



NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

**Faculty of Health, Natural
Resources and Applied
Sciences**

School of Agriculture and
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NAMIBIA

QUALIFICATION : BACHELOR of NATURAL RESOURCE MANAGEMENT HONOURS	
QUALIFICATION CODE: 08BNRMH	LEVEL: 8
COURSE: INTEGRATED WATER AND WETLAND MANAGEMENT	COURSE CODE: IWW821S
DATE: JULY 2024	SESSION:
DURATION: 3 HOURS	MARKS: 110

SECOND OPPORTUNITY/ SUPPLEMENTARY: QUESTION PAPER

EXAMINER: *Ms. Shirley Bethune*

MODERATOR: *Mrs. Ndina Nashipili*

INSTRUCTIONS

1. Answer all questions on the separate answer sheet. Note choices.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.
6. Read all questions carefully before answering.

PERMISSIBLE MATERIALS

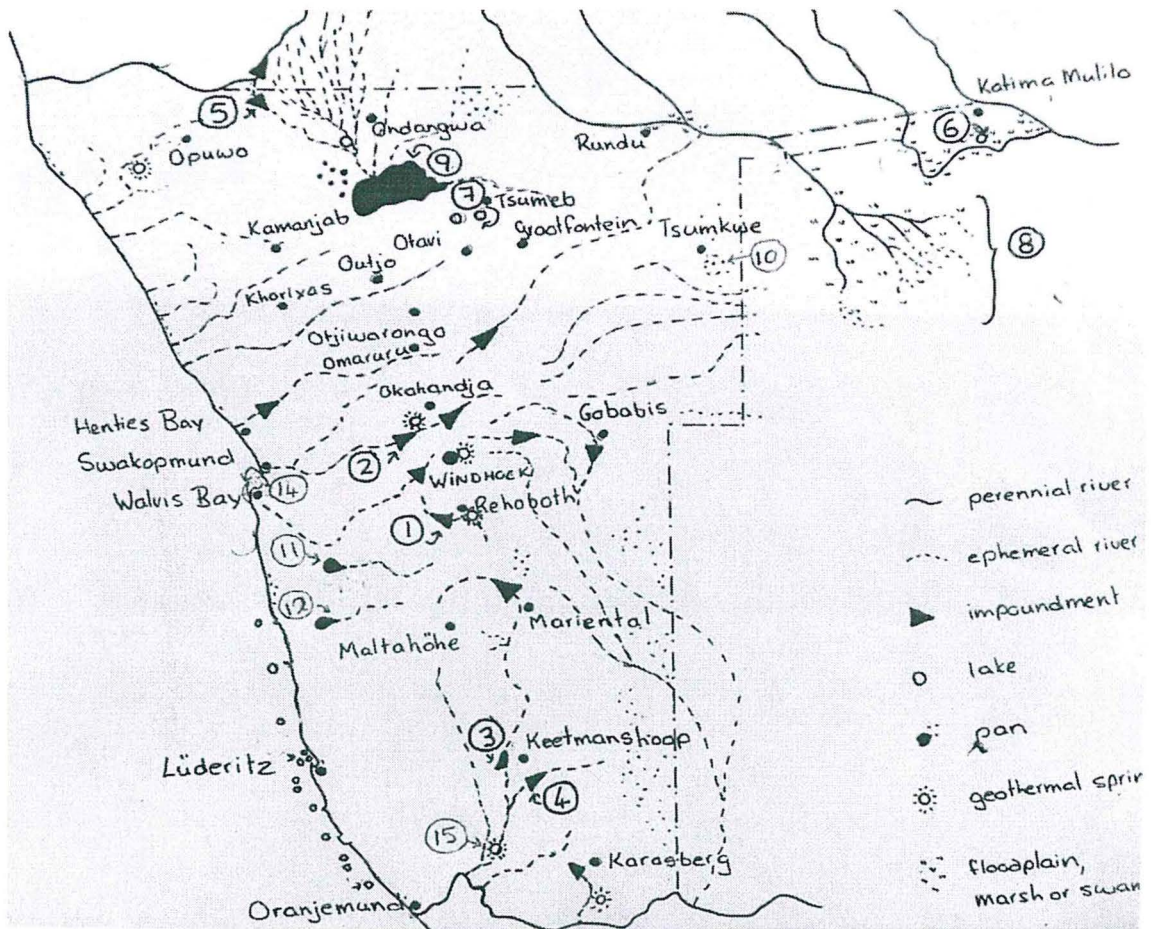
ATTACHMENTS

1. *The Criteria for Identifying Wetlands of International Importance* sheet.
2. *The Mini-SASS Data* sheet.
3. *Namibian Islands Marine Protected Area Pamphlet*

This paper consists of 3 pages including this front page.

QUESTION 1. WETLAND MAP

- 1-5 Name the dams and the rivers they are on,
- 6 + 7 Name the lacustrine wetlands,
- 8 + 9 Name the inland Ramsar Sites,
- 10 -12 Name the ephemeral lacustrine wetlands, and the rivers 11 and 12 are on
- 13-14 Name the coastal Ramsar sites,
- 15 Name the geothermal spring,



[20]

QUESTION 2. INTERNATIONAL WETLAND CONVENTION – RAMSAR

2.1 CHOOSE EITHER A OR B

A The Ramsar representative at MET has asked you to draw up a table to show that the Karst sinkholes and caves, would qualify as a future Ramsar Site, under the Ramsar category “*Karst and other subterranean Hydrological systems*”. Prepare this Table, showing six relevant criteria and how the Karst sinkholes and lakes meet each. Be sure to give both the **common and scientific names of the biota** you use in your motivation. (12)

OR

B When comparing the Walvis Bay bird count results for 2024 that you helped with, to the count of 2023 there was a clear increase in the numbers of Lesser and Greater flamingos, indicating that they had breed successfully in Etosha Pan last year. Use the Ramsar Criteria you are given to draw up a table to show how this Ramsar Site that is so important for the breeding of Namibia's flamingo populations meets five of the Ramsar Criteria. (12)

2.2 Based on your experience at the Walvis Bay Ramsar site in February and at the Kunene River near the Epupa and Ruacana waterfalls, discuss how you can link this year's international World Wetland Day Theme to your experience at these wetlands. (4)

Which learner excursion did you assist with, discuss **two** things that you learned from your experience with the learners, adding why each will be useful to you in future. (4)

[20]

QUESTION 3. RIVER BASIN MANAGEMENT

NATIONAL LEVEL

Write a short essay to explain how the water suppliers at the coast make use of unconventional water sources to meet the growing demand, discuss the challenges related to these **and** give the reasons for the increase in water demand. Conclude by mentioning effective WDM strategies, that the municipalities of the coastal towns are implementing. (10)

INTERNATIONAL LEVEL

a) Name the three riparian countries that share the Okavango River Basin (1)

b) Currently there is world-wide concern that activities upstream in Angola and Namibia can threaten the integrity or health of the Okavango Delta in Botswana. Write a paragraph to discuss **two, current, major** activities, one **each** the Angolan and Namibian sections of the Okavango River Basin that are likely to reduce flow into the Okavango Delta. Conclude with the main impacts that reduced water flows will have on the Delta. (4)

c) Draw a map of the Okavango Delta in Botswana clearly labelling the three main sections and clearly link this to the type of wetland in each section and how it is related to the flow in the river upstream. (6)

[20]

QUESTION 4. WETLAND RESOURCES MONITORING

4.1 The geography teacher at Ruacana High School would like her Grade 12 learners to test the health of the Kunene River below the Ruacana HydroPower Station. She has asked you to suggest a simple method that her class can use to do this. Please reply by recommending a suitable biomonitoring method learners can use and say why it is suitable. Carefully explain how it works, and what equipment you need. Explain how her learners should conduct this practical biomonitoring method. Use the mini-SASS data sheet given to you to explain how they should record information about the site as well as their results and how to calculate and interpret their results. Also recommend a suitable, safe site where they can work and offer to go along to help the first time. (16)

4.2 Explain why the river health condition was better at the site 10km upstream of Epupa than at the site just downstream of the outlet from the Ruacana Hydro Power station. (2)

4.3 The two school teams that visited Ruacana as part of the World Water Day event also noted that the Ruacana falls were dry. Explain why even during the rain season there was no flow over the falls. (2)

[20]

QUESTION 5. CONSERVATION OF WETLANDS

Read the MFMR pamphlet *Namibian Islands Marine Protected Area* and recalling what you know from your lectures and experience at Walvis Bay answer the following questions.

- a) How do these marine islands fit into the Ramsar definition of Wetlands? (2)
- b) During Covid the fishery staff who lived on two of these islands to protect the seabird colonies from predators such as seals and gulls and people illegally collecting bird eggs were taken off the islands. There is now concern that the islands are at risk. Briefly prepare a short motivation in your **own** words based on the values these islands to Namibia, our fisheries and the birds found on these islands. (6)
- c) Four of these islands are important birding areas or IBAs, give the common names of **three** species of seabirds **and** their IUCN status that nest in colonies on these islands, **as well as** the species of marine mammal that is endemic to the Benguela system. (7)

[15]

QUESTION 6. INTEGRATED WATER RESOURCES MANAGEMENT

- 6.1 Based on the river basin that you did your IWRM poster on, discuss water supply to your basin, who manages this, the main uses of the water and two main threats your chosen river basin faces. (8)
- 6.2 In a short essay briefly discuss NamWater's inter-basin transfer of water from the Karstveld to the Swakop River Basin to augment the water supply to central Namibia. (7)
You may add a sketch of the layout of the ENWC.

[15]

TOTAL 110



The Criteria for Identifying Wetlands of International Importance

Group A. Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

Criterion 5: A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.


Specific criteria based on other taxa

Criterion 9: A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

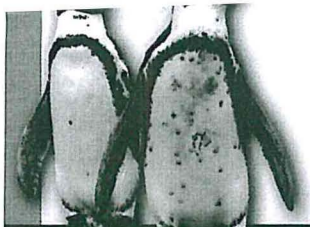


Mini-SASS Data sheet

SITE INFORMATION TABLE	
River name:	Date (dd/mm/yr):
Site name:	Collector's name:
GPS co-ord Lat(S): Long(E):	School/organisation:
Site description: <i>e.g. downstream of industry</i>	Notes: <i>e.g. weather, impacts, flow, etc.</i>
pH: Water temp: °C Dissolved oxygen: mg/l Water clarity: <i>info at www.minisass.org</i>	

Ecological category (Condition)	River Category	
	Sandy Type	Rocky Type
 NATURAL CONDITION (Unchanged/untouched – Blue)	> 6.9	> 7.2
 GOOD CONDITION (Few modifications – Green)	5.9 to 6.8	6.2 to 7.2
 FAIR CONDITION (Some modifications – Orange)	5.4 to 5.8	5.7 to 6.1
 POOR CONDITION (Lots of modifications – Red)	4.8 to 5.3	5.3 to 5.6
 VERY POOR CONDITION (Critically modified – Purple)	< 4.8	< 5.3

GROUPS	SENSITIVITY SCORE
Flat worms	3
Worms	2
Leeches	2
Crabs or shrimps	6
Stoneflies	17
Minnow mayflies	5
Other mayflies	11
Damselflies	4
Dragonflies	6
Bugs or beetles	5
Caddisflies (cased & uncased)	9
True flies	2
Snails	4
TOTAL SCORE	
NUMBER OF GROUPS	
AVERAGE SCORE (miniSASS Score)	



Namibia's
commitment to
the health of our
planet and our
future

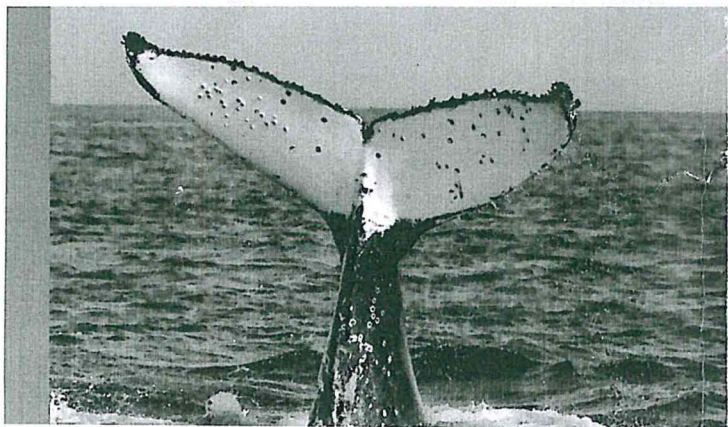


From parks to people, a strong conservation ethic runs deep in Namibia. Now, with the proclamation of the Namibian Islands' Marine Protected Area (MPA), it also runs deep into the Atlantic Ocean.

Spanning 400km in length from Meob Bay in the north to Chamais Bay in the south and 30km from the coastline into the sea, the Namibian Islands' MPA has been established to help maintain essential ecological and life support systems; to ensure the sustainable utilization of species and ecosystems; and to preserve biotic diversity.

But there is more. Marine ecosystems and resources are fundamental to the sustainable development of coastal countries such as Namibia, providing food, minerals, pharmaceuticals, and a vast range of other products. They support tourism and recreation industries and play a vital role in transport and in the culture and lifestyle of coastal people.

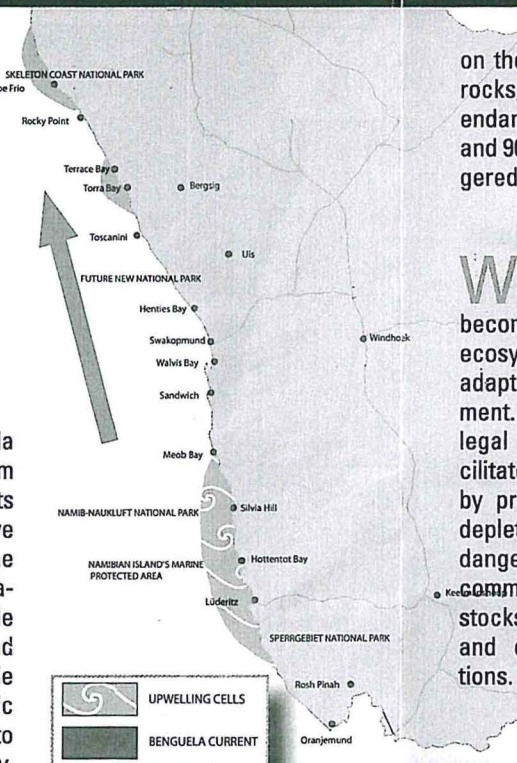
Given Namibia's holistic approach to conservation, the Namibian Islands' MPA is also part of our country's commitment to the protection and regeneration of marine resources that contribute to the socio-economic welfare of our country now and for future generations.



Namibia's first Marine Protected Area covers almost one million hectares of marine and sea area where 10 small islands and 8 more islets or rocks, so small they sometimes appear to disappear under high tides, provide sanctuary to an astonishing variety of life.

The wind-driven Benguela Current upwelling system on Namibia's coast supports one of the most productive marine ecosystems in the world. These nutrient-rich waters nourish fish and provide important retention areas and nursery grounds for juvenile and larval stages of pelagic fish, which are important to Namibia's fishing industry. The rocky areas around the islands provide rich inter-tidal zones and crucial substrate for kelp beds which west-coast rock lobster use for shelter.

Sharing the waters in the Namibian Islands' MPA, the southern right whale and Heaviside's dolphin breed, the humpback whale migrates, while the dusky dolphin, the minke whale, the southern



right whale dolphin and the killer whale or orca are regularly seen.

True to Namibia's geological strength, these islands are considered desert islands, supporting life against extreme environmental odds. Seabirds and seals dominate the islands' land fauna. Of the 14 seabird species breeding in Namibia, 11 species breed

on these islands and inshore rocks, including Namibia's endangered African penguins and 90% of the world's endangered Bank Cormorants.

Worldwide, Marine Protected Areas have become popular tools for ecosystem conservation and adaptive fisheries management. Given their recognized legal status, MPAs can facilitate fisheries management by protecting the habitat of depleted, threatened or endangered species (including commercially important fish stocks) in an effort to restore and enhance their populations.

Buffer zones, sub-divided into four degrees of protection, encompass the Namibian Islands' MPA, providing high protection status for specific islands, rock lobster and line fishing sanctuaries and limiting certain harmful affects caused by marine mining activities.

The marine environment is critical to the natural and cultural heritage of the world. Not only do many marine areas support a great diversity of plants, animals, and natural habitats, but the oceans play an essential role in climatic cycles and other global processes. Protecting our marine areas is essential to the world's environmental health.



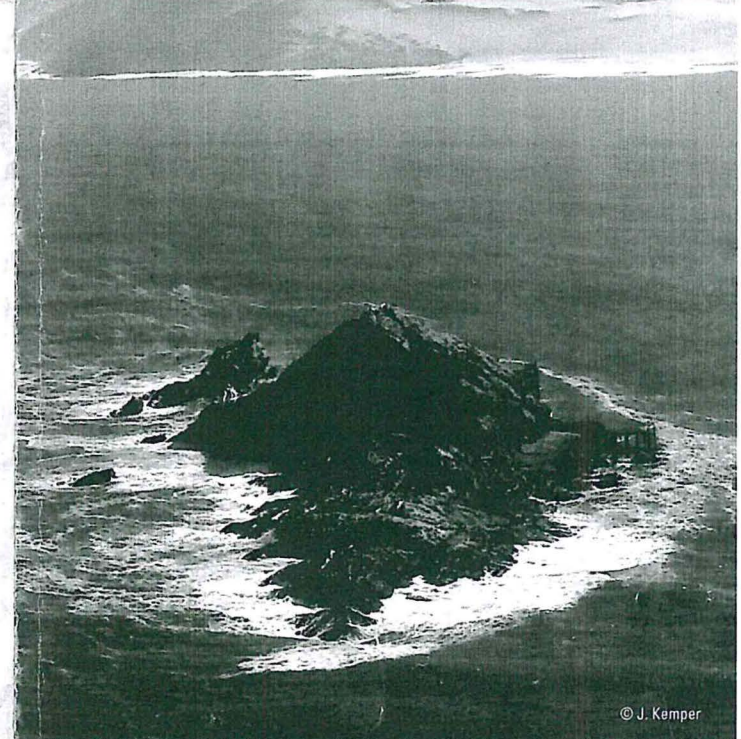
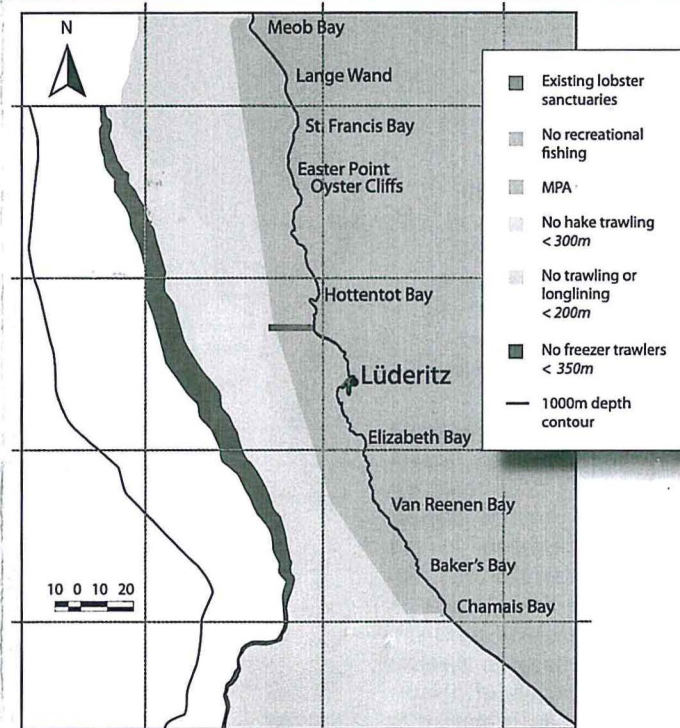
NAMIBIAN ISLANDS'

⇒ Marine Protected Area

Benefits of the Namibian Islands' Marine Protected Area:

- Conservation of biodiversity and ecosystems
- Maintenance of genetic diversity
- Protection of rare or threatened species and habitats
- Contributions to scientific knowledge
- Conservation of scientific reference sites
- Conservation of cultural heritage
- Educational opportunities
- Environmental monitoring

The sea is a valuable national resource and community asset. The Namibian Islands' Marine Protected Area will help to ensure that our marine resources are conserved, protected and used wisely for the benefit of all Namibians and future generations.



FOR MORE INFORMATION:

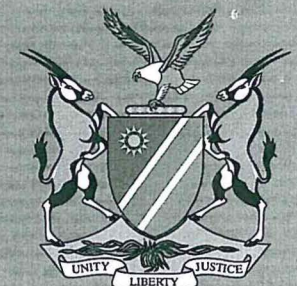
Contact Ministry of Fisheries and Marine Resources
Lüderitz Marine Research
Tel: 063-202-415 <http://www.mfmr.gov.na>

Or visit the Namibian Coast Conservation and Management (NACOMA) project's website: <http://www.nacoma.org.na>

The MPA project was supported by:



NEARLY A
MILLION
HECTARES
OF MARINE
AND SEA
AREA
PROTECTED



Ministry of Fisheries
and Marine Resources