NTNU

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Department of Biology

Examination paper for BI2060 Marine Ecology

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All questions count equally

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Informasjon om trykking av eksamensoppgave
Originalen er:
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1. Biodiversity

1.1 How has the term **biodiversity** been defined and after which occasion did it become an accepted term in ecology?

1.2 Describe in some detail and discuss the concepts of **species richness** and **functional diversity.** Give examples for functional diversity.

1.3 Describe in some detail the terms **ecosystem structure** and **ecosystem function** and discuss their usefulness for marine management.

1.4 Describe and discuss the **rives** and the **redundancy hypotheses** for species richness and ecosystem functioning.

1.5 Is biodiversity a **meaningful term** for microorganisms? Why cannot results for **microbes and macrobes** be compared?

2. Primary production

2.1 Explain the term **photosynthesis** and differences between **autotrophy and heterotrophy**.

2.2 What are the **main primary producer** groups in aquatic systems (**benthic and pelagic**) and where do they grow?

2.3 Define the most important **macro- and micronutrients** and their availability depending on the **nutrient status of the ocean**.

2.4 Describe the different **phases of phytoplankton growth** and explain why cells with a low **biovolume** usually experience higher growth rates.

2.5 Describe differences in **abiotic conditions** in **tropical and polar marine systems** with special emphasis on the **factors restricting primary production** in both regions

3. Light and primary producers

3.1 Define **light climate.**

3.2 How does **light climate affect marine organisms** with respect to photosynthesis and respiration in primary producers and diurnal vertical migration (DVM) in zooplankton?

3.3 Define **albedo**. Give examples (approximate range) of albedo from snow and ocean. Why is albedo important for primary producers?

3.4 What are the three **Inherent Optical Properties** (IOPs) in sea water? Why is the IOPs important for marine ecologist when using (interpreting) remote sensing data of phytoplankton bloom from satellites.

3.5 **Which regions of the oceans are most productive** with respect to annual **primary production**? If possible, provide numbers of these regions in Pg C per year.

4. Secondary production

4.1 Define the term "secondary production", and exemplify it with simple marine food webs.

4.2 What are the common methods for measuring biomass and production? Give examples from the course textbook.

4.3 Explain the concept P/B ratio. Give example from the course textbook.

4.4 Explain, using marine examples, the concepts "Top-Down controlled" and "Bottom-Up" controlled marine ecosystems.

4.5 About climate change and NAO (North Atlantic Oscillation): What are the mechanisms which are suggested to weaken the secondary production of traditionally important fish stocks in the North-East Atlantic?

5. The marine provinces defined by John Ryther

5.1 Describe the **physical** conditions and **biological** characteristics of algal (plant) and fish production in the marine provinces described by John Ryther in his 1966 paper.

5.2 Describe the main characteristics of the different **food chain structures** in Ryther's provinces, and discuss its importance for the harvestable production.

5.3 Explain how the **rate of upwelling** and the **duration of upwelling** determines the yields of fish production in upwelling systems. What are the optimal conditions for fish production?

5.4 What is the main mechanism of coastal upwelling and describe why the concept of Ekman transport can be important for generating upwelling?

5.5 Describe in some detail how equatorial upwelling is generated and discuss briefly the consequences for production.

6. Impacts

6.1 Report briefly on the two large fish stocks in the North Atlantic which collapsed in the last century due to over-exploitation.

6.2 What is the content of the so-called Match-mismatch model of recruitment to fish stocks in the temperate climate zone?

6.3 What is ICZM?

6.4 Define N_e - "Genetically effective population size" in words, and calculate the N_e for a production unit which crosses 2 female salmon with 98 males.

6.5 What are the contents of the concepts "Ecolabelling" and "Marine reserves"?