

Ecosystem health of the Phongola floodplain, South Africa, based on fish diversity, community structure and health of selected species

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Abstract

Following the construction of the Pongolapoort Dam in 1974, the potential impacts on the lower Phongolo River and floodplain due to alterations in the natural flow regime have caused concerns. Fish communities and population structures are directly influenced by these alterations. The only protected section of the Phongolo River is a 15 km reach and its associated pans that flow through the Ndumo Game Reserve. Historic data shows that the community and population structure of the fish in the Phongolo Floodplain has changed as a result of irregular flood releases. The Ndumo Game Reserve plays an important role in the conservation of many ecologically and economically important species as the pans inside the reserve serve as a refuge area in which these species can breed to replenish the fish numbers in the Phongolo River. The fish diversity inside the Ndumo Game Reserve is also higher when compared to outside. During the high flow period fish move into the floodplain pans as a result of the higher water level. *Oreochromis mossambicus*, the most common species found in this area, utilize Nyamiti Pan for breeding but the health of this species is under pressure due to severe infestations of *Lernaea cyprinacea* and nematode parasites. *Lernaea cyprinacea* is a parasitic copepod associated with the introduced exotic fish species *Cyprinus carpio* which is found in large numbers in various pans inside Ndumo Game Reserve. The presence of this alien species in the refuge area raises concerns as it competes for the same resources as the economically important native fish species. Nyamiti Pan is largely populated by adult cichlid species between the ages of six and ten years old. The importance of flood releases which simulate natural flow regime is emphasised by the negative impacts irregular floods have on fish health, community and population structure.

Keywords: Age determination, *Coptodon rendalli*, *Hydrocynus vittatus*, Floods, Fish community structure, Fish health, Ndumo Game Reserve, *Oreochromis mossambicus*

Opsomming

Na die konstruksie van die Pongolapoort Dam in 1974 het veranderinge in die natuurlike vloeipatroon van die laer Phongolo Rivier en die vloedvlakte kommer gewek. Visgemeenskappe en populasiestrukture word direk beïnvloed deur hierdie veranderinge. Die enigste beskermde deel van die Phongolo Rivier is 'n 15 km gedeelte en sy geassosieerde panne wat deur die Ndumo Natuur Reserwaat vloei. Historiese data wys dat die gemeenskap en populasiestruktuur van vis in die Phongolo vloedvlakte verander het as gevolg van onreëlmatige vloede. Die Ndumo Natuur Reserwaat speel 'n belangrike rol in die bewaring van talle ekologiese en ekonomiese belangrike spesies aangesien hierdie spesies die panne binne die reserwaat dien as 'n heenkome waar visse kan broei om die Phongolo Rivier se visgetalle te herstel. Die visdiversiteit binne Ndumo Natuur Reserwaat is ook hoër in vergelyking met dié buite die reserwaat. Gedurende die hoë vloeiperiodes beweeg vis in die panne van die vloedvlakte in as gevolg van die hoër watervlak. *Oreochromis mossambicus*, die algemeenste spesie in die gebied, benut Nyamiti Pan as 'n broeiarea, maar die gesondheid van hierdie spesie is onder geweldige druk as gevolg van ernstige infeksies van *Lernaea cyprinacea* en nematodeparasiete. *Lernaea cyprinacea* is 'n copepodparasiet wat geassosieer word met die eksotiese visspesie *Cyprinus carpio* waarvan hoegetalle in verskeie panne in die reserwaat gevind is. Die aanwesigheid van hierdie indringer spesie wek kommer aangesien dit vir dieselfde hulpbronne kompeteer as die ekonomies belangrike inheemse visspesies. Nyamiti Pan word hoofsaaklik deur volwasse cichlids bevolk tussen die ouderdomme van ses en tien jaar oud. Die belangrikheid van vloede wat die natuurlike vloeipatrone simuleer is beklemtoon deur die negatiewe invloede wat dit het op die visgesondheid, gemeenskap en populasiestruktuur het.

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Table of Contents

Abstract	i
Opsomming	ii
Acknowledgements.....	iii
List of Abbreviations	viii
List of Figures	x
List of Tables	xiv
Chapter 1: General introduction	1
1.1 Introduction	2
1.2 The Phongolo Floodplain.....	3
1.3 Community structures.....	4
1.4 Population structures.....	4
1.5 Age determination	5
1.6 Previous work.....	6
1.7 Economically important species.....	8
1.7.1 <i>Oreochromis mossambicus</i>	8
1.7.2 <i>Coptodon rendalli</i>	10
1.7.3 <i>Hydrocynus vittatus</i>	10
1.8 Aims of the study	12
1.9 Objectives:.....	12
1.9.1 Objectives for Aim 1:	12
1.9.2 Objectives for Aim 2:	12
1.9.3 Objectives for Aim 3:	12
1.10 Layout of dissertation.....	13
Chapter 2: Study area, site description and general methods and materials	15
2.1 Study area and site selection.....	16
2.1.1 Sites in the Lebombo Uplands ecoregion	19

2.1.2 Sites in the Lowveld ecoregion.....	19
2.2 Site description	20
2.2.1 Site 1 (Phongolo River)	20
2.2.2 Site 2 (Phongolo River)	22
2.2.3 Site 3 (Upper Ngwavuma River).....	24
2.2.4 Site 4 (Middle Ngwavuma River).....	26
2.2.5 Site 5 (Lower Ngwavuma River).....	28
2.2.6 Site 6 (Nyamiti Pan)	30
2.2.7 Site 7 (Phongolo River – Pump station).....	32
2.2.8 Site 8 (Ndumo floodplain pan).....	34
2.2.9 Site 9 (Ndumo floodplain pan).....	36
2.2.10 Site 10 (Outflow of Nyamiti Pan)	37
2.2.11 Site 11 (Usutu River).....	39
2.2.12 Site 12 (Nomaneni pan)	41
2.2.13 Site 13 (Bumbe pan)	43
2.3 Surveys	45
2.4 Materials and methods	45
2.4.1 Fish collection	45
2.4.2 Fish health	47
2.4.3 Water quality	48
2.4.4 Fish Response Assessment Index (FRAI).....	48
Chapter 3: Effects of flood releases on community structure and diversity of fish in the Phongolo Floodplain.....	50
3.1 Introduction.....	51
3.2 Historic data review	53
3.2.1 Flow after the dam was built.....	53
3.3 Results.....	55
3.3.1 Flow results.....	55

3.3.2	Historic data vs. recent data	57
3.3.3	Recent results from additional sites.....	65
3.3.4	Statistical analysis.....	71
3.3.5	Species diversity of the Phongolo Floodplain, 1974–2014.....	73
3.4	Discussion.....	75
3.4.1	Flow regime	75
3.4.2	Historic data vs. recent data	75
3.4.3	Statistical analysis.....	81
3.4.5	Fish biodiversity	82
3.5	Conclusion.....	83
Chapter 4: Community structure and species diversity of fish inside Ndumo Game Reserve compared outside the reserve		84
4.1	Introduction.....	85
4.1.1	The role of Ndumo Game Reserve.....	86
4.1.2	Ecological Category determination using the Fish Response Assessment Index (FRAI)	86
4.2	Materials and methods	88
4.3	Results	89
4.3.1	Species diversity	89
4.3.2	Fish Response Assessment Index (FRAI).....	91
4.4	Discussion.....	92
4.4.1	Site 2 (Outside the Game Reserve).....	92
4.4.2	Site 7 (Inside the Game Reserve)	92
4.4.3	Fish diversity of the Phongolo River	93
4.4.4	Fish Response Assessment Index	93
4.5	Conclusion.....	96
Chapter 5: Population structure and health status of three economically important fish species.		97
5.1	Introduction.....	98

5.1.1 Economically important freshwater fish species	98
5.1.2 Population structure	99
5.1.3 Fish health	101
5.2 Materials and methods	103
5.2.1 Ageing determination	103
5.2.2 Fish Health Assessment Index (FHAI).....	105
5.2.3 Histology-based health assessment	106
5.3 Results	108
5.3.1 Age determination and population structure	108
5.3.2 Fish Health Assessment Index	118
5.3.3 Histology-based health assessment	120
5.3.4 Gonad development.....	125
5.4 Discussion	129
5.4.1 Population structure	129
5.4.2 Fish Health Assessment Index (FHAI).....	131
5.4.3 Histology-based assessment.....	133
5.5 Conclusion.....	134
Chapter 6: Conclusion	136
6.1 Introduction.....	137
6.2 Aim 1: The effect of irregular flood releases on the fish community structure in the Phongolo River and floodplain	137
6.3 Aim 2: Diversity and abundance of fish inside and outside the Ndumo Game Reserve	139
6.4 Aim 3: Determining the health status and population structures of selected fish species within Ndumo Game Reserve	140
6.5 Recommendations with regards to the flow and flooding regime	141
6.5.1 Low flow	141
6.5.2 High flow	142
References	143

List of Abbreviations

APE	Average Percentage Error
CD	Circulatory Disturbances
CF	Condition Factor
CV	Coefficient of Variance
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
EC	Ecological Category
FD	Fast Deep
FHAI	Fish Health Assemblage Index
FI	Fish Index
FRAI	Fish Response Assessment Index
FROC	Frequency of Occurrence
FS	Fast Shallow
GSI	Gonadal-Somatic Index
GI	Gill Index
H&E	Hematoxinilyn and Eosine
HSD	Honest Significant Differences
HSI	Hepato-Somatic Index
I	Inflammation
KI	Kidney Index
KZN	KwaZulu-Natal
LI	Liver Index
NEMBA	National Environmental Management: Biodiversity Act
NWA	National Water Act
OI	Ovary Index
PC	Progressive Changes

PCA	Principle Component Analysis
PRESPA	Pongolo River Ecosystem Services for Poverty Alleviation
RC	Regressive Changes
RDA	Redundancy Analysis
RHP	River Health Programme
SD	Slow Deep
SL	Standard Length
SS	Slow Shallow
SSI	Spleno-Somatic Index
T	Tumours
TDS	Total Dissolved Solids
TI	Testis Index
TL	Total Length
TOPS	Threatened or Protected Species
VBGM	Von Bertalanffy Growth Models
WRC	Water Research Commission
WUA	Water User Association

List of Figures

Chapter 1:

Figure 1.1: Map of the Ingwavuma district where Sereda & Meinhardt (2005) sampled for DDT contaminants. (<i>Adapted from Sereda & Meinhardt 2005</i>).....	7
Figure 1.2: Distribution map of <i>Oreochromis mossambicus</i> in Southern Africa and an example of this species caught in Nyamiti Pan. (<i>Map adapted from Skelton, 2001</i>).....	9
Figure 1.3: Distribution map of <i>Coptodon rendalli</i> in southern Africa and an example of this species caught in Nyamiti Pan. (<i>Map adapted from Skelton, 2001</i>).....	10
Figure 1.4: Distribution map of <i>Hydrocynus vittatus</i> in Southern Africa and an example of this species caught in Nyamiti Pan, Ndumo Game Reserve. (<i>Map adapted from Skelton, 2001</i>)12	

Chapter 2:

Figure 2.1: A map of the study area indicating the selected sites for this study.	16
Figure 2.2: Map of ecoregions within South Africa (Department of Water Affairs and Forestry, 2003). The red rectangle indicates the ecoregions of this study.	17
Figure 2.3: Location of the study sites within the two regions.	18
Figure 2.4: Site 1.....	21
Figure 2.5: Site 2.....	23
Figure 2.6: Site 3.....	25
Figure 2.7: Site 4.....	27
Figure 2.8: Site 5.....	29
Figure 2.9: Site 6.....	31
Figure 2.10: Site 7.....	33
Figure 2.11: Site 8.....	35
Figure 2.12: Site 9.....	36
Figure 2.13: Site 10.....	38
Figure 2.14: Site 11.....	40
Figure 2.15: Site 12.....	42
Figure 2.16: Site 13.....	44
Figure 2.17: Methods of collecting fish for the study.....	46
Figure 2.18: Assessing fish health in the field lab.....	47

Chapter 3:

Figure 3.1: Fish population dynamics during a flooding event.	52
Figure 3.2: The institutional structure of the Water Users' Association.	54
Figure 3.3: Flow data of the Pongolapoort Dam.	56
Figure 3.4: Principle Component Analysis (PCA) bi-plot of species at different sites from five different surveys (2012–2014).	71
Figure 3.5: Redundancy Analysis (RDA) tri-plot of environmental variables, species and sites from five different surveys (2012–2014).	72
Figure 3.6 Community members using traditional fishing methods to catch fish.	77
Figure 3.7: Photos of <i>Cyprinus carpio</i> caught at various pans within the Ndumo Game Reserve.	81

Chapter 5:

Figure 5.1: A) Dorsal view of the vestibular apparatus of a typical teleost where the dorsal part of the head is cut away, B) Anatomy of the vestibular apparatus (<i>Adapted from Secor et al., 1992</i>).	101
Figure 5.2: Otolith preparation and sectioning: A) removal of otoliths, B) baking otoliths, C) difference in colour of a baked otolith (left) compared to non-baked (right), D) embedding the otoliths in resin, E) marking of embedded otolith for the sawing process, F) sectioning the otolith with an otolith saw.	104
Figure 5.3: The deviation in age during the four counts for the different species used.	108
Figure 5.4: Micrograph of a sectioned lapillus otolith from a four-year-old <i>Hydrocynus vittatus</i> specimen.	109
Figure 5.5: Size at relative age data of <i>Hydrocynus vittatus</i> , males and females combined, obtained from sectioned otoliths ($n = 136$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	110
Figure 5.6: Size at relative age data of <i>Hydrocynus vittatus</i> females obtained from sectioned otoliths ($n = 67$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	110
Figure 5.7: Size at relative age data of <i>Hydrocynus vittatus</i> males obtained from sectioned otoliths ($n = 68$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	111
Figure 5.8: Population structure of all the <i>Hydrocynus vittatus</i> caught during 2012 to 2014 ($n = 166$).	111
Figure 5.9: Micrograph of a sectioned sagittal otolith from a 7-year-old <i>Oreochromis mossambicus</i>	112

Figure 5.10: Size at relative age data of <i>Oreochromis mossambicus</i> , males and females combined, obtained from sectioned otoliths ($n = 139$). The solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	113
Figure 5.11: Size at relative age data of <i>Oreochromis mossambicus</i> , females obtained from sectioned otoliths ($n = 61$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	113
Figure 5.12: Size at relative age data of <i>Oreochromis mossambicus</i> males, obtained from sectioned otoliths ($n = 78$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	114
Figure 5.13: Population structure of all the <i>Oreochromis mossambicus</i> caught during 2012 to 2014 ($n = 383$).	114
Figure 5.14: Micrograph of a sectioned sagittal otolith from a 9-year-old <i>Coptodon rendalli</i>	115
Figure 5.15: Size at relative age data of <i>Coptodon rendalli</i> , males and females combined, obtained from sectioned otoliths ($n = 111$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.....	116
Figure 5.16: Size at relative age data of <i>Coptodon rendalli</i> females obtained from sectioned otoliths ($n = 55$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	116
Figure 5.17: Size at relative age data of <i>Coptodon rendalli</i> males obtained from sectioned otoliths ($n = 66$). Solid line indicates the von Bertalanffy growth models fitted to the data. Parameters are provided in Table 5.4.	117
Figure 5.18: Population structure of all the <i>Coptodon rendalli</i> caught during 2012 to 2014.	117
Figure 5.19: Micrographs of the gills, kidney and liver sections ($5 \mu\text{m}$) of <i>Hydrocynus vittatus</i> stained with H&E: A) Normal gill, B) gill monogenean between secondary lamella (arrow), C–D) hyperplasia of the gill epithelium (arrows), E) congestion of the gill epithelium (arrows), F) hyaline droplet degeneration in kidney tissue (arrow), G) increase in Bouwman’s space in kidney tissue (arrow), H) vacuolation of renal tubials in kidney tissue (arrow), J) intercellular deposits in liver tissue (arrow), K) vacuolation of hepatocytes in liver tissue (arrows), L) normal liver.	121
Figure 5.20: Micrographs of the gills and kidney sections ($5 \mu\text{m}$) from <i>Oreochromis mossambicus</i> stained with H&E: A) increase in mucus cells and infiltration of granulocytes (arrows), B) hyperplasia of the gill epithelium (arrows), C) telangiectasia and rupture of pillar cells (arrows), D) normal kidney tissue, E) increase in melano-macrophage centre in the kidney tissue (arrow).	122
Figure 5.21: Micrographs of the liver sections ($5 \mu\text{m}$) from <i>Oreochromis mossambicus</i> stained with H&E: A) increase in melano-macrophage centre in the liver tissue (arrow), B) intercellular deposits in liver tissue (arrows), C) pycnosis of nuclei in liver tissue (arrows), D) infiltration of granulocytes in liver tissue (arrows), E) infiltration of lymphocytes in liver tissue (arrow), F) vacuolation of hepatocytes (arrows).	123

Figure 5.22: Micrographs of the kidney and liver sections (5 µm) *Coptodon rendalli* stained with Hematoxylin and Eosine (H&E): A) nephrocalcinosis in kidney tissue, B) intercellular deposits in liver tissue (arrows), C) vacuolation of hepatocytes in liver tissue. Scale 50 µm. 124

Figure 5.23: Logistic ogives depicting the length at which 50% maturity is reached for *Oreochromis mossambicus* males. 125

Figure 5.24: Bar graph showing the relationship in percentages of immature and mature male *Oreochromis mossambicus* in each length class. 126

Figure 5.25: Micrographs of testis sections (5 µm) stained with H&E: A) Stage 0, B) stage 1, C) stage 2, D) stage 3. 127

Figure 5.26: Micrographs of ovary sections (5 µm) stained with H&E: A) stage 0, B) stage 1, C) stage 2, D) stage 3, E) stage 4. 128

Figure 5.27: A) A photograph of a heart from an *Oreochromis mossambicus* infected with nematodes, B) infection of *Lernaea cyprinacea* on *Oreochromis mossambicus* indicated by the white circles. 132

List of Tables

Chapter 2

Table 2.1: Summary of the ecologically important features of Site 1 and the sampling method applied.	20
Table 2.2: Summary of the ecologically important features of Site 2 and the sampling method applied.	22
Table 2.3: Summary of the ecologically important features of Site 3 and the sampling method applied.	24
Table 2.4: Summary of the ecologically important features of Site 4 and the sampling method applied.	26
Table 2.5: Summary of the ecologically important features of Site 5 and the sampling method applied.	28
Table 2.6: Summary of the ecologically important features of Site 6 and the sampling method applied.	30
Table 2.7: Summary of the ecologically important features of Site 7 and the sampling method applied.	32
Table 2.8: Summary of the ecologically important features of Site 8 and the sampling method applied.	34
Table 2.9: Summary of the ecologically important features of Site 9 and the sampling method applied.	36
Table 2.10: Summary of the ecologically important features of Site 10 and the sampling method applied.	37
Table 2.11: Summary of the ecologically important features of Site 11 and the sampling method applied.	39
Table 2.12: Summary of the ecologically important features of Site 12 and the sampling method applied.	41
Table 2.13: Summary of the ecologically important features of Site 13 and the sampling method applied.	43
Table 2.14: Summary of surveys conducted from 2012 to 2014.	45
Table 2.15: Steps and procedures to calculate the Fish Response Assessment Index (FRAI) (Adapted from Kleynhans, 2007).	49

Chapter 3

Table 3.1: Comparison of the total inflow (natural flow) vs. output (artificial floods) from 1986 to 2013 in and out of the Pongolapoort Dam.	55
Table 3.2: Comparison of historic (1993) vs. recent (2012) community structures of fish at Site 6 during the November surveys (Low flow).	57

Table 3.3: Comparison of historic (1993/4) vs. recent (2013) community structures of fish during the April surveys (High flow).....	58
Table 3.4: Comparison of historic (1993/4) vs. recent (2013/14) community structures of fish during the April surveys (High flow).....	59
Table 3.5: Comparison of historic (1993/4) vs. recent (2013/14) community structures of fish during the April surveys (High flow).....	60
Table 3.6: Comparison of historic (1994) vs. recent (2013/14) community structures of fish during the April surveys (High flow).....	61
Table 3.7: Comparison of historic (1994) vs. recent (2013) community structures of fish during the July surveys (Low flow).	62
Table 3.8: Comparison of historic (1994) vs. recent (2013) community structures of fish during the September surveys (Low flow).	63
Table 3.9: Comparison of historic (1994) vs. recent (2013) community structures of fish during the September surveys (Low flow).	64
Table 3.10: Recent community structures results from different sites in the Phongolo Floodplain collected during five surveys from November 2012 to April 2014.	67
Table 3.11: Comparative species list of the fishes collected from of the Lower Phongolo River and floodplain (Data from Merron <i>et al.</i> 1993a, b, 1994a–e; present study). Names in brackets refer to previous nomenclature.	73

Chapter 4

Table 4.1: The Ecological Category (EC) description of rivers (adapted from Kleynhans, 2007).	88
Table 4.2: Species diversity and number of individuals caught at two sites on the Phongolo River during low flow and high flow.	89
Table 4.3: Fish Response Assessment Index (FRAI) scores for the selected sites in the Phongolo River during low flow and high flow.	91

Chapter 5

Table 5.1: Histological criteria used to classify the severity of histological responses.....	106
Table 5.2: Histological criteria used in gonad staging of male and female <i>Coptodon rendalli</i> , <i>Oreochromis mossambicus</i> and <i>Hydrocynus vittatus</i> (Adapted from Schmitt & Dethloff, 2000).	107
Table 5.3: Average percentage error (APE) and Coefficients of Variation (CV) of recorded age for different species (n = number of samples).....	109
Table 5.4: Parameters for the von Bertalanffy growth curves for each species used (n = number of samples; L_{∞} = L infinity; k = growth rate; t_0 = function of the age of the fish).	118
Table 5.5: Mean body mass (g), standard length (mm), Condition Factor (CF), Hepato-somatic Index (HSI), Gonado-somatic Index (GSI), Spleno-somatic Index (SSI) and Health	

Assessment Index (HAI) values for *Oreochromis mossambicus*, *Coptodon rendalli* and *Hydrocynus vittatus* from Nyamiti Pan during two surveys. Ranges are shown in parentheses 120

Table 5.6: Mean index values for *C. rendalli*, *O. mossambicus* and *H. vittatus*. Gill Index (GI), Liver Index (LI), Kidney Index (KI), Testis Index (TI), Ovary Index (OI) and Fish Index (FI). (Ranges are shown in parenthesis)..... 124