



# Biotic Health Assessment of Kpong Reservoir in Ghana using Fish-Based Index of Biotic Integrity (FIBI)

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## INTRODUCTION

- Globally, aquatic ecosystems face increasing destruction with the biological components being the most impacted (Allan & Flecker, 1993).
- As a result, biological assemblages in aquatic ecosystems have been used as key indicators of degradation inherent in such systems (Frissell, 1993).
- Index of Biological Integrity (IBI) is the synthesis of varying information on the biotic components of the aquatic system and their relationship to anthropogenic perturbations.
- The Fish-based Index of Biotic Integrity (FIBI) utilizes fish as the biological indicator of degradation.

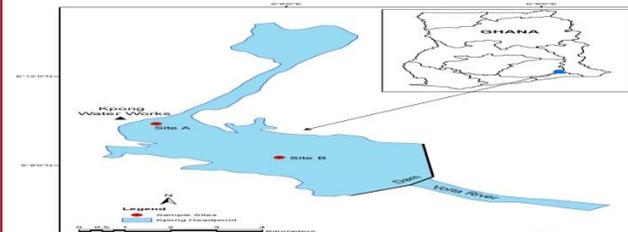


Fig. 1: Kpong Head pond, Ghana showing Sampling Stations

## METHODOLOGY

- Fish sampled through experimental fishing
- Benthos, planktons sampled following Esenowo & Ogwumba (2010); Al-Hassan, (2015)
- Study duration 12 months

- Three (3) descriptors and twelve (12) metrics were adopted from Hugueny, *et al.*, 1996, Karr *et al.*, 1986; Hughes & Oberdorff, 1998, Hocutt *et al.*, (1994) and Hay *et al.*, (1996).
- Metric scoring criteria for the FIBI were based on the highest metric scores observed between the test site (present study areas) and reference site (Antwi & Ofori-Danson (1993))

- Traditional scoring method adopted thus:  
5 = approximates reference site  
3 = deviate somewhat from reference site  
1 = deviate completely from reference site
- Total FIBI score used to classified biotic health using Karr, 1981 classification matrix.

Table 1: Metrics of fish community from original IBI by Karr (1981) vs adapted ones

Category	Metric number	Original metrics (Karr, 1981)	Adapted metrics (Present study)
Species richness and composition	I	Number of species	Number of species
	II	Absent in Karr (1981) metrics	Number of fish families (following Noss (1992) and Witkowski, (1992))
	III	% number of Cichlid species	Retained
	IV	Number of intolerant species	Adapted to % number of Bagrid species (Kpong) Mockokid species (Ovun) respectively
	V	% number of darter species	Adapted to % number of Mormyrid species
	VI	% number of sucker species	Adapted to % number of benthic species
Trophic composition	VII	% number of individuals that are omnivores	% number of individuals that are omnivores
	VIII	% number of individuals that are piscivores	% number of individuals that are piscivores
	IX	% number of individuals that are invertivores	% number of individuals that are invertivores
	X	% number of individuals that are herbivores	% number of individuals that are herbivores
Fish abundance and condition	XI	Number of individuals	Number of individuals
	XII	% of individuals with anomalies	% of individuals with anomalies

## RESULTS

Table 2: Traditional IBI scoring criteria and scores for Kpong reservoir

Category	Metrics	+5 (best)	+3 (fair)	+1 (worst)	Present study result	Score
Species richness and composition	i. Number of species	>21	7-15	<6	17	3
	ii. Number of fish families	>15	8-10	<5	5	3
	iii. % number of Cichlid species	>35%	15-20%	<5%	77.7%	5
	iv. % number of Bagrid species	>35%	15-25%	<10%	5.6%	1
	v. % number of Mormyrid species	>13%	6-12%	<5%	8.7%	1
	vi. % number of benthic species	>51.5%	21-50%	<20%	52.94%	5
Trophic composition	vii. % number of individuals that are omnivores	>25%	10-20%	<5%	15.8	3
	viii. % number of individuals that are piscivores	>30%	10-25%	<5%	12.1	3
	ix. % number of individuals that are invertivores	>17%	6-12%	<3%	6.6%	3
	x. % number of individuals that are herbivores	>25%	10-20%	<5%	65.7%	5
Fish abundance and condition	xi. Number of individuals	>1850	1001-1500	<1000	1415	3
	xii. % of individuals with anomalies	<50	51-99	>100	45	5
Total					42	

Table 3: Karr (1981) Index score classification

Class	Index No.
Excellent	57-60
Excellent to Good (E-G)	53-56
Good (G)	48-52
Good to Fair (G-F)	45-47
Fair (F)	39-44
Fair to Poor	36-38
Poor (P)	28-35
Poor to Very Poor (P-VP)	24-27
Very Poor (VP)	≤ 23

## Discussion

- The descriptor for species richness and composition recorded the highest cumulative FIBI score of 18, trophic interaction recorded 14 while the least was fish abundance and condition with 8
- Kpong reservoir recorded reduced percentages invertivores and piscivores vs reference site indicative of reduced biotic health (Fausch *et al.*, (1990))

## Conclusion

- Kpong reservoir demonstrated distinct change in trophic composition vs reference site
- Changes in trophic composition could be as a result of poor management arising from anthropogenic perturbations (Karr *et al.*, (1986) as seen in the persistent algal blanket at the reservoir
- The reservoir total calculated FIBI score of 42 placed its biotic health as FAIR following Karr, (1981) classification matrix.

## Recommendations

- The breadth of the sensitivity of the IBI to a variety of types of disturbances should be tested by modifying the Index to cover other disturbances like organophosphates and adapting the outcome to general usage if successful.
- Regular nutrient control should be strictly adhered to at the reservoir through denitrification and restoration processes to forestall the advent of full blown eutrophication.

## References

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