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Note

Potential use of small water bodies of villages in Karnataka for aquaculture

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ABSTRACT

Small water bodies of villages (SWBOV) are available aplenty in the state of Karnataka and have great potential for aquaculture, but absence of data on their magnitude could be a reason for their under-utilisation. An assessment of SWBOV in Karnataka was done during 2003-2005 by coining and defining a collective term for them, compiling documented information from government organisations and surveying in logically selected agro-climatic zones. SWBOV *per se* and water resources forming SWBOV include: open wells, rain water harvesting structures (RWHS), irrigation bore wells, *gokatte, kunte,* quarry ponds and irrigation canal-fed ponds. As documented information could be obtained only on the numbers of the first three, survey was conducted to derive their water spread area (WSA) and to estimate the numbers and WSA of the latter four. As the total potential and effective WSA of SWBOV are estimated to be 0.063 million ha (mha) and 0.048 mha respectively compared to 0.008 mha of brackishwater area, SWBOV could be classified as a category of inland water resource for aquaculture.

Keywords: Aquaculture, Inland, Rural, Small waterbodies

Though the existing small water bodies of villages (SWBOV) are characterised by good aquaculture productivity, possibility of monitoring by individual farmer, support to integrated farming, organic fish production and supplementary income, they are highly under-utilised for aquaculture. There is increasing evidence which shows that it is the local food production that has the greatest chance of assuring food security. The present study was conducted during 2003-2005 to assess the magnitude of SWBOV, by collecting information (documented or otherwise), on them; survey them in logically identified regions and extrapolate their water spread area (WSA) to aid organised rural aquaculture. The sources of irrigation in Karnataka are canals (serving 38.32% of total irrigated land), borewells (31.89%), wells (12.06%), tanks (5.74%), lift-irrigation (3.50%) and other sources (temporary irrigation by rivers, streams *etc*., 8.49%) (Anon, 2006a). Among these, only the first three form the SWBOV.

For the purpose of this study, a collective term *viz*., 'small water bodies of villages (SWBOV)' has been coined and defined as: `any perennial or seasonal, natural or man-made, private or government owned water body of a village, whose effective water spread area, in a year of good rainfall or good inflow from other sources, vary from few ten to 2000 m^2; irrespective of its shape, depth, material of construction, location, period of water retention and purpose or extent of usage. SWBOV in Karnataka include: (i) bore/tubewell water storage pond, (ii) open-well/irrigation well/dug well, (iii) water-harvesting structures like farm pond, check dam *etc*., (iv) *gokatte,* (v) *kunte,* (vi) quarry pond, (vii) irrigation canal-fed pond and any other such small water body in a village.

Bore/tubewell water storage/transit pond (BWWSP): while borewell taps hard rock, tubewell taps sedimentary/ alluvium for groundwater. Borewell was the mainstay in study locale. BWWSP are earthen or partially/fully stone/concrete-inlaid ponds at an elevation, for storing groundwater. Stored water flows through bottom outlet to crops by open channel. They are usually shallow and with abundant growth of algae and higher plants (Fig.1).

Open wells: have smallest WSA amongst SWBOV, privately-owned, round or square, with varying dimensions, dug from ground surface into water bearing stratum (Fig. 2).

Rain water harvesting structures (RWHS): are earthen/ stone/cement masonry structures which are the results of land management practices that involve arable-land treatments, one of which is construction of farm pond and drainage-line treatments, whose lower-reaches treatment include construction of check dam, nala bund, percolation tank and vent dam (Anon, 2007). Except farm pond,

Fig. 1. Earthen BWWSP

Fig. 2. Open well

all RWHS are common properties and most of them are unused for fish culture, due to lack of coordination amongst villagers. Farm ponds are earthen dug-outs with a minimum of two hactares of catchment area. Their dimensions (L x W x D) vary from 9x9x3 to 21x21x21 m (WDD, 2007) and water retention period vary from few days to few months in a year (Fig. 3).

While farm ponds are more important for aquaculture due to their large numbers, there are other RWHS which can also be utilised for the purpose *viz*., check dams (stone masonry barriers constructed across deep drainage nala in lower reaches of watershed, 50x15x1.5 m), nala bunds (homogenous earthen embankment constructed across nalas or valleys, percolation tanks with a stone and cement masonry outlet when there is less scope for cut outlet, 100x100x4 m) and vent dam (cement masonry structure, in high rainfall area, whose vents can be closed by wooden flanks).

Irrigation canal-fed ponds : are found in six command areas of the state, privately owned and the largest in WSA amongst SWBOV (Fig. 4). Non-arable lands are suitable for these ponds. In Karnataka, 30% (34688 ha) of total irrigated area of Bhadra Irrigation Project, 6% (25653 ha) of Malaprabha and Ghataprabha Projects and 5% (11892 ha) of Cauvery Basin Projects (total: 72233 ha) are non-arable due to salinity, alkalinity and water logging (Anon, 2006b). Data on Irrigation Projects (IP) Zone, Gulbarga; Upper Krishna Project and Tungabhadra Project were not available.

Gokatte and Kunte:`*Go*' and `*Katte*' in the official language of Karnataka State (*Kannada*) mean `cattle' and `pond' respectively. These, normally earthen structures,

Fig. 3. Farm pond

Fig.4. Canal-fed pond

is present in almost every village at a low basin and the rain water collected here is meant for drinking and bathing purposes of cattle (Fig. 5). *Kunte* is similar to *gokatte*, but is larger and deeper. Both are public properties and mostly unused for fish culture due to local issues of usage rights.

Quarry ponds: abandoned, low lying, quarry pits form good storage ponds for either run off rain water or groundwater from borewell (Fig. 6). They have advantages of rainwater inflow and absence/less of seepage, but have irregular contour.

Information on the magnitude and details of SWBOV in Karnataka was gathered from the concerned offices of Government of Karnataka (GoK) (Table 1). Documented

Fig. 5. Gokatte

Fig. 6. Quarry pond

data on only numbers of borewells (Anon, 2006c), open wells (Anon, 2006c) and subsidised RWHS (Anon, 2007) could be obtained. There was no documented information on canal-fed ponds, *gokatte*, *kunte* and quarry ponds. Survey was conducted to derive WSA of SWBOV formed by borewells, open wells and RWHS and to estimate the numbers and WSA of canal-fed ponds, *gokatte*, *kunte* and quarry ponds.

The number of farm ponds increased by 16 times (from 1968 to 32076) in 2006 as compared to 2001 and more than doubled to 75429 in 2006-07, indicating the importance given for rainwater harvesting (Table 2). This trend is likely to continue, giving scope for aquaculture. Effective WSA (EWSA) of RWHS is assumed to be only 25% of potential WSA (PWSA) (Table 3) considering vagaries of rainfall, breach/leakage, seepage and heavy siltation.

Study locale for the survey was selected based on number of SWBOV present. Canal-fed ponds were enumerated in three taluk*s* of Shimoga, Bhadravathi and Shikaripura in Shimoga District. For studies on SWBOV other than canal-fed ponds, regions with more borewells were selected. It was assumed that presence of a borewell in a village is concomitant with BWWSP, as power supply in rural areas is normally discontinuous, necessitating water storage in pond/s during power supply hours. About 25.78% of minor irrigation schemes, including borewells in Nelamangala Block, Bangalore Rural District are under-utilised due to inadequate power (Minor Irrigation Census 2000-2001, Appendix-I Concepts and Definition, Department of Minor Irrigation, Karnataka, Pers. Comm.).

First three districts of Karnataka with highest number of borewells were: Kolar, Tumkur and Bangalore Rural (Anon, 2006c) all (except eight taluks of Tumkur District) coming, coincidentally under Eastern Dry Zone (Anon, 2006d,). Kolar and Bangalore Rural districts were selected, as their stage of groundwater development was 196% and 172% respectively, compared to 111% of Tumkur District (Anon, 2005a). Kolar and Nelamangala taluk*s* were selected for the study as they were easily accessible from Bangalore. The state departments of fisheries, agriculture and horticulture were consulted to know the names of villages with more irrigated crops in the selected taluks. A survey was conducted in 10% of the villages in each taluk using a format, for information on SWBOV (Table 4).

According to the Department of Fisheries, the number of water bodies of less than 0.20 ha area in Karnataka is only 1613 and the total number of water bodies is 25717 (Pers. Comm.), which appears meagre, at less than one SWBOV per village of the state that has 29406 villages (Anon, 2006a) and hence it was felt that updation is required. The most accurate and elaborate information on SWBOV, albeit for a smaller area, *viz*., *Sindhuvalli Grama Panchayati*, Mysore Taluk and District, Karnataka

Table 1. List of offices of Government of Karnataka consulted for obtaining information on SWBOV

Government organisation consulted along with the Designation of head of the organisation
Director, Department (Dept.) of Fisheries, GoK, Visvesvaraiah Tower, Bangalore-1
Director, Dept. of Agriculture, GoK, Commissionerate of Agriculture, # 1, Seshadri Road, Bangalore–1
Director, Watershed Development Dept., GoK, VII Floor, Cauvery Bhavan, KG Road, Bangalore–9
Director, Karnataka State Remote Sensing Applications Centre, GoK, VI Floor, M.S. Building, Bangalore–1
Executive Director, Jala Samvardhane Yojana Sangha, Dept. of Water Resources (Minor Irrigation), 42, V Cross, Sadashivanagar, Bangalore–80
Engineer-In-Chief, Water Resources Development Organization, GoK, Anand Rao Circle, Bangalore-9
Director, Dept. of Minor Irrigation, GoK, K.R.Circle, Bangalore-1
Director, Drought Monitoring Cell, GoK, IX Floor, BWSSB Bldg, Cauvery Bhavan, Bangalore-9
Director, Dept. of Rural Development and Panchayat Raj, GoK, Multi Storeyed (M.S.) Building, III Floor, Bangalore-1
Director, Karnataka Power Transmission Corporation Limited, GoK, Cauveri Bhavan, Bangalore-1, www.kptcl.com
Director, Directorate of Economics & Statistics, GoK, VII Floor, I Stage, M.S. Building, Bangalore-1
Director, Karnataka Rural Water Supply & Sanitation Agency, RDPR Dept., GoK, II Floor, Cauvery Bhavan, Bangalore-1
Secretary, Irrigation Department, GoK, M.S. Building, Dr. B. R. Ambedkar Road, Bangalore-1
Director, Dept. of Mines & Geology, GoK, Race course Road, Bangalore-1

Table 2. Estimation of WSA of subsidised RWHS in Karnataka from 2001 to 2006

Parameter	Farm pond	Nala bund	Percolation tank	Check dam
No. of RWHS*	75429 (2001-07)	6321 (2001-06)	1560 (2001-06)	18339 (2001-06)
RWHS dimensions (LxWxD) (m)	9x9x3	100x100x2	100x100x2	50x15x1.5
Potential water spread area (ha)	611	6321	1560	1375
Total PWSA of RWHS (ha)		9867		

* Anon, 2007c

Table 3. Extrapolation of water spread area of SWBOV in Karnataka

Name of SWBOV	Quantity documented/enumerated	Average WSA (m^2)	PWSA (ha)	EWSA		% of Total EWSA
				Presumed % of PWSA	EWSA (ha)	
BWWSP	530370 (No. of BW)[a] X 0.6427 (Av. % of BW with ponds, in decimals)	153.15	5220	95	4959	10.29
Open wells	481068[a]	657.1	31611	95	30030	62.30
RWHS	Estimated PWSA of RWHS, (except vent dam), *vide* Table 2	-	9867	25	2467	5.12
Gokatte	29406 (No. of villages)[b] X 2.45 (Av. no. of *gokatte*/village)[c]	1141	8220	40	3288	6.82
Quarry ponds	29406 (No. of villages)[b] X 0.47 (Av. no. of quarry ponds/village)[c]	538.5	744	80	595	1.23
Canal-fed ponds	10% of total non-arable land (72233 ha)[d] is assumed to be potential for aquaculture.	-	7223	95	6862	14.24
Total			62885		48201	100.00

Anon, 2006c, [b]Anon, 2006a, [c]Table 3. [d]Anon, 2006b.

Table 4. Inferences from the survey on small water bodies of villages in Karnataka

Inference	BWWSP*	Open wells*	*Gokatte**	Quarry ponds*
Average (Av.) total nos.	660.5	456.5	73.5	16.5
Av. nos. /Village	22.41±3.2	14.73±1.3	2.4±0.7	0.53±0.7
Av. WSA (m^2)	153.15±25.3	657.1±19.1	1141±112.3	538.5±156.4
Av. depth (m)	1.46±0.4	11.14± 1.2	1.68±0.3	1.66 ±0.5
% of SWBOV used for aquaculture (% of 1)	2.27±1.8	2.41±0.5	6.99±1.3	30±2.9
% dry during the survey	0	81.63±4.5	34,58±3.9	23.61±5.0

* Av. values of SWBOV in taluk*s* of Kolar (37 out of 361 villages) and Nelamangala (25 out of 243 villages).

is documented by the Karnataka State Remote Sensing Applications Centre through satellite imaging SWBOV, followed by manual field survey (Pers. Comm.). For *e.g*., minor details documented about wells include type of well (open well, square, round, lined, unlined, borewell, dug-borewell, hand pump), owner and integrated details (diameter, total depth, water depth, casing length and water yield).

The number of irrigation pump sets (of less than 10 HP) energised is 1503028 (Anon, 2005b), while the number of irrigation wells documented is 530370 (Anon, 2006c). For calculation of WSA of BWWSP (Table 3), the latter is considered, assuming that pumps energised include pumps of open wells, whose total number is 481068 and ranks third amongst the irrigation sources (Anon, 2006c) in the State.

An average of 64% of the enumerated borewells had storage ponds and BWWSP seems to be the best SWBOV for regular aquaculture activities. Irrigation borewells numbering 19569 in Kolar District have BWWSP with WSA of about 150 ha, usable for aquaculture (Krishnamurthy, 2001). Assuming that 481068 open wells in the state (Anon, 2006c) are with water, their cumulative WSA calculated using estimated average WSA is so high that they form 62% of the estimated total EWSA of SWBOV (Table 3).

The number of canal-fed ponds in Shimoga District was 25, in the taluk*s* of Shimoga (13), Bhadravathi (8) and Shikaripura (4), with WSA of 12 ha. None of these ponds was dry during the survey and 88% of them were used for fish culture. Low pond-depth (1.75 m) resulting in lower fish yield and lack of extension services are the reasons for poor/non usage of problematic soils for canal-fed ponds (Fish Farmers Development Agency, Shimoga, Pers. Comm.). Canal-fed ponds are to be 2.75 m deep to overcome water level reduction at the end of canal-dry period/s of one to two months and they are to be filled up almost to brim, three days before stoppage of canal water supply (Venkatagiri and Krishnamurthy, 2003). Canal-fed ponds, as SWBOV, can boost aquaculture, as their number and WSA can be higher than any other SWBOV and adoption of package of practices for aquaculture from the stage of pond construction to harvest is possible, to reach commercial scale of production.

Smaller area and uncertainties about the extent and duration of water holding in SWBOV could be the reasons for lesser attention given to them. However, it is becoming increasingly evident that scattered smaller water bodies hold promise of sustained irrigation and groundwater recharge, rather than large water bodies like tanks and reservoirs. With estimated total EWSA of 48201 ha (Table 3), compared to 8000 ha of brackishwater in Karnataka, SWBOV qualifies to be classified as a category of inland water resource for aquaculture. This assessment and categorisation of SWBOV is expected to boost the prospects of aquaculture in these waterbodies, through suitable policy formulation and implementation.

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