



NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2023

MARINE SCIENCES: PAPER I

MARKING GUIDELINES

Time: 2½ hours

150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

SECTION A**QUESTION 1**

- 1.1 1.1.1 C
 1.1.2 A
 1.1.3 A
 1.1.4 D
 1.1.5 C
 1.1.6 B
 1.1.7 B
 1.1.8 C
 1.1.9 D
 1.1.10 A

- 1.2 Definitions are provided in COLUMN A below. Write the correct term for each of the definitions in the space provided in COLUMN B.

	COLUMN A	COLUMN B
1.2.1	A species that is restricted to a geographical area and does not occur naturally in any other geographic region.	Endemic
1.2.2	Giving false or misleading information about the environmental benefits of a product or service.	Greenwashing
1.2.3	The limit on the number of fish that an authorising body permits fishers to harvest.	Total Allowable Catch
1.2.4	The almost microscopic heterotrophs in soil or sediment ecosystems.	Meiofauna
1.2.5	Organisms that can tolerate a wide range of salinities.	Euryhaline
1.2.6	An aerial root specialised for gaseous exchange.	Pneumatophores
1.2.7	A type of seaweed that grows on the surface of another plant but does not derive nutrients from the host plant.	Epiphytic
1.2.8	Extracted from red algae and used as a stabiliser and gelling agent in meat, dairy, and vegetarian products.	Carrageenan
1.2.9	Mature individual fish used by the aquaculture industry for breeding.	Broodstock

1.2.10	A red-orange pigment found in certain seaweeds that is added to multivitamins as an antioxidant to protect the body from free radicals.	Beta-carotene
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- 1.3 Study the following table that consists of a term in COLUMN I and TWO items (numbered 1 and 2) in COLUMN II. Decide which item(s) relate to the term. Write down your choice in the space provided in the Answer column, making use of the following codes:

- A** only item 1 relates to the term
B only item 2 relates to the term
C both items 1 and 2 relate to the term
D neither item 1 nor 2 relates to the term

	COLUMN I	COLUMN II	Answer
1.3.1	Ekman transport in the Southern Hemisphere.	1. Surface waters move at 90° anticlockwise from the wind direction. 2. The movement due to wind ceases at a depth of about 100 meters.	C
1.3.2	Scavenger on the upper shore.	1. Plough snail (<i>Bullia</i> sp.) 2. Ghost crab (<i>Ocypode</i> sp.)	B
1.3.3	South African kelp that occurs in the inshore zone.	1. <i>Ecklonia maxima</i> 2. <i>Laminaria pallida</i>	A
1.3.4	Move sediment seaward through the surf zone.	1. Rip currents 2. Longshore drift	B
1.3.5	Deposition of material by high-energy waves.	1. Scarp 2. Berm	D

SECTION B**QUESTION 2**

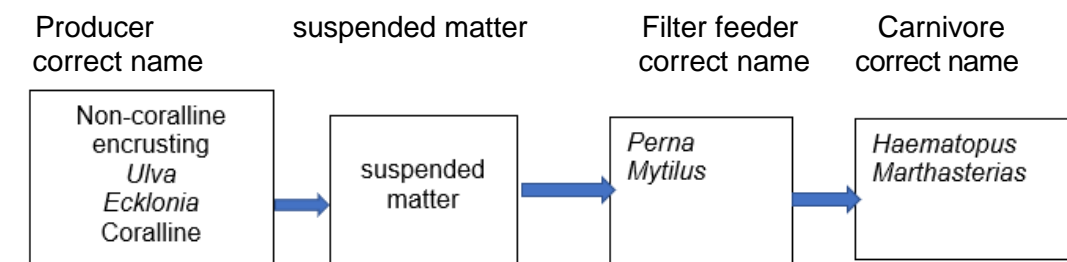
- 2.1 2.1.1 Southwest or west must be correct to score reason marks
Presence of *Ecklonia maxima* or kelp

or
Mytilus or *Perna*
or
Pyura stolonifera

- 2.1.2 2 m

- 2.1.3 Infratidal/subtidal

- 2.1.4



Organisms in logical order
Arrows in the correct direction

- 2.2 2.2.1 Littorina zone Littorinid zone

- 2.2.2 Withdraws into shell to reduce surface area for desiccation
Closes off shell with operculum to prevent desiccation
Hides in crevices to reduce heat stress and desiccation
Inactivity to minimise exposure to thermal stress
Snails climbing and settling on others to form a stack/ tower/ to reduce contact/conduction with hot surface
Form aggregates/clumps to create a microclimate within their aggregation can reduce the exposure of their bodies to direct sunlight and wind, reducing desiccation
Shell is attached to the substratum via a mucus holdfast, so that the body is lifted from the surface reducing contact/conduction with hot surface

- 2.2.3 Upper balanoid / balanoid

- 2.2.4 Interspecific competition between two species over limited space

QUESTION 3

- 3.1 Lack of maintenance of coal power station/ half not functional.
Aging power stations
Deteriorating performance of coal power fleet
- 3.2 The regular cold fronts with their associated low-pressure systems that pass west to east just to the south of the continent or very windy area
- 3.3 There is a continuous supply of energy/not dependent on weather such as solar or wind
- 3.4 Turbine not submerged – reduces stress of wave action or reduces fouling by organisms or reduces maintenance costs or reduces corrosion

Bidirectional turbine – continual power production
- 3.5 There are very few moving parts or There are no moving parts in the water –
It is easy to maintain
The concept is adaptable and can be used on a range of collector forms situated on the coastline, in the nearshore region, or floating offshore – It uses sea space efficiently
- 3.6 Sited in remote areas – additional transport costs for materials
Sited in remote areas – construction of access roads.
Sited in remote areas – proximity to existing transmission lines additional costs
Building a structure in areas of strong wave action difficult/dangerous
Structures require anchorage – limited rocky shores/difficulty anchoring on the sandy shore
Loss of land
Technical staff
- 3.7 Public may not accept presence of structures – visual pollution
Construction and anchoring will cause environmental damage to ecosystems
Use of non-environmentally friendly materials
- 3.8 The workforce of 120 000 in the mining and power plant industry is too large
OWCs, once set up, don't require a large operational staff
and require relatively little maintenance
Mines and power plants tend to be inland away from the coast
This would involve relocating large numbers of people
- 3.9 If the whole coast was used, OWC could generate 8 GW to 10 GW of power = only 13% of total power
The building of OWC would take too long as infrastructure would have to be built to get to remote areas Job preservation – economically viable

QUESTION 4**Answer must be in the form of a paragraph**

Characteristics	Tsunamis	Wind-driven Waves
<i>Formation</i> (max 1 each)	Caused by large and sudden displacements of the ocean water by underwater earthquakes/ seismic events, landslides	Caused by friction between wind and surface water – Wind strength, duration, fetch (distance over water which wind blows over)
<i>Location of energy</i> (max 1 each)	throughout the vertical water column	Surface layers of the vertical water column
<i>Wavelength</i> (max 1 each)	Very long (500–1 000 kilometres)	Relatively short (90–180 metres)
<i>Wave period</i> (max 1 each)	Long (minutes to hours)	Short (seconds to minutes)
<i>Wave speed</i> (max 1 each)	Fast in deep water (hundreds of km/h) Deep water: (800–1 000 km/h) Nearshore: (30–50 km/h)	Slower than tsunamis (tens of km/h) (8–100 km/h)

QUESTION 5

- 5.1 Minimise physical, social, behavioural, and psychological impacts to the tourist destination and the communities who live in the region.
Build environmental awareness, cultural awareness and respect among tour operators, the local communities and the tourists.
Provide positive experiences for both visitors and hosts.
Provide direct financial benefits for conservation.
Generate financial benefits for both local people and private industry.
Deliver memorable interpretative experiences to visitors, thus raising sensitivity to host countries' political, environmental and social climates.
Design, construct and operate low-impact facilities.
Recognise the rights and spiritual beliefs of indigenous people in the community and work in partnership with them to create empowerment.
Implement practices that are sustainable ('... meet the needs of the present without compromising the ability of the future generations to meet their own needs').
- 5.2 number of respondents per activity
- 5.3 Face-to-face interviews were conducted
Used trained fieldworkers
Selected locations known to be key CMT locations
Specific criteria – had to be participating in CMT activities
Proportioning the sampling approach between peak and non-peak periods

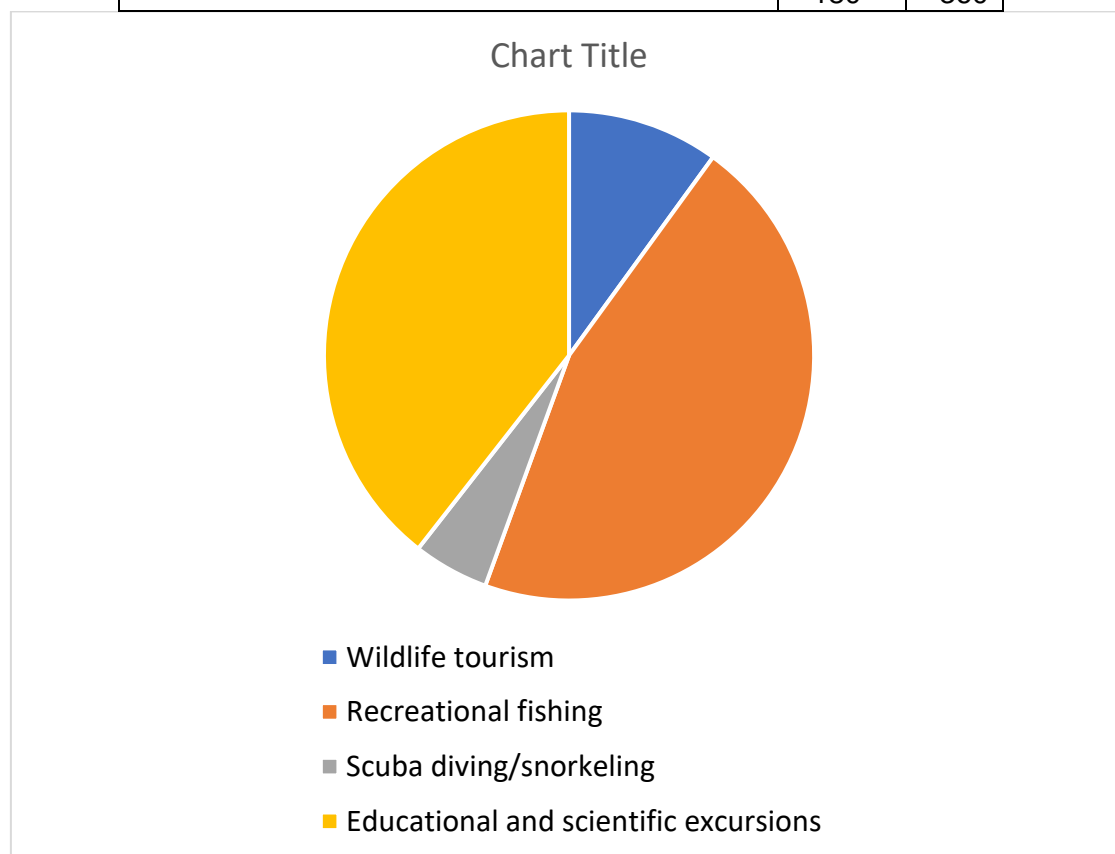
5.4 Individuals under 18 are considered minors, and conducting surveys involving minors may require parental consent or specific ethical considerations. Some of the activities may have age restrictions due to the danger involved, which would affect the survey results.

Part of the survey involved spending pattern, minors would not have financial independence to make decisions or earn an income, which would affect the survey results.

5.5 Sampling venues
Sampling dates
Sampling method
Activity categories

5.6

		Angle
Wildlife tourism	18	36
Recreational fishing	82	164
Scuba diving/snorkelling	9	18
Educational and scientific excursions	71	142
	180	360



Descriptive heading mentioning both variables

- For each correctly drawn segment (correct degrees)
- Per segment labelled correctly

- 5.7 Most tourists choose leisure activities and sightseeing over activities involving marine organisms.
- boat-based whale watching/ shark cage diving is expensive so the cost of these activities is prohibitive
 - OR that they are not marketed enough so tourists don't know about them
 - OR that they come to SA for sunshine and beaches and are not interested in other activities
 - OR some activities are not suited to whole families due to specialist nature of the activity such as scuba diving Or fear of the activity

SECTION C**Answer must be in the form of an essay****25 marks for content****10 marks: allocated as per the rubric****There has to be a link established between a statement/fact and reason when marking the essay.****QUESTION 6**

Overfishing in South Africa remains a critical issue, affecting both the marine ecosystem and coastal communities heavily reliant on fishing.

Problems associated with overfishing include:

- Overfishing is a persistent problem driven by both the commercial fishing industry and subsistence fishing.
- Unsustainable harvesting practices have led to severe depletion of species like the West Coast rock lobster and abalone.
- It poses a significant threat to fish stocks and marine biodiversity.
- Illegal, unreported, and unregulated (IUU) Fishing exacerbates the problem as it operates outside legal boundaries.
- Depletion of fish stocks disrupts the ecosystem's balance, affecting the broader marine environment.
- Coastal communities heavily depend on fishing for their livelihoods, making their economic stability vulnerable to overfishing.
- Bycatch – the accidental capture of non-target species during fishing leads to ecological imbalances, biodiversity loss, waste of valuable resources, economic losses for fishermen, legal challenges, social and cultural impacts, technological difficulties, and inadequate monitoring due to insufficient data.
- While there have been some successes in sustainable resource management, short-term gains often outweigh long-term sustainability efforts, emphasising the need for rigorous regulation and international cooperation.
- Fishing method – damage caused
- Ghost fishing – abandoned nets/equipment

Solutions to combat overfishing include:

- Embracing responsible resource management to ensure sustainable fisheries that provide a continuous source of income for fishing communities without depleting fish stocks.
- To address these issues, South Africa needs to implement and enforce regulations that promote sustainable fishing.
- Government intervention is crucial for monitoring and controlling overfishing activities.
- Leveraging scientific research and modern technology for precise monitoring and control of fishing activities, reducing bycatch, promoting sustainability.
- Implementing effective management techniques such as quotas and seasonal closures in various regions.
- Encouraging collaboration among stakeholders, including government, industry, and local communities, is imperative.

- Utilising education and awareness programs to help communities understand the importance of sustainable practices.
- Promoting responsible consumer choices and conservation efforts through public awareness campaigns and education programs (SASSI).
- Engaging fishing communities in the decision-making process and providing training in sustainable fishing practices.
- Supporting small-scale fishermen in transitioning to sustainable practices and aquaculture to enhance both environmental and economic sustainability.
- Addressing bycatch involves adopting sustainable fishing practices, enhancing fishing gear and technology, implementing effective policies and regulations, raising public awareness, fostering international cooperation, promoting selective fishing methods, reducing discards through improved handling and gear modifications, conducting research to understand and mitigate bycatch impacts, and prioritising ecosystem-based management approaches.

(maximum 6 marks)

Problems associated with aquaculture:

- Intensive aquaculture practices can lead to environmental degradation, including water pollution and habitat destruction.
- Escapes of farmed species can harm native ecosystems and genetic diversity by mating with indigenous species.
- High-density aquaculture environments can facilitate the spread of diseases among farmed fish. The use of antibiotics to control diseases can lead to antibiotic resistance and pose risks to human health.
- Aquaculture requires significant amounts of freshwater or marine resources, which may strain local water supplies.
- Many aquaculture species rely on fishmeal and fish oil derived from wild-caught fish for their feed.
- This dependency can exacerbate overfishing and resource depletion.
- Ensuring responsible and sustainable aquaculture practices requires effective regulations and monitoring.
- Enforcing compliance can be challenging, leading to instances of irresponsible farming.
- Genetic decline if using same brood stock over time
- Inconsistent electricity supply – cost of generator

The potential role of aquaculture as a solution:

- Aquaculture has contributed significantly to South Africa's economy by generating jobs and revenue.
- It supports local industries related to fish farming, processing, and distribution.
- Aquaculture helps meet the growing demand for seafood, enhancing food security in South Africa.
- It provides a consistent and controlled source of fish protein for local consumption.
- Aquaculture reduces pressure on wild fish stocks, allowing them to recover and maintain biodiversity.
- It contributes to the diversification of the seafood sector and reduces overfishing.
- The aquaculture industry provides employment opportunities in rural and coastal areas, improving livelihoods.

- It offers jobs across various stages, from hatcheries and farms to processing plants and distribution.
- Aquaculture allows for controlled conditions, minimising the impact of environmental factors and diseases.
- Farmers can optimise water quality, temperature, and feeding, resulting in healthier and more efficient fish growth.
- The benefits of aquaculture may not always reach local communities, contributing to socioeconomic disparities.
- Large-scale commercial operations may overshadow smaller, traditional fishers.

Introduction

Content

Conclusion

QUESTION 7

Positive Aspects of Marine Ecotourism:

- Economic benefits: Ecotourism generates revenue and creates job opportunities.
- Related industries such as accommodations, dining, and attractions
- Environmental awareness: Responsible ecotourism promotes environmental awareness and conservation.
- Cultural exchange: It fosters cultural exchange and appreciation for marine ecosystems.

Negative Aspects of Marine Ecotourism:

- Habitat disturbance: Unregulated ecotourism can lead to habitat disturbance and harm marine life.
- Unsustainable practices: Overtourism and lack of regulation can stress fragile ecosystems.
- Resource consumption: Ecotourism can lead to overconsumption of resources like water and energy.
- Economic imbalance: Benefits may not always reach local communities or contribute to social inclusion.

Negative Aspects of Global Warming on Marine Ecotourism

Ocean Warming:

- Challenge: Rising sea temperatures can disrupt the balance of marine ecosystems, affecting the distribution and behaviour of species, potentially leading to shifts in the availability of marine life for ecotourism activities.
- Mitigation: Establish marine protected areas to preserve critical habitats and enforce sustainable fishing practices to reduce additional stress on marine species.

Coral Bleaching:

- Challenge: Increased sea temperatures can cause coral bleaching, affecting the vibrant coral reefs that are essential for diving and snorkelling tourism.
- Mitigation: Implement strict regulations to protect coral reefs, promote responsible diving practices, and support coral restoration projects.

Extreme Weather Events:

- Challenge: More frequent and severe storms can disrupt ecotourism operations, endanger tourists, and damage coastal infrastructure.
- Mitigation: Invest in climate-resilient infrastructure, develop comprehensive disaster response plans, and provide tourists with safety guidelines during extreme weather conditions.

Reduced Food Availability:

- Challenge: Changes in ocean conditions can affect the abundance and distribution of marine species, affecting seafood availability for tourists and local communities. (May not duplicate – SEE ABOVE)
- Mitigation: Encourage sustainable fishing practices and diversify food sources for local communities to reduce dependence on seafood.

Algal Blooms:

- Challenge: Warmer waters can lead to increased algal blooms, negatively affecting water quality, and impacting the aesthetics of ecotourism destinations.
- Mitigation: Implement strict regulations on coastal development and agricultural runoff to reduce nutrient pollution that contributes to algal blooms.

Loss of Coastal Habitats:

- Challenge: Coastal development and erosion can destroy critical habitats for marine organisms, affecting the health of local ecosystems.
- Mitigation: Enforce strict coastal development regulations, support habitat restoration initiatives, and engage local communities in conservation efforts.

Impact on Local Communities:

- Challenge: Reduced seafood availability and damaged infrastructure can harm the livelihoods of coastal communities dependent on ecotourism.
- Mitigation: Diversify income sources for local communities, provide training for alternative employment, and engage them in sustainable tourism practices.
- Challenge: Coastal erosion can threaten cultural heritage sites and traditions of indigenous coastal communities.
- Mitigation: Collaborate with local communities to protect and preserve their cultural heritage, raising awareness among tourists about the significance of these sites.

Influence of Climate Change on Marine Ecotourism: Challenges and Opportunities

- Increased risks and costs: Climate-related extreme events can disrupt ecotourism operations and raise costs for businesses.
- Responsibility and mitigation: Marine ecotourism operators must adopt responsible and sustainable practices to address climate change's influence. Mitigation efforts, like reducing carbon emissions and supporting marine conservation, become increasingly vital.

Mitigation measures

- Sustainable innovation: Climate challenges can drive innovation in sustainable tourism practices. Adoption of eco-friendly technologies and approaches may enhance the industry's resilience.
- Adaptive tourism: Tour operators can adapt experiences to showcase the effects of climate change, educating tourists and fostering conservation awareness.
- Community involvement: Engaging local communities in climate resilience efforts and ecotourism can strengthen the industry's sustainability.

Introduction

Content

Conclusion

INTRODUCTION (5)	Excellent (5)		Good (4)		Average (3)		Below Average (2)		Poor (1)
	Exceptionally engaging and captivating. Provides a clear overview of the scientific topic, showcasing its relevance and sparking curiosity. Establishes a strong foundation for the essay's scientific concepts, making the reader excited to delve deeper.		Clear and effective. Introduces the scientific topic and offers insightful context. Encourages the reader to anticipate the scientific content of the essay, maintaining their interest.		Adequate. Introduces the scientific topic and provides context but requires more detail and clarity. Ensures the reader gains a basic understanding of the scientific focus.		Ineffective. Lacks engagement, fails to capture the reader's interest in the scientific topic, and offers limited context. The scientific focus is vague or unclear, making it challenging for the reader to anticipate the scientific content.		Highly ineffective. Fails to establish the scientific topic, lacks context, and doesn't convey the importance of the subject matter. Leaves the reader uninterested and unlikely to continue reading about the scientific topic.
CONTENT (25)	22–25	18–21	14–17	10–13	6–9	3–6	0–2		
CONCLUSION (5)	Excellent (5)		Good (4)		Average (3)		Below Average (2)		Poor (1)
	The conclusion expertly restates the thesis or main points, offering a succinct and powerful summary. It effectively synthesises the key arguments and evidence presented in the essay, creating a cohesive narrative. It provides meaningful reflections, insights, or recommendations that leave a strong and lasting impression on the reader.		The conclusion effectively restates the thesis or main points, providing a concise summary. It demonstrates a clear understanding of the essay's key arguments and evidence. It offers thoughtful insights or suggestions for further exploration related to the topic.		The conclusion adequately restates the thesis or main points. It attempts to summarise the key arguments made in the essay. It may offer a brief reflection or insight into the broader implications of the topic.		The conclusion briefly restates the thesis or main points but lacks depth. It may attempt to tie loose ends but does so ineffectively or superficially. There is minimal synthesis of ideas, and it doesn't leave a lasting impression.		The conclusion lacks a clear restatement of the thesis or main points. It does not offer any insights or closing thoughts related to the topic. It may introduce new information or ideas not previously discussed.

Total: 150 marks