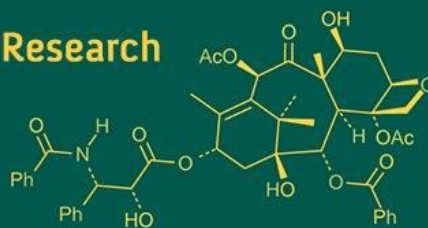
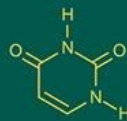
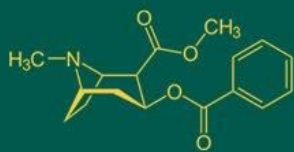


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ITK based fish catching practices through use of plant based materials by the tribal communities in Arunachal Pradesh, under eastern Himalayan zone of India

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Abstract

Indigenous Technological Knowledge (ITK) is the knowledge that has been developed over the time by the people of a specific community of a region for betterment of their life and livelihood and is based on experience befitting the local culture, custom, available resource and environmental conditions. It is often holistic, culturally embedded, and expressed through diverse forms like stories, laws, and traditions. This dynamic knowledge is vital for community survival, cultural identity, and sustainable development, providing insights into local ecologies and societal well-being. In fact it is not just an information system in general but a complex system encompassing spiritual, social, cultural, economic, and environmental dimensions, deeply connected to a specific environment and the conditions of a particular community. Among different tribal communities in Arunachal the fishery based ITK is predominantly related to farm inputs has been developed by the farmers themselves, based on their experiences learned from their ancestors. For the study of these Indigenous Technological Knowledge, (ITK) the different villages were selected randomly among 10 districts of Arunachal Pradesh *i.e.* Tawang, West Kameng, East Kameng, Pakke Kessang, Papumpare, Lower Subansiri, Upper Subansiri, East Siang, West Siang and Aalo formerly known as along during 2023 to 2025. As per survey records it has been found that the maximum 11 nos. of plants bark are used followed by 10 nos. of plants fruit, 9 nos. of plant leaf and whole plant, while 6 nos. of plant roots followed by the 5 nos. of plant seeds are used for the catching of fishes. It has also been recorded that the 1 plant flower and 1 plant stem used for the same which is very less in comparison to others plant parts used.

Keywords: ITK, custom, traditions, sustainable, spiritual & ancestors etc

Introduction

Indigenous technological knowledge refers to the accumulated practical knowledge and practices held by local and indigenous communities over generations through their interaction with specific environments. It is the knowledge that has been developed over time by the people of a specific community of a region for betterment of their life and livelihood and is based on experience befitting the local culture, custom, available resource and environmental conditions. It is often holistic, culturally embedded, and expressed through diverse forms like stories, laws, and traditions. (Kalita *et al.* 2007) ^[14] This dynamic knowledge is vital for community survival, cultural identity, and sustainable development, providing insights into local ecologies and societal well-being. Most of the traditional knowledge acquired through ages, often tested over centuries of use, continue to develop and get improvised based on environmental and societal changes and transmitted from generations to generations Negi K S & Kanwal K S, (2009). Indigenous Technological Knowledge is not just information but a complex system encompassing spiritual, social, cultural, economic, and environmental dimensions and it is deeply connected to a specific environment and the conditions of a particular community. These are the traditional skills related to a particular purpose/activity. Documenting and validating these local knowledge systems is crucial for sustainable development, as they offer practical, often organic, solutions for issues like pond management, fish health, and sustainable harvesting, as seen in initiatives within Arunachal Pradesh and other parts of NER India.

The land of North East India is a one of mega biodiversity hot spot and home to a variety of plants that play a vital role in the lives of humankind since long. Plants are considered an eminent source of wild forage and are of high ethnobotanical and pharmacological importance around the world. However, some of these plants can also have toxic properties, which can be both harmful and beneficial (Rahman *et al.*, 2003) ^[18]. Since the foundation of human civilization, these toxic plants were used for fishing, hunting and safeguarding against enemies (Begossi and Richerson, 1993) ^[2]. Among states of NER India Arunachal Pradesh, covers an area of 83, 743 sq. km. is not only abundant in biodiversity (Myers *et al.*, 2000) ^[16], but also has 28 major tribes and more than 110 sub-tribes, each treasuring diverse cultural heritage, religious beliefs and lifestyles. Also, the state has diversified vegetation, topography, ecosystem and valued traditional knowledge system varies from place to place. The fishery based ITK is predominantly related to farm inputs has been developed by the farmers themselves, based on their experiences learned from their ancestors. Farmer's innovation is based on their indigenous knowledge. This indigenous knowledge is the accumulated knowledge, skills, and technology of the local fish farmer derived from the interaction of the natural ecosystem. The knowledge has been inherited from generation to generation. This radically changes the use of chemical based inputs and advised some unique right-hand thumb rule for disease diagnosis and treatment without the costly drugs, antibiotics and chemotherapeutic agents, which is mostly useful for middle class fish farmers in a very eco-friendly manner as these farmers are equipped with a very rich indigenous knowledge system having their customary right over the natural resources to meet their daily requirements. Hence, their lives are surrounded by forest-based resources, which include fish, animals, birds, wild edible plants and non-timber forest products. Most of tribes in Arunachal Pradesh are using the poisonous plants, primarily for fishing and hunting, (Balasubramaniam A., 2017& Jawale CS., 2018) ^[1, 12]. Consumption of these poisoned fishes and animals is a common practice of these tribes. Moreover, considering the remoteness of this region, the research and primary information on the use of these plants as medicine, poison or food is still inadequate. Therefore, the present paper highlights the use of various plant species of the state for the fish catching practices used by the different tribal communities from the study area.

However, the cytotoxic effect of these poisonous plants is still unexplored in this area. Moreover, considering the remoteness of this region, the research and primary information on the use of these plants as medicine, poison or food is still inadequate. Therefore, the article highlights the use of plant species as fish poisons for fish catch use among the indigenous tribes of Arunachal Pradesh.

Material and Methods

The present study was conducted through a detailed survey during 2023 to 2025. The detail about the research methodology has been discussed below under different heads.

Location of the study and sampling plan

For the study the different villages were selected randomly among 10 districts of Arunachal Pradesh *i.e.* Tawang, West Kameng, East Kameng, Pakke Kessang, Papumpare, Lower

Subansiri, Upper Subansiri, East Siang, West Siang and Aalo formerly known as along during 2023 to 2025. The inhabitants of the above said village were considered as the population for the study to access the traditional knowledge acquired by the inhabitants on fish capture by use of plant materials based ITK.

Type of study participants/ population

The various type participants were participated in the survey process comprised of farmers, farm women's, labourers and unemployed rural youth. The socio- demographic profile of participants varies from semi-urban to rural, illiterate to post graduates, landless to land holders and different categories with age group ranging between 25-65 years.

Research design and data collection

A knowledge test comprising of fifteen objective type questionnaires was framed to assess the traditional knowledge about fish catching techniques through plant based materials. Individual participant knowledge was recorded in the given survey format and proceeds for further compilation.

Result and discussion

Preliminary information about the availability of aquatic resources in Arunachal Pradesh: As most of terrain in Arunachal Pradesh is hilly rather than that there is enormous potential for the development of fisheries sector with the available resources as given below in Table No 1.

Table 1: Availability of aquatic resources in Arunachal Pradesh

S. No.	Name of Resources	Area/ Length
1	Rivers and Canals (Km)	10, 957
2	Reservoirs (ha)	136
3	Wetlands, lake and swamps (ha)	3, 277
4	Ponds/Mini barrages (ha)	29, 122

As per available record the state has the area under the category of rivers and canal is about 10, 957 km, area under reservoir is very less *i.e.* 136 hectares only which is very less in comparison to other state of country because of its hilly and tough terrains. The area under wetlands, lakes and swamps is 3, 277 hectares while the area under ponds and mini barrage is 29, 122 ha. Besides these good aquatic resources the fish production through aquaculture practices is still at the level of subsistence only and most of fish comes from other states. The other state fish supply in Arunachal Pradesh somehow fulfills the demands of daily fish consumption especially in urban areas but the villagers living in remote places and far flung areas are away from the different markets which enforce them to explore the riverine resources to meet out their fish consumption demands using the different methods for capture from the wild natural aquatic resources *i.e.* flowing rivers. Among various fish capture methods the use of plant parts and their derivatives are utilizing by the tribal communities since very long and the knowledge for that is circulating from generation to generation in form of ITKs.

Location specific use of different Plant material among various tribal areas: The different plant material like bark leaf seed and sometimes roots are used for the various purposes related to fish catch activities. On the basis of the assessed participant's knowledge some specific plant part and their role are depicting in table No 2.

Table 2: Plant material used in fish catching

S. No.	Scientific name of the plant	Family	Parts of plant used
1	<i>Zanthoxylum rhetsa</i>	<i>Rutaceae</i>	Fruit
2	<i>Aesculus assamica</i>	<i>Sapindaceae</i>	Bark
3	<i>Derris scandens</i>	<i>Leguminosae</i>	Roots
4	<i>Persicaria hydropiper</i>	<i>Polygonaceae</i>	Leaf, Seed and Whole plant
5	<i>Gymnocladus burmanicus</i>	<i>Fabaceae</i>	Bark and leaves
6	<i>Albizia Chinensis</i>	<i>Fabaceae</i>	Bark
7	<i>Gynocardia odorata</i>	<i>Achariaceae</i>	Fruit Bark and leaves
8	<i>Acacia pennata</i>	<i>Leguminosae-Mimosoideae</i>	Bark
9	<i>Spilanthes spp</i>	<i>Asteraceae</i>	Leaves and flowers
10	<i>Croton tiglium</i>	<i>Euphobiaceae</i>	Seeds and young leaves
11	<i>Croton euryphyllus</i>	<i>Euphobiaceae</i>	Bark and Seed
12	<i>Diospyros lanceifolia</i>	<i>Ebenaceae</i>	Root and Fruit
13	<i>Zanthoxylum rhesta</i>	<i>Rutaceae</i>	Seed and bark
14	<i>Acacia rugata</i>	<i>Leguminosae-Mimosoideae</i>	Stem and Bark
15	<i>Aconitum ferox</i>	<i>Ranunculaceae</i>	Tuberous root
16	<i>Stipa sibirica</i>	<i>Poaceae</i>	Seed, leaves
17	<i>Acmella paniculata</i>	<i>Asteraceae</i>	Whole plant
18	<i>Spilanthes peniculata</i>	<i>Asteraceae</i>	Whole plant
19	<i>Senna alata</i>	<i>Fabaceae</i>	Bark
20	<i>Raphidophora decursiva</i>	<i>Araceae</i>	Fruits
21	<i>Psydrax dicoccos</i>	<i>Rubiaceae</i>	Root
22	<i>Polygonum pubescens</i>	<i>Polygonaceae</i>	Whole plant
23	<i>Persicaria barbata</i>	<i>Polygonaceae</i>	Whole plant
24	<i>Trevesia palmate</i>	<i>Araliaceae</i>	Fruits
25	<i>Zanthoxylum nitidum</i>	<i>Rutaceae</i>	Fruits
26	<i>Zanthoxylum armatum</i>	<i>Rutaceae</i>	Fruit, Root, bark, leaves
27	<i>Milettia pachycarpa</i>	<i>Fabaceae/ Papilionaceae</i>	Fruits, Bark, root
28	<i>Mesua assamica</i>	<i>Calophyllaceae</i>	Fruits
29	<i>Delphinium brunonianum</i>	<i>Ranunculaceae</i>	Whole plant
30	<i>Cyclosorus extensus</i>	<i>Thelypteridaceae</i>	Whole plant
31	<i>Cassia nodosa</i>	<i>Fabaceae</i>	Roots
32	<i>Canthium dicoccum</i>	<i>Rubiaceae</i>	Bark and leaves
33	<i>Canarium strictum</i>	<i>Burseraceae</i>	Leaves
34	<i>Athyrium filix-femina</i>	<i>Athyriaceae</i>	Whole plant
35	<i>Anamitra cocculus</i>	<i>Menispermaceae</i>	Fruits
36	<i>Ageratum conyzoides</i>	<i>Asteraceae</i>	Whole plant

- Zanthoxylum rhetsa*:** Locally known as 'Onger' is one of the important plant widely used for the purpose of fish catching (Chowdhery *et al.*, 2006) ^[11]. The fruits of this plant are pounded and used as a piscicides (fish poison) by the "Adi" tribes as well as by the "Nyishi" tribes of the state.
- Aesculus assamica*:** As per the data recorded from the participants it has been found that the bark of *Aesculus assamica* belonging from the *Sapindaceae* family is being used as a fish poison in smaller streams to catch the fishes from there by the Nyishi and Adi tribes
- Derris scandens*:** The root of *Derris scandens* (Family: *Leguminosae*) is widely utilized for its piscicidal effects not only in Arunachal Pradesh but in the whole NE region. The most of tribals from the state is using the root of this plant as a natural piscicides to catch the fishes from the river and streams in the respective districts from the states. As per record obtained, it is found as a popular piscicide across Northeast India.
- Persicaria hydropiper*:** The leaf, seed and sometimes whole plant of *Persicaria hydropiper* belonging from the family *Polygonaceae* also known as water pepper is used by the most of tribes in the state to catch the fishes due to its piscicidal activities. This annual herb is traditionally used for fish catch as per record and is well known for its pesticidal effects, particularly in stagnant

water bodies like ponds and lakes. The entire plant is often crushed and mixed into the water.

- Gymnocladus burmanicus*:** As per observation recorded from the participants the *Gymnocladus burmanicus* tree from family *Fabaceae* bark and leaves are used as a fish poison by the Nyishi and Adi communities in their respective places for the fish catch. The observation shows that plant material of this tree is frequently used by the said tribes.
- Albizia chinensis*:** The reddish latex is prepared from the bark of this plant after crushing which is then thrown into streams to stupefy the fish and in this techniques they are catching the fishes from the water sources. This plant belongs from the family *Fabaceae* and is famous material used by the tribal communities mostly by the "Adis" as per observation found during the survey programme.
- Gynocardia odorata*:** In Arunachal Pradesh, indigenous tribes traditionally use the poisonous fruits of the *Gynocardia odorata* (Family- *Achariaceae*) tree, vernacularly known as *Teeksin*, to stun or poison the fish and make them easier to catch. The crushed leaves and bark of this plant produce the milky and bubbly latex used for fish poisoning especially by Tagin, Adi and Nyishi communities. The *Gynocardia odorata* tree seeds and fruit pulp also contains psychoactive compounds, when ground into a fine powder and

scattered into slow-moving water bodies, these compounds can cause fish to become unconscious. This method of fishing, which utilizes plants with piscicidal properties, has been a long-standing practice for communities not only in Arunachal but in whole Northeastern part of India as per record obtained from during the survey from the participants.

8. ***Acacia pennata*:** The indigenous tribes of the Arunachal Pradesh, used *Acacia pennata* from family *Leguminosae-Mimosoideae* as a fish poison (piscicide) for traditional community fishing. The whole plant is used as a fish poison to stun or immobilizes fish, making them easy to catch in streams and rivers. Various parts of the plant are utilized for this purpose, depending on the specific tribe and location. As per observation it has been found that the bark or entire plant is pounded into a crude pulp or extract, releases the toxic compounds like saponins, tannins, and flavonoids, which are responsible for its piscicidal effect. During the traditional fishing event of the Galo tribe called as *Tam Lignam* and *Hibok Penam* the crushed plant material is thrown directly into a river or stream. The poison affects fish by impairing their ability to breathe, causing them to float to the surface where they can be easily collected from the water body. This practice, is also found in other parts of Northeast India, is part of a broader Indigenous Technical Knowledge (ITK) system related to fishing.
9. ***Spilanthes spp.*:** In Arunachal Pradesh, indigenous tribes use *Spilanthes* species as a traditional botanical piscicide to stun or immobilize fish for an easier catch. It is belongs from the genus *Spilanthes* (family *Asteraceae*) as it has been documented in botanical record. The bioactive compound called spilanthol, which is present in the plant's leaves and flowers that causes stun or immobilize effect in the fishes. The use of plant-based fish poisons is a common practice among Miri and Adi tribes of Arunachal Pradesh and many more parts of Northeast India. This flowering herb is used in smaller water bodies like ponds and low-volume streams. Pounded whole plants or their extracts are added to stagnant water, causing fish to become lethargic and rise to the surface. Spilanthol has a stupefying effect on fish, causing them to become lethargic and float to the surface, makes them easy to collect by hand or with nets. The spilanthol, is a potent N-alkylamide found throughout the plant, known for its local anesthetic effect, which likely contributes to the stunning of the fish. The entire plant is often pounded into a paste or the juice is extracted before being applied.
10. ***Croton tiglium*:** Arunachal Pradesh, indigenous tribes use the plant *Croton tiglium* as a traditional piscicide, seeds and young leaves are known to be highly toxic to fish. The seeds, in particular, contain a potent poison that has been studied for its effectiveness in aquatic environments. The toxic plant parts are typically processed, crushed, and introduced into water bodies such as rivers and ponds. The toxins disorient and stun the fish, causing them to float to the surface for easy harvesting. Tribes such as the Adi, Galo, Miri and Wancho have been found to use this plant material for stupefying fish to catch the fishes in easy going way. Normally the seeds of this plant are powdered and used as a fish poison in general. This method is often employed during community fishing events, particularly during the rainy season when river water levels rise, and fish migrates towards upstream.
11. ***Croton euryphyllus*:** *Croton euryphyllus* (family-Euphorbiaceae) is reported here as a new distributional record for India from the Longding District of Arunachal Pradesh. During the survey programme it has been reported that the species was encountered during an ethnobotanical survey of the Wancho tribe. It is primarily grown as a natural fence and traditionally used to stupefy fishes for catching. They use the bark and fruits of the *Croton euryphyllus* tree to stupefy fish.
12. ***Diospyros lanceifolia*:** It is belonging from the *Ebenaceae* family and the indigenous tribes of the state use the crushed roots and fruits of *this plant* as a fish poison to temporarily immobilize and catch fish in streams. This practice is part of the traditional fish harvesting methods from wild/natural sources. During the survey programme it has been recorded that the seeds, roots, and crushed fruits are widely used for fish catching as *Diospyros lanceifolia* contain Naphthoquinone compounds derivatives like biplumbagin and chitranone with piscicidal (fish-poisoning) properties.
13. ***Zanthoxylum rhesta*:** This plant is belongs to *Rutaceae* and used particularly among the tribes of the Siang district in Arunachal Pradesh. The bark and seeds of *Zanthoxylum rhesta* plant is traditionally used as a piscicide, a substance that poisons fish to catch them easily. As per survey record it has been found that the extracts from the plant bark and seed are added to water bodies, causing fish mortality, which is then followed by mass collection, by the Adi tribes for fishing and hunting practices. This method is sometimes part of community fishing events in the Siang district during their festive seasons.
14. ***Acacia rugata*:** It belongs from the family of *Mimosoideae* and in Arunachal Pradesh, the Adi tribe traditionally use this plant as a fish poison, or piscicide, to stun or stupefy fish for easier catching. It is locally Known as *Riji* or *Pasoi tenga*, and one of many indigenous botanicals used for traditional community fishing. The stems or bark of the *Acacia rugata* plant are pounded and crushed to release their toxic compounds, such as saponins. The crushed plant material is thrown directly into a stream or river. The saponins released into the water cause the fish to become temporarily stunned, disoriented, or narcotized. Stunned fish float to the surface, where they can be easily collected. The practice is often part of a traditional community fishing method known as *Tam lignam*, which involves using plant-based poisons to harvest fish from streams.
15. ***Aconitum ferox*:** It belongs from the *Ranunculaceae* family is a significant fish poison employed by the Nyishi and Adi tribes in Arunachal Pradesh. Depending on the survey record and based on ethno-botanical studies of Arunachal Pradesh, the highly toxic roots of *Aconitum ferox* are traditionally since long normally used for hunting of animals and in local warfare, but are not widely documented for use as a fish poison. During the survey it has been found that participants and their

relatives are frequently using this plant also for poisoning fish like other plant species are more commonly used for poisoning fish. It has been recorded that generally the Monpa, Nyishi, and Adi, have historically used the tuberous root of *Aconitum ferox* as a deadly poison. The paste from the root is applied to the tips of arrows for hunting wild animals.

16. ***Stipa sibirica*:** *Stipa sibirica* (Siberian needlegrass) belongs from the family Poaceae, (Dutta AC., 1985) [8] contain toxic compounds that can be used to stupefy or kill fish, a practice known as piscicide fishing. It has been recorded during the field survey that this traditional method also used by some indigenous communities, particularly in the "Adi tribe" areas but very few observations made on this. The plant is reportedly used to make a paste or extract, which is then added to a body of water. This causes the fish to become stunned, paralyzed, or disoriented, and float to the surface, allows people to easily collect the fish by hand or with simple nets.
17. ***Acmella paniculata*:** It belongs to the family Asteraceae and used as a piscicide (fish poison) for traditional fishing, as *Acmella paniculata* is attributed to its bioactive compounds, specifically N-alkylamides and saponins. In Arunachal Pradesh, indigenous tribes use this plant for that the whole plant is processed and added to water bodies, where its toxic properties stupefy or kill fish, making them easier to collect. As per recorded observation this method is primarily used in slow-moving or stagnant water bodies like small rivers, streams, ponds, and pools, particularly when water levels are low during autumn and pre-winter. During the use of this plant material the entire *Acmella paniculata* plant is harvested and crushed into a paste. The paste is then introduced into water bodies like streams and rivers to temporarily stun or kill fish, making them easier to collect. The bioactive compounds available in the paste, such as alkaloids and saponins, stupefy the fish by impairing their oxygen consumption without harming their edibility. As the fish become stunned, they float to the surface and are easily collected by hand or with baskets. This method is part of the indigenous knowledge system of various tribal groups in the state of Arunachal Pradesh including Adi, Nyishi, and Galo tribes.
18. ***Spilanthes paniculata*:** It is traditionally used as a fish poison, or piscicide, by certain indigenous tribes and belongs to the family of Asteraceae. It is used as piscicides not only in Arunachal Pradesh but in other parts of Northeast India. The practice of using plant-based toxicants is a traditional method for stupefying or killing fish to make them easier to catch.
19. ***Senna alata*:** It belongs to the family of Fabaceae and the traditionally its bark is being used by certain tribes in Arunachal Pradesh, India as a fish poison (piscicide). The use of *Senna alata* is an age-old tradition among many ethnic tribes in the region, including the Nyishi and Adi tribes. This practice is part of a broader indigenous technical knowledge system in Northeast India, where various plants are used for fishing. The bark of the *Senna alata* shrub is coarsely pounded or crushed to a paste. The crushed bark is then thrown into small streams or ponds. The bioactive compounds, particularly saponins, dissolve in the water. The saponins enter the fishes' bloodstream through their gills and act on their respiratory systems. The affected fish become stunned, come to the surface, and are easily collected by fishermen. Community fishing using these plants is often a traditional festival or communal event.
20. ***Rhaphidophora decursiva*:** This plant belongs from the family Araceae and the Indigenous tribal communities in Arunachal Pradesh use the fruits of *Rhaphidophora decursiva* as bait for trapping fish. In traditional fishing methods, local tribes in the region use various plants with toxic or stupefying properties to stun or poison fish, making them easier to catch. However, in the case of *R. decursiva*, its fruits are used to attract the fish rather than poison them directly. This practice is part of a broader ethnobotanical tradition in Arunachal Pradesh, which utilizes many plant species for fishing and hunting. For example, some tribal communities practice "Hibok Panem," where they block a river course, add crushed plant toxins to stun fish, and then collect them from the shallow water. As per observation recorded during field survey it has been recorded that the traditional use of *Rhaphidophora decursiva* is specifically for trapping fish with bait. The use of such methods is part of a rich body of indigenous knowledge related to bio-resource utilization in the area.
21. ***Psydrax dicoccos*:** It belongs to the family of Rubiaceae and the indigenous tribal communities in Arunachal Pradesh traditionally use the poisonous roots of this plant as a piscicide (fish poison) for fishing. This method, which stuns or kills fish, is part of a broader traditional practice of using locally available plant resources for fishing. As per survey observation it has been recorded that to catch the fish by using this method, different parts of the *Psydrax dicoccos* plant are prepared and introduced into small bodies of water. The roots and sometimes other plant parts are coarsely ground or crushed into a paste. The crushed plant material is thrown directly into a stream, riverbed, or other water body, often after the water flow has been diverted to create a smaller pool. The toxic chemicals from the plant seep into the water, causing fish to become stunned and float to the surface for easy collection. The fish collected this way are typically considered safe for human consumption.
22. ***Polygonum pubescens*:** The plant *Polygonum pubescens* belongs to the Polygonaceae family and as per observation it is used by tribes like the Adi and Nyishi tribes of Arunachal Pradesh as a traditional fish poison, or piscicide, to catch fish. The crushed plant material is added to water, which temporarily stuns or stupefies the fish, allowing for easy collection. The use of plant-based poisons is an ancient, community-based practice among tribes in the northeastern states of India, including Arunachal Pradesh. The process involves several steps. The entire *Polygonum pubescens* plant is gathered and crushed into a paste. The paste is then mixed into the water of streams or rivers. The substance from the plant stuns the fish, causing them to float to the surface where they can be collected by hand or with baskets. This method is often described as eco-friendly, as it does not permanently kill the fish. Those that are not caught can revive in the fresh water, which helps preserve the ecosystem, unlike the use of chemical poisons. This is a widespread traditional knowledge

among local communities and this practice is well-documented among the Adi, Nyishi, and other tribes in the region, showcasing a deep connection to their local environment.

23. ***Persicaria barbata***: This plant belongs from *Polygonaceae* family (Dominic and Ramanujam., 2012) ^[9], and in Arunachal Pradesh, tribal communities such as the Adi, Nyishi, and Apatani traditionally use the whole plant of *Persicaria barbata* as a fish poison to aid in catching fish. This practice is part of the region's rich ethno-botanical tradition, where indigenous plants are used for fishing and hunting. As per survey observation it has been observed that the plant, including its leaves and stems, is crushed to create a paste or extract and after that this preparation is introduced into rivers, streams, or pooled water. The toxic compounds in the plant stun or stupefy the fish, causing them to float to the surface where they can be easily collected by hand or with nets.
24. ***Trevesia palmate***: It belongs to the family *Araliaceae* (Yumnam *et al.*, 2011) ^[22] as per survey records it has been recorded that mainly the Adi and Galo tribe tribes in Arunachal Pradesh, use the fruits of the *Trevesia palmata* plant as a fish poison to make catching them easier. This fruit contains natural toxins that stun or stupefy the fish, causing them to float on the surface for an easy harvest. During the process the fruits are collected and crushed into a pulp, thrown into the water, particularly in stagnant ponds or diverted sections of a river. The toxic compounds in the fruit affect the fish, causing them to become disoriented and float to the surface, where they can be easily scooped up by hand, nets, or bamboo baskets. This is often done as part of a community fishing festival, such as the *Hibok Panem* practiced by the Galo tribe, where a part of a river is temporarily diverted. This traditional method is practiced in community fishing events as it is considered relatively harmless to humans who consume the fish afterward.
25. ***Zanthoxylum nitidum***: This plant comes under the *Rutaceae* family and in the Arunachal Pradesh tribal communities have traditionally used the fruits of *Zanthoxylum nitidum* as a piscicide to aid in catching fish practices. Depending on the survey observation it has been found that this method is used normally in a community-based fishing practice that is gradually being replaced by modern techniques. The Local Adi tribes communities, use the fruit of this plant to use in fish catch by crushing them. The fruits contain natural compounds, primarily alkaloids like sanguinarine, that have a toxic or stupefying effect on fish. The crushed fruits are thrown into a dammed-up river or shallow pool of water. The toxic compounds in the fruit disperse into the water, stunning the fish and causing them to float to the surface. This is often part of a traditional communal fishing method where the water flow is diverted to make the fish easier to collect. This makes the fish easy to collect by hand or with nets.
26. ***Zanthoxylum armatum***: This plant belongs to the *Rutaceae* family and as per the record through conducted survey it has been found that the local tribal communities in Arunachal Pradesh use the plant *Zanthoxylum armatum* as a piscicide (fish poison) for catching fish. Various parts of the plant are crushed and put into streams, causing fish to become paralyzed or disoriented, making them easy to catch. The fruits and bark of the plant are collected from the forest, as these parts contain the toxic compounds that affect fish. For use to fish catching practice the plant material is crushed into a fine powder or paste. It has also been observed that sometimes the crushed plant parts are thrown directly into a stream or other water body. The toxins spread through the water and affect the fish, causing them to float to the surface in a dazed state. The stunned fish are then easily collected by hand or with nets.
27. ***Millettia pachycarpa***: This plant comes under the *Fabaceae/ Papilionaceae* and in Arunachal Pradesh, the plant *Millettia pachycarpa* is mostly used by local "Adi" tribes as it has been observed during conducted survey for the said purpose. The use of *Millettia pachycarpa* in Arunachal Pradesh and other parts of Northeast India is a traditional fishing technique and is distinct from aquaculture or fish farming. The substance is applied to river and stream bodies to temporarily incapacitate fish. The various parts of the plant, including roots and pods, are used for the purpose of catch. Plant parts are typically crushed and released into the water. The rotenone is absorbed through the gills of fish, inhibiting cellular respiration and causing them to float to the surface, where they are easily gathered and catch becomes easy.
28. ***Mesua assamica***: It belongs to the family *Calophyllaceae*. Tribal communities in Arunachal Pradesh have used the fruit of *Mesua assamica* as a traditional fish poison, or piscicide, to aid in catching fish. This practice is part of the indigenous technical knowledge of the region which passed down through generations to capture fish. The crude, pounded fruit of *Mesua assamica* is used to stupefy or stun the fishes, causing them to float to the surface where they can be easily collected. During the poison material preparation the, tribal fishers first grind or pound the fruits of the tree. The resulting paste or powder is then thrown into a small stream or river.
29. ***Delphinium brunonianum***: It comes under *Ranunculaceae* family and has been used as a fish poison (piscicide) in Arunachal Pradesh for traditional fishing purposes. The toxic whole plant is crushed to release its poison into the water, stunning or killing fish so they can be easily collected. As per survey observation it has been found that it is mostly used by the by the "Galo" tribes during "Tam Lignam" a traditional practice to catch the fishes through the use of poisonous plant parts, including roots and the whole plant, are crushed into a paste and then thrown into streams and rivers. The toxic compounds in the plant spread through the water and are absorbed by fish through their gills. The fish are then paralyzed or killed, causing them to float to the surface where they can be collected. This method is often performed in dammed-off sections of a river where the water volume is low, which increases the poison's concentration and effectiveness.
30. ***Cyclosorus extensus***: As per available data this plant comes under the *Thelypteridaceae* family. Survey result shows that it is the part of traditional ethno-fisheries knowledge of the Hill Miri tribe in Arunachal Pradesh

(Tag and Kalita 2005) ^[21]. The whole plant of *Cyclosorus extensus* is used as a fish poison to aid in catching fish and the process involves grinding the entire plant and throwing the paste into a stream. After waiting for about 10-15 minutes, the stunned fish can be easily collected. This practice is part of a wider use of piscicidal (fish-stunning) plants by tribal communities not only in Arunachal Pradesh but in other parts of throughout Northeast India, which rely on natural plant-derived poisons for traditional fishing methods. During the use the whole fern is ground into a paste, thrown into a stream or other body of water, causing temporarily stun or stupefying of fish, causing them to surface where they can be easily harvested.

31. ***Cassia nodosa*:** The plant of *Cassia nodosa* belongs to the family of *Fabaceae*, the roots of *Cassia nodosa* are used as a traditional fish poison, or piscicide, to aid in catching fish by the people in Arunachal Pradesh. This method is part of a broader indigenous practice of using toxic plants for fishing in the region. The Plant roots contain active chemical compounds that can stun or kill fish, causing them to surface and become easy to collect. The most common part of the plant used for this purpose is the root. As per participants knowledge it has been recorded that the roots are crushed and pounded into a powder, which is then thrown into water bodies, such as stagnant ponds or slow-moving streams, where the fish are located. The toxins in the plant, which may include saponins and rotenone, affect the fish by entering their bloodstream through their gills. Once the fish are affected, they are easily harvested by hand as the toxins present in the root powder of *Cassia nodosa* stun the fish, causing them to become lethargic and float to the water surface. The toxins can either stun the fish, causing them to become lethargic and float to the surface, from where they can catch in an easy way.
32. ***Canthium dicoccum*:** It comes under the family-*Rubiaceae* and is traditionally used as a fish poison in Arunachal Pradesh by the Indigenous Adi tribe communities, as per observation recorded they use the coarsely ground bark and leaves of this plant to stupefy or kill fish in small ponds and streams. The bark and leaves are roughly ground and then the crushed plant material is thrown into small, water bodies, like ponds or slow-moving streams. The piscicidal (fish-toxic) compound releases from the crushed materials, after about 30 to 40 minutes the fish become senseless or immobilized, allowing for an easy catch. The process is most effective during periods of low water volume. As per survey observation it has been found that this method is often associated with communal fishing events, which serve as festive, large-scale fish-catching activities in rivers and wetlands.
33. ***Canarium strictum*:** This plant belongs to the family of *Burseraceae* and as per survey it is observed that indigenous communities such as the Adi tribe In Arunachal Pradesh traditionally use the crushed leaves and bark extracts of *Canarium strictum* as a fish poison, or piscicide, to aid in fishing. The bark or leaves of this plant are gathered and crushed into a paste, and then it is thrown into slow-moving or stagnant bodies of water, such as shallow pools and streams. The toxic compounds released from the plant material into the water cause the fish to become stupefied or paralyzed,

floating to the surface where they can be easily collected by hand. This method is most effective in small, enclosed, or slow-flowing water bodies during the dry season. Among the Adi tribes, this is a traditional, community-based practice, often led by men.

34. ***Athyrium filix-femina*:** It is called as (Lady Fern) comes under *Athyriaceae* family (Singh & Srivastava., 2009) ^[19]. Indigenous tribal communities in Arunachal Pradesh, including the Adi, Galo, Miri, and Tagin, have historically used the fern *Athyrium filix-femina* as a fish poison, or piscicide. This practice is part of traditional community fishing methods that employ plant-based toxins to temporarily stun fish, making them easier to catch. The whole *Athyrium filix-femina* plant is collected and finely crushed or ground. The crushed plant material is thrown directly into a stream or a section of a diverted river. The plant's toxic compounds cause fish to become stupefied and float to the surface within 10 to 15 minutes, allowing for easy collection. This technique, known locally as *Tam Lignam* by the Galo tribe, is an ancient practice that uses a variety of plants, leaves, fruits, and roots as fish poison. This is often a communal fishing event, especially in the western part of the state, where entire villages participate.
35. ***Anamirta cocculus*:** It belongs to the family of *Menispermaceae* (Chowdhery *et al.*, 2011) ^[7] and tribal communities in Arunachal Pradesh use the crushed seeds of *Anamirta cocculus* as a traditional fish poison (piscicide) to stun or kill fish for easier collection. The plant is known locally as "fishberry" due to this use. The fruit seeds of *Anamirta cocculus* contain picrotoxin, a powerful neurotoxin that affects the central nervous system of vertebrates. As per survey recorded information it is mostly used by "Adi" tribe community and during the use the semi-ripe or dried seeds are typically crushed into a powder or paste. Before use of paste they first create a shallow pool by blocking a portion of a river before introducing the poison. Then it is introduced into the slow moving water body where fish are to be harvested. When fishes ingest or absorb the toxin through their gills, it causes convulsions, intoxication, and eventually, the fish become stupefied and float to the surface. This makes them easy to collect by hand or with nets.
36. ***Ageratum conyzoides*:** This plant belongs to the family *Asteraceae* (Chowdhery *et al.*, 2009) ^[6], the tribal communities in Arunachal Pradesh, such as the Adi, Tagin, and Galo, traditionally use *Ageratum conyzoides* plant having piscicidal (fish-stunning) properties to aid in fish catches. The whole plant of *Ageratum conyzoides* is used as a fish poison in communal fishing events like *Hibok Penam* practiced by the Galo, a natural toxin (*tam*) from various plants is introduced into the river. As per survey record it has been found that the crushed or pasted plant material is thrown into diverted, shallow parts of a river, where it affects the fish's nervous and respiratory systems. The stunned fish float to the surface and are easily collected. The most common mode of application is preparing a ground paste or aqueous extract from the plant, which is then dispersed in the water. The toxins in the plant are reported to cause moribund behavior, erratic swimming,

and affect the respiration by oxygen deprivation in fish. The piscicidal effects of *Ageratum conyzoides* are caused by phytochemicals including alkaloids, flavonoids, and terpenoids which are likely responsible for its toxicity to fish.

Different Plant parts and their used proportion in fish catch by different tribes: The part wise distribution of plant material use in fish catching is depicted in Fig given below.

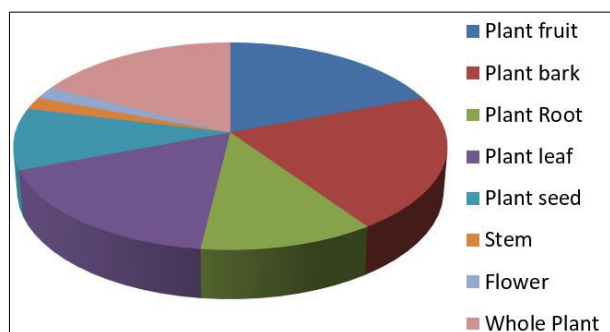


Fig 1: Share of plant parts used in ITK based Fish catch

As per data recorded it has been observed that the maximum 11 nos. of plants bark are used followed by 10 nos. of plants fruit, 9 nos. of plant leaf and whole plant, while 6 nos. of plant roots followed by the 5 nos. of plant seeds are used for the catching of fishes. It has also been recorded that the 1 plant flower and 1 plant stem used for the same which is very less in comparison to others plant parts used. Almost the same data have also been recorded by the Gumbin Noshi 2023^[10], in the study of Indigenous Fishing Method and its impact on rural livelihood among Galo Tribe of West Siang District, Arunachal Pradesh, India.

Conclusion

ITK is eco-friendly; economic and highly credible with a practical point of view, without any side effect. There is also a possibility for combining the indigenous technical knowledge and knowledge of scientific management practices in fishery related activities to create effective hybrid management systems. It is imperative to analyze such technologies so that the scientific principle behind them could be properly understood. Once this is done, it will be easier to further refine and upgrade them by blending them with modern scientific knowledge.

References

- Balasubramaniam A. Biodiversity Profile of India. Technical Report. Centre for advanced studies in Earth Science, University of Mysore; 2017.
- Begossi A, Richerdson B. Ecology of fishing on the Grande River (Brazil): technology and territorial rights. Fisheries Research. 1993;23(3-4):361-373.
- Chauhan AS, Singh KP, Singh DK. A contribution of the flora of Namdapha, Arunachal Pradesh. In: Hajra PK, editor. Botanical Survey of India; 1996:422.
- Chowdhery HJ, Giri GS, Pal GD, Pramanik A, Das SK. Material for the flora of Arunachal Pradesh, Vol I. In: Hajra PK, Verma DM, Giri GS, editors. Botanical Survey of India; 1996:693.
- Chowdhery HJ, Giri GS, Pal GD, Pramanik A, Das SK. Materials for the flora of Arunachal Pradesh, Vol. II. In: Giri GS, Pramanik A, Chowdhery HJ, editors. Botanical Survey of India; 2008:492.
- Chowdhery HJ, Giri GS, Pal GD, Pramanik A, Das SK. Materials for the flora of Arunachal Pradesh, Vol. III. In: Chowdhery HJ, Giri GS, Pramanik A, editors. Botanical Survey of India; 2009:350.
- Choudhary RK, Oh S, Lee J. An ethnomedicinal inventory of knotweeds of Indian Himalaya. J Med Plants Res. 2011;5(1):2095-2103.
- Dutta AC. Dictionary of economic and medicinal plants. 1st ed. 1985:371.
- Dominic R, Ramanujam SN. Traditional knowledge and ethno-botanical uses of piscicidal plants of Nagaland, Northeast India. Indian Journal of Natural Products and Resources. 2012;3:582-588.
- Gumbin N. Indigenous Fishing Method and its impact on rural livelihood among Galo Tribe of West Siang District, Arunachal Pradesh, India. Int J of Hum and Soc Sc Res. 2023;9(6):11-15.
- Gajurel PR, Rethy P, Singh B, Angami A. Ethnobotanical studies on Adi tribes in Dehang Debang Biosphere Reserve in Arunachal Pradesh, Eastern Himalaya. Ethnobotany. 2006;18(1-2):114-118.
- Jawale CS. Piscicidal plants in India. Trends in Fisheries Research. 2018;7(2):33-45.
- Jumli K, Mandal SC, Parhi J, Hussain SM. Traditional Fishing Gears and Fishing Methods of West Siang District, Arunachal Pradesh. J of Krishi Vigyan. 2020;(Special Issue):293-299.
- Kalita B, Dutta A, Choudhury M. Herbal fish toxicant used by fishers of Karbi-Anglong district, Assam. Indian J Tradit Knowle. 2007;6(2):334-336.
- Myers N. The biodiversity challenge: expanded hot spot analysis. Environmentalist. 1990;10:243-256.
- Myers N, Mittermeier RA, Mittermeier CG. Biodiversity hot spot for conservation priorities. Nature. 2000;403(6772):853-858.
- Negi KS, Kanwal KS. Plants used as fish toxins in Garhwal region of Uttarkhand Himalaya. Indian J Tradit Knowle. 2008;8(4):535-538.
- Rahman MT, Khan OF, Saha S, Alimuzzaman M. Antidiarrhoeal activity of the bark extract of *Careya arborea* Roxb. Fitoterapia. 2003;74(1-2):116-118.
- Srivastava RC, Adi Community. Traditional knowledge of the Adi tribe of Arunachal Pradesh on plants. Indian J Tradit Knowle. 2009;8(2):146-153.
- Singh RK, Srivastava RC. Biocultural knowledge and Adi community: conservation and sustainability in biodiversity hotspot of Arunachal Pradesh. Current Science. 2009;96(7):883.
- Tag H, Das AK, Kalita P. Plants used by the Hill Miri tribe of Arunachal Pradesh in ethno-fisheries. Indian J Tradit Knowle. 2005;4(1):57-64.
- Yumnam JY, Bhuyan SI, Khan ML, Tripathi OP. Agrodiversity of East Siang - Arunachal Pradesh, Eastern Himalaya. Asian J Agric Sc. 2011;3(4):417-426.