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Traditional Wisdom: Evaluating the Indigenous Approaches to Fisheries Governance in Kerala, India

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ABSTRACT

This Article explores the indigenous governance systems that have historically shaped fisheries management in Kerala, India. Drawing upon traditional knowledge and practices, this Article examines how local communities, particularly fishing villages, have developed sustainable methods for managing marine resources. It highlights the role of community-based governance structures, such as the Panchayat system, local councils, and informal networks, in maintaining ecological balance and ensuring the resilience of fisheries.

Keywords: *Indigenous governance, Fisheries management, Traditional knowledge, Sustainable fisheries, Ecological balance.*

I. INTRODUCTION

Fisheries is an important source of food, jobs and income in India. They support around 16 million fishermen and fish farmers, with twice the value series. Fish is a rich and inexpensive source of protein that helps fight hunger and malnutrition. According to the plan by the government, there is a lot of potential for fishermen and farmers to increase income. India has more than 10% of the world's fish and shellfish species, including deep seas, lakes, rivers and ponds. Marine fisheries covers the 8118 km beach, a 2.02 million sq km exclusive economic zone (EEZ), and 0.53 million sq km continental shelf. Inland fisheries offer good opportunities for economic development. India, the third largest fish producers, increased fish production from 0.75 million tonnes in 1950–51, increased to 14.16 million tonnes in 2019-20, increased by 8% annually. About 74% of this production comes from inland sources and the rest of the marine fisheries. India's fisheries capacity is 22.31 million metric tons, with 5.31 million from sea and 17 million from inland sources.

Fisheries contributes 3% to Kerala's economy. The fisheries play an important role in the economy of Kerala, contributing 3%. About 10.85 lakh people rely on it, including 6.10 lakh

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in maritime fishing. The Kerala coast is 590 km long, with nine coastal districts with 222 fishing villages and 187 landing centers. Despite their skills, Fisher Folk has poor life conditions, and their literacy rate is 72.5%. Fishermen possess important traditional knowledge (ITK) that has been handed down through generations. This knowledge helps them decide about farming, fishing and management of natural resources. Experts suggest that incorporating this traditional knowledge with modern technology can help better manage resources. Modern technology such as GPS and Fish Finders is replacing traditional knowledge, and young fishermen are more dependent on these devices. If this traditional knowledge is not recorded soon, it may lose forever. Saving this knowledge is important for future generations and to keep fishing practices durable.

Historical Context of Fisheries in Kerala

Fishing has been an important part of human life for a long time. About 150,000 years ago, Neanderthal used spear for fishing, making the Spear one of the first fishing equipment. Over time, people invented better fish Early humans created obstacles in shallow water to trap the fish.[3] During the paleolithic era, they created a basic fishing tool called "gorge", which was a small, pungent piece of wood or bone used like a hook. In the Middle Stone Age,5th to 3rd millennium BCE People made better fishing equipment for fishing, such as bone hooks, nets and other equipment for fishing. They also started using boats, helping them fish in deep water. During the New Stone Age,3rd to 2nd millennium BCE , they developed thorny hooks, metal spears and net ciners, and line became popular fishing. Ancient Chinese and Mayan civilizations also used nets, hooks and harpuns for fishing. By 1500 BC, Chinese silk was using fishing lines.

Archaeologists in India have found evidence that fishing was popular in ancient times. In the Indus Valley (Harappa and Mohenjo-Daro), they discovered fishing hooks made of soil and iron, as well as with pure pattern on earthen pots. Fishhooks were found in Rajasthan from 28th to 27th century BC, and copper hooks from 21st to 17th century BC were found in Karnataka. This shows that fishing in India started around 3rd millennium BC. The people of the Indus Valley lived in the sea and the older books like Mahabharata talk about fishing hooks, and Manasolasa (belonging to the 12th century) says that the Kings loved fishing for fun. Rig Veda mentions using nets for fishing, and Ramayana talks about fishing with spears and arrows.

[3] Asian Agri-History Foundation, et al. “Glimpses of the Agricultural Heritage of India.” Asian Agri-History Foundation, edited by Y L Nene et al., 2007.

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For humans, fishing is one of the oldest activities, older than hunting because fishing took simpler tools to catch fish. Early humans caught fish by hand from lakes, rivers and seas. As tribes became larger, they improved their fishing techniques from spears and simple traps made of twigs. Gradually, they developed more advanced traps made of stones, reeds, and wooden frames, culminating in the invention of fixed nets.Fishing gear evolved from single fish catchers to fish catchers of mass scale. The Romans appear to have been the first to use the large nets they called Sagena, now referred to as seine nets. Early humans used floating logs to access deeper waters and eventually developed canoes and boats. As sails, rudders and engines improved fishing vessels, people ventured farther from shore in search of fish. Nets were crucial for fishing , but took millennia to get right. Nets were originally handwoven from hemp and cotton, but synthetic fibers such as nylon made them stronger and more efficient in the 1960s. Bottom trawling , a method of dragging nets along the seabed , probably began in the 17th century, and it became an industry in the last 150 years . It began with plain shore-seine nets, then advanced into beam trawlers and modern steam-driven otter trawls, increasing the efficiency of fishing.

II. THE ROLE OF INDIGENOUS KNOWLEDGE IN FISHERIES MANAGEMENT

In India, fishing in Kerala, is not only a means of existence; This is a way of life passed from one generation to another. Fishing has attracted communities for centuries, and even today, every fishing community in the region has developed its own knowledge and methods that facilitates better productivity in the local environment[4]**.** One such tradition is stake net fishing or oonnivala in the vernacular language, wherein the net (in this case, cone-shaped) stays fixed and flows within any current of water like rivers, backwaters, or nearer to the sea[5]. The current, in its normal course, carries fish and prawns, which find themselves trapped in the net. This method is employed at places such as the Astamudi and Vembanad backwaters in Kerala, where the tides have a strong force.

Initially local fishermen put a stake net just to catch fish for household consumption, but more and more numbers have taken to using these nets over time; thus it necessitated the government to introduce a license system to limit their numbers. That rule proved ineffective, however, as many people chose to continue using unlicensed nets. By the late 1990s, there were about 17,724 stake nets in use, but only about 70% were authorized[6]. Because of this

[4] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
[5] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
[6] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater

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growing problem and the fights between legal and illegal fishers, new licenses stopped being granted in 1983 by the government. Initially, fishermen weave their fishing nets with natural materials such as cotton and coconut fibers. By the end of the 1950s, however, synthetic materials became available; Nylon, plastic, and like them began to be used by fishermen because they were strong and more durable. The mesh is usually 7 to 17 meters long, with a opening sometimes about 20 meters wide. On the surface of the work, two wooden pillars will be protected by pushing the water in the sloppy bottom of the body[7].

Such poles are usually made from coconut or areca nut tree trunks. The two main poles are known as thaimaram, while many smaller poles-known as charu, kaikutti, or thangukutti-are attached to them for additional support[8]. Setting up a net is a group activity among fishermen. Generally, six or seven fishermen set out on two small wooden boats to install the poles and nets. In some areas of India like Gujarat, similar nets are used but supported on steel poles. This stake net is set out without any motorized wooden boats, which are usually between 5.5 and 7.6 meters in length. Before putting the net out, fishermen close the codend-to be-the bottom part of the net. During this time, they have paddled out from the start of the ebbing high tide. Using a fork stick, they put the corners of the net over the poles and adjust them so that the net can open completely. Once the tide slows down, they return to pull the net up and load it onto the boat. When they reach the shore, they untie the bottom of the net to take out the catch. The fish and prawns are then cleaned to remove mud, sorted (usually by women and children in the family), and sold directly to buyers there are no middlemen or agents involved[9].

Fishing usually takes place during the evening and early morning and lasts anywhere between 5 and 7 hours of each session[10]. Fishermen sometimes venture away to the sea in a daylight setup, under the flow of tide and wave conditions, on account of a good chance of a catch. Such an outing is sometimes referred to as anthikettu after sunset on most days and pularchakkettu at dawn. Filifera punctata, Parapenaeopsis stylifera, and Parapenaeopsis acclivirostris are usually some of the Penaeidae types caught in commercially fished waters[11].

Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).

[7] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).

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Basically, this is the most commonly caught and means more hassle for them. But a serious problem lies with their nets. The nets do not only catch full-grown prawns; they also catch very young, small sized prawns that have not had any chance at all to grow or breed. This could gradually destroy the very population of prawns and in effect hurt future catches.This practice can affect the long-term health of the fishery. For example, studies conducted in locations like Vypeen, Cochin indicate that most of the prawns caught in such nets are still immature, meaning they have not had a chance to grow or reproduce, and complications can be created in future generations of prawns[12].

Interestingly, fishing like this also follows the moon. In each month, there are two productive periods of fishing-day after full moon and new moon. The fishing starts on the 10th or 11th day after this moon (these days are known as "dashami" or "ekadashi"). After that, fishing continues until the 4th day after (known as chathurthy, meaning the 4th day after new moon). Such active fishing periods are known as pakkam or thakkam[13]. Hence, these two lunar cycles of full and new moons also determine rest days. Rest days are called pakkasheshippu and are used by fishermen to clean and repair their boats and nets. After each fishing session, the nets are washed and stored on the boats. At the end of each thakkam, thorough cleaning, drying, and repair for the next fishing period is done. This natural rhythm of fishing defined by tides and moon at hindrance can prevent overfishing in the natural resource and give time and opportunity for fish and prawns to grow and replenish. Thus this tradition affects not only the livelihoods of fishing communities but also the environment they depend on.

Fishing freely in most places generally results in a lot of fishing without fishing. Handling what is left with the fish in these areas can harm the fish population, and in Kerala, stake net fishing has a different approach. It is based on old community traditions that manage fishing fairly well. In places like Aroor and Azheekal, strict local rules have been followed for quite some time. One of those provisions is known as the 'paadu' system[14]. This is a kind of turn-based framework whereby selected members of the community get to fish in certain spots. By this way of doing things, an individual can spend their time fishing, keeping fishing under control. This system worked really well when fishing was doing so with licensed nets. Gradually, however, with more people using nets without permission, the system has lost most of its strength. Unfortunately, the paadu method is today well-known worldwide as a

[12] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
[13] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
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smart way to manage fisheries. It has also been functional in other areas, such as in the Negombo Lagoon of Sri Lanka.

Another interesting bonus point in this traditional fishing is that fishermen maintain their tools in the natural-economical way. Long ago, cotton nets were manufactured and treated with natural stuff such as kalasu bark or panachikka plant seeds to ensure longevity[15]. Most nets nowadays are getting manufactured through synthetic means; however, fishermen now add some treatment from natural sources. One common practice as of now is immersing the nets in a boiled mixture made from tamarind seed powder and water. They initially soak the net for 24 hours, and then after 2-3 months at shorter intervals, it remains in perfect condition. Fisherman believes that this treatment reinforces the net for better fish catching. Of oils stones apply by fishery with the boats or canoes under this system. Sardine oil and Cashew nut shell liquid (CNSL) are natural oils used to prevent the wood being eaten away by seawater and minuscule creatures that might injure it. Fishermen carry out this practice about once or twice every year. They are the first to clean the boat, repair damages, and then layer two or three times of oil. In Maharashtra, where similar fishing is done using dol nets, fishers use another oil called chandrus for the same purpose. Many boats are now coated with fiberglass as an improvement, strengthening and prolonging their lifespan.

However, stake adding fish net is not only regarding that but also loaded with spiritual customs and beliefs sustained from generations to generations. Clearing a new stake net unit before setting one is completed by rituals called vratham[16]. These include a daily visit to the temple and 14 days of abstaining from eating meat, drinking alcohol, smoking, or even having marital relations. In those days, women were also prohibited from touching nets or sorting fish while menstruating. Even the date to start fishing with a new net is carefully chosen by a local astrologer, known as a kaniyan, based on the moon's calendar[17]. This indicates the deep respect and spiritual connection the fishing community has with their tradition. Fishermen in this tradition also align their work schedules with the phases of the moon. They believe that the tides and the shine of the moon affect prawns' behavior and movement in the water. Modern scientists also confirm that moon phases can have an effect on breeding, molting, and migration of prawn. Rain also plays a very big role in the scenario. Heavy rains flood the rivers, thus sending young prawns into hiding in the mud. But the persistent deluge soon

[15] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
[16] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
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freshens salty water, luring prawns of all ages toward the sea. The collection of prawn catches in good numbers in nets follows.

Stake net fishing otherwise called oonnivala likewise has much more than catching prawns or fish. It's maintaining balance. There are certain days, termed pakkashshippu, on which fishing is not allowed[18]. During this time, it gives a rest to nature and contributes to fish conservation. The paadu system simply ensures not too much fishing goes on, while the natural modes of treating nets and boats prevent harmful chemicals from affecting the natural environment. Altogether, this system pays respect to nature, follows the rhythms of the moon and sea, and keeps age-old traditions alive. That is an excellent example of how people, culture, and environment can come together to look after marine life-for now and for generations to come[19].

III. INDIGENOUS GOVERNANCE STRUCTURES IN KERALA'S FISHERIES

The story of cooperative movements in the fisheries sector of Kerala can be traced back more than a century to 1917, when the old Travancore state made its first moves to organize fishermen as cooperatives[20]. The cooperatives formed at that time actually were largely on religious and caste lines: Hindus formed cooperatives beneficial to Hindus, Muslims did the same for Muslims, and Christians operated cooperatives of their own. By 1933, there were already 95 such cooperatives alive and functioning in the region, with a total of membership surpassing 8,000 fishermen. Yet, unfortunately, all these early efforts were not quite successful. The cooperatives didn't achieve the desired result, and many cooperatives failed to function well or be of assistance to making the fisherman's condition better. The government launched a special committee in 1934 to figure out what went wrong. The committee looked into the matter and offered suggestions, one of the significant recommendations was to convert these cooperatives into multipurpose organizations that would not only be engaged in one task, such as fish selling, but also would enable fishermen to deal with all sorts of needs[21].

When the modern Kerala was created in 1956, the government, in particular, stepped up its efforts in strengthening these cooperatives much more to transform the economic situation of persons involved in the fishing sector. A big move was that mechanized boats were introduced

[18] Saly N. Thomas, G. Archana & Leela Edwin, Indigenous Resource Management System in Selected Backwater Stake Net Fisheries of Kerala, 56 FISHERY TECH. 179, 179-83 (2019).
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through the cooperatives to the fishermen by classifying fishing activities as modernized forms of fishing. This idea was logically underlined with catching greater amounts and, hence, higher levels of income from fishing incomes. But there were a number of struggles within the groups. New boats were unmanageable, or these organizations were left with the problems of disagreement among the members on how to operate the boats; the traditional fishermen didn't really like the changes, while new boats just didn't seem to earn much. In fact, this brought in a midway solution from the government: it started issuing motors for traditional wooden boats (known as country crafts) instead of giving costly mechanized boats in 1980. Thus, small-scale fishermen started arriving at their destinations for a higher yield without really altering fishing techniques, and many started reaping better earnings.

In fact, taking a big step by the government of Kerala was formation of a central organization for the Kerala co-operative federation for the development of fisheries called Matsyafed. Matsyafed brought hundreds of small village cooperatives more than 650 in number from all ten coastal districts of Kerala under one umbrella[22]. Matsyafed was set up with the purpose of establishing several aspects of development beneficial to both fishermen and their communities. Its purview included the creation of jobs and training and advisory services to set up fish farms and undertake capacity building programs for women in fisher households. Its goal wasn't just to make fishing better, but also to uplift entire fishing communities.

With time, the cooperative movement was no longer just economic or government initiated. Rather, civil society groups and political parties became involved in the direction and management of the cooperatives. For instance, many cooperatives in Trivandrum and Quilon slowly became part of the wider group, South Indian Federation of Fishermen Societies[23]. As for other regions, some political parties had taken over. For example, of the ten cooperatives active in Ernakulam district, two were controlled by supporters of the Congress party, another two by the Communist Party (Marxist), whereas the remaining groups had independent representations from among fish workers[24]. Certainly, politics became inextricably intertwined in the way cooperatives ran their affairs.

There was a network of cooperative societies and fish worker organizations almost across the coast of Kerala, and yet there was no clear line in the involvement of these organizations in the management of fisheries. That was a major weakness. Kurien (1980) suggested that the

[22] Kaleekal Thomas Thomson, *Engaging Communities and Cooperatives in Fisheries Governance: Emerging Challenges and Pathways in Kerala, India* (Conference Paper, Jan. 2019).
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formation of the cooperatives did not empower such cooperatives to make independent decisions regarding fishery resources management. Other researchers like Achari (1990) also noted that successful cooperatives were able to establish themselves mostly when fishermen initiated them as members of the community rather than through outsiders or politicians[25]. Strong values such as community spirit, fairness, teamwork, and mutual respect formed the basis of these successful cooperatives. They were democratic and flexible in their working methods, with members completely involved in major decisions, especially those concerning loans, grants, development plans, and the use of funds. Since they operated from within the community and based their agenda on the real needs of fishermen, they were generally more effective and sustainable than their top down run counterparts.

IV. CASE STUDY OF INDIGENOUS FISHERIES GOVERNANCE

The Mullukuruma fishers a tribal society that possesses superior knowledge about rivers and fish behavior shared an interesting piece of traditional ecological knowledge: an association like symbiosis between two species of fish. The fishers say that there exists a fish, the Hypselobarbus micropogon, which they called the pink carp or Korhi[26]. The fish is endangered and hence it is standing at a very precarious position and needs protection. The Mullukuruma fishers have observed that the pink carp often inhabits areas near mahseer-another kind of large popular freshwater fish that is important in river ecology. Now, the real interesting phenomenon takes place during the spawning season when the mahseer come to the river bed to spawn: the pink carp, locally known as kallunthi, start pushing little stones and pebbles in the spawning areas. The name kallunthi derives from two Malayalam words kallu meaning "pebble" and unthu meaning "to push"[27]. This suggests that local people have observed the behavior of this fish very carefully. While they shift the pebbles, the pink carp clean the spawning site, which, in turn, helps the mahseer to prepare their nest for laying eggs. Once the mahseer have laid their eggs, the pink carp slyly take advantage of this situation and feed upon some of the eggs. Thus, in effect, whiles the pink carp have conferred the benefit of cleaning the spawning area, it takes an added benefit for itself. It is a unique kind of relationship-one that is not wholly detrimental or beneficial: the pink carp does assist in nest preparation, but it also feeds on the eggs[28]. This type of mutual interaction between species is

[25] Kaleekal Thomas Thomson, *Engaging Communities and Cooperatives in Fisheries Governance: Emerging Challenges and Pathways in Kerala, India* (Conference Paper, Jan. 2019).

[26] **"Tales from Velimeen Land,"** *Mahseer Trust*, Aug. 20, 2021, archived at https://www.mahseertrust.org/post/tales-from-velimeen-land.

[27] **"Tales from Velimeen Land,"** *Mahseer Trust*, Aug. 20, 2021, archived at https://www.mahseertrust.org/post/tales-from-velimeen-land.

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rare, pointing to the fact that nature is a complex web of relationships. The considerations of Mullukuruma fishers become very significant, as they demonstrate that traditional knowledge can capture insights that may escape scientific study and prompt investigations to try to conserve endangered species like pink carp.

V. CONCLUSION AND SUGGESTIONS

The ancient systems of fisheries governance in Kerala are indeed wisdom models contained in networks of community knowledge, cultural heritage, and an innate sensitivity orientation toward the natural environment. Over centuries, these indigenous systems have evolved and shaped their patterns of sustainability that closely synchronized with the rhythms of nature and also the needs of local communities. They are grounded in lived experiences and long-term observations of nature and serve as an age old guide to responsible marine resource management. Perhaps the most remarkable aspect of this mode of governance is stake net fishing, called paikoni in local terms, which plays by the rules of harmonized tidal flows and the lunar cycles. Such conditions would assure that fishing activities do not interfere with the natural balance, that the fishing follows its ecological cues from the sea. Community-managed schemes, such as the paadhu system, would allocate fishing grounds fairly and regulated fishing so that these lessen the likelihood of over exploitation and promote social harmony among fishers. In addition, certain spiritual rituals, rest periods (pakkashshippu), and seasonal observances are syntactical in both ecological and cultural functions-reaffirming the people place relationship.

These are not mere economic enterprises but rather a holistic view of the reality within which fishing is considered as closely related to ethics and identity as well as the community. These indigenous techniques also bring about ecological conservation through the provision of rest periods for the ecosystem and using natural materials for fishing gear maintenance. Incorporating such knowledge to support governance systems like the cooperative institutions-in the well known Matsyafed demonstrates how grassroots led fisheries management would empower communities and guard environmental sustainability. These institutions from their ideological roots of mutual assistance, democratic participation, and localized decision making have heavily contributed over time to cloning fisheries governance in Kerala.

Yet, today, these traditions are increasingly beset by modern encroachments. Industrial fishing spreads fairly rapidly while the policy shifts are in favor of mechanization and

https://www.mahseertrust.org/post/tales-from-velimeen-land.

commercialization, leading to overfishing, leaving small-scale fishers marginalized, and rendering traditional regulatory structures weaker. Technologies such as GPS and synthetic nets have increased the efficiency of fishing but cause loss of traditional knowledge among the younger generation because they hardly apply the traditional methods. It is only through political intrusion in cooperative arrangements and poor autonomy in decision-making that institutional problems have weakened several community-based organizations. There is now abundant evidence of these problems to intervene. If well-documented, preserved, and effectively assimilated into formal governance systems, this traditional ecological knowledge runs a very tangible likelihood of total annihilation. A leading example of the importance of such knowledge can be drawn from Mullukuruma fishers of Wayanad. Their ideas on species interactions, mainly around the symbiotically spawing endangered pink carp (Hypselobarbus micropogon) and mahseer, illustrate ecological associations that even scientific studies might fail to uncover. Such insights show that concerns related to indigenous knowledge are not just cultural or historical but also crucial for biodiversity conservation purposes. Not only is bridging traditional wisdom with modern science a question of historical conservation, but it is a necessity toward an inclusive and sustainable fisheries governance future.

There must be some concerted effort to safeguard and document for posterity the traditional knowledge systems that form the rich heritage of indigenous fisheries governance in Kerala. Oral histories, spiritual customs, fishing calendars based on lunar cycles, and local ecological observations - all these have guided generations of sustainable fishing. Capturing these practices in both digital and printed formats shall ensure future access by generations to come, researchers, and policymakers alike. Putting them into the curricula of academic courses and resource management manuals can lend official status to traditional knowledge in modern fisheries governance. Such policy reforms should also actively embrace traditional governance systems like the paadu system or lunar-tide-based fishing cycles as recognized regulatory mechanisms within modern governance approaches. That makes very credible, compliance measures and sustainable strategies within small-scale fisheries. In this regard, supporting such efforts, government institutions must ensure that legal frameworks fully recognize the rights of communities and help to facilitate decentralized and participatory decision making.

The fact is that building capacity for and engendering continuity of knowledge across generations is also important in itself. Workshops at the community level, along with practical lessons for youths, would effectively bridge the gap between tradition and modernity, drawing in the youth into sustainable approaches that could also be supplemented with modern devices

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such as fish finders or GPS. Women and other marginalized groups, which are often underappreciated for their substantial but rarely acknowledged roles in fisheries management, must also be empowered by such programs. This strengthening of community-based fisheries management (CBFM) is one pillar in the foundation. The revitalization of local cooperatives, working towards autonomy, set in a more collective stewardship over marine resources. Successful grassroots cooperatives that are based on mutual trust rather than directed from above should be identified and replicated in all coastal regions-with enough leeway for adaptation to local conditions. In addition, it provides for Kerala's specific spiritual traditions and ecological ethics incorporated in the fishing rituals that offer a significant eco-spiritual frame for conservation education. These are culturally resonant into ways of promoting responsibility towards the environment. Education strategies can be both formal and informal.

Furthermore, research and collaborative studies between academic institutions and local fishers would unravel even deeper understanding of traditional ecological knowledge on, for example, spawning of fish, habitat management, and species interacting, such as the symbiosis observed by Mullukuruma fishers. Thereby, local voices would shape the inquiry, and the resulting outputs would be very scientifically airtight and socially relevant at the same time. Meanwhile, with modernization of the fishing sector, it now became important to monitor and regulate the technological transition involved. These should harmonize without undermining eco-friendly innovations and incentives for hybrid models that combine traditional and modern tools, while fighting practices harmful such as invalid trawling or overuse of synthetic nets. Finally, in time of climate change and environmental instability, traditional knowledge provides a resilient adaptive strategy anchoring experience on weather, tides, and fish migration. Understanding and integrating how local communities managed related adaptations in monsoon variability and ecological shifts throughout history, Kerala can craft a fishery policy that is adaptive as well culturally and environmentally aligned.

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