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Current Trend of Water Hyacinth Expansion and Its Consequence on the Fisheries around North Eastern Part of Lake Tana, Ethiopia

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Abstract

The study was conducted from June, 2015 to October, 2016 to assess the effect of water hyacinth on fishing and fishers around the North-Eastern part of Lake Tana. The presence of water hyacinth in Lake Tana has been recognized in 2011. Starting from the last five years, especially after 2014, fishing in the study area becomes tiring due to the expansion of this invasive weed. Water hyacinth entangles the fishing nets and boats' propeller, making it difficult to fish and resulting in reduced fish catches. Hence, a reduced fish catch would have an adverse effect on the quality of life of the communities around the lake and consequently affect sustainable development in the region. Despite the fact that several efforts have been made by different parties, water hyacinth in Lake Tana continues to expand itself year after year. Therefore, its expansion is not easy to manage and complete eradication is unimaginable. Therefore, if the expansion of water hyacinth continues in this trend, it can negatively affect the livelihood of fishers in both directions by increasing costs of fishing and reducing the amount of fish caught.

Keywords: Livelihood; Inefficient fishing; Water hyacinth expansion; Big threat

Introduction

Invasive species are widely accepted as one of the leading causes of biodiversity loss and can have significant effects on resource availability and can suppress the relative abundance of native species [1,2]. In Ethiopia, close to 35 invasive alien plant species are posing negative impacts on native biodiversity, agricultural lands, rangelands, national parks, waterways, lakes, rivers, power dams, roadsides, urban green spaces with great economy and social consequences [3]. They may also alter biological communities and ecosystem structure and processes in terms of food web structure and energy flow [4].

At present Water hyacinth (*Eichhornia crassipes*) have been ranked as one of the world's worst invasive weeds [1,5] causing problems for millions of users of water resources. It is known as "Blue Devil" or "Bengal terror" in India, "Florida devil" in South Africa, "German weed" in Bangladesh and "Water terror" by South Western Nigeria with its disruptive impacts on aquatic ecosystems, agriculture, fisheries, transportation, living conditions and social structures [1]. Water hyacinth is justifiably called the world's worst aquatic weed due to its ability to rapidly cover whole waterways.

Under favorable conditions, water hyacinth can double its mass every 5 days and it also grows from seed, which can remain viable for 20 years or longer [2,6]. Due to its high reproduction rate, the complex root structure and the formation of dense mats with up to two million plants per hectare [7]. In Ethiopia, water hyacinth was officially reported in 1956 in Koka Lake and the Awash River [4,8-10]. In addition, water hyacinth has been recognized as the most damaging aquatic weed in Ethiopia since 1965 [4]. However, in the case of Lake Tana its presence has been recognized since 2011 [4,11-13].

The Lake Tana and the adjacent wetlands provide directly and indirectly a livelihood for more than 500,000 people [14]. In Lake Tana fisheries, there are ten districts that have a potential for fishing and more than 5400 fishers have been engaged in fishing in a seasonal and full time basis at this time. Moreover, the poorest rely in a larger proportion on fishing activities while the better off, mainly rely on agricultural activities and fishing as a supplementary [15,16].

Even if a tremendous amount of human labor, time and money has been exerted each year by both surrounding community and government, its coverage continues to escalate from 20 ha in 2012 to more than 50,000 ha in 2014. In addition, the 2014 assessment study shows that close to one-third or more than 30% of the shoreline of the north-eastern part of the Lake's shore is now invaded by water hyacinth [17]. Therefore, this study aimed to assess the impact of water hyacinth on fishers around Lake Tana.

Materials and Methods

The study was conducted from June, 2015 to October, 2016 in the North-Eastern part of Lake Tana. Based on the expansion magnitude of water hyacinth, purposive sampling method was used to select Fogera, Libo-kemkem, Gondar Zuriya and Dembia districts. Qualitative data, focusing on the current status of water hyacinth infestation and its possible impact on fishing activities was collected using PRA tools such as: Focus group discussion, key informant interview and direct observation.

In addition, consultancy workshop on the issues of water hyacinth and related Lake Tana threats were also held at Dembia, Gondar zuriya and Fogera districts with a total of 182 (31.5% of them were female) participants. During the workshop, the participants in the group discussion were ranging from the highest officials to the lower local experts and fishers. Moreover, secondary data were reviewed from literatures and annual reports. Finally, the collected data were analyzed and narrated qualitatively.

Results and Discussion

Fisheries of Lake Tana and water hyacinth expansion

Even though fish catch from Lake Tana is not as the previous, fisheries of Lake Tana serves as a source of direct cash for more than 5400 fishers. Now a day, anthropogenic activities and the newly emerged water hyacinth [18] poses a big threat on the fisheries of Lake Tana. Important feeding and spawning grounds of the fish are reduced or lost altogether. When the fish in question are unique endemic ones, the problem is compounded. This is indeed true for the barbs of Lake Tana, which are facing imminent extinction as the food web of Lake Tana changes in time. The decline of barbs has been observed presently in Eastern shore of the Lake Tana, which is shallower and where extensive removals of papyrus and nutrient inputs have been observed [13]. As a result, Catch Per Unit of Effort (CPUE) of *Labeobarbus* in 2010 had dropped to an alarming 6 kg/trip in comparison with 28 kg/trip in 2001 and 63 kg/trip in 1991-1993 (63 kg/trip) [19].

In 2012, water hyacinth had proliferated and covered about 15% of the Northern shore of the Lake. Due to this infestation, a massive annual removal campaign was organized by the regional government in 2013 and more than 40,000 farmers were involved [13]. Even though such a massive physical removal was implemented, water hyacinth flourishes alarmingly year to year. According to a 2014 assessment study of Wassie et al. [17] close to one-third or more than. Furthermore, the reports of Bahir Dar fisheries and other aquatic life research center (annual report) (2015) and [12] showed the current (2015) estimate of water hyacinth infestation coverage is approximately 34,500 ha (3,000 ha thick, 2,500 ha intermediate and 29,000 ha scattered). However, thick mat covered areas are smaller in the 2015 survey than in 2014, this is largely as a result of the community based mass physical removal campaign and to some extent long dry season dormancy (Figure 1).

Effects of water hyacinth expansion on fishing activities

According to Opande et al. [20] when water hyacinth infestation is present, access to fishing sites become difficult for riparian communities which rely solely on fishing as their main economic activity. Similarly, a study by Frezina [6] also reported that water hyacinth can present many problems for the fishers. On the other hand, water hyacinth provides highly complex habitat structure by restricting the growth of other submersed macrophytes. This modification and habitat complexity at the surface of the water are likely affect fishing (Figure 2).

Starting from the last five years, especially after 2014, fishing in the study area becomes tiring due to the expansion of this invasive weed. In the area of severe infestation, especially around the shore area fishing is therefore too much difficult. This results in blockage of fish landing sites and destruction of fishing gear [20]. Hence, as much as water hyacinth is viewed; it has had a negative impact on fishing, as it causes difficulty in fishing [21]. Water hyacinth can also greatly affect fish catch rates, because mats of water hyacinth can block access to fishing grounds and clog eye of the net (Figure 2).

As a result, fish production in the Lake has declined since the weed has blocked many fishing grounds. In this regard, Nabega Kebele in Fogera district is an indicator that all fishers change their landing site to the neighboring district Libo-Kemkem because of water hyacinth expansion obstructs their fishing activities. Therefore, for fishermen, the hyacinth mats have reduced their catch by covering the grounds,

increasing fishing costs because of the time and effort spent in clearing waterways, and causing loss of nets. It had inflicted heavy financial burden on the surrounding fisher folk, who complained that their fishing ground was infested with the weed, fish landings had dwindled and that even navigation had become impossible in the infested areas. Similarly, Aloo et al. [22] reported that many landing sites have been abandoned and income-generation from the sale of fish has been negatively affected.

A study by Kateregga and Sterner [23] confirmed that fish stocks decline have been at least temporarily halted by the declining catch ability of fish because of the growing abundance of water hyacinth. A study in Lake Victoria by Bhattacharya et al. [1] also showed fish catch rates decreased by 45% because water hyacinth mats blocked access to fishing grounds, delayed access to markets and increased costs (effort and materials) of fishing. Similarly, Mitchel [21] and Mailu [24] stated that the hyacinth mats reduced their catch by covering fishing grounds, delaying access to markets due to loss of output, increasing fishing costs due to the time and effort spent clearing waterways, forcing translocation, and causing loss of nets.

Effects of water hyacinth on fishing equipment's

Access to sites becomes difficult when weed infestation is present, loss of fishing equipment often results when nets or lines become tangled in the root systems of the weed. Therefore, fishers turn back to the landing site after they lost a lot of extra fuel and labour without any or with a minimum catches. Furthermore, each branch of water hyacinth becomes attached to the fishing net, and when the fishers pull their fishing net (mostly monofilament gillnet) during fishing it becomes damaged. Besides repairing the damaged fishing net, fishers invest considerable amount of time on detaching water hyacinth parts (branches) from gillnet after catching or fish (Figure 1). According to an interview with a key informant by Mitchel [21] 'fishers experience loss of fishing gear, time wasting during fishing and difficulty in movement, and even sometimes prevent people from fishing'. All these lead to reduction in fish catch and subsequent loss of livelihood.



Figure 1: Fishing net entangled by water hyacinth at the landing site (a) and fishing at area free from water hyacinth (b).

On the other hand, an area of sparsely infested water hyacinth dawdles the speed of the fishing boat by ravelling the propeller. This reduces the energy of the motorized boat without reducing the amount of fuel consumed. This leads to increase in their expenditure on fuel for their boat's engine. However, in a densely infested area (Figure 2) fishing by using both types of boats (motorized and reed boat) is unimaginable. According to the focus group discussion and key

informant interview, artisanal fishers, who couldn't enter into the pelagic area using reed boat, are highly vulnerable to the problems derived by water hyacinth. Therefore, water hyacinth affects smallholder fishers by increasing costs of fishing and reducing the amount of CPUE.



Figure 2: Shore area infested by water hyacinth at Serava kebele.

Furthermore, some fishers around Gorgora states that, fishing in the areas that are highly infested by water hyacinth (Figure 2) are risky because of the weed slow down the speed of the boat and we couldn't escape from a hippopotamus. Even though originally perceived as a practical problem for fishing and navigation, recent research indicates that aquatic weeds are now also considered a threat to biological diversity affecting fish fauna, plant diversity and other freshwater life and food chains Mitchel [21]. Moreover, Gichuki et al. [25] reported that the weed forms thick mats over the infested water bodies causing obstruction to economic development activities and impacting negatively on the indigenous aquatic biodiversity.

Eventually, further expansion of this plant may lead to drying up and shrinking of the lake. Depending on the degree of evapotranspiration and the lake size, there would be completely dry-up and disappearance of the Lake. Aba Samuel reservoir is a small lake near Addis Ababa was choked with water hyacinth and completely dried up in recent memory [13].

Conclusion and Recommendations

Like climate change and other anthropogenic activities, the newly emerged water hyacinth becomes a big threat for Lake Tana in general and the fishers in particular. effects of water hyacinth are dependent on the extent of the invasion, the uses of the impacted water body, and the controlling methods used. If the expansion of this aquatic invasive weed continues at this rate, the livelihood of subsistence fishers could be endangered because of water hyacinth strongly reduces the efficiency of fishing. Unless a well-designed and organized preventive approach is followed, the expansion of water hyacinth could endanger not only fishers and surrounding community but also the sustainability of the Lake. The local community around Lake Tana are at risk of losing their livelihood from fisheries following the infestation of the Lake by water hyacinth. Once water hyacinth has established, it is very difficult to eradicate hence, continuous monitoring is very important to reduce its rate of expansion. Farmers who are directly and indirectly beneficial from Lake Tana considered water hyacinth as a curse and they are willing to participate in the prevention campaign. Therefore, the government and other concerned stakeholders must surmount their facilitation and coordination role in the physical removal campaign. Moreover, conducting a multidisciplinary research to know their effects on the aquatic systems, fish health and Lake's productivity is vital.

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