-season water area, average and maximum depth, inlet and spillway condition, water sources, catchment description, bottom-soil pH, basic water-quality results, stocking batch, feed record, mortality, growth samples and harvest. These measurements convert the regional evidence in this paper into an auditable pond-level decision.

Limitations

This study is a structured, targeted evidence synthesis, not a systematic review or field trial. It does not provide a validated Potka pond-suitability map, a current pond census, pond bathymetry, dry-season water balances for individual farms, a contaminant survey, disease prevalence, or measured production and profitability. The source datasets differ in year, spatial denominator and purpose. Soil statistics are district-wide, groundwater resource status is block-scale, and groundwater quality is represented by a limited number of monitoring points. These limitations prevent estimation of a defensible block-wide production potential.

The next research step should therefore be a georeferenced pond inventory followed by at least one full production cycle in a monitored cohort. Seasonal source and pond-water sampling, dry-season depth tracking, bottom-soil testing, seed and feed traceability, monthly fish growth, mortality and harvest records would allow the present framework to be calibrated against observed outcomes.

Conclusion

East Singhbhum's land and water environment is compatible with inland pond aquaculture, but the opportunity is spatially and seasonally conditional. Potka is favourable at the block scale because it receives substantial monsoon rainfall and remains within the Safe groundwater category. The principal constraints are acidic soils, erosive runoff, variable pond retention, late-season water stress and locally heterogeneous groundwater chemistry.

For practical development, rainfall capture and surface storage should remain the primary water strategy, with groundwater reserved for tested supplementary use. Existing perennial ponds with stable embankments and clean catchments are the preferred entry point for composite carp culture. Seasonal ponds require shorter crops or nursery functions. Across all pond types, the essential controls are measured dry-season depth, bottom-soil pH, source-water testing, protected inflow and overflow, moderate stocking, oxygen-aware feeding and planned harvest. Potka's aquaculture potential will therefore be realised most reliably by improving the management of verified ponds rather than by treating the block as uniformly suitable.

Declarations

Data availability

All quantitative data analyzed in this study are contained in the cited government, institutional and peer-reviewed sources. No new primary dataset was generated. A compiled extraction table used for the synthesis can be made available by the corresponding author upon reasonable request.

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Ethics

This study used secondary documentary and monitoring data and did not involve experimental manipulation of humans or animals, collection of identifiable personal data, or intervention on live fish. Institutional ethics approval and informed consent were therefore not applicable.

AI disclosure

The corresponding author used OpenAI's ChatGPT during drafting and revision to assist literature organisation, language refinement, reference-format checking and document preparation. The tool was not treated as an author or as an evidentiary source. The human authors selected and reviewed the scientific content, source use, numerical interpretation and conclusions and accept responsibility for the final manuscript.

Author contribution

Kallol Saha (Principal Researcher and Corresponding Author): conceptualization, methodology, evidence synthesis, land-water and geospatial interpretation, data curation, formal analysis, visualization, original drafting, review and project coordination. Smita Shweta: fisheries and aquaculture science, technical interpretation, pond-management and water-quality review, fisheries-extension evidence and manuscript review. Atanu Sen: fisheries-linked livelihood systems, tribal-development and implementation perspectives, institutional and field-operational review, and manuscript inputs. Barnali Chakraborty: community institutions, gender and inclusion, local East Singhbhum/Potka context, field mobilisation and safeguarding perspectives, and manuscript review.

Competing interests

The authors declare no competing interests. They are collaborating on fisheries research, field implementation and enterprise-development initiatives in Jharkhand; any future commercial or funded role arising from this work will be disclosed as applicable.

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