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A Review Paper on Limnology in Fresh Water Fishes

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Abstract: *Limnology, often known as the study of fisheries biology, has been an increasingly important component of research into freshwater fisheries over the course of the last several decades. This pattern has been steadily becoming more obvious over the course of the last several years. It was formerly believed that humans and fish were equally important to the health of the environment. However, as the 20th century progressed and the foundational research traditions of limnology became more established, this viewpoint started to change. It should not come as much of a surprise that the field of limnology has reduced its emphasis to encompass just the study of lakes, rivers, and other bodies of water that are comparable. This significantly led to the gap in understanding that developed between the two different study fields. In recent years, there has been a modification made to the methodology that is used when analysing fisheries found in freshwater. As a result of this, they have been forced to reconsider the objectives of the research as well as the technique, and they have thrown doubt on the traditional role that limnology has played in the area of fisheries science. The necessity of seeing fisheries as dynamic socio-ecological systems has resulted in the expansion of current fisheries research to include a wide variety of subfields of academic inquiry. The relevance of having knowledge about fishing was directly responsible for this expansion. It is necessary to have a holistic perspective in order to have a complete understanding of fisheries since they include both social and ecological processes. The only way to achieve this level of comprehension is to combine the information gained through scientific and social-science research. However, although it was formerly the key enabling science in fisheries research, it is currently simply one of many significant scientific areas. In the past, it was the primary science in fisheries research. This trend might be attributed to the emergence of more sophisticated methods in scientific research. Limnology has been around for a long time for a reason, and one of those reasons might be the insight it gives into the complex web of interactions that exist between people and fish. Because of this, it has endured for such a considerable amount of time. Documenting the inherent dynamics of social-ecological fishing systems is one of the ways that this technique will contribute to limnology. Limnology is an important area of research because of its capacity to capture the dynamics that are intrinsic to social-ecological fishing systems. As a result of this, it offers some potential benefits in one form or another. Limnology is a field that is ideally adapted to capture the dynamics that may be found in social-ecological fisheries systems; thus, it is possible that it might be beneficial in this particular situation. It is necessary for significant paradigm shifts to take place in both limnology and freshwater fisheries research before academic limnologists and freshwater fisheries researchers can begin to collaborate more closely.*

Keywords: Angling, Limnology, History, Fisheries, Social-Ecological, System, Fresh Water System

I. INTRODUCTION

Limnology is the scientific discipline that looks at the behaviour patterns as well as the physical elements of inland rivers. This ecological area of study, according to the opinions of some people, ought to investigate "anything that has an influence on fresh water." [Citation needed] (LAMPERT and SOMMER, 1999). The year 1922 was the year when the first edition of their book, which NAUMANN and THIENEMANN worked together on and wrote jointly, was made available to the public for purchase. The combination of components derived from the disciplines of hydrology,

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chemistry, and physics leads to the formation of a single body of knowledge as a consequence of this integration. Since its inception in the latter part of the nineteenth century, the limnological technique has had a significant impact, both positively and negatively, on the biology and study of freshwater fisheries. This influence may be broken down into two categories: positive and negative. This influence may be thought of in terms of two distinct categories: the good and the negative. Take, for instance, the manner in which the subfield of study known as freshwater fisheries science is often portrayed in the general media (ELSTER, 1974, 1993). Limnology has been of the opinion for a very long time that the most appropriate way to characterise it is as a "synthetic science," with the study of biology and botany functioning solely as a base for the discipline. This viewpoint has been held for a very long time. This perspective has been prevalent for a significant amount of time. Regarding this particular point, practically everybody is able to reach a consensus that they are correct. After being written by both NAUMANN and THIENEMANN, the book did not appear in print for the first time until 1922, despite the fact that both writers had contributed to the project. This school of thinking may be considered of as an exhaustive method of learning about the construction and operation of inland waterways in the modern day and age. In order to accomplish this objective, it is necessary to take into account the whole of the network of inland waterways.

A significant portion of the time and effort that researchers in the field of freshwater fisheries biology have devoted over the course of the past few decades has been focused on the endeavour of attempting to forecast and comprehend the future growth of fish populations and fish productivity. This has been one of the primary goals of their work. In order for us to achieve what we set out to do, we were forced to stray from the normal scientific procedure, which is the method that is utilised in the vast majority of research dealing with the biology of marine fisheries. This was the only way that we were able to find success. For instance, the biology of freshwater fisheries has always taken into account the huge number of biotic and abiotic elements that have an impact on the quantity of fish that may be captured. This has been the case for as long as the field has been studied. These factors are as follows: Geological properties, the morphometry of basins, the structure of catchments, and the size of catchments are all examples of extraneous elements that go beyond the narrow purview of fish population dynamics. Other examples of extraneous aspects include the following: There is a possibility that fish populations will be affected by each of these causes. Two further examples of such criteria are the configuration of the basin, as well as the geological properties of the area. On the other hand, we have decided to stop using this tactic since it has not been productive for us in recent years (BARTHELMES, 1981). Several various models of yield prediction, including RYDER's 1965 model, HRBÉK's 1969 model, OGLESBY's 1977 model, and BARTHELMES' 1981 model, have been offered as possible solutions to this issue. (RYDER, 1965; HRBÉK, 1969; OGLESBY, 1977; BARTHELMES, 1981) These models take into account a broad variety of factors, including, amongst other things, the location of lakes and rivers, the quantity of fertiliser loaded, primary production, and the biomass of invertebrates. Other factors that are taken into account include: These models furthermore included a wide range of other production characteristics, including, amongst other things, the geography of lakes and rivers, as well as a wide range of other components. These models furthermore included other aspects that were connected to production, such as the geographical distribution of water sources like lakes and rivers. In the past, stock dynamics models that were hyper-focused on a particular species were used in the process of determining the maximum sustainable harvest levels for marine fisheries. These models were used to determine the levels of catch that would not deplete the population of the species. The full influence that fish have had on the ecosystem and the food chain was not taken into consideration by these models. To phrase it another way, nobody knew for certain what percentage of a crop would be viable for commercial reasons. Even though there were less fish that were able to interact with their environment, the maximum catch that was legally acceptable was still decided. This was done in spite of the fact that there were fewer fish (HJORT et al., 1933; BEVERTON and HOLT, 1957; CUSHING, 1981). This was made possible, without a shadow of a doubt, due to the fact that fishing and fish production fleets in the oceans operate on a significantly larger scale than those in interior rivers, as well as due to the difficulty of understanding complex biological processes acting over such vast geographic and temporal scales. In other words, the oceans made it possible for this to be accomplished. To put it another way, the fact that there are oceans paved the way for this to be feasible. To put it another way, the existence of oceans prepared the path for this to be possible and made it possible in the first place. When compared to the number of fish farms and fishing fleets operating in coastal waterways, the number of fish farms and fishing fleets operating in inland rivers is often a significant lot lower. When compared to other kinds of

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waterways, the accessibility of inland rivers makes them a place that is more suited for the implementation of fishing limits than any other kind of waterway. In recent years, there has been a rise in the use of ecosystem-based fisheries models, and established limnological processes that may be found in marine ecosystems have been made accessible to the public. Both of these developments have taken place in recent years (FRANK et al., 2005). Trophic cascades and the management of food webs from the top down are only two examples that exemplify these processes. To name just two of them: (CARPENTER et al., 1985). This marks the beginning of calling into question long-established beliefs and initiating shifts in the established order (WALTERS and MARTELL, 2004). Research on fishing in both freshwater and saltwater ecosystems has begun to converge in recent years as a result of this reason. This is a consequence that stems directly from the circumstance.

Fish and hydrobiology have never been the sole components of freshwater fisheries biology, in the opinion of fisheries biologists (WUNDSCH, 1931, 1932/1933; NIELSEN 1999). Since the beginning, those working in the subject of freshwater fisheries biology have recognised that it encompasses a wider range of topics than just fish and hydrobiology. This is due to the fact that the biology of freshwater fisheries has absolutely nothing to do with the biology of fish or hydrobiology. This is one of the reasons why this is the case. The following are some of the reasons behind this: In point of fact, the idea is a great lot more profound and all-encompassing than what was said above. We will argue, in line with the objectives of our research, that applied limnology is the most appropriate framework in which to analyse the biology of freshwater fisheries. This will be done via the use of an example. [Here's a good example:] [Here's a good example:] (THIENEMANN, 1933). This subject was discussed for the very first time in 1933, and we will return to it in later conversations in order to carry out an investigation of it that is more comprehensive. (THIENEMANN). In the realm of freshwater fishing, there is a sizeable body of previous study that has made use of limnological research approaches. This research has been compiled over the course of many decades. A corpus is the end result of this research's compilation. In addition to the growing concern that existed in the early 1900s regarding the catastrophic pollution of a substantial percentage of aquatic ecosystems, this may be explained by the fact that fish and their environments interact physiologically on a high level. Another possible explanation is that this may be explained by the fact that fish and their environments interact physiologically on a high level. It's possible that this may also be explained by the fact that fish and their environs have a very high degree of physiological interaction (NIELSEN, 1999). (NIELSEN, 1999). On the other hand, until the second half of the 20th century, there was a significant gap between research on freshwater fishing and the development of contemporary limnology. Until that time, limnology was primarily focused on studying marine ecosystems. During this whole time period, freshwater fishing was a very common area of academic interest (RIGLER, 1982; BARTHELMES, 1988). In addition to the work that Barthelmeis produced in the same year, Riggler's (1982) work is also relevant (1988). We propose that the shift away from fish in limnology and toward the study of tiny planktonic creatures, the chemistry of water, and the hydrology of water led to the separation of limnology and the study of freshwater fisheries, which is what led to the split between the two fields of study, which is why limnology and the study of freshwater fisheries became two separate fields of study. When we state that the two fields were divided, we mean exactly what we just described. Limnologists, for instance, focus the majority of their study efforts on the examination of planktonic creatures that are very minute. We propose that limnology and research on freshwater fishing are two independent but related branches of the scientific community that originated in a variety of locales and at different times in history. Both of these subfields of study are important to the overall field of limnology. These two branches of the scientific community are intertwined and interdependent on one another (PERSSON et al., 1988). Recently, the subfield of limnology has switched its focus away from fish, which has resulted in a subsequent drop in the importance of fisheries thinking within the framework of the larger ecosystem. In particular, in regard to scholarly endeavours in the industry of fishing (NORTHCOTE, 1988; PERSSON et al., 1988; MAGNUSON, 1991). For illustration purposes, fish make up somewhat more than five percent of the total number of pages in the great majority of publications on limnology that are written for students in their first year of study (PERSSON et al., 1988). Fisheries biology and fisheries studies are merely given a passing look in the vast majority of recent articles that have been authored in the field of limnology (ELSTER, 1993, cited above). The waning of the fishing industry and other fundamental agricultural businesses in favour of service sectors, in addition to the ways in which research is sponsored and organised, is one indication of how the values, priorities, and primary employment of society have evolved over time. Other indicators include the means by which research is sponsored and organised. One

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such indicator is the disappearance of the resources that were once used to support and organise research. The historical ties that have existed between limnology and the biology and science of freshwater fisheries are now being called into question as a result of a paradigm shift in fisheries research toward the integration of the social sciences. This shift is the result of a fisheries research paradigm shift toward the integration of the social sciences. This is a very important new turn of events. There is a possibility that this shift might be traced back to the novel approaches that have been used in order to investigate fisheries. These unconventional methods include the following: The following actions are being done at this time in order to attract the attention of the largest possible number of people to these changes: The majority of the time spent on discussing this article is dedicated to the following three topics: The writers' goals may be broken down into the following categories: (3) to provide some ideas on the possible role that applied limnology will play and the relevance that it will have in the future of research on freshwater fisheries. This article's goals are as follows: (1) to provide a brief history of applied limnology; (2) to discuss some of the most significant social and scientific advancements in inland fisheries and freshwater fisheries science; and (3) to provide a brief history of applied limnology. (1) to provide a brief history of applied limnology; (2) to discuss some of the most significant social and scientific advancements in inland fisheries and freshwater fisheries science. Case studies obtained from German research institutions will be utilised in an effort to realise the objectives that the authors have outlined for the project.

II. HISTORY

The 20th century saw the development and rise to prominence of a number of specialised subfields within the overarching science of limnology.

Subsistence Long, winding rivers and lakes provided prime habitat for the first hunter-gatherers. Mankind also inland fished. Humanity's advanced civilization over the last two millennia owes a great debt to fish and fisheries. When it comes to food and culture, fish and fishing have altered human history (KOCH, 1925; HOFFMANN, 1994; WOLTER, 2007). Fisheries and writings about fish (BALDNER, 1666; BLOCH, 1782) suggest that early naturalists were captivated by the richness and variety of the ocean's fish populations (WALTON, 1853). (2002). Limnology was advanced by this pragmatic approach (ELSTER, 1974). The breadth of limnology is shown by Forbes and Forel (1887). (1927). (1901). Earlier limnologists studied fish habitats, as reported in SIL papers (NORTHCOTE, 1988; MAGNUSON, 1991). In 1922, the International Society of Limnology was established by THIENEMANN (Germany) and NAUMANN. Location: Northcote, Sweden (Sweden). In defining the essential limnological concept of longitudinal zonation of rivers, it is not surprising that FRI (1872) and VON DEM BORNE (1877) turned to river fish assemblages in a fisheries scenario. THIENEMANN got his idea from the field of applied fisheries (WUNDSCH, 1960). At a macro level, fish are a must-have.

The fields of limnology and hydrology both saw rapid growth in the late 19th and early 20th centuries (ELSTER, 1974; FREY, 1963). The Zoological Station in Naples, Italy, established European limnology in 1872. (1879). Organizations across Europe that study fisheries biology and limnology were impacted by this station (HEMPEL, 2003). The Max-Planck-Institute of Limnology owes a great deal to ZACHARIAS's 1891 establishment of the Hydrobiological Station in Plon, which was later renamed the Max-Planck-Institute of Limnology in Germany (ELSTER, 1974; LAMPERT, 2007). Berlin's Biological and Fisheries Experimental Station didn't get going until the following year (KOWALCZUK, 1989; STEFFENS and SCHPERCLAUS 1993). This facility is managed by the Leibniz-Institute for Freshwater Ecology and Inland Fisheries. Due to their location in the lowlands of northern Germany, these institutions did not focus on the ecology of pre-alpine lakes or fishing in those lakes. The Institute for Lake Fisheries and Lake Research was founded by DEMOLL in 1920 at its current location in Langenargen on Lake Constance (2005). Fishing for sturgeon (Acipensersturio) and Atlantic salmon (Salmosalar) almost stopped at least a decade after the German Fisheri (VON DEM BORNE, 1882; SCHIEMENZ, 1919). Because of this need, institutions dedicated to limnology and fisheries research were set up to study and/or administer modified aquatic ecosystems (although fish intro- ductions and stocking were probably not seen negatively in those times).

Studies in limnology span many different 20th century fields of study. Three subjective subfields in limnology are recognised. The biological and hydrological processes of aquatic habitats were the focus of basic limnology (LAMPERT, 2007). In experiments of this school, researchers attempted to modify whole aquatic ecosystems or replicate natural conditions as closely as possible in controlled settings (RINGELBERG, 1997). enhance existing

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biological processes in freshwater without immediately using this knowledge (RINGELBERG, 1997; LAMPERT, 2007). It was uncommon to check the quality of human beings or marine products. Extremely fished fish populations and habitats are seldom the focus of basic limnological research.

Part 2 addressed societal issues by investigating the effects of eutrophication on aquatic ecosystem structure and function (VOLLENWEIDER, 1976). Human impact on aquatic ecosystems was compared by limnologists. Managers of water systems were given a solid education thanks to this training. Humans were perceived as non-natural external disruptions whose primarily negative repercussions drove the investigation, and fish and fisheries were often seen as vectors rather than goals (ELSTER, 1993). (e.g., pollution, nutrient input). With the help of ecotechnologies created for this project, environmental factors like water quality may be improved in a way that is acceptable to society (DITTRICH and KOSCHEL, 2002; MEHNER et al., 2002).

Limnology in the third sector is the study of aquatic ecosystems and the application of scientific knowledge to ecologically responsible natural resource management, with a focus on the goods and services provided by fish. Experts in the fishing industry looked at fish production. In their role as "bottom-up" freshwater fish producers and applied limnologists, they emphasised fisheries. Expertise, according to researchers, aided in the administration of fishery resources (SCHIEMENZ, 1919). Fish were first identified as the product of a continuous flow of organic matter through predator-prey interactions, physicochemically driven nutrient dynamics, and energy fluxes after fishermen and fisheries specialists began to concentrate on ecological links rather than just collecting fish. Fish may soon be produced by the combined efforts of fishing and ecology. Examining fish populations and aquatic ecosystems required limnological techniques. The discipline of limnology is dedicated to the analysis of aquatic environments (WUNDSCH, 1931, 1963; ELSTER, 1974; BARTHELMES, 1981, 1988). Researchers want to improve both industrial and leisure fishing (WUNDSCH, 1960; RIGLER, 1982; MAGNUSON, 1991; NIELSEN, 1999). Inland waterways were necessary to address social and economic issues.

Fishing is neglected in limnology (RIGLER, 1982; PERSSON et al., 1988; MAGNUSON, 1991). Consequently, there is a growing divide between "fish(eries)" applied limnology and "non-fish(eries)" applied limnology. Environmental science was also a focus of limnologists. Several problems within the system have been the subject of research by limnologists and fisheries specialists.

Time and space, visited a wide range of conferences, and spent my coffee breaks chatting with colleagues at a wide range of research institutions. There is a wide range of opinion among academics. The research of RIGLER (1982) indicated that limnologists and fishery biologists seldom communicate with one another. When asked what divided them, he stated it was their divergent opinions on marine ecosystems. Limnologists looked at processes on a microscopic scale, whereas "piscicentric" fisheries biologists studied ecological systems, fish populations, and commercial fishing (RIGLER, 1982). Fisheries biologists and the "real world" were ignored by academic ecologists, particularly limnologists (KERR, 1980). Those who specialise in fishing often "forget" about the contributions they make to the fields of limnology and ecology (LARKIN, 1978). Not fish or fishers, but lakes and rivers were the focus of research for limnologists. Pure limnologists investigated the chemical and physical characteristics of lakes, the dynamics of phytoplankton and zooplankton, and the sampling challenges of late-maturing fish populations. It may have benefitted to have easier sampling and faster results. Researchers in the field of limnology very seldom focus on fishermen, fisheries management, or the economic and social contexts in which fishing takes place. It is important to properly manage fisheries. It made it harder to study and share information on freshwater fisheries.

3. Adaptations to Our Ways of Thinking with Regards to Fishing Models The Crucial Role That Science Will Play in the Continued Development of Limnology

Some definitions of fisheries science today still place a heavy emphasis on the biology of the exploited species, reflecting a historical tendency toward an inappropriately narrow definition of fisheries science as fisheries biology. Overly narrow definitions of fisheries science have been the norm for some time (i.e. fisheries biology, HART and REYNOLDS, 2002). Traditional approaches to the study of fisheries biology have traditionally focused extensively on the dynamics of exploited fish populations. In addition, a lot of work has gone into finding strategies to sustain output levels at their greatest potential level because of the motivation to continually harvest fish. This was most obvious in commercially-operated fisheries (LARKIN, 1978), and it has been an important role in the development of freshwater fisheries research for decades. This was most pronounced in commercially-operated fishing grounds (LARKIN, 1978).

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According to many studies (WUNDSCH, 1963; BARTHELMES, 1981; NIELSEN, 1999), etc. Today, virtually everywhere in the industrialised world, recreational fishing is seen as a more important user of fish stocks than commercial fishing. It's likely that this trend will continue (WELCOMME, 2001; ARLINGHAUS et al., 2002). Concurrent with this transformation are shifts in public opinion on the nature of "good" fisheries practise and sustainable fisheries management. It is anticipated that these alterations would have far-reaching consequences for the fishing sector in the future (NIELSEN, 1999). For instance, until recently, it was widely recognised and often used to improve fisheries by relocating fish and introducing non-native species of fisheries value. This was due to the fact that these methods were considered useful in the fishing sector. Implementing such a method was seen to be a useful means of making better use of "underutilised" food supplies. One such example occurred between 1965 and 1968, when herbivorous and phytoplanktivorous Asian carp species were introduced into German lakes in order to increase primary output. Those two times are the ones in which this occurred. According to (STEF-FENS, 1986). Most freshwater fisheries are now fished only by anglers, and commercial fisheries are under a lot of pressure from the economy to stay in business. Because of this, commercial fishing is a risky business (ARLINGHAUS, 2004, 2006). The public has become increasingly sceptical of aggressive stocking and introduction programmes as the number of people who care about environmental protection rises. This has resulted in a nationwide ban on introducing non-native species into Germany's fisheries and under the country's environmental protection laws. The needs of fishermen are always changing and becoming more nuanced, thus it is crucial that fisheries management take this into account. As a result, recreational fisheries no longer pursue maximal biological output, a target long linked with fisheries biology (LARKIN, 1977, 1978) and inland fisheries management (NIELSEN, 1999; ARLINGHAUS et al., 2002). However, there is a dearth of fisheries research that may offer a scientific foundation for accomplishing these more varied goals. Since there is a critical lack of (ARLINGHAUS, 2006). According to established limnological theory,

Conventional freshwater fisheries biology has not academically equipped the (German) fisheries manager to account for these changes, at least in the form it was taught and understood in the context of commercial inland fisheries (BARTHELMES, 1981). This holds true even when the context of inland commercial fishing is taken into account. This has always been the case, regardless of where it was first given or examined. When it comes to recreational fishing, for instance, traditional fisheries research isn't applicable since it doesn't take into consideration the dynamic interaction between people (anglers) and the natural systems with which they interact. It's important to work on this problem right now.

Fisheries research has historically focused on fish and their natural surroundings, but as society develops, this focus must broaden to include the many social, economic, and political issues that affect the behaviour of fisheries and the choices made by individual fishermen and anglers. Since fish and their habitat have long been the primary focus of fisheries study, a change in perspective is necessary. To be effective, fisheries research must be applicable to today's problems, thus scientists are shifting their attention (LARKIN, 1978; CARPENTER and BROCK, 2004). Although it has long been recognised that fisheries research and management must account for the complex human elements of fishers and anglers (e.g., LARKIN, 1978), it is only very lately that freshwater fisheries science has meaningfully integrated human dynamics with fish dynamics. This is because freshwater fisheries science has lagged behind marine fisheries research. For fisheries management, this is of paramount importance (e.g., CARPENTER and BROCK, 2004). It is noteworthy that a modern-day limnologist of STEVEN R. CARPENTER's stature is actively pursuing the integration of the social and ecological sciences within limnology and fisheries science. CARPENTER et al. (1985) is just one example of a landmark publication that has inspired decades of fundamental and applied limnological research. CARPENTER's writings have been influential for decades in both basic and practical research. For decades of limnological study, both fundamental and applied, have been inspired by CARPENTER's writings (CARPENTER and BROCK, 2004; CARPEN- TER and FOLKE, 2006). For a long time before this technology existed, fishermen and anglers, and the dynamics of their interactions, were seen as "basically gremlins in an otherwise ordered statistical machine" (LARKIN, 1978). Human dynamics, however, do have a role in shaping the characteristics of fisheries as systems, and this is particularly true in fisheries systems dominated by regionally migrating and extremely diverse predators known as anglers. That is to say, the features of fisheries as systems are not completely independent of human dynamics (CARPENTER and BROCK, 2004). The diversity of angler behaviour in this context is only now being acknowledged (ARLINGHAUS, 2004). The fish stocks, interactions between fish and other components of the

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ecosystem, aquatic-terrestrial coupling, diverse users of fish stocks and inland waters, and the type and nature of decision makers at all levels are all part of the coupled social-ecological system known as a freshwater fishery. A recently developed area of fisheries science is devoted to studying topics like these (ARLINGHAUS et al., 2007). Although limnology's importance in understanding social-ecological fisheries systems remains high, it is no longer the major supporting science and has instead become one of several required scientific disciplines engaged in fisheries research. This shift is the result of limnology's incorporation into fisheries science, which formerly encompassed just a subset of the scientific disciplines. Humans are taken into account as part of the system under study in the emerging field of fisheries research. People are seen to be an integral element of the system rather than an artificial, external disruption that has to be managed. For the benefit of freshwater fisheries research, it is time to learn more about human consumers of fish stocks and the behavioural dynamics of fish populations; however, the means by which this may be done need to be investigated outside of conventional limnology.

Researching human beings in isolation from the local ecosystem and fish populations is not a viable option. This is because anthropogenic fisheries management practises like stocking drive limnological processes and may affect the structure and function of whole ecosystems. One of these tactics is stocking (ROTH et al., 2007). Studies of fishermen and aquatic ecosystems are intricately connected; the former cannot be conducted without the latter. This is because understanding the dynamics of anglers' behaviour depends in part on the kind of feedback signals that originate from the aquatic environment. Therefore, there is an inherent connection between the study of fishermen and the research of marine ecosystems. What is required, in actuality, is an approach that not only nominally acknowledges the value of interdisciplinary work, but actually actively pursues it. That should seem like a perspective where social scientists and natural scientists work together on a shared system called a fishery. As a result, researchers in the field of limnology and fisheries biology, who were previously primarily interested in the dynamics of fish production, must now widen their focus to include the dynamics of human exploitation and dependence on aquatic ecosystems. Prior to this, they had only been thinking about the dynamics of fish production. Research into the social dynamics of those who exploit or depend on aquatic resources has to get started, and limnologists and fisheries biologists are the professionals most suited to begin such an investigation. Traditional fisheries experts, therefore, need to extend their perspective in order to analyse the whole social-ecological system, rather than only the habits of one highly desired fish species. Large interdisciplinary teams investigating (and, presumably, resolving) pressing fisheries problems need collaboration between traditional limnology and contemporary fisheries research. However, balanced participation from the social and biological sciences is essential for the field's advancement.

III. CONCLUSION

The majority of the challenges that modern freshwater fisheries must overcome are not of a biological nature but rather stem from socioeconomic causes (ARLINGHAUS, 2004, 2006). It is only through the support of interdisciplinary and transdisciplinary study, as well as the integration of social and limnological or fisheries biological investigations, that these challenges may possibly be addressed in a manner that is seen to be acceptable. If fishermen and anglers, who are the primary users of fish resources, are not the primary focus of fisheries research, then the study can be referred to as fisheries biology, limnology, ichthyology, ecology, hydrology, or anything else that seems to be a more appropriate name for the study. Fishermen and anglers are the primary users of fish resources. Fisheries ecology, fisheries hydrology, fisheries ecology, fisheries ecology, fisheries ecology, and fisheries ecology are all different names for the same field of research (ROYCE, 1983). If we are going to discuss this in terms of the science of fisheries, then we need to keep in mind that fishing is a practise that is carried out by people (ROYCE, 1983). It is essential to keep in mind that fisheries science encompasses more than just fish and fisheries biology; rather, it is an interdisciplinary approach that seeks to understand the human and biological dynamics of social-ecological fisheries systems by traversing and fusing the boundaries between the natural sciences and the social sciences. It is essential to keep in mind that fisheries science encompasses more than just fish and fisheries biology. It is crucial to bear in mind that the field of fisheries research has a wider scope than merely fish and the biology of fisheries. It is very necessary for us to have this fact at the forefront of our thoughts at all times. There are three factors that are absolutely essential in order to achieve considerable progress in this area of research, and they are as follows: 1) that fundamental limnologists (branch 1) start (re)appreciating the value of applied questions to generate fundamental insights (or at the very least not disregard them

as inferior science); 2) that applied limnologists (branch 2) start viewing humans as a part of nature with a legitimate role within aquatic ecosystems and culturally shaped landscapes/catchments; and 3) that fisheries scientists start viewing humans as a part of nature with a legitimate role within aquatic ecosystems and culturally shaped landscape Only at that point will limnologists and fisheries scientists be able to get closer to one another and start the process of re-establishing what had been lost – a beneficial scientific connection that contributes to the advancement of both fields. This requirement does not in and of itself represent a shift in paradigm for the field of limnology; rather, it sheds light on a new role for applied limnology within the intricate field of fisheries research.

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