Socio-ecological suitability for fish production in small water bodies in South Western Uganda, East Africa

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Outline of presentation

1. Introduction
2. Methods and Materials
3. Results
4. Conclusions
5. Proposed approaches for fish production
6. Implications for Research and Management

Introduction

1. Abundant water resources in the SWU **BUT** very low fish supply region
2. Fish consumption in the Zone = 4 kg/Person/Year; compared National Average = 8kg/year; Recommended consumption
   a) FAO – 17kgs
   b) WHO – 25kgs
3. Region rely on fish supply from Lake Victoria, at unaffordable prices
4. FAO estimates that the increased demand of fish will be 35-40 million tones by 2030.

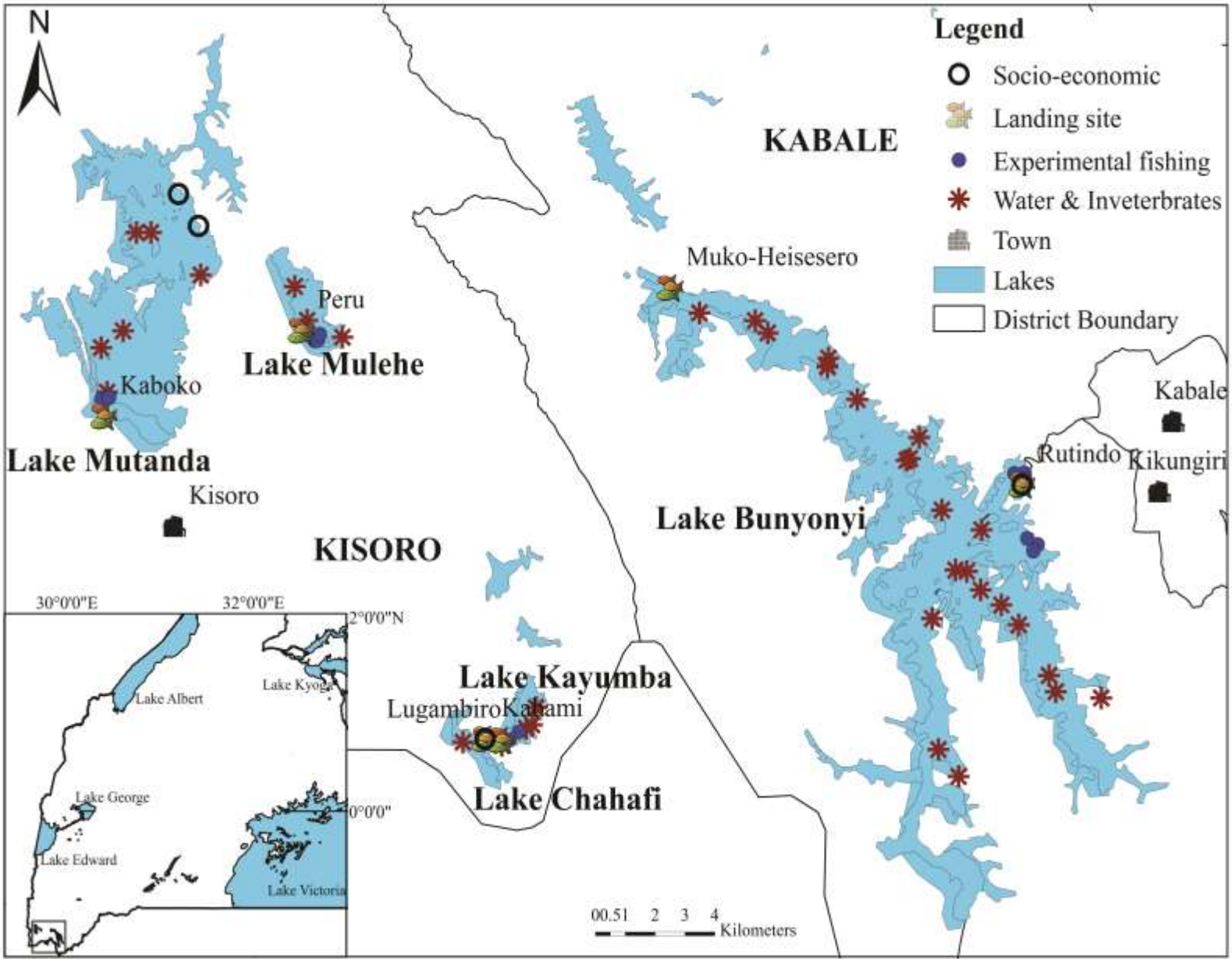
Introduction (contd)

5. In Uganda alone there is an immediate gap in fish supply of 330,000 tonnes
6. This increase cannot be met by only fisheries, but a combination of approaches including aquaculture
7. Despite the abundance of small water bodies in SWU their potential for commercial fisheries remains largely unknown

Objective

This study therefore contributed to that effort by examining the suitability of the SWB in SWU aimed at determining approaches to actualise their potential for fisheries production

Materials and Methods



Map of study lakes in SWU (4 in Kisoro) and (1 in Kabale)

Materials and Methods (contd)

1. The physico-chemical, phytoplankton and Invertebrates requirements for fish growth were determined using described methods (Kiziito et al. 1993, Wetzel & Likens, 2000; Eftire 2007 respectively),
2. Fisheries data was obtained through lake-wide censuses of fishing inputs, commercial Catch Assessments and experimental fishing (gill netting, electro-fishing and basket trapping) following SOPs (LVFO, 2007)
3. Community perceptions and socio-economics were obtained through structured questionnaires and FGD
4. All the sampling aimed at covering the dry and wet seasons (Dry Season July 2014; Wet season April 2015/March 2016)

Methods and Materials Cont'd

Electro-fishing

Gillnetting

Focused Group Discussion

Results – Key Physico-chemical variable

	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda	Optimum
Surface area (Km^2)	61	1.0	2.2	4.1	26.4	
Depth (m)	3.3-41.5	0.5-5.4	0.5-5.3	0.5-6.0	1.2-60	>2 and <20
Temp (ºC)	21.5	21.6	21.5	21.4	22.1	21-32
DO (mg/L)	6.4	6.8	6.1	8.2	8.4	> 3.0
pH	7.1	7.9	7.8	7.7	7.1	6.8-9.5
Cond (µS/cm)	236.6	218.6	142.7	230.7	247.4	100-2,000
SD (m)	1.6	0.6	0.6	0.5	2.0	0.5- 0.6
TP (mgL-1)	0.08	0.09	0.16	0.19	0.10	<1.0
NO_3-N (mgL-1)	0.06	0.06	0.07	0.09	0.06	0-1
NO_2-N (mgL-1)	0.004	0.006	0.009	0.006	0.006	<4
Salinity (ppt)	6.5	16.2	14.6	10.1	2.6	15-33
TSS (mgL-1)	3.1	5.4	6.9	5.4	2.6	>10

Results – Biological components –Fish

Fish group	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda
Mosquito fish	1	1	1	0	1
Haplochromines (Obuyamba)	3	4	5	4	4
Tilapiines (Ngenge)	1	2	1	2	2
Clarias spp (Cat fishes)	2	2	3	2	2
Barbals spp (Enjuguri)	2	1	1	1	1
Cray fish	1	1	1	0	1
Total number of species	10	11	12	9	11
Number of individuals	924	672	1593	4598	1706
Density (individuals/sq. km)	**15**	**672**	**724**	**1121**	**65**

Some fish species in the study area


Astatoreochromis alluaudi

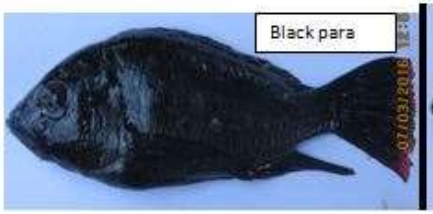

Astatotilapia Pseudomulticolor


Haplochromis lividus


Oreochromis leucostictus


Barbus kerstenii


Oreochromis esculentus


Black para


Unidentified


Astatoreochromis sp


O. niloticus


Clarias carsonii


Astatotilapia Pseudomulticolor


Unidentified


Barbus perince


Procambarus clarkii

Results – Biological components –Fish food

Macro-invertebrates groups	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda
Ephemeroptera (May flies)	0	0	0	0	1
Odonata (Dragon flies)	0	0	0	0	1
Diptera (two winged insects)	4	4	4	4	7
Hirudenia (Leeches)	0	0	0	1	0
Oligachaetes (Earth worms)	0	1	1	0	1
Total Number of species	**4**	**5**	**5**	**5**	**10**
Density (individuals/m^2)	**565**	**133**	**1745**	**2498**	**171**

Results – Biological components –Fish food

Algal groups	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda
Blue Green	14	15	15	23	13
Green algae	9	12	14	16	10
Diatoms	7	3	4	8	8
Dinoflagellates	1	0	1	1	1
Total Number of species	**31**	**30**	**34**	**48**	**32**
Bio-volume (mm^3L^{-1})	**1356**	**389**	**312**	**2626**	**1460**
Productivity (Bio-volume per Sq. Km)	**22.2**	**388.5**	**141.9**	**640.6**	**55.3**

Fishing effort

Name of Lake	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda	Total
No. of landing sites	20	1	1	6	26	54
No. of fishing crafts (Dug-outs)	119	8	25	27	172	351
No. of fishers (crew)	142	8	25	42	306	523
Total number of gill nets	180	10	82	76	295	643
% gillnets < 4"	50.6	40.0	62.2	98.7	82.7	72.3
% gillnets > 4"	49.4	60.0	37.8	1.3	17.3	27.7
Other fishing gears						
Long-line hooks	480			600	555	1635
Hand-line hooks		2		5	94	101
Traps	1255	110	100	35	545	2045
Spears	7					7
Mosquito nets	6					6

Distribution of fishing Effort (Landing sites)

Common fishing boats on the lakes

Fish catch (t) and Beach Value (000 UGX)

	Bunyonyi	Chahafi	Kayumbu	Mulehe	Mutanda	Av. Price/Kg
Clarias					20.8	6,000
Cray fish	255.3	0.0	1.9			20,000
Haplochromines		0.0	0.1	11.2		2,000
Tilapias		0.4		3.9		6,000
Total fish catch (t)	255.3	0.4	2.0	15.0	20.8	293.5
Total Value of catch (000 UGX)	2,552,914	2,663	37,441	45,675	124,860	2,763,553

Community concerns, perceptions and impacts

1. Open access fishery
2. Ineffective fisheries management
3. Decline in fish catch= low fish supply

4. Largely depend on fish supplies from far areas (Lake Victoria)

Community concerns, perceptions and impacts

5. Predation by otters

6. Infestation by fish parasites

Community concerns, perceptions and impacts

7. Cultivation up to the lake shorelines and sand mining in some cases

8. No gazzetted breeding/nursery grounds

Conclusions

1. Generally all the lakes were suitable for fish production in terms food availability (primary and secondary production) and habitat
2. The study lakes were found to have low levels of fish production and supported subsistence fishing
3. The region was found to have high fish demand with over 95% of fish sourced from the far districts of Kampala, Masaka and Rakai
4. All stakeholders showed total support for the project to realize fish production in the region
5. Community practices e.g. destruction of the lake catchment threaten fish biodiversity and water quality

Proposed approaches for enhancing and sustaining fisheries productivity

1. Cage aquaculture (*O. niloticus, O. esculentus* and *Clarias gariepinus*) for the deep lakes (Bunyonyi and Mutanda)
2. Restocking with herbivorous fishes (*O. niloticus, O. esculentus*) initially beginning with the shallow lakes (Mulehe, Kayumbu and Chahafi)
3. Licensing, gazzetment and protection of fish breeding sites and closed season in all the lakes (especially after restocking initiatives)
4. Improved management (effort regulation and habitat protection/restoration) for all the lakes

Implications for Research and Management

1. Package and submit a fish restocking concept/proposal to the DiFR for implementation **(R)**
2. Undertake site specific suitability and carrying capacity for Cage Aquaculture for lakes Bunyonyi and Mutanda **(R)**
3. Further research to identify and map fish breeding/nursery sites and seasons to guide gazzetment and protection in all the lakes (especially after restocking initiatives) Licensing **(R)**
4. Strengthen fisheries monitoring, control and surveillance for all the lakes (M)
5. Build capacity of the community in cage aquaculture skills to facilitate up scaling and sustainability of the project .

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