



Research Note

Fish Attractants used in Deep Pool at Hogenakkal Falls of River Cauvery, India

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Major peninsular Indian rivers like Godavari, Krishna and Cauvery have many deep pools with unique indigenous fish germplasm. Cauvery is known as one of the most water-scarce among the South Indian large rivers with low water discharge, especially the Tamil Nadu stretch where water flow and discharge are dependent on water release from several dams and barrages. Water depth and flow is very less in most of the river stretches except few deep pools. It was observed that indigenous large-sized fishes contribute a significant share of the total landings of downstream of Hogenakkal falls, a deep pool region of river Cauvery in Tamil Nadu. Hogenakkal stretch of river Cauvery is inhabited by at least 45 types of fish species as recorded during the study. In this deep pool, fishes of all different food habits viz. planktivores, piscivores, insectivores, detritivores, etc are available which may be broadly categorized as herbivores and carnivores. Due to higher water flow as well as disturbances caused by the massive rush of tourists during day hours, gill net fishing is challenging. Hence, fishers are mostly habituated with hook & line fishing to capture fishes from the congregation of fishes in the deep pool below Hogenakkal falls. Use of hook and line in deep pool fishery was reported from river Krishna especially at Satrasala, catching large sized eel, *Anguilla* sp. (Manna et al., 2003; Manna et al.,

2011). The success of hook & line fishery is highly dependent on the selection of suitable fish attractants used as bait (Løkkeborg et al., 2014). Investigation revealed that as many as eight types of baits are used by hook and line fishers at deep pool below Hogenakkal falls to attract the fishes at different trophic levels. Importance of bait in marine hook & line fishery from India has been well studied by several researchers (Balasubramanyan, 1964; Aneesh Kumar et al., 2017). However, in inland riverine sector of India, published research articles related to hook & line fishery only mentioned different types of baits but without the details like preparation, method of use, targeted species, efficacy, etc (Srivastava et al., 2002; Gurumayum & Choudhury, 2009). Present article is an attempt to describe different types of fishing baits, their mode of use and target fish species in hook and line fishery in deep pool of river Cauvery at Hogenakkal falls downstream (12°07'02.5"N, 77°46'33.8"E) in Tamil Nadu, India. Information on baits used in Hook and line fishery in the deep pool was collected from fishers during seasonal sampling in 2017-2020 using different participatory tools including interviewing, group discussions and on-field observations.

Below the Hogenakkal falls area, the river Cauvery is passing through a gorgy hilly landscape. The deep pool stretch is about 600 m long where river width varies from about 10 m to 60 m. Both the river banks are steep with hills, where fishers somehow manage to sit or stand in a small plain surface between the rocky area and carry out the fishing operation with hand-held baited long line. This form of the fishery is locally known as 'Thoondil'. Hooks made of

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stainless steel and monofilament line are used for this purpose. Thicker lines (>0.33 mm dia) are mostly attached with larger hooks (6-14 nos), whereas smaller hooks (16-20 nos) are used with thinner lines. Most common number 8 large metallic J-hook was having length of 5.1 cm, gape 1.4 cm, bend 1.6 cm, bite 1.8 cm, whereas smaller sized J-hooks number 16 was having size 2.1 cm, gape 0.5 cm, bend 0.7 and bite 0.7. There are about 100 fishers at Hogenakkal who are associated with hook and line fishery. Most of the fishers are having two sets of gears. On an average, 25% of the total gears are operated in a day.

The length of the line goes up to 45-50 m. Fishing rods were mostly not used in the deep pool area. It was estimated that about 77% of the fishes caught at Hogenakkal were of indigenous variety. The others are consisted of exotics like *Oreochromis niloticus* (Nile tilapia), *O. mossambicus* (Mozambique tilapia), *Clarias gariepinus* (African catfish), with some contribution of *Cyprinus carpio* (Common carp), *Ctenopharyngodon idella* (Grass carp), *Hypophthalmichthys molitrix* (Silver carp), etc. Target fishes included large-sized *Labeo rohita* (Rohu), *L. Calbasu* (Calbasu), *L. Catla* (Catla), *Barbodes carnaticus*

(Carnatic carp), *Systomus sarana*, *Oreochromis niloticus*, *Wallago attu* (Freshwater shark), *Mastacembelus armatus* (Spiny eel), *Sperata seenghala*, *S. aor*, *Channa marulius* (Giant snakehead), *C. striata* (Striped snakehead), etc. Fishers used their acquired and inherited knowledge to select the suitable bait for catching targeted fish species based on their food and feeding habit. Table 1 describes eight types of fish attractants, which were used as bait and their targeted fish species along with the hook numbers used for this purpose as recorded during the study.

Periphytic algae as bait: Upstream of Hogenakkal is a hilly stretch with rocky river bed. Water level in this stretch fluctuates regularly due to controlled release of water from upstream Krishnsrajasagar (KRS) dam. The intermittent change of water depth supports growth of filamentous algae along with aquatic macrophytes in the coves and bays with stagnant water during low water discharge regime. The filamentous algae were often used as bait to attract large sized herbivorous fishes especially Indian Major Carps (*Labeo rohita*, *Labeo calbasu*, *Labeo catla*) and other minor carps such as *Systomus sarana*, etc. Algae were kept in a small plastic packet in water to preserve it in fresh condition and used as

Table 1. Types of baits used in hook & line fishery at Hogenakkal in river Cauvery

Sl.	Bait type	Major fish species caught	Hook number used
Bait for herbivores			
1.	Periphytic algae	<i>Labeo rohita</i> , <i>L. calbasu</i> , <i>L. catla</i> , <i>Tor</i> sp. (Mahseer)	16, 18, 20 (8-12 nos for big size fish)
2.	Moulded Bun bread	<i>L. calbasu</i> , <i>Barbodes carnaticus</i> , <i>Systomus sarana</i> , <i>Oreochromis niloticus</i>	14, 16, 18, 20
3.	Modified bait using Dhosa	<i>L. calbasu</i> , <i>S. sarana</i>	16, 18, 20
Bait for Carnivores			
4.	Live fish / Fish flesh	<i>Wallago attu</i>	6, 7, 8
5.	Live prawn	Catfishes like <i>Sperata seenghala</i> , <i>S. aor</i> , <i>Mastacembelus armatus</i>	8, 10, 12, 14
6.	Earthworm	<i>W. attu</i> , <i>S. seenghala</i> , <i>S. aor</i> , <i>M. armatus</i> , <i>Hemibagrus punctatatus</i> , <i>Mystus cavasius</i>	10, 12, 14
7.	Egg sack of <i>M. armatus</i>	<i>M. armatus</i>	10, 12, 14 (18-20 nos for small size fish)
8.	Live frog	<i>Channa marulius</i> , <i>C. striata</i> , <i>Tor</i> sp. (Mahseer)	8, 10, 12, 14

bait in hook and line fishery at Hogenakkal deep pool. Analysis revealed that the filamentous algae mostly consisted of *Oedogonium* sp. The same filamentous algae were also observed to be used as bait for catching *Tor* sp. (Mahseer) at Biligundlu, upstream of Hogenakkal reminding the omnivorous nature of Mahseer. However, from the Hogenakkal deep pool area, Mahseer catch is rarely reported. Use of algae as fish bait from Bahrain was reported by Basson (1989).

Moulded Bun bread as bait: Bread made of wheat flour is an easily available material for use in bait preparation in hook and line fishery. For the preparation of bait, the bread (preparation popularly known as *Bun*) is taken and an adequate quantity of water is added to prepare a dough after thorough mixing. The sticky nature of the mould makes it very easy to put required small portion as bait in hooks. As small-sized hooks are mostly used, small to medium-sized herbivorous carps like *L. calbasu*, *B. carnaticus*, and *S. sarana* are observed to be mostly caught by this bait. Like other upstream and downstream river stretches, large-sized exotic *Tilapia* (*Oreochromis* sp.) contributed significantly in overall fishery of Hogenakkal area which is also observed to be caught by this bait.

Bait from Dhosa mix: It was observed that bait was prepared by the local people using Dhosa as the main ingredient. Dhosa is mainly made of rice and black gram. As rice is one of the constituents, it makes the bait sticky in nature and can be easily attached as bait with the hook. However, Dhosa was observed to be modified before its use. A mixture is prepared using Dhosa, fried pulse (split seed of peas, *Pisum sativum*) and turmeric. It was thoroughly mixed to have a dough to be used as bait for herbivorous fishes like *L. calbasu*. A unique bait made of different ingredients using boiled rice as binder to lure herbivorous Indian Major Carps was reported from river Ganga (Manna et al., 2020b).

Live fish / fish flesh as bait: Juveniles of minor carps like *L. calbasu*, *L. dyocheilus*, *L. bata*, *Bangana dero*, *Cirrhinus reba*, etc which are available in plenty in the upstream of Hogenakkal area viz. Ottamalai, are used to attract the carnivorous fishes like *W. attu*, *C. marulius*, etc. in the deep pool. Those juvenile fishes are mostly caught by cast nets from upstream shallow areas, kept in live condition in plastic containers), carried to the deep pool area and used as live bait. The large-sized hooks (6-8 number) are

pierced at the front dorsal sides of the juvenile fishes (bait) in such a way that the fishes remain alive for a long time and swim inside water in hook-attached condition. Fishes like *W. attu* being piscivorous, get attracted by the small-sized live fishes and get hooked. Live bait is common in hook and line fishery especially targeting carnivorous fishes as reported from several parts of the world (Sternberg, 1996; Aneesh Kumar et al., 2017).

Live prawn as bait: Small prawns are caught from the shoreline area of upstream river stretch using small mesh nets and kept in live condition by putting them in a plastic bag with water. Fishers used to put such plastic bags floated in river. Small-sized prawn species like *Macrobrachium nobilii*, *M. scabriculum*, *M. rude* and *M. lamarrei* are mostly used for this purpose. Large catfishes like *S. seenghala*, *S. aor* etc are caught by luring them with live prawn as bait in hook and line fishery at Hogenakkal deep pool.

Earthworm as bait: The earthworm has been observed as the most ubiquitous bait in hook and line fishery of river Cauvery. It is also one of the most common baits in hook and line fishery in many other Indian rivers (Gurumayum and Choudhury, 2009; Manna et al., 2020a). In Hogenakkal deep pool area also, the earthworm is among those baits which are most frequently used. For the purpose of its use as bait, earthworm is collected and kept in live condition in sand-mud mixture for use. Though catfishes such as *Hemibagrus punctatus*, *S. seenghala*, *S. aor*, etc are mostly targeted by the earthworm bait at Hogenakkal, as per observations, *M. armatus* is also captured in hooks by using earthworm bait.

Egg sack of *M. armatus* as bait: Landings of *Mastacembelus armatus* used to vary significantly with seasons. During monsoon and post-monsoon months of August-November, *Mastacembelus* catch used to be more and goes up to 45-50 kg/day. During other months, daily catch varied in the range of 10-15 kg/day. Interestingly, the egg of the species itself is used as bait to catch the fish by hook and line. For use as bait, eggs are collected from market where the fishes are processed for the consumer after the sale. During the processing of large-sized *M. armatus* in the market, egg sacks are carefully removed and kept for the fishers who collect it and use it as bait. Due to eggsack and sticky nature of the egg, the fish eggs remain together in water and act as bait. The hook is inserted such that the egg case hides it.

Live frog as bait: Freshwater frogs are often used as live bait in hook and line fishery to catch pelagic carnivorous fishes. Gurumayum & Choudhury (2009) reported use of small frogs in hook and line fishery in rivers of northeast India. Large-sized murrelets (*C. marulius*, *C. striatus*, etc) are regularly caught from Hogenakkal deep pool area with these baits. A significant share of the catch is achieved during late monsoon period when water frogs are readily available. To keep the frogs in live condition, hook is pierced in their hind legs or upper jaw and released in the deep pool water. Fishes like *Channa* spp. often gets attracted by the swimming frog and caught. In the deep pool area, a single frog is attached to a single line, but in upstream of Hogenakkal (like Ottamalai fishing village), they are also used in set long line with multiple hooks.

Hook and line fishery serves the purpose of continuous supply of fish in the area as there is consistent demand of fish at Hogenakkal due to regular visit of tourists for enjoying the waterfalls. It has been recorded that around 20-30 fishers operate hook and line regularly in this deep pool. Many of them operate both large and small hooks simultaneously. Less availability of natural food during monsoon might attract more fishes towards bait, which may be another factor. The average catch of small hook operators was 2.5-3.0 kg/day, while wide variations were recorded in the catch of fishers operating larger hooks, which reached up to 5.0-6.0 kg/day.

Analysis of catch revealed that many fishes like *L. calbasu*, etc. were caught by hook and line are much below their lengths at first maturity of 32.8 cm. This was due to the use of smaller sized hooks which must be avoided for conservation and sustainability of the resources. Though large-sized fishes used to occupy deep pools in rivers, such fishes migrate downstream during breeding time in search of shallow water with mild flow for their breeding success. Also, diel foraging movement from deep pools in search of food is reported. Considering the importance of deep pool in riverine fishery, deep pool atlas has been prepared in other major rivers of the world along with fish stock mapping using Hydro-acoustics survey (Sinthavong et al., 2006; Halls et al., 2013). For sustainability of the fishery resources, similar areas in river Cauvery may be identified and regulation may be in place during this potamodromous migration of riverine fishes. Again, Passive fishing gears like baited hooks may

have higher encounter rates with actively foraging individuals which may be selectively removed causing evolution of behavioural traits like reduced boldness of fishes as reported by Claireaux et al. (2018). Hence, role of bait i.e. fish attractant in hook and line fishery in perspective of the targeted fish species needs special attention. From fish attractant point of view, different types of baits are reported from fishery of open water for the same species; hence efficacy study may be done to select the most suitable bait, which is an important area of research considering increased sport fishing activities throughout the world.

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