

Table of contents

List of figures.....	iv
List of tables.....	v
List of abbreviations	vi
Acknowledgement	viii
Summary.....	ix
Zusammenfassung.....	xi
1. General introduction, research questions and objectives	1
1.1. Fisheries sector	1
1.2. Objectives.....	2
1.3. Structure of thesis	3
2. Literature review	4
2.1. Climate variability and change.....	4
2.2. Vulnerability.....	5
2.3. Adaptation	8
2.3.1. Types of adaptation	11
2.4. Africa's vulnerability to climate change.....	13
2.5. Fishing communities and their livelihoods	15
2.6. Sustainable livelihoods approach	16
2.6.1. Livelihood assets	17
2.6.2. Livelihood strategies	19
2.6.3. Factors affecting livelihood assets and strategies.....	20
2.6.4. Livelihood outcomes	22
2.6.5. Use of the livelihoods concept in climate change vulnerability and adaptation research.....	22
2.7. Impacts of climate change on fishing communities and livelihoods.....	24
2.7.1. Impact on marine ecosystems	26
2.7.2. Impacts on marine species	27
2.7.3. Impacts on natural capital	27
2.7.4. Impacts on physical capital.....	29
2.7.5. Impacts on social capital	29
2.7.6. Impacts on financial capital	30
2.7.7. Impacts on human capital	30
2.7.8. Impacts on livelihood strategies and outcomes	31
2.8. Vulnerability assessment.....	31
2.9. Adaptation of fishing communities to climate change.....	33

3.1. Methodological approaches for vulnerability assessment	36
3.1.1. Comprehensive vulnerability assessment approach	36
3.1.2. Common principles in climate change vulnerability literature	38
3.1.3. Selection of the study countries	40
3.2. Data collection	41
3.3. Data sources for vulnerability assessment	41
3.3.1. Climatic data	41
3.3.2. Temperature anomaly	41
3.3.3. Fisheries catch	43
3.3.4. Marine protected areas	44
3.3.5. CO₂ emission	44
3.3.6. Other indicators	45
3.4. Standardization of indicators	45
3.4.1. Exposure (E)	46
3.4.2. Sensitivity (S)	49
3.4.3. Adaptive capacity (AC)	50
3.5. Fish abundance, distribution and biodiversity assessment	51
3.5.1. Selection of Africa large marine ecosystem (LME)	52
3.5.2. Fish species occurrence record	53
3.5.3. Environmental data	55
3.5.4. Sea surface temperature (SST)	56
3.5.5. Bathymetry	57
3.5.6. Rarefaction and Jaccard similarity	58
4. Results of vulnerability assessment	60
4.1. Exposure assessment	60
4.2. Sensitivity assessment	62
4.3. Adaptive capacity assessment	63
4.4. Vulnerability	64
4.5. Discussion	66
4.6. Conclusions	71
5. Results of the impact of climate change on regional marine and freshwater fisheries in Africa	72
5.1. Impact of sea level rise	73
5.2. Impact of sea surface temperature (SST)	73
5.3. Impact of air temperature (AT)	74
5.4. Analysis of the impact of rising water temperature on marine and freshwater fish stock	75

Table of contents

5.5. Discussion.....76

5.5.1 Sea level rise76

5.5.2. Sea surface temperature, air and water temperature79

5.5.3. Increasing water salinity83

5.5.4. Fishing pressure84

5.5.5. Water depth.....84

5.6. Conclusions84

6. Results of analysis of the impact of climate change on Africa large marine ecosystem87

6.1. Impact of climate change on species abundance.....87

6.2. Species biodiversity88

6.3. Discussion.....98

6.3.1. Fish biodiversity98

6.3.2. Fish abundance, distribution and migration100

6.4. Conclusions.....102

7. Overall summary and conclusions104

7.1. Major findings.....105

7.2. Implications of the research findings110

7.3. Research gaps and future recommendations112

References114