

**Ecology Masterclass@Taiwan (EMT):
Next-generation mentality and knowledge for conservation
(Ecology and Conservation 2021 Spring)**

Course Code	DIC 8001
Credits	Three
Organizers	Benny K.K. Chan, John Wang, Ryuji Machida
Time	Monday, 14:00-17:00
Place	<ul style="list-style-type: none"> •B204, Biodiversity Research Center, Academia Sinica (B204, BRCAS) •Lab, Biodiversity Research Center •Marine Research Center, Green Island
Description	The aim of this course is to study the ecology of unique habitats in Taiwan and use modern technology, including NGS and Oxford Nanopore sequencing, to test some ecological hypotheses in these habitats. The students will have both theoretical and hands-on training for the entire experimental pipeline: ecological fundamentals, hypothesis testing, field training, molecular biology for genomics analysis, bioinformatics, data analysis and statistical testing, and scientific manuscript writing. A semester course format allows students to assimilate all the information and conduct both the wet and dry experiments on real (not mock) samples, ideally producing a bona fide manuscript.
Grading/Evaluation of students	<ul style="list-style-type: none"> • 30%, class participation including homework and teamwork <ul style="list-style-type: none"> ○ 20%, quality; 10% effort • 20%, data analysis and presentation • 20%, midterm: progress report after Green Island field work • 30%, final: draft of manuscript

Syllabus

Date	Content	Lecturer	Venue
Class 1 <i>2/22</i>	Introduction Course approach, expectations, and weekly schedule Lecture on the basics and overview of ecology and biodiversity studies: Questions asked, techniques used, modern approaches (case studies) Example studies from both marine and terrestrial biology	BKKC, JW, RM	B204, BRCAS
Class 2 <i>3/1</i>	Basic concept in molecular ecology. What is DNA, RNA, DNA sequencing, use of DNA sequencing in biodiversity/phylogeny. NGS sequencing and its applications, metabarcoding, etc.	JW, RM	B204, BRCAS

Class 3 3/8	Lab practical: DNA extraction for Sanger sequencing– practice for DNA extraction and PCR	RM	Lab, BRCAS
Class 4 3/15	Supply-side Ecology and hypothesis setup This lecture introduces the concept of supply-side ecology and biology/ecology of different marine larvae. Introduce the project in this course.	BKCC	B204, BRCAS
Five consecutive days@ Green Island Class 5-9 March 22-26 (tentative, depends partly on the weather forecast)			
Class 5 3/22	Sampling strategies and techniques and data lecture <1 hr lecture> Sampling of plankton by boat, initial prepping of samples; sampling to test supply side ecology (different depths <half day>	BKCC, RM	Green Island
Class 6 3/23	Standard morphology, taxonomy, preservation, curation of samples <1 hr lecture> Sorting specimens by eye and identify major groups of larvae <half day practical>	BKCC, RM	Green Island
Class 7 3/24	Learn and fix samples for molecular (and microscopy) studies <1 hr lecture> Learn DNA, RNA purification (meta, eDNA and single organisms/individuals) <half day practical >	BKCC, RM	Green Island
Class 8 3/25	Barcoding (individual-based), metabarcoding, environmental DNA, metatranscriptomics <1 hr lecture> Second sampling with aim for NGS or Sequencing <1 hr> Do/apply sample classification; lab: Simple PCR of organism barcodes (PCR and basic molecular biology)	BKCC, RM	Green Island
Class 9 3/26	Second and third generation sequencing and application to ecology <1 hr lecture> On-site Oxford Nanopore sequencing with promising samples or unsequenced species <half day practical>	JW, RM	Green Island

Class 10 3/29	Organization and presentation of data obtained from Green Island	JW	B204, BRCAS
Class 11, 12 –Two Consecutive days (based on students' schedules)			
Class 11-12 to be decided	Day 1: Bioinformatic analysis of NGS and Oxford Nanopore data, part 1 <1 hr lecture> Prepare eDNA and RNA samples for NGS sequencing <half day practical> Day 2: Bioinformatic analysis of NGS and Oxford Nanopore data, part 2 <1 hr> Finish preparing eDNA and RNA samples for NGS sequencing <half day practical>	JW, RM	Lab, BRCAS
Class 13 4/19	Learn basics of simple NGS analysis and assembly; introduction to genome annotation and analysis<1 hr lecture> Computer lab to learn basic command line interface; conduct analysis on mock data and real data from class #11 <half day practical>	JW, RM	Lab, BRCAS
Class 14 4/26	Teaching manuscript writing 1 (using 'communities' as a focal point) <1 hr lecture> Annotation of genome or partial genome <half day practical>	BKKC, JW	Lab, BRCAS
Class 15 5/3	eDNA and metatranscriptomics data analysis pipeline <1 hr lecture> Analysis of eDNA and metatranscriptomics <half day practical>	JW, RM	Lab, BRCAS
Class 16 5/10	Teaching manuscript writing 2 (using 'behavioral ecology' as focal point) <1 hr lecture> Guide writing of results and materials and methods. Guide good figure and table presentations. Continue analysis of eDNA and metatranscriptomics	JW, RM	B204, BRCAS

	<half day practical>		
Class 17 5/17	Statistical analysis in ecological and biodiversity research <1 hr lecture> Computer problem sets with both mock and real data. <half day practical>	JW, RM	Lab, BRCAS
Class 18 5/24	Teaching manuscript writing 3 (using 'life history' as focal point) <1 hr lecture> Guide writing of intro and discussion <half day practical>	BKKC	B204, BRCAS