**Academic Year**  **Semester**  1
**Course Coordinator**  Kyle Morgan
**Course Code**  ES4303
**Course Title**  Marine and Freshwater Ecology
**Pre-requisites**  ES 2303 Introduction to Ecology
**No of AUs**  3
**Contact Hours**  39

**Proposal Date**
AY 2022/23

**Course Aims**

This course aims builds on the basic concepts learned in Introduction to Ecology and will allow students to apply these to Marine and Freshwater ecosystems. In this course students will become familiar with the major processes, systems and impacts associated with marine and freshwater habitats and related taxa of organisms, and how these habitats and organisms interact.

**Intended Learning Outcomes (ILO)**
By the end of this course, you (as a student) would be able to:

. Clearly communicate the key concepts of marine and freshwater processes, systems and impacts orally and in writing

. Describe, compare and contrast key aquatic habitats

. Discuss ecological concepts in the context of aquatic ecosystems

. Address scientific questions related to marine and freshwater ecosystems through critical analysis

. Discuss a current issue in a measured and concise manner

. Lead and facilitate a class tutorial

. Analyse and interpret Environmental and Biological data using PRIMER

**Course Content**

The course is split into three main sections: (i) Processes, where you will be exposed to the key ecological processes that occur in all aquatic systems, such as production, nutrient cycling and decomposition and remineralisation of organic matter; (ii) Systems, where you will learn how these processes differ in aquatic environments, and how this influences biological communities; and (iii) Impacts, or how anthropogenic influences effect these systems and processes

**Assessment (includes both continuous and summative assessment)**

| Component | Course LO Tested | Related Programme LO (App I) | Weighting | Team/ Individual | Assessment Rubrics |
|---|---|---|---|---|---|
| 1. Data report<br>You will use PRIMER software to analyse a set of data, and interpret the output to produce a written consultancy style report | 1,2,3,4,7 | 1, 2, 3 | 40% | Individual | App II |
| 2. Tutorial presentation<br>In a small group, you will teach the class about a current issue in marine or freshwater ecology | 1,4,5,6 | 1, 2, 4, 6 | 40% | Team | App III |
| 3. Continuous assessment<br>5 x Bi-weekly online quizzes in week 4, 6, 8, 10 & 12 | 1,2,3,4,5,6 | 1, 2, 4 | 20% | Individual | N/A |
| Total | | | 100% | | |

**Formative feedback**

You will receive informal feedback continuously throughout the course where appropriate, and formal feedback following every assignment. In addition, I will be available to answer questions regarding your research or assignments throughout this course.

**Learning and Teaching approach**

| Approach | How does this approach support students in achieving the learning outcomes? |
|---|---|
| Active learning | Students will engage in active learning techniques periodically throughout lectures, and during tutorial sessions. |
| Independent learning | This is an upper level course and therefore students are required to show self motivation and initiative in their learning process. |

**Reading and References**

Course textbooks:
- Kaiser, Marine Ecology: Processes Systems and Impacts 2$^{nd}$ edition.
- Dobson and Frid, Ecology of Aquatic Systems
- Solon and Whitely, Stressors in the Marine Environment

Supplemental reading will be given for tutorials and debates

**Course Policies and Student Responsibilities**
 (1) General

Students are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. Students are expected to participate in all seminar discussions and activities.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

**Academic Integrity**

Good academic work depends on honesty and ethical behaviour.  The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community.  Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU.  Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty.  You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating.  If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information.  Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

**Diversity and inclusion policy**

Integrating a diverse set of experiences is important for a comprehensive understanding of science. It is our goal at ASE to create an inclusive and collaborative learning environment that supports different perspectives and learning experiences, and that honours your identities; including ethnicity, gender, socioeconomic status, sexual orientation, religion or ability.

To help accomplish this:
- If you are neuroatypical or neurodiverse, have a learning difficulty such as dyslexia or ADHD, or have a social anxiety disorder or social phobia;
- If you feel like your performance in the class is being impacted by your experiences outside of class;
- If something was said in class (by anyone, including the instructor) that made you feel uncomfortable;

Please speak to your teaching team, a peer or senior, Natasha or Fadhila (either in-person or via email) about how we can help facilitate your learning experience.

As a participant in course discussions, you should also strive to honour the diversity of your classmates. You can do this by: using preferred pronouns and names; being respectful of others opinions and actively making sure all voices are being heard; and refraining from the use of derogatory or demeaning speech or actions.

All members of the class are expected to adhere to the NTU anti-harassment policy. if you witness something that goes against this or have any other concerns, please speak to your instructors or an ASE faculty member

**Course Instructors**

| Instructor | Office Location | Phone | Email |
|---|---|---|---|
| Kyle Morgan | N2 | | kmorgan@ntu.edu.sg |

**Planned Weekly Schedule**

| Week | Lecture/Tutorial | Topic | Course LO |
|---|---|---|---|
| 1 | Class | **Introduction to the course and assignments**<br>**Introduction to Marine and Freshwater Ecology**<br>- Evolution of Marine and Freshwater Ecology and why it is important today<br>- Overview of the key differences between Marine and Freshwater Environments | 1, 2, 3 |
| 2 | Lecture | **Patterns in the Marine and Freshwater Environment**<br>- Biogeography and zonation<br>- Biodiversity<br>- Abundance and size | 1, 2, 3 |
|  | *Tutorial* | *Introduction to Data Lab* | 1, 7 |
| 3 | Class | **PROCESSES: Production**<br>- Primary Production<br>- Secondary Production | |
|  | *Tutorial* | *Computer Lab: PRIMER session I* | 1, 4, 7 |
| 4 | Class | **PROCESSES: Organic Material**<br>- Production and degradation | 1, 2, 3 |
|  | *Tutorial* | *Computer Lab: PRIMER session II* | 1, 4, 7 |
| 5 | Class | **SYSTEMS: Lentic Systems**<br>- Lakes and Reservoirs | 1, 2, 3 |
|  | *Tutorial* | *OTOT – data report or work on your tutorials* | 1, 5, 6 |
| 6 | Class | **SYSTEMS: Lotic Systems**<br>- Rivers and Canals | 1, 2, 3 |
|  | *Tutorial* | *Class tutorial 1* | 1, 5, 6 |
| 7 | Class | **SYSTEMS: Estuaries and Coasts**<br>- Estuaries<br>- Rocky/Sandy shores | 1, 2, 3 |
|  | *Tutorial* | *Class tutorial 2* | 1, 5, 6 |
| 8 | Class | **SYSTEMS: Tropical and Sub-tropical**<br>- Mangrove Forests and Seagrass Beds | 1, 2, 3 |
|  | *Tutorial* | *Class tutorial 3* | 1, 5, 6 |
| 9 | Class | **SYSTEMS: Extremities**<br>- The Deep Sea<br>- Polar regions | 1, 2, 3 |
|  | *Tutorial* | *Class tutorial 4* | 1, 5, 6 |
| 10 | Class | **SYSTEMS: Tropical and Open water**<br>- Coral Reefs<br>- Pelagic Ecosystems | 1, 2, 3 |

| | Tutorial | Class tutorial 5 | 1, 5, 6 |
|---|---|---|---|
| 11 | Class | **IMPACTS: Threats and Management**<br>- Pollution<br>- Disturbance<br>- Climate change | 1, 2, 3, 4 |
| | Tutorial | Class tutorial 6 | 1, 5, 6 |
| 12 | Class | **IMPACTS: Threats and Management**<br>- Fisheries and Aquaculture | 1, 2, 3, 4 |
| | Tutorial | Class tutorial 8 | 1, 5, 6 |
| 13 | Class | **IMPACTS: Threats and Management**<br>- Marine Protected Areas | 1, 2, 3, 4 |
| | Tutorial | Final round up and questions | 1, 5, 6 |

## Appendix I. ASE learning outcomes

At the completion of your course of study in ASE, you will be able to:

1) Demonstrate intellectual flexibility and critical thinking in order to apply environmental knowledge in the real world

2) Communicate environmental concepts with enthusiasm to varied audiences both orally and in writing

3) Formulate scientific questions, and be able to access and analyse quantitative and qualitative information to address them

4) Exhibit the motivation, curiosity and skills for lifelong learning

5) Demonstrate ethical values and responsibility

6) Collaborate and lead by influence

## Appendix II. Assessment Criteria for Data Report

| Grade / Numerical Score | Criteria |
|---|---|
| A+ (Exceptional) A (Excellent) | - A strong working understanding of PRIMER software, and the ability to troubleshoot issues as they arise using any and all tools at your disposal<br>- You have autonomy and ownership of your learning process, and use creative problem solving, critical thinking and prior knowledge to interpret the analysed data<br>- You effectively communicate in writing the processes and reasons behind this analysis, and can aid other students in their learning.<br>- The analysis is all completed correctly.<br>- Interpretation of the results is insightful, focused and correct, taking into account larger scale context.<br>- Report is written and formatted to a professional standard, prioritizing information effectively. |
| A- (Very good) | - A working understanding of PRIMER software, or the ability to troubleshoot issues as they arise using any and all tools at your disposal<br>- You have autonomy and ownership of your learning process, and use creative problem solving, critical thinking and prior knowledge to interpret the analysed data<br>- You communicate in writing the processes and reasons behind this analysis<br>- The analysis is all completed correctly.<br>- Interpretation of the results is correct and takes into account larger scale context.<br>- Report is written and formatted in a logical and understandable way, prioritizing information effectively |
| B+ (Good) B (Average) | - You show a fair ability to troubleshoot issues in PRIMER as they arise, using any and all tools at your disposal<br>- You show some autonomy and ownership of your learning process, and use creative problem solving, critical thinking and prior knowledge to interpret the analysed data<br>- The analysis is mostly completed correctly, and interpretation of the results is mostly correct, sometimes accounting for larger scale context.<br>- Report is mostly written and formatted in a logical and understandable way, with information prioritised somewhat effectively |
| B- (Satisfactory) C+ (Marginally satisfactory) C (Bordering unsatisfactory) | - You show a limited ability to troubleshoot issues in PRIMER as they arise<br>- You show limited autonomy and ownership of your learning process, and use creative problem solving, critical thinking and prior knowledge to interpret the analysed data<br>- The analysis is mostly completed incorrectly, and interpretation of the results is mostly incorrect<br>- Report is not written or formatted in a logical or understandable way, and information is not prioritised effectively |
| C- (Unsatisfactory) D (Deeply unsatisfactory) | - You show no ability to troubleshoot issues in PRIMER<br>- You show no autonomy or ownership of your learning process<br>- The analysis is completed incorrectly, and results are incorrectly interpreted<br>- Report is not written or formatted in a logical or understandable way |
| F (0-44) | Failure to submit report |

# Appendix III. Assessment Criteria for Tutorial Presentation

| Grade / Numerical Score | Criteria |
|---|---|
| A+ (Exceptional)<br>A (Excellent) | - Your group is exceptionally prepared for the tutorial.<br>- The scope of the topic is completely appropriate for the time allotted and education level of the class<br>- Tutorial content is structured in a logical way, which also provides insights that allow the audience to make wider world connections<br>- The content is appropriate for the scope of the tutorial, and is challenging and interesting yet understandable and fully explained.<br>- Content delivery is clear, articulate and concise.<br>- Discussion points are insightful, relevant and thought provoking, and are lead with a clear trajectory and conclusion<br>- The session is consistently managed to optimize discussion time on the most interesting points, including any small groups discussions<br>- The group works together in a collaborative and supportive way throughout the tutorial, in order to deliver the content in the most effective and enjoyable way<br>- Questions from the audience are answered knowledgably<br><br>- Questions asked to other groups are thoughtful, insightful and unexpected, sometimes presenting a new viewpoint to the discussion.<br>- You ask thoughtful questions to the other presenters, showing understanding and engagement with the rest of the class, and have obviously read the given materials as well as several additional materials for context |
| A- (Very good) | - Your group is well prepared for the tutorial.<br>- The scope of the topic is appropriate for the time allotted and education level of the class<br>- Tutorial content is structured in a logical way, which also provides insights that allow the audience to make wider world connections<br>- The content is appropriate for the scope of the tutorial, with some challenging or interesting points<br>- Content delivery is clear, articulate and concise.<br>- Discussion points are relevant and thought provoking, and are concluded effectively<br>- Time is consistently managed to leave ample time for both delivery of content and discussion or activity<br>- The group works together in a collaborative and supportive way throughout the tutorial<br>- Questions from the audience are answered knowledgably<br><br>- Questions asked to other groups are thoughtful and insightful<br><br>- You ask thoughtful questions to the other presenters, and have obviously read the given materials as well as several additional materials for context |
| B+ (Good)<br>B (Average) | - Your group is mostly prepared for the tutorial.<br>- The scope of the topic is reasonably appropriate for the time allotted and education level of the class<br>- Tutorial content is mostly structured in a logical way<br>- The content is mostly appropriate for the scope of the tutorial<br>- Delivery and communication styles are somewhat clear and understandable<br>- Discussion points are mostly relevant to the topic<br>- Time is not consistently managed, meaning not enough time is dedicated to either content delivery or discussion/activity<br>- The group mostly works well together |

| | |
|---|---|
| | - Questions from the audience are answered somewhat knowledgeably<br><br>- Some questions are asked to other groups |
| B- (Satisfactory)<br>C+ (Marginally satisfactory)<br>C (Bordering unsatisfactory) | - Your group is mostly prepared for the tutorial.<br>- The scope of the topic is reasonably appropriate for the time allotted and education level of the class.<br>- Tutorial content is mostly structured in a logical way.<br>- The content is mostly appropriate for the scope of the tutorial.<br>- Delivery and communication styles are somewhat clear and understandable.<br>- Discussion points are mostly relevant to the topic.<br>- Time is not consistently managed, meaning not enough time is dedicated to either content delivery or discussion/activity.<br>- The group mostly works well together.<br>- Questions from the audience are answered somewhat knowledgeably.<br><br>- Some questions are asked to other groups |
| C- (Unsatisfactory)<br>D (Deeply unsatisfactory) | - Your group has not obviously prepared for the tutorial.<br>- The scope of the topic is not appropriate.<br>- Tutorial content is poorly structured.<br>- The content is not appropriate for the scope of the tutorial.<br>- Delivery and communication styles are neither clear nor understandable.<br>- Discussion points are not relevant to the topic.<br>- Time is not consistently managed, meaning not enough time is dedicated to either content delivery or discussion/activity.<br>- Poor teamwork between the group members<br>- Unable to answer questions from the audience.<br><br>- No questions asked to other groups. |
| F (0-44) | Failure to participate |