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Monitoring and Evaluation of Stocked Water Bodies for Fish Production and their Ecological Status; the Case of Gomit and Selameko Reservoirs

***Wondie Zelalem, Erke Asmare, Brehan Mohamed and Dereje Tewab**

Bahir Dar Fisheries and Other Aquatic Life Research Center, Ethiopia

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***Corresponding author:** Wondie Zelalem, Bahir Dar Fisheries and Other Aquatic Life Research Center, P. O. Box 794, Bahir-Dar, Ethiopia, Email: wondiehm@gmail.com

Abstract

The ecological status, fish resource potential and the socio-economic value of Selameko and Gomit reservoirs, south Gondar zone were studied between, 2014-2015, through identifying the physico-chemical characteristics, composition and abundance of plankton and fishery potential and socio-economic value of the reservoirs. Though spatial variations were not statistically significant, seasonal variation of NO_2, Alkalinity, TDS, salinity and K_{25} were significant in Gomit. While seasonally, pH, DO and NO_2 were statistically significant in Selameko reservoir. A total of 42 and 53 phytoplankton species belonging to seven taxonomic groups and 21 and 23 zooplankton species belongs to three taxonomic groups were identified from Selameko and Gomit reservoirs, respectively.

The fishery potential of the two reservoirs using morpho-edaphic index estimated as 2.695 and 0.925 tons/year for Gomit and Selameko, respectively. However, currently only Selameko had Fish stock, which are ready to harvest. Though both reservoirs provide good opportunity to the local community, they face big challenges of catchment problem especially Gomit. There should be wire to stop fish movement out of the dam via spillway and an integrated catchment management including growing aquatic Macrophytes with in and around the shore area, which used as refuge and breeding ground for fish and buffer zone delineation for the sustainable production and increasing density of fish in the reservoirs.

Keywords: Stocked water body; Fish potential; Gomit; Selameko; Ecological status; Abundance

Introduction

Gomit and Selameko reservoirs are the two small man-made reservoirs within the Lake Tana water shade, in the Blue Nile basin. These reservoirs were primarily constructed to store water and used for irrigation in the dry season so as to overcome drought and to satisfy the food demand of the continual rising human population in the vicinity and in the region at large. Gomit reservoir is getting its water from three small rivers namely, Gomit, Washrko and Gebrael Rivers and it was impounded in an area of 21.52ha during its first full filled time. Similarly, Selameko reservoir is confined on an area of 11.6ha and it is impounded mainly on Selameko River but also a small seasonal stream 'Teskaru Minch' contributed to reservoir water. Gomit and selameko reservoirs are mainly getting water during main rain season from 23.43 and 8.79 km^2 of catchment areas and are intended to cultivate crops on 90ha (Co-SAERAR,1992) [1] and 63ha Jemal A [2] of land, respectively. The reservoirs water is greatly reduced during the dry season as a result of water withdrawal and municipal usage, evaporation and sedimentation.

In addition to their roles in provision of water for agriculture, these reservoirs were intended to play an important role in fish production and contribute to the livelihoods of the communities along their vicinity. In this aim during 2009 and 2014 about 964, and 500 *Oreochromis niloticus* species and 50 *Clarias garipinus* species, respectively, were introduced to Selameko from the Bahir Dar Fishery and Other Aquatic Life research center. While, 33 thousand of *O. niloticus* fish, which brought from Lake Hayk, South Wollo, was introduced to Gomit reservoir during 2010, by fishery experts from the regional Bureau of agriculture. Despite introduction of fish species, no one studied for the current status of these reservoirs, regarding to the water quality and fish and fishery potential.

Recently, environmental monitoring through regular assessment of water quality has become a crucial factor in the conservation or exploitation of aquatic resources. Water quality also regulates biotic diversity and biomass, energy and material cycles, and rate of succession. However, accumulation of excess sediments due to anthropogenic impacts and natural processes such as; precipitation inputs and erosion, influences aquatic ecosystems and create unstable system, which define the ecological production processes of the water body. Therefore, this monitoring and evaluation activity was aimed to evaluate the ecological status, fish resource potential and the socio-economic value of these reservoirs through identifying the physico-chemical characteristics, composition and abundance of plankton and fishery potential and socio-economic value of the reservoirs, and to identify problem(s) and threat(s) facing the reservoirs and recommend possible mitigation measures for sustainable fish production.

Materials and Methods

Study Sites

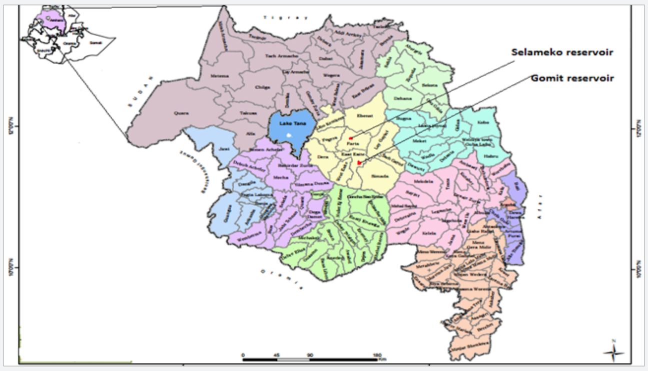

Figure 1: Map of Amhara region and study sites, indicated with red point.

The study was carried out on Gomit and Selameko reservoirs, which are located in South Gonder zone of the Amhara regional state. Gomit micro dam is found in Estie woreda, on the boarders of zigura and Goshibert kebeles and is 8 kms far from the town Mekaneyesus. Geographically the area lies on coordinates of 110 33' 42.9'' N and 0380 01' 13.3'' E and at an altitude of 2392 meters above sea level (m a.s.l.). Similarly, Selameko reservoir is found in the south-west part of Debere-Tabor town, in Selameko-weybla kebele. The reservoir is located at 038° 05' 00" E and 11° 53' 24" N at an altitude of 2513 m.a.s.l., which is categorized as the 'Dega' agro-climatic region. It is 2.5km far from Debre-Tabor town to the south-west direction (Figure 1).

Sampling protocols

Limnological data Sampling was carried out at three points in each reservoir. The limnological data including physico-chemical and biological samples were collected on special and temporal bases of the reservoirs. In-situ measurements of temperature (Temp.), dissolved oxygen (DO), specific conductivity (K25), pH, TDS, salinity (sal), were measured using YSI multi probe system instrument, Model YSI 556. Water turbidity and nutrients such as Nitrate (NO3-N), Nitrite (NO2-N), Ammonia (NH3-N), Phosphate (PO4-P), Total hardness (TH), hydrogen sulphid (H2S) and Alkalinity (Alk.) were measured following standard procedure using Palintest Transmittance display Photometer model 5000.

The composition and abundance of phytoplankton and zooplankton species were assessed after collecting water samples using 10 liter buckets. Water samples were filtered with 50 and 80μm nets for phytoplankton and zooplankton, respectively. Identification and enumeration of planktons were done in the laboratory using standard keys such as Gasse [3]; Komarek & kling [4]; Komarek & Anagnostidis [5] and Taylor et al. [6] for phytoplankton and Defaye [7]; Fernando [8]; Smirnov [9] and Smirnov [10] were used for zooplankton identifications. Plankton numerical abundance was calculated according to Lind [11]. The presence, abundance and composition of fish species were assessed using gill nets with 6, 8 and 10 cm and monofilament gill nets with different stretched mesh sizes (from 2mm to 4cm). Socio economics data was collected using focus group discussion (FGD) direct observation, expert consultation, and Key informant interview from the local community.

Statistical Methods

Simple statistical methods; descriptive statistics and one-way ANOVA test were employed to see differences among sites and between seasons using statistical analysis tool, SPSS for window (version 20) at 95 % significance level. Simple line graph were used to demonstrate seasonal pattern of plankton density using Microsoft office Excel.

To estimate the fishery potential of the reservoirs the following empirical formula were employed.

$Yield(in\ kg/ha/year) = 14.3136((conductivity\ in\ \mu S/cm)/(mean\ depth\ in\ m))^{0.4681}$ Henderson & Welcome [12] and

Total yield in tone per year= 8.32(Area in km^2) Crul [13].

Results

Physico-chemical variables

Results of measured physical and chemical characteristics of the two reservoirs are displayed in Tables 1 & 2 below. The water temperature of Gomit and Selameko reservoirs was ranged between 20.13 to 26.76 and 20.5 to 25.67 with mean value 23.08±1.69 and 22.29±1.63, respectively. The maximum water temperature (25.670C) in Selameko reservoir was recorded during the dry season while, the minimum (20.500C) was during the wet season. On the contrary, the maximum water temperature (26.760C) in Gomit reservoir was recorded during wet season, while the minimum (20.130C) was during the dry season. However, statistically there were no significant spatial and temporal differences among study sites.

pH values recorded were ranged between 6.73 to 8.91 and 7.26 to 9.53 with mean value of 8.05±0.84 and 8.26±0.86 for Gomit and Selameko reservoirs, respectively. The minimum value of pH was recorded during wet season, while the maximum was recorded during dry season in both reservoirs. Though there was no statistically significant spatial difference among the study sites in both reservoirs, highly significant temporal difference (p=0.017) (Table 1) of pH was recorded in Selameko reservoir. Marginally highest pH values were recorded in the open site of both reservoirs.

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Table 1: Mean ±SD values of the physico-chemical parameters of Selameko and Gomit reservoirs.

Variable	Selameko		Sig.	Gomit		Sig.
	Dry season	Wet season		Dry season	Wet season	
	Mean±SD	Mean±SD		Mean±SD	Mean±SD	
Temp (°C)	21.36±0.79	22.91±1.78	0.064	23.49±2.01	22.87±1.91	0.6
pH	7.61±0.22	8.61±0.88	0.017	7.72±0.82	8.5±0.7	0.115
DO (mg/l)	7.91±0.57	6.48±0.85	0.02	6.79±0.77	6.48±1.06	0.563
K25(µS/cm)	121.0±7.4	130.0±13.4	0.151	159.3±47.0	244.2±55.4	0.017
TDS(mg/l)	85.0±5.0	88.0±7.0	0.357	108.6±32.9	168.0±38.3	0.016
Sal(mg/l)	60.0±0.0	62.7±6.5	0.325	77.14±24.98	122.0±29.5	0.017

The values of DO recorded were ranged between 5.27 to 8.03mg/l and 5.03 to 8.57 mg/l with mean value of 6.66±0.87 and 6.99±1.02 mg/l for Gomit and Selameko, respectively. There was no statistically significant spatial difference among study sites in both reservoirs, however, there was statistically significant difference (p=0.02) between dry and wet season in Selameko reservoir. Nevertheless, lowest mean value of DO was recorded during the dry season in both reservoirs. The value of K_{25}, TDS and Salinity was ranged between 131 to 279µS/cm³, 90 to 190mg/l and 60 to 140mg/l with mean value of 194.7±65.0, 133.3±45.4 and 95.8±34.5, respectively for Gomit reservoir. Whereas, 110 to 149µS/cm³, 76 to 96mg/l and 50 to 70mg/l, with mean value of 126±12.2µS/cm³, 86.7±0.6mg/l and 61.8±5.3mg/l, respectively for Selameko reservoir. Statistically there was no significant spatial difference among study sites in both reservoirs. However, seasonally ANOVA result showed highly significant difference for K_{25}, TDS and Salinity, respectively in Gomit reservoir. The mean value of K_{25}, TDS and Salinity in both reservoirs were higher during the dry season (Table 1).

Concentration of inorganic nitrogen species [Nitrate (NO3-N), Nitrite (NO_2-N and Ammonia (NH_3-N)] was ranged between 0.21 to 5.59mg/l, 0.00 to 0.459mg/l and 0.00 to 0.528mg/l with mean value of 2.48±1.51mg/l, 0.11±0.15mg/l and 0.13±0.16mg/l, respectively for Selameko reservoir. Although ANOVA results showed the spatial variations to be not significant in this reservoir the mean concentration of Nitrate (2.88±0.87mg/l) was highest in the inlet site, while the mean concentration of Nitrite (0.144±0.21mg/l) and Ammonia (0.185±0.24mg/l) was highest in the outlet site. Similarly, concentrations of Nitrate, Nitrite and Ammonia in Gomit reservoir were ranged between 0.79 to 6.29mg/l, 0.00 to 0.12mg/l and 0.00 to 0.45mg/l, with mean value 2.5±1.9mg/l, 0.043±0.035mg/l and 0.173±0.17mg/l, respectively. Though there were no statistically significant spatial difference, highest mean value of Nitrate (2.97±0.78mg/l), Nitrite (0.079±0.04mg/l) and Ammonia (0.387±0.09mg) were recorded in the outlet site.

Temporally, however, concentration of Nitrate, Nitrite and Ammonia was higher in the wet season in both reservoirs. Although, Nitrate and Ammonia did not show statistical significant temporal differences, concentration of Nitrite was differed significantly in both reservoirs (Table 2). Concentrations of PO_4-P and sulphid (in the form of H_2S) were ranged between 0.06 to 1.09mg/l and 0.00 to 0.848mg/l with mean value of 0.368±0.31mg/l and 0.031±0.027mg/l, respectively for Selameko reservoir. The concentrations were ranged between 0.16 to 5.45mg/l and 0.00 to 0.127mg/l, with mean value of 1.96±2.54mg/l and 0.04±0.04mg/l, for PO_4-P and sulphid, respectively in Gomit reservoir. In both reservoirs however, the higher concentration of PO_4-P was recorded during the wet season, where as concentration of H_2S was higher during wet season in Selameko and dry season in Gomit reservoirs. Statistically, there were no significant spatial and temporal variations in PO_4-P and H_2S concentrations.

Table 2: Seasonal (Mean ±SD) values and differences of Nutrients in Selameko and Gomit reservoirs.

		Selameko Mean±SD	Sig.	Gomit Mean±SD	Sig.
Phosphate (mg/l)	wet season	0.375±0.38	0.950	3.30±2.79	0.065
	dry season	0.364±0.29		0.628±0.21	
Nitrate (mg/l)	wet season	3.11±1.9	0.215	3.203±2.05	0.199
	dry season	2.13±1.2		1.35±0.93	
Nitrite (mg/l)	wet season	0.255±0.19	0.002	0.069±0.028	0.011
	dry season	0.035±0.03		0.0178±0.02	
Ammonia (mg/l)	wet season	0.130±0.11	0.985	0.202±0.18	0.629
	dry season	0.128±0.19		0.145±0.171	
Hardness (mg/l)	wet season	48.83±18.2	0.280	87.60±22.33	0.875
	dry season	59.91±20.1		92.80±68.26	

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Sulphide (mg/l)	wet season	0.0318±0.037	0.906	0.025±0.021	0.127
	dry season	0.0297±0.014		0.079±0.067	
Alkal (mg/l)	wet season	43.00±3.46	0.297	69.40±19.86	0.039
	dry season	45.27±4.45		129.00±76.0	
Turb (NTU)	wet season	18.00±10.16	0.229	127.40±56.1	0.099
	dry season	47.56±56.04		63.40±52.39	

Concentration of Total hardness and Alkalinity concentrations were ranged between 26 to 90mg/l and 38 to 52mg/l with mean value of 56.0±19.6mg/l and 44.5±4.17mg/l, respectively in Selameko reservoir. While in Gomit reservoir concentrations of Total hardness and Alkalinity was ranged between 42 to 155mg/l and 47 to 158, with mean value of 100.2±38.2 and 91.7±42.2mg/l, respectively. Though, there was no statistically significant spatial and temporal variation in reservoirs, higher concentration of Total hardness and Alkalinity was recorded during the dry season. The value of turbidity (inverse of water transparency) was ranged between 26 to 170NTU and 3 to 165NTU in Selameko and Gomit reservoirs, respectively. Higher turbidity was recorded during wet season in Gomit reservoir. Unlikely, higher mean turbidity value was recorded during dry season in Selameko reservoir, which is associated with turbidity caused by cattle when watering.

Biological Variables

List of plankton species identified in this study is displayed in Tables 3 & 4. A total of 42 and 53 phytoplankton species belonging to seven taxonomic groups were identified from Selameko and Gomit reservoirs, respectively. Bacilliarophyceae was the most species-rich taxa in both reservoirs, which comprised 27 and 32 species, followed by Chlorphyceae, which comprises 9 and 10 species for Selameko and Gomit, respectively. Bacilliarophyceae, which contributed 92% to the total phytoplankton density, was also the most abundant taxa in Selameko reservoir, while Chlorophyceae, which contributed 69%, was abundant in Gomit reservoir.

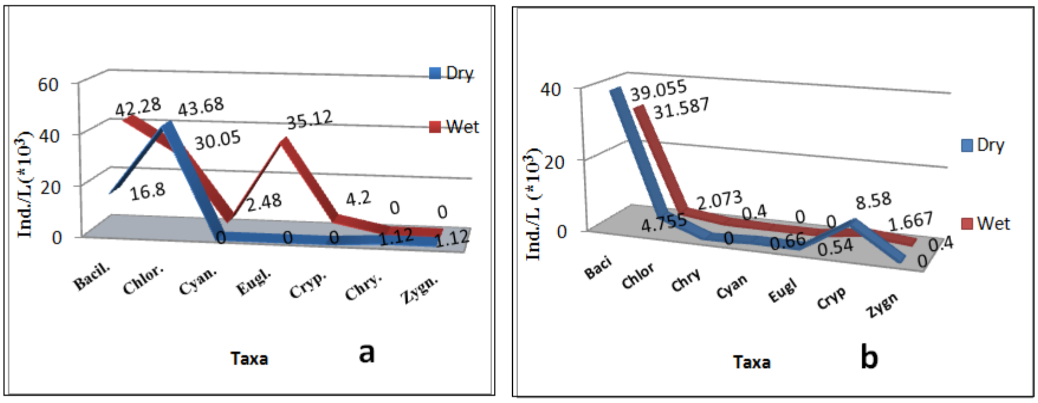

Figure 2: Seasonal trends of phytoplankton in Gomit.
a. Selameko,
b. Reservoirs.

Density of phytoplankton taxa was varying seasonally (Figure 2). Bacillariophyceae (42.28 X 10^3 Individual per Litter (Ind. /L)) and Chlorophyceae (43.68 X 10^3Ind. /L) were dominant during wet and dry season, respectively in Gomit reservoir. Baciliarophyceae, however, was prominent throughout sampling period in Selameko reservoir. *Aulacoseira granulate* was the most abundant and common species in both reservoirs. Other species such as *Stephanodiscus hantzschii*, from Bacilliarophyceae and *Schroederia setigera* from Chlorophyceae were common and abundant species in both reservoirs. However, Zygnematophyceae, Cyanophyceae, Euglenophyceae and Chrysophyceae were poorly represented and did not found abundantly in the two seasons (Figure 2) & (Table 3).

Table 3: List of phytoplankton species identified from Selameko and Gomit.

Phytoplankton Taxa Name	Selameko	Gomit	Phytoplankton Taxa Name	Selameko	Gomit
Bacilliarophyceae			*Amphora sp.*	+	+
Aulacoseira granulata	+	+	*Achnanthes minutissima*		+
Gomphonema lanceolatum	+	+	*Achnanthes sp.*	+	+
Fragilaria cf. crotonensis	+		*Tabellaria sp.*	+	

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Mastogloia sp.		+	*Gyrosigma obtusatum*		+
Surirella engleri		+	*Mastogloia sp.*		+
Surirella capronii		+	Chlorophyceae		
Surirella cf. linearis		+	*Pediastrum duplex*	+	+
Synedra berolinensis	+		*Closterium acerosum*		+
Synedra ulna	+	+	*Hormidium sp*	+	
Stephanodiscus hantzschii	+	+	*Cruceginia tetrapedia*		+
Navicula sp.	+	+	*Crucigenia rectangularis*	+	
Navicula decussis		+	*Crucigenia quadrata*	+	+
Navicula damasii	+	+	*Oocystis sp.*	+	+
Navicula halophila	+		*Dictyosphaerium sp.*		+
Navicula americana		+	*Scenedesmus armatus*		+
Navicula schroeteri	+	+	*Scenedesmus lunatus*	+	
Navicula radiosa		+	*Schroederia setigera*	+	+
Navicula trivialis	+		*Sphaerocystis sp.*	+	
Navicula laevissima		+	*Chlamidomonas sp.*		+
Navicula cuspidata		+	*Pandorina sp.*	+	
Nitzschia sp.	+	+	*Eudorina sp.*		+
Nitzschia umblicata		+	Zygnematophyceae		
Nitzschia cf. fonticola	+		*Cosmarium margaritiferum*	+	
Nitzschia thienemanii	+	+	*staurastrum anatinum*		+
Nitzschia gracilis	+		Cyanophyceae		
Nitzschia latens		+	*Gloeocapsa minima*		+
Pinnularia sp.		+	*Gloeocapsa turgida*		+
Pinnularia gibba		+	*Gloeocapsa sp.*	+	
Cymbella pusilla		+	*Oscilatoria lacustris*		+
Cymbella sp.	+		*Oscillatoria lacustris*		+
Cymbella turgidula	+		Euglenophyceae		
Cymbella affinis	+		*Euglena acus*		+
Cymbella fonticola	+		*Euglena sanguinea*		+
Cyclotella comta	+	+	*Euglena sp.*	+	+
Cyclotella sp.	+		Cryptophyceae		
Rhopalodia vermicularis		+	*Cryptomonas marssonii*	+	+
Rhopalodia gibberula	+	+	*Cryptomonas ovata*	+	+
Rhopalodia gracilis	+	+	Chrysophyceae		
Eunotia incisa	+		*Mallomonas sp.*		+
			Rhodomonas sp.	+	

Table 4: List of Zooplankton species identified from selameko and Gomit reservoirs.

Zooplankton Taxa Name	Selameko	Gomit	Zooplankton Taxa Name	Selameko	Gomit
Copepod			*Brachionus angularis*		+
Afrocyclops gibsoni		+	*Brachionus calciflorus f.anuraeiformis*		+
Mesocyclops aequatorialis	+		*Brachionus calciflorus f. dorcas*	+	+
Microcyclops varicans	+		*Brachionus calciflorus spinolus*	+	+
Thermocyclops decipiens	+	+	*Brachionus plicatilis*	+	+
Cladocera			*Brachionus patulus*		+
			Brachionus quadridentatus	+	+
Alona intermedia	+		*Euchlanis dilatata*	+	+

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Alona quadrangularis		+	*Filinia maior*	+	+
Alona sp.	+		*Filinia longiseta*	+	+
Bosmnia longrostris		+	*Filinia opoliensis*		+
Ceriodaphnia rectirostris	+		*Hexarthra intermedia*		+
Daphnia corinata	+		*Keratella cochlearis*	+	+
Macrothrix sp.		+	*Keratella tropica*	+	+
Moina dubia		+	*Platyias cf. ledoupi*	+	
Rotifer			*polyarthra remata*	+	+
Asplanchna girodi		+	*polyarthra vulgaris*	+	+
Asplanchna sieboldi		+	*Testudinella sp.*		+
Asplanchna sp.	+	+	*Trochosphaera sp.*	+	

Among zooplankton taxa, Rotifer contributed 98% and 82% of the total zooplankton Biomass in Gomit and Selameko reservoirs, respectively. Rotifers are also comprised most divers species in both reservoirs (Table 4). *Polyarthra remata* and *Keratella cochlearis* was the most dominant species among Rotifers. Seasonally, Rotifer accounted for 84% of the total zooplankton biomass during the dry season, but 80% during the wet season in Selameko reservoir. On the other hand, they accounted for 98% of the total zooplankton density in the dry season but beaten by copepod in the wet season in Gomit reservoir. Copepod was contributed 17% and 2% of the total zooplankton biomass in Selameko and Gomit reservoirs, respectively. However, contribution of cladocera was very poor in both reservoirs. Seasonally, copepod was dominant in Gomit reservoir during the wet season.

From the effort in fish catch, Gomit reservoir has only one fish species namely, *Gara Dembech*, the species which is not commercially important and common to many lakes, reservoirs, rivers and streams. However, in Selameko reservoir we caught *O. niloticus* species whose length ranged from 130mm to 300mm and weight ranged from 62g to 953g. This fish species are reach to table size and ready for harvest with mean value of 210mm and 321g length and weight, respectively. However, due to lack of skill about how to catch and process fish to eat for local community, there is no any fishing practice in the reservoir yet. From the socioeconomic survey we found that Selameko and Gomit reservoirs gave ample opportunities for the surrounding community in a variety of ways. Among these; the wetland around the reservoirs have been supported the community as a water source and cattle grazing land. Their potential to grow major crops such as potato, tomato, and onion with in an area of 63 and 90hactars of land for Selamko and Gomit reservoirs, respectively.

Regardless of these opportunities both reservoirs have been faced challenges such as

1. Effluents from point and non point sources,
2. The constructed outlet did not consider fish production in reservoirs. As a result, the fish species could escape easily from the reservoir with water through spillway,
3. Degradation and non-existence of aquatic Macrophytes with in and around the reservoir exacerbate siltation/sedimentation,
4. Degradation of breeding ground for fish due to free grazing and
5. Reduction in the volume of water during dry season (starting from February) due to irrigation load.

Discussion

Spatial variations in small impoundment like Selameko and Gomit are not common. But seasonal variations might be pronounced depending on the geophysical environments and land use practices in the vicinity Zhang, et al. [14]. Based on the Ethiopian agro-climatic zonation selameko and Gomit reservoirs are recognized as Dega and woina-Dega regions, respectively Tamiru Alemayehu [15]. Temperature, one of the factors which affect biological and chemical processes in a water body, is affected by altitude Lewis [16]. The recorded mean values of temperature in both reservoirs also signify these variations. The mean value of temperature recorded in Selameko was slightly higher than previous study by Tilahun Adugna [17]. Similarly, the mean water temperature recorded in this study was higher than the value (20.75) reported by Goraw & Chalachew [18]. These variation probably due to climate change effect for the last 6 -10 years Taye, *et al*. [19], Enyew et al. [20]. Though this temperature may not be optimum to warm water species, it can support growth of fish species like Tilapia and cat fish which are recommended in the Lake Tana catchment.

DO concentration more than 5.0 mgl- Das [21], and pH within the range of 6.5 to 9.0 Stone & Thormforde [22], favours good growth of aquatic flora and fauna. The recorded values of DO and pH in this investigation were safe to the survival and healthy growth of aquatic life as reported by Boyad & Tucker [23]. The significant seasonal variation of DO and pH with maximum value during dry season in Selameko can be explained by the decreased temperature, which enhance DO holding capacity of the water during dry season Naz & Turkmen [24]. In Gomit reservoir however, the concentration of DO was reduced during wet season. This situation probably associated with siltation, which decreased depth and increased sediment oxygen

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demands Agostino et al. [25]. DO concentration also affected by the consumption of microbes for decomposition process. An excess CO2 over DO promotes reduction in the pH value of the water.

Both reservoirs had highest mean value of K_{25}, TDS and salinity during wet season. This phenomenon may be associated with runoffs from the catchments due to heavy rain. Similar result was reported by Pulugandi [26]. Higher K_{25} value was recorded in Gomit but still it is within the range for fresh water (10-1000 µs/cm) Chapman & Kimstach [27]. Available nitrogen (in the form of NO_3-N, NO_2-N and NH_3-N) and Phosphorus in the form of PO_4- P were higher in both reservoirs during the wet season, which can be explained by high runoff from agricultural land increases sediment and nutrient loading. The presence of these available nutrients was enhanced the phytoplankton biomass in Selameko reservoir which had low turbidity during wet season. Unlikely, in Gomit though the higher concentration of available nitrogen and phosphate, the phytoplankton biomass was lower during wet season. This is probably due to higher turbidity, which hinder algal productivity as light and nutrients acted jointly as important limiting factors for phytoplankton in shallow reservoir Scheffer [28].

In addition to fluxus with its rich nutrient and organic mater, siltation is the most dominant factor of aging process in reservoirs Agostino *et al*. [25]. this is because silt reduces depth and affects storage capacity of the reservoir. In this investigation such phenomenon have been observed in gomit reservoir with a maximum depth of 3.6m, has 15m difference from the masured depth by Goraw & Chalachew [18]. Based on the measured physico-chemical parameters, no major detrimental limnological characteristics were observed in both reservoirs. Dominancy of the phytoplankton by diatoms and green algae and the notable absence of cyanobacteria in both reservoirs jointly reflect desirable water quality characteristics which are indicative of healthy lentic ecosystem Fábio, et al. [29].

Seasonality of phytoplankton and zooplankton was only pronounced in Gomit reservoir but moderate in Selameko. This reflects much greater seasonality of a more turbid reservoir. Similar result was also reported by Eshete Dejen, et al. [30]. Seasonal limitation of algal growth is plausibly attributable not only low nutrient status and moderate light limitation, but also by the grazing control by zooplankton Lampert [31]. The observed biomass variability of phytoplankton in this study can be also explained by the concomitant variability of zooplankton biomass. It is also reported that in most tropical water bodies' phytoplankton growth mostly regulated by temperature, the size of the watershed, reservoir basin morphology, volume of outflow, and the food-web structure Calijuri & Dos Santos [32].

Rotifers are important elements of the zooplankton taxa followed by copepods and cladocerans in both reservoirs. It is obvious that the abundance of zooplankton is influenced by the availability of food. An increased in zooplankton density was associated with elevated phytoplankton density in both reservoirs. The success of rotifers in reservoirs can be explained by their feeding plasticity, opportunistic feeding characteristics and rapid population growth during short favorable conditions as reported by Nogueira [33].

Reservoirs productivity is a factor of energy, nutrient dynamics and biotic interactions with in a water body. It can also be related to morphometric, edaphic and climatic factors. Mean depth over maximum depth, catchment to reservoir area ratio, flushing rate Sugunan [34] and relative water level fluctuation Jul-Larsen et al. [35] are anticipated factors to reservoir productivity. In this study the fish production potential estimated using morph-edaphic index, an average yield of 2.695 ton/year and 0.925 ton/year in Gomit and Selameko reservoirs, respectively, is comparable to the production potential of a hypothetical African lake with 1000 ha area (0.348 ton/ha) van Zwieten, et al. [36]. In addition to inputs of nutrients and food from riparian areas, an increase in habitat structure and diversity can enhance reservoir productivity Kolding & Zwieten [37].

Although previous reports indicate Gomit reservoir was introduced with 33 thousands of Nile tilapia, none of them was existent during this study in the reservoir. The observed high siltation which made the reservoir water turbid during main rainy season and the flow reservoir water through spillway with no any wire to stop the fish movement from going down in to the irrigation canal are the two main reasons for their absence. The dam is in a position to collapse in the main dam side because part of its outer side is being slide and leave its position. This shows the reservoir is under big threat which, need serious attention.

In Selameko, however, though two fish species were stocked at different times, we only caught Nile tilapia "*O. niloticus*" species during this investigation. As Tilahun Adugna [17] report, none of the fish species were caught in the reservoir during his study period. According to him, their absence was attributable to low temperature. Certainly, low temperature affects healthy growth of fish, however the recorded temperature cannot be the merely factor to their absence [38,39]. The flow of reservoir water through spillway with nothing to stop the fish movement from going down tos the irrigation canal, poor shoreline development with very poor aquatic plants growth around the shore area, which used as refuge and breeding ground for fish, hampered the density of fish in the reservoir water. In our sampling we could not caught cat fish. This is probably because of the nets which were sat on the surface of the open water and shore areas.

The fish we caught were reached table size, and were ready for production. Although, there is less siltation and less turbidity problems associated with small catchment and low intensity of Agricultural activates, there is pollution problems in Selameko reservoir. Effluent comes from Debretabor town via Selameko River and from the nearby slaughtering house 'Kera' via small streams 'Meshesha' are the main sources of pollution that influences the reservoir productivity.

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Conclusion

Water quality and reservoir productivity are equally important with the growth of good fisheries. The two studied reservoirs have reasonably good water quality for aquatic life but have some problems that needs serious attention for the sustainable fish production and fishery development. Among the problems: the reservoirs water is subjected to agricultural runoffs, with high siltation and nutrient load. Especially, Gomit reservoir, which has greater watershed area, is suffering of high siltation due to agricultural runoffs. Similarly, Selameko reservoir has been suffered by municipal waste from municipality. All these were revealed by the recorded high level of Phosphate and Nitrate, especially during rainy season. Therefore, all concerned parties have to take mitigation measures to alleviate the problem and for the development of sustainable fishery in the reservoirs.

Recommendation

To reduce siltation problems there has to be catchment treatment using physical and biological methods. For Gomit reservoir serious attention has to be given to reduce siltation, and even maintenance for the main dam side. As biological control growing trees in the catchment area including aquatic Macrophytes with in and around the shore area of the reservoir, which used as effluent filtration, refuge and breeding ground for fish. There is a need to have buffering zone delineation for the sustainable production and increasing density of fish in the reservoir. Materials such as wire mesh have to be fixed to stop fish movement out of the dam via spillway. Training has to be given to the beneficiaries as to develop fisheries in the reservoirs. Particularly for Selameko reservoir technically skilled fishermen has to be established so as to use the fish resource. Finally, to assure sustainable fish production, there should be continuous monitoring and Stocking the reservoirs.

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