

The Fish Catching Devices with their Efficacy and Cost-benefit Analysis in the Towkak River in Assam and Nagaland, India

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Abstract

Approach had been made to study the various fishing techniques in the Towkak River in Assam and Nagaland. The combination of both hills and plain regions along the river, showed a higher diversity of fishing gears and equipments. The cost benefit and efficiency analysis results that Cast net was most efficacious fishing gear and also possesses the highest value of Mechanization Index (MI) which portrayed, a popular and most used gear.

Keywords: Fishing gears; Cost-benefit; Efficiency; Towkak river; Assam; Nagaland

Introduction

Fish catching devices, popularly called “Fishing gears and crafts” are the implements to harvest fishes from a water body. These exhibit bewildering diversity globally, nationally, regionally and locally. Variations also exist according to fish type, fishermen type and season type.

Fishing is one of the earliest traditions for the people of North-East India as well as rest of the country. The fisherman’s catch fishes not only to taste fishes but also to survive their livelihood. The application of fishing gears and methods are dependent on various factors, such as geomorphology of the water body, physiography of the water body, nature of the fish type available, people involved during the time fishing operation, the characteristic of the raw material from which a particular fish gear is prepared and time/season of operation [1,2]. The fisherman’s usually used following fishing equipments to catch the fishes from the Towkak river and also from nearby wetlands.

Methods

The efficacies of the gears have been determined on the basis of fish catch (catch/person/gear/hour: CPGH) [3,4]. Attempts have been made to calculate Mechanisation Index (MI) [5], Hanging Co-efficient (HC), and Niche Width (NW) [6] from the field data [7-10].

- **Mechanisation Index (MI):** MI is the index ratio of the total space covered by a specific gear to the total fish catch. i.e.,

$$MI = \frac{\text{Volume of a specific year}}{\text{Total fish catch}}$$

Hanging Co-efficient (HC): $HC = \frac{\text{Height of the specific gear}}{\text{Depth of water}}$

Niche’ Width (NW): $NW = \frac{\text{Total area fish found}}{\text{Total area of water body}}$

Results

An account of the fishing gears, in Towkak River in Assam and Nagaland is briefly given below:

The jals or nets

Borjal (Drag net)

Drag net is used to cover a wide area of the River in some places

where the river area less spread, the drag net covers the entire area of the river. The net is usually used in lower and middle portion of the river. Minimum eight-ten fishermen are required for its operation (Figure 1).

Tongijal (Dip net)

Dip net, generally used around the riverside. The dip net practice is not so laborious and easy to handle. It can be operated by a single person only. The operation procedure involves, keep the net under water for few minutes and then pickup, a rope with a bamboo support is generally used to pull up the net, traveling or feeding fishes are lifted out by rapid operation of the act (Figure 2).

Fasijal (Gill net)

On the basis of mesh size gill net is different according to the size of the fishes to be captured. It is rectangular in shape and has various meshes, joint by two strong strings at both sides. Fisherman fixed the net at one end of river with a support (i.e., bamboo or any wooden tag) where a rope is fixed at a end of the net. The captured fishes are taken out of water along with the net or collect from the water (Figure 3).

Khewali jaal (Cast net)

Cast net is a circular net. The operation of the net is very artistic to watch, fisherman need to do a lot practice to operate this net. The structure of net is in conical shape, where gill is attached in bottom side maintaining a specific difference and made pockets joining gill attached line to upper body of the net. This net is encircling in nature and gradually wider from top, fishermen through the net on water bodies and fishes are get trap in pockets and catch (Figure 4).

Dheki Jal (Lift net)

Lift net is a one of the biggest net used in the river and is rectangular

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Figure 1: Drag Net (Borjal).



Figure 2: Dip Net (Tongijal).



Figure 3: Fasijal (Gill net).

in shape. Where all corner are been tied to a flexible bamboo. A bamboo is generally used to pull up the net. A rope is tied for drag up at the top of the bamboo, where crossing point is attached. The net used to catch all types of the fishes in slow flowing water (Figure 5).

Scooping net

It is a round shaped smaller net just like tennis racket having smaller mesh size. The net is prepared with metallic round ring or with bamboo (make it round shape), where net is attached and the net is then tag with a bamboo stick with required length. The net is used to catch the fishes from the upper layer of water mainly. In the river, fisherman used toxicities, because of which fishes float very rapidly and without any direction in the upper layer of the river, therefore, it become easy to catch the fishes using scoope net.

Thealjaj

It is a triangular shaped net, used in all parts of the river. The net is prepared with two bamboo stick and with one metallic string, all are joined to make a triangular structure, where the net is attached. The net is push behind to a supportive side, where it can be easily pull up. It is operated in the sides of the river (Figure 6).

Polo (Cage trap)

Cage is a type of trap made of bamboo sticks only. Bamboo sticks are cut into thin strips and then joints them into a circular way, the



Figure 4: Khewali jaal (Cast net).



Figure 5: Dheki Jal (Lift net).



Figure 6: Thealjaj (Pushing net).

upper head is smaller and the base is much wider, secured in place by a strong bamboo rim. Fisherman used it in low depth areas, the fishes get inserted into the cage is easily taken out with hand itself (Figure 7).

Borakhi (hook and line)

Another type of available fishing instrument used in all parts of the river is Borakhi (Hook and line). The hook is prepared with iron string having an anchor the end which is attached with a nylon or fiber thread and supported by a bamboo or plastic stick (in some cases). The bait, used to attract the fish may be earthworm, nymph of beetle, small fish, of small frogs, boiled rice or wheat flour, placed to the anchor of the hook, where fishes get caught while taking the bait. The selection of bait is varied and depends upon the feeding nature of the fishes. There are also several types of hook and line are used by the fisherman of the Towkak River and surrounding areas are as: Borakhi, Khuti Borakhi, Machine Borakhi etc., (Figure 8).

Jakoi (Basket trap)

It is a type of triangular shape bamboo trap and made by weaving with very thin bamboo strip, joints triangularly at three ends. One end of the trap is so closely packed with bamboo strips and the other end is open. The opening mouth is attached to a strong bamboo sticks and supported by a rope. The rope, help to the fisherman to handle the Jakoi easily. Mainly women fisherman used this equipment more than man (Figure 9).

Dhanu-kand or posa (bow and arrow)

The fisherman of the region also used bow and arrow as a fishing equipment, they usually used this type of instrument to catch the large size fishes form the far distance.

Chepa (valve trap)

Chepa or vale trap is another type of fishing gear used in this region, where bamboo strips are held together by strings of cane and is shaped like a curved drum. The valve is made in such a way that fishes enter the trap but are unable to get out again (Figure 10).

Khoka

A fishing device made by bamboo thin stick and cane used for catching big fishes (Figure 11). This device keeps under deep water for sheltering fishes in it. This device is checked after a period of 4-5 days. The fishes that entered into the device then caught easily by the fisherman with the help of boat or take it into a riverside (Table 1).



Figure 7: Polo (Cage trap).



Figure 8: Borakhi (hook and line).



Figure 9: Jakoi (Basket trap).



Figure 10: Chepa (valve trap).

Khaloi (fishing basket)

A basket that is purely made of bamboo sticks and which looks like earthen pot. It is made by weaving cane and mouth is open. Fisherman always ties the basket on their hip through plastic or nylon or any other rope. Fishermen hold handle of the trap with left hand and rope by right hand and a plunge it into water. After catching the fishes fisherman usually kept puts them into the khaloi and one can easily carry it to a certain place. Then it is drown towards the body after which it is lifted from water and trapped fishes are taken out and kept in fishing basket.

Discussion

In Towkak River, the operation of fishing gears also exhibit



Figure 11: Khoka.

seasonality in their operation. Most of the gears operate during winter and pre-monsoon seasons mainly, cast net and dip net has no seasonality and is operated throughout the year. Gear-specificity to fish types revealed that, Borjal (Drag net) hauls mainly large type fishes, e.g., Wallago attu, Chitala, Tor etc., while Tonngijal (Dip net), Scoope net, Thelajal catches mainly the small fishes like Puntius spp., Mystus spp, Amblypharygodon mola, Salmostoma bacaila etc., Fasijal (Gill net), Khewali jaal (Cast net), Dheki Jal (Lift net), catches both types of small and large fishes, depending upon their mesh sizes. Polo (Cage trap), Khoka etc., are very much occurred seasonally and these fishing equipments are prepared to catch fishes mainly, Labeo spp, Mastacembalus armatusi, Glossogobius spp, Cyprinus carpio etc., Jakoi (Basket trap), Chepa (valve trap), are prepared to catch the fishes where water level is low, the fishes caught with these kind of equipments are mainly, Puntius spp, Channa spp, Anabus testudineus, Danio spp, etc., Borakhi (hook and line), Dhanu-Kand or Posa (bow and arrow) are the specially prepared equipments to catch specific fishes like Channa spp, Mystus spp, Clarius spp etc.,

Analysis of efficacy of the fishing gears through CPGH, as shown

in the (Table 2), reveals that Khewali jal (Cast net), seems to be the most efficacious fishing gear. The (Table 2) also reflects significant differences between the different kinds of gears with regard to their CPGH. Efficacy of the Khewali jal (Cast net), is also reflected from its high HC value.

On the other hand, analysis of MI portrayed that, Khewali jal (Cast net), possesses the highest value of MI. Also, high value of MI of Khewali jal (Cast net), makes it a popular and most used gear.

In addition to above discussed methods and techniques of fishing techniques also seems to operate in the river, there have some other miscellaneous methods of fishing technique. Some other important fishing activities carried out in the Towkak River are: Trap fishery: Though there are various types of trap used both in the down and up stream of the river. The method of operation, season of operation are slightly different, this is because of different in topographical nature prevailing in the hills and valley. Fishermen usually used locally available wood, bamboo, stones, mud and tree branches etc., to prepare various traps. The main season of trap fishing is the dry season (September to February), where depth of the river becomes low.

1. Fishing by using explosives: The use of explosives to catch fishes is a common and practice for the fisherman in the upstream portion. Moreover, in the upstream most of the fishing ground is not suitable for fishing, uneven rocky bottom, so operation of any types of nets is difficult. Because of this constraint, the fishermen in this reason used several explosive to caught fishes.

2. Fishing by using certain toxic materials: The poison is used to capture the fishes from the open water by applying directly to the stream. There are two types of fish poison used for fishing: i) chemical poison, ii) Xhthyo-toxic plants. The chemical products are directly or indirectly imported to the water of river from the Tea-factories,

SI No	Gear Type	Length (m)	Width (ft)	Mesh Size (mm)	Material Used	Longevity of the gear	Mode of operation
1	Borjal (Drag net)	1.5-2	80-100	4-5	Nylon or polystar tread	4-5 years	From the bottom of the river to upper level
2	Tonngijal (Dip net)	-	10-12	2-4	Nylon or polystar tread and bamboo	1-2 years	From the upper level to middle or lower level
3	Fasijal (Gill net)	1.5-2	50-60	Varied	Nylon or polystar tread	4-5 years	Upper level to the lower level
4	Khewali jaal (Cast net)	3	40-60	2-8	Nylon or polystar tread	3-4 years	From the upper level to middle or lower level
5	Dheki Jal (Lift net)	4-5	30-70	5-10	Nylon or polystar tread and bamboo	3-4 years	Upper level to the lower level
6	Scoope Net	0.3-0.4	2-2.5	5-6	Polyamide (PA)	1-2 years	Upper level
7	Thelajal (Pushing net)	1.5-2	10-15	3-4	Nylon or polystar tread and bamboo	1-2 years	Upper level to the middle level
8	Polo (Cage trap)	0.5-1	2-3	-	Bamboo and thread	1 year	Upper level to the lower level
9	Borakhi (hook and line)	-	-	-	Thread and iron or still	4-5 years	Upper level to the lower level
10	Jakoi (Basket trap)	1-1.2	3-4	-	Bamboo and thread	2-3 years	Middle level to lower level
11	Dhanu-Kand or Posa (bow and arrow)	-	-	-	Bamboo, thread and iron or still	4-5 years	Upper level
12	Chepa (valve trap)	-	-	-	Bamboo and thread	1-2 years	Middle level to lower level
13	Khoka	3-4	3-4	-	Bamboo and thread	1-2 years	Lower level

Table 1: Diversity of Fish catching devices in Towkak River in Assam.

SI No	Gear Type	Species Captured	Fishing efforts
1	Borjal (Drag net)	Large Sized Species, e.g. <i>Wallago attu</i> , <i>Chitala chitala</i> , <i>Tor tor</i> etc., and 1-6 species per catch.	Maximum; more than one person required
2	Tonngijal (Dip net)	Small sized fishes; e.g. <i>Puntius</i> spp., <i>Mystus</i> spp, <i>Amblypharygodon mola</i> , <i>Salmostoma bacaila</i> etc.; 10-100 species per catch.	Less; one man can performed
3	Fasijal (Gill net)	All types of fishes captured; 1, 2-40 species per catch depending upon the type of fish.	Less; one man can performed
4	Khewali jaal (Cast net)	Small sized fishes; e.g. <i>Puntius</i> spp., <i>Mystus</i> spp, <i>Amblypharygodon mola</i> , <i>Salmostoma bacaila</i> etc.; 10-100 species per catch.	Maximum; one man can performed
5	Dheki Jal (Lift net)	All types of fishes captured, 1, 2-40 species per catch depending upon the type of fish.	Maximum; one man can performed
6	Scoope Net	Small sized fishes; e.g. <i>Puntius</i> spp., <i>Mystus</i> spp, <i>Amblypharygodon mola</i> , <i>Salmostoma bacaila</i> , <i>Channa</i> spp etc.; 10-100 species per catch.	Less; one man can performed
7	Thelajal	Small sized fishes; e.g. <i>Puntius</i> spp., <i>Mystus</i> spp, <i>Channa</i> spp, <i>Amblypharygodon mola</i> , <i>Salmostoma bacaila</i> etc.; 1-20 species per catch.	Less; one man can performed
8	Polo (Cage trap)	<i>Labeo</i> spp, <i>Mastacembalus armatusi</i> , <i>Glossogobius</i> spp, <i>Cyprinus carpio</i> .; 1-10 species per catch.	Less; one man can performed
9	Borakhi (hook and line)	<i>Channa</i> spp, <i>Mystus</i> spp, <i>Clarius</i> spp etc.; 1 species at one successful attempt.	Less; one man can performed
10	Jakoi (Basket trap)	<i>Puntius</i> spp, <i>Channa</i> spp, <i>Anabus testudineus</i> , <i>Danio</i> spp.; 2-20 species per catch.	Less; one man can performed
11	Dhanu-Kand or Posa (bow and arrow)	<i>Channa</i> spp, <i>Mystus</i> spp, <i>Clarius</i> spp etc.; 1 species at one successful attempt.	Less; one man can performed
12	Chepa (valve trap)	<i>Puntius</i> spp, <i>Channa</i> spp, <i>Anabus testudineus</i> , <i>Danio</i> spp.; 2-10 species per catch.	Less; one man can performed
13	Khoka	<i>Labeo</i> spp, <i>Mastacembalus armatusi</i> , <i>Glossogobius</i> spp, <i>Cyprinus carpio</i> ; 2-8 species per catch.	Less; one man can performed

Table 2: Counting the species and the fishing effort for each fishing net.

SI No	Gear Type	Fabrication cost (Rs)	Catch (g/haul)	Return (Rs/haul)	CPGH (kg)	MI	NW (%)	HC
1	Borjal (Drag net)	5,000.00	250	8	0.033 ± 0.26	5.51	0.50	0.0013
2	Tonngijal (Dip net)	3,000.00	200	7	0.031 ± 0.18	4.32	0.43	0.001
3	Fasijal (Gill net)	3200.00	210	7	0.035 ± 0.29	4.86	0.45	0.0023
4	Khewali jaal (Cast net)	4000.00	240	9	0.045 ± 0.32	5.45	0.53	0.0034
5	Dheki Jal (Lift net)	2800.00	200	6	0.035 ± 0.28	4.12	0.43	0.0018
6	Scoope Net	1900.00	150	6	0.027 ± 0.24	4.1	0.38	0.0011
7	Thelajal	600.00	120	7	0.026 ± 0.21	3.8	0.34	0.0014
8	Polo (Cage trap)	1000.00	80	5	0.021 ± 0.17	3.4	0.31	0.0015
9	Borakhi (hook and line)	200.00	30	2	0.012 ± 0.06	1.8	0.16	0.0007
10	Jakoi (Basket trap)	500.00	50	5	0.02 ± 0.16	2.1	0.23	0.0013
11	Dhanu-Kand or Posa (bow and arrow)	500.00	10	2	0.016 ± 0.07	1.7	0.15	0.0006
12	Chepa (valve trap)	300.00	40	5	0.018 ± 0.12	2	0.19	0.0012
13	Khoka	400.00	30	4	0.018 ± 0.14	1.8	0.18	0.0016

CPGH: Catch/Person/Gear/Hour; MI: Mechanisation Index; NW: Niche' Width; HC: Hanging Co-efficient.

Table 3: Cost-benefit analysis and efficacy of the fishing gears of Towkak River (after [4] (Figures are average values).

located just near to the river catchment, throughout the river. And few chemical products are also mixed in the water by the fisherman itself. Some fisherman also prepared naturally made toxic products from the several plants, which latter mixed with the water to catch fishes.

3. Fishing without gear etc.: In low depth areas or in the upstream areas where numerous big rocks and boulders are present fisherman, catch fishes simply by hand. In these conditions they block a particular area for a little period and the fishes that comes under these region where been caught up by fisherman by their hands only. And in some cases they also used mosquito net to catch and collect fishes (Table 3).

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