THE ROLE Of EXOTIC FISH SPECIES: Carp and Catfish in Lake Ziway ecosystem

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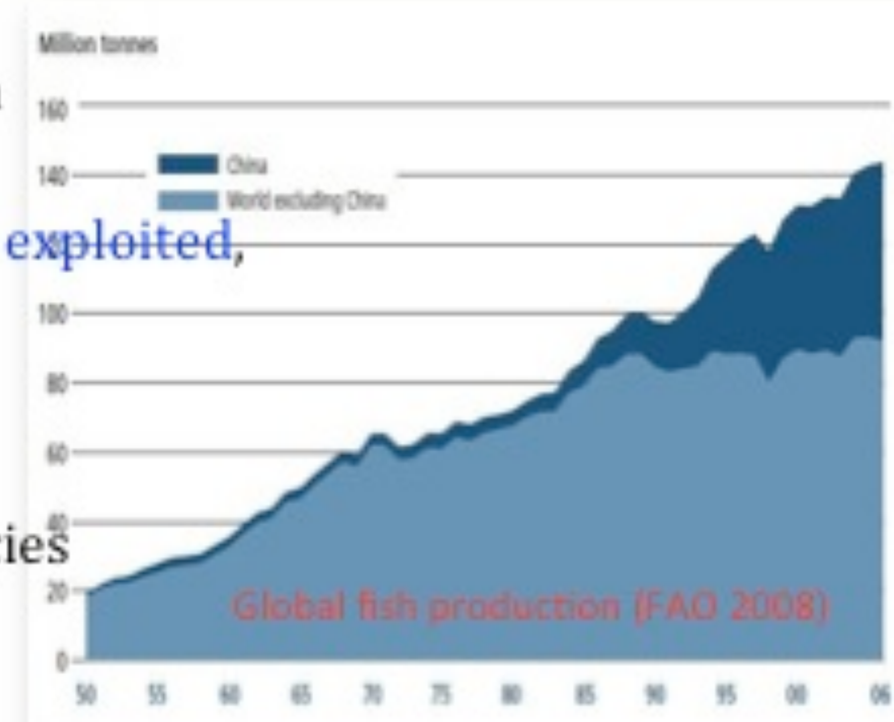
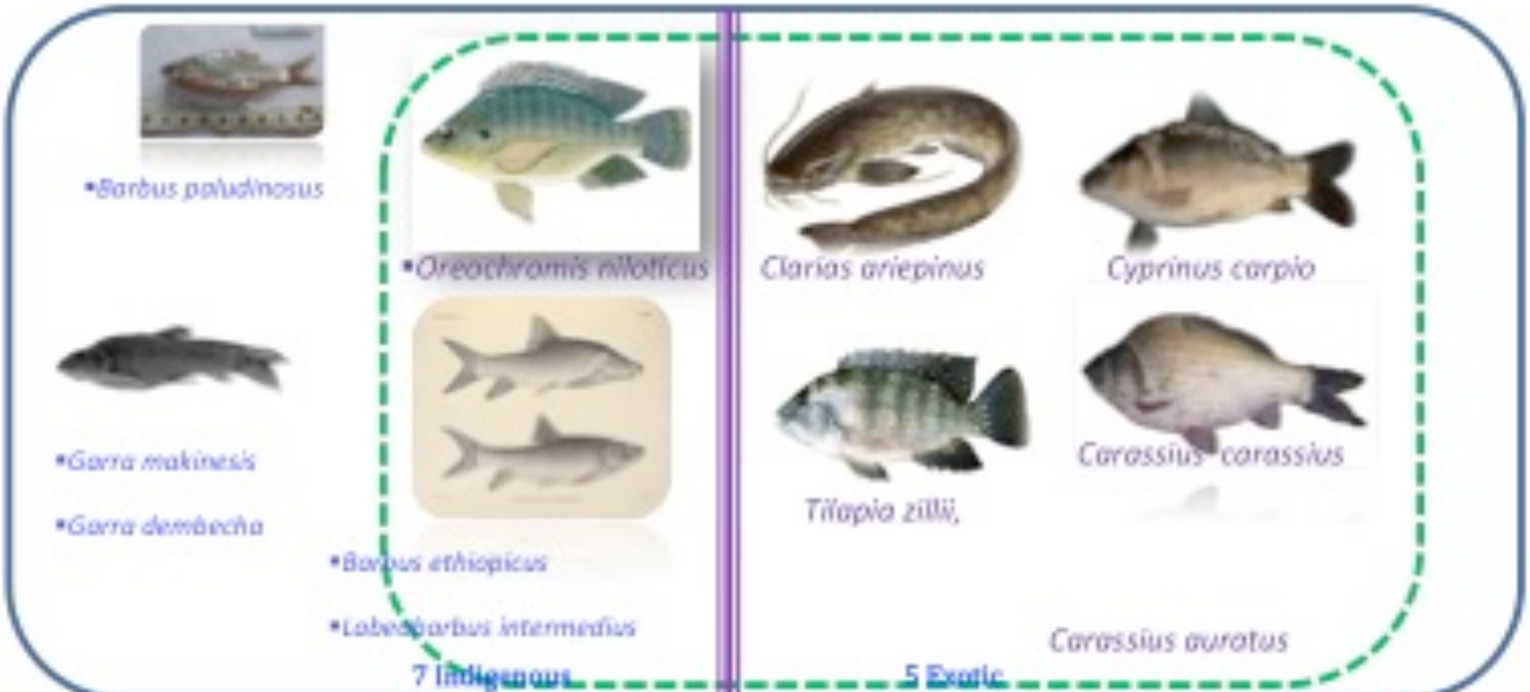
Introduction

- Increasing demand for fish
- 81% fish stocks were fully exploited, overfished or depleted
- Introduction of exotic species
  - To enhance fisheries
- Exotics have the capacity to develop invasive populations



Introduction



Fish species in lake Ziway

Introduction

Cyprinus carpio and *Carassius carassius*

- Introduced to Ethiopia in 1936 .
- Withstand various environments
- High fecundity

Introduction

Clarias gariepinus

- Indigenous to ETH.
- Found in major Lakes Rivers and reservoirs
- Exotic to Lake Ziway
- Accidentally introduced in late 1980's

Introduction

Lake Ziway

- Altitude **1636** m,
- Surface area **434** km^2
- Mean depth **2.5** m.
  - IRRIGATION
  - POTABLE WATER
  - Fish >2000 tons year^{-1}

Materials & Methods

- The ECOPATH approach ==>> NO FISH is an **ISLAND**
- **EwE** : Mass balance model *EwE version 6*

P =Fishery catch +predation +net migration +BA + non predation M

$$\mathbf{B_i\left(\frac{P}{B}\right)_i EE = \sum_{j=1}^{n} B_j\left(\frac{Q}{B}\right)_j DC_{ij} + B_i\left(\frac{P}{B}\right)_i (1 - EE_i) + EX_i}$$

Bi=Biomass P/B=production biomass EE= eco-trophic efficiency

Q/B=consumption biomass DC=Diet content EX= net export

Materials & Methods

Group	Reference
Phytoplankton	Tsegaye (1988); Elizabeth & Willen (1998); Tilahun (1988, 2006)
Zooplankton	Adamneh Dagne *et al.* (2008); Fernando *et al.* (1990); Green and Seyoum Mengistou (1991); Semeneh Belay (1988)
Fishery	Golubtsov *et al.*, 2002, Stiassny and Abebe Getahun, 2007; Eshete Dejen *et al.*, 2010; Eyualem Abebe and Getachew Tefera, 1992; Zenebe Tadesse, 1988; Demeke Admassu and Ahlgren, 2000; Daba Tugie and Mesert Taye, 2004; Alemayehu Negassa and Abebe Getahun, 2003; Zenebe Tadesse, 1988; Alemayehu Negassa and Parabu, 2008; LFDP, 1996, 1998; Felegeselam Yohannes, 2003; Gashaw Tesfaye, 2006
	Calibration for 2011 by collection of new data sets

Materials & Methods

$$\log(P) = 0.06 + 0.79\log(B) - 0.16\log(M_{max}) + 0.05\,T$$

$$\log\left(\frac{Q}{B}\right) = 5.847 + 0.280\log\left(\frac{P}{B}\right) - 0.152\log W_{\infty} - 1.360T' + 0.062A + 0.510h + 0.390d$$

$$\log D = 0.954\log PP + 0.863\log E - 2.41$$

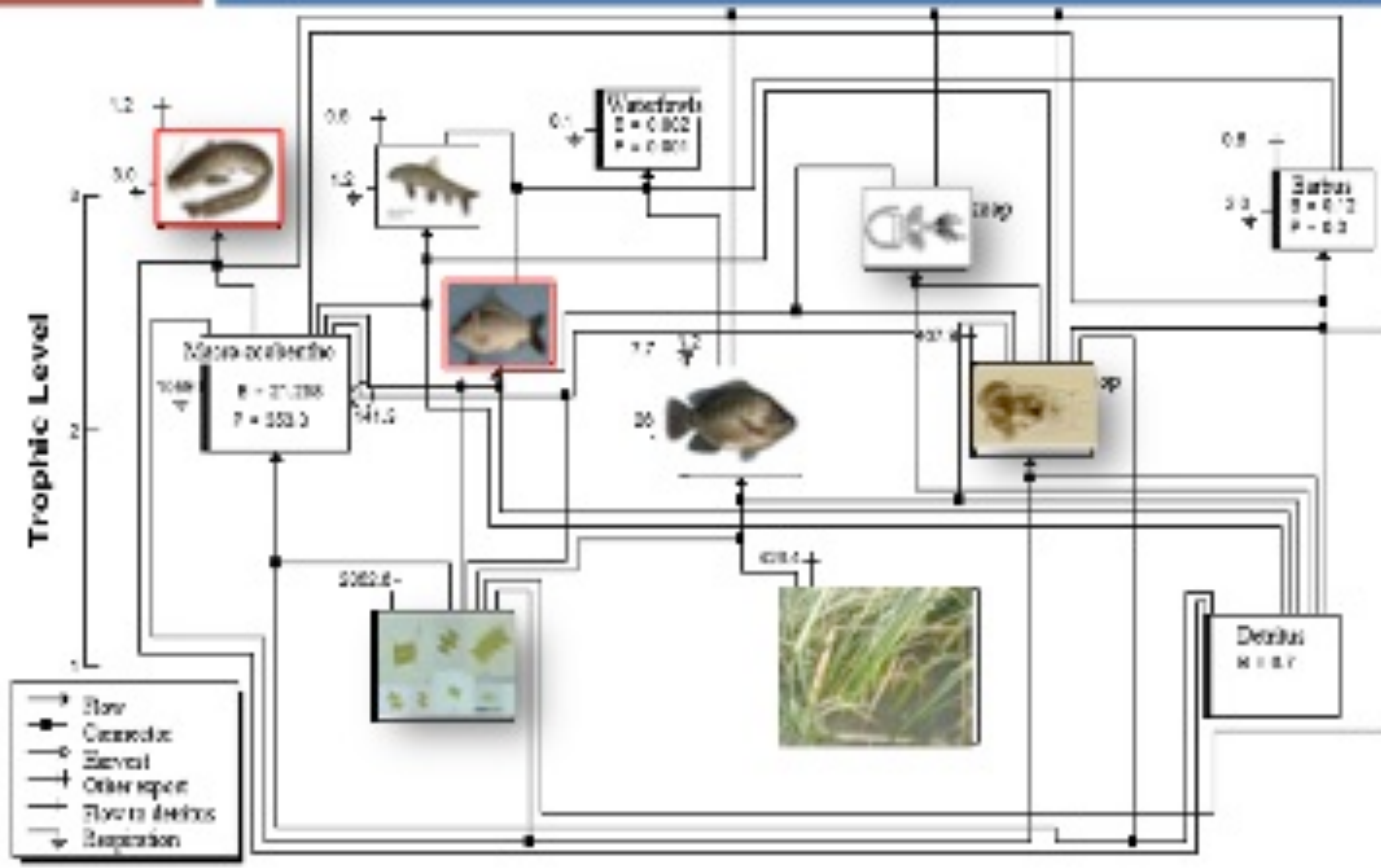
Materials & Methods

No	Functional group	Group members	Biomass (t/km^2)	P/B $year^{-1}$	Q/B $year^{-1}$
1	Waterfowls	Cormorant, African fish eagle	0.0030	0.250	58.000
2	Cat fish	*Clarias gariepinus*	1.090	1.340	5.970
3	Carp	*Cyprinus carpio ,Carassius carrasius*	0.270	0.740	22.550
4	Tilapia	*Oreochromis niloticus* and *Tilapia zilli*	1.280	1.93	28.40
5	Barbus	*Barbus paludinosus*	0.120	2.490	24.410
6	Garra	*Garra dembecha and Garra makiensis*	0.0800	2.540	21.990
7	Macro-zoobenthos	Insects, Oligochaets, Nematods	23.620	16.62	83.100
8	Carnivores zoopl.	*Mesocyclops aequatorialis*	0.0170	38.35	191.75
9	Herbivores zoopl.	Thermocyclops, Cladocerans, Rotifers	0.970	272.8	1364.0
10	Phytoplankton	Cyanophyta, Chlorophyta, Bacilariophyta	15.990	241.9	
11	Macrophyte	*Typha, Arunda, Potamogeton, Cyprus*	3011.68		
12	Detritus		6.720		

Materials & Methods

No	Prey	Predator								
		1	2	3	4	5	6	7	8	9
1	Waterfowls [a]									
2	Cat fish [b]									
3	Carp	0.007								
4	Tilapia [c]	0.712	0.15							
5	Barbus	0.211	0.05							
6	Garra	0.070								
7	Macro-zoobenthos[d]		0.20	0.10		0.58	0.85	0.08	0.10	0.08
8	Carnivores zooplan [e]		0.05	0.01						
9	Herbivores zooplan[e]		0.45	0.30	0.02	0.25	0.05	0.06	0.68	
10	Phytoplankton			0.44	0.76	0.15		0.31	0.12	0.85
11	Macrophyte				0.20					
12	Detritus		0.10	0.15	0.02	0.02	0.10	0.55	0.10	0.07

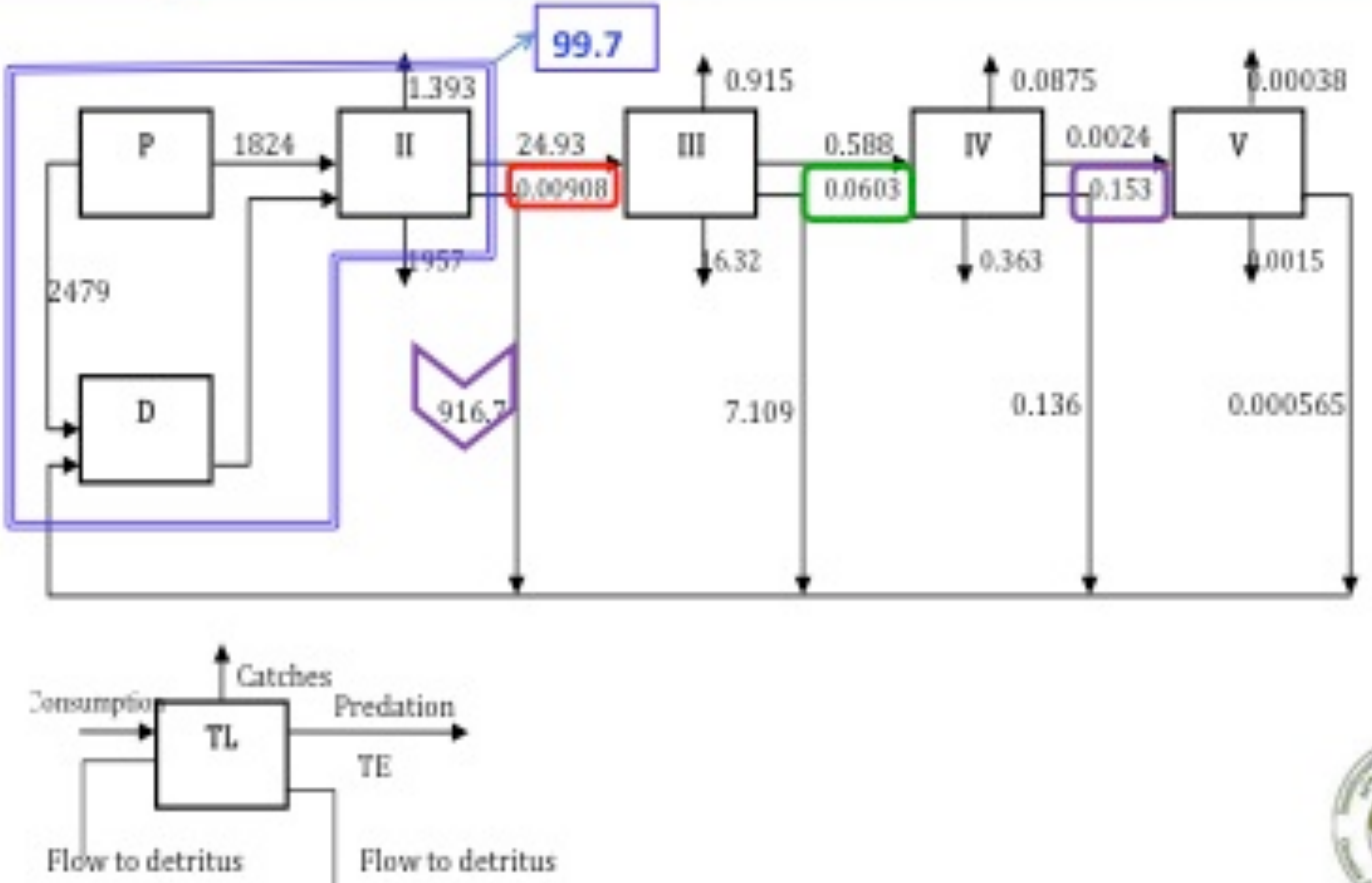
Result & Discussion



Result & Discussion

Functional groups	TL	EE
Waterfowls	3.29	0.00
Catfish	3.07	0.84
Carp	2.46	0.99
Tilapia	2.02	0.84
Macro-zoobenthos	2.16	0.75
Carnivores zooplank.	2.86	0.51
Herbivores zooplank.	2.09	0.39
Phytoplankton	1.00	0.47
Detritus	1.00	0.32

Result & Discussion

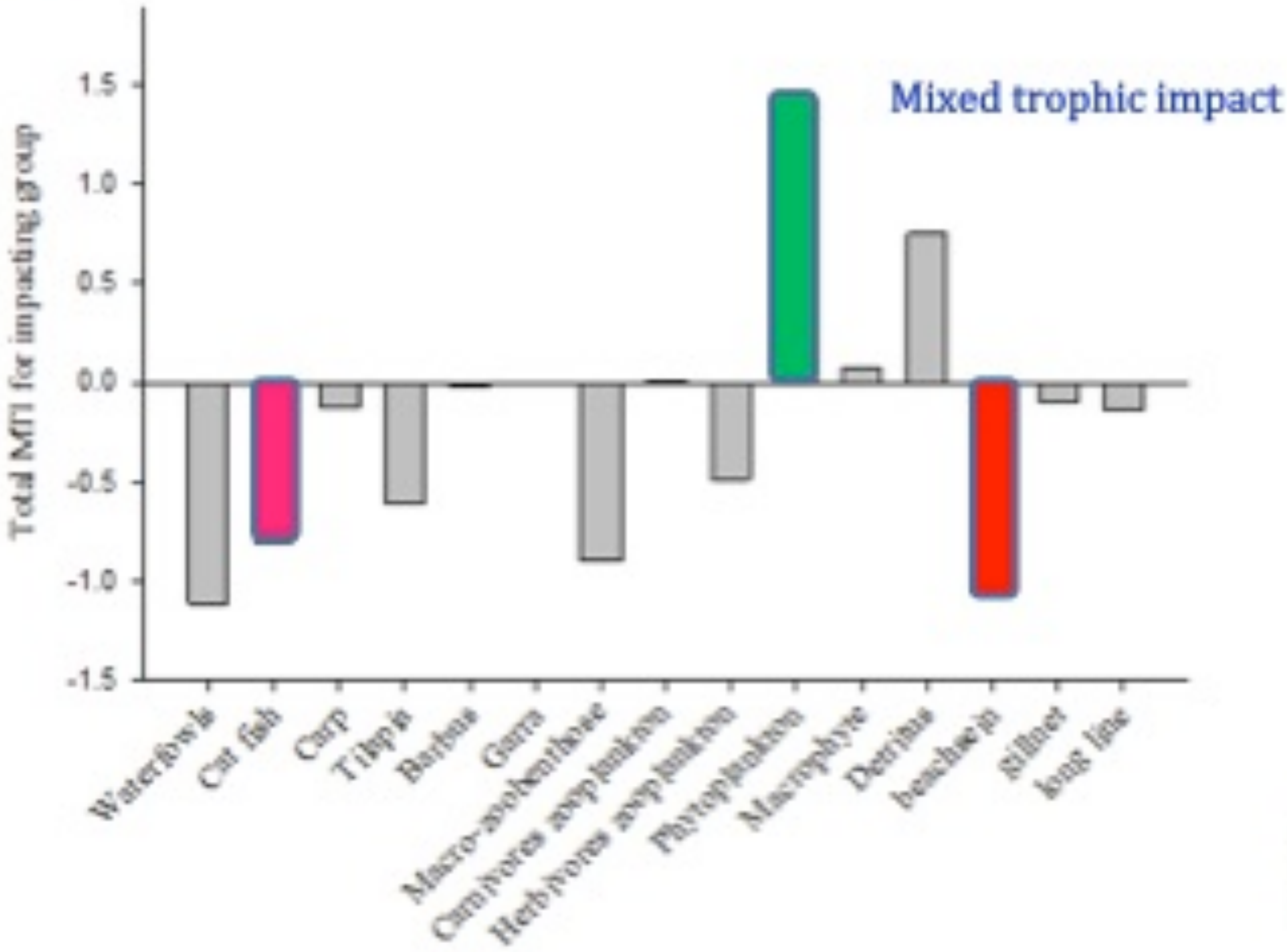


Result & Discussion

	Mean TE %
Lake Ziway	4
Lake Nakuru	8
Lake Tahiu	6.9
Lake Awassa	14

- Might be attributed to the low efficient utilization of the first three trophic levels,
- Due to low diversity of fish group.
- Might have resulted from the absence of feed specialization

Result & Discussion



Result & Discussion

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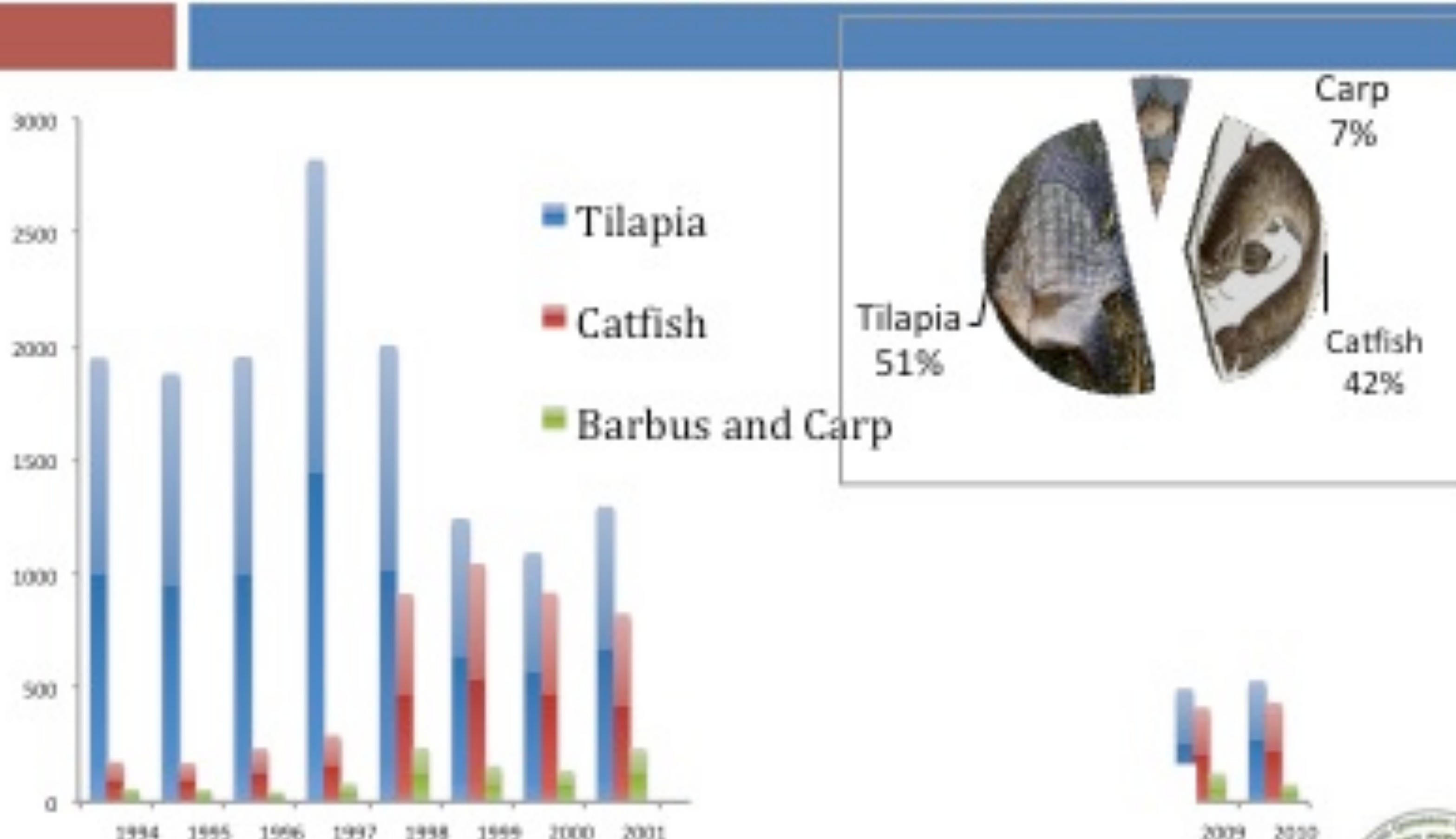

Conclusion

- Introduction has improved energy TE
  - Their feed is dominated on groups acting as a sink
- TE has increased after introduction of exotics
  - Lake Kivu, Lake Victoria, Lake Hayq
- Carps did Not over dominated
- Catfish contribute 42 % of the catch
- Exotics contribute ~ 50% the catch

THANK YOU

FOR YOUR ATTENTION

Basic concepts

- Ecotrophic efficiency= part of the total production consumed by predators or captured in the fishery or exported

$$EE_i = \frac{\sum_j M_{ij} + F_i}{PB_i}$$

PB_i is usually an input (total mortality rate+biomass accumulation rate), while $M_{ij}=Q_{ij}/B_i$ and $F_i=Catch_i/B_i$ are calculated from other inputs PB,QB,DC