Applied Marine Biology (AMB)
Course Timetable & Syllabus
2023～2024

(Updated on June 1, 2023)

Faculty of Agriculture
Tohoku University

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Fisheries Biology and Ecology	水産資源生態学	27
Aquatic Plant Ecology	水圏植物生態学	28
Marine Biochemistry	水産化学	29
Biological Oceanography	生物海洋学	30
Applied Genetics in Aquatic Organisms	沿岸生物学	31
Aquatic Invertebrate Biology	水圏無脊椎動物学	32
Applied Aquatic Botany	水圏植物学	33
Marine Product Technology	水産利用学	34
Seafood Management	水産食品管理学	35
Planktology	プランクトン学	36
Marine Coastal Ecology (Integrate Aquatic Biology)	沿岸環境学 (水族生理生態遺伝学)	37
Introduction to Fisheries Science	水産科学概論	38
Practical Training	実地研修	39
Marine Biology	海洋生物学	40
Introduction to Resource and Environmental Economics	資源環境経済学概論	41
Applied Biological Chemistry	応用生物化学	43
Current Topics of Shellfish Physiology	先端海洋生物生理学	44
Current Topics of Fish Ecology	先端海洋生物生態学	45
Current Topics of Marine Biotechnology (Current Topics of Fish Biochemistry)	先端海洋生物工学 (先端海洋生物化学)	46

Current Topics of Global Marine Ecology (Current Topics of Genetics in Aquatic Organisms)	先端地球海洋生態学 (先端海洋生物遺伝学)	47
Current Topics of Coastal Ecology	先端沿岸生態学	48
Current Topics of Fish Molecular Biology	先端海洋分子生物学	49
Current Topics of Plankton Biology	先端プランクトン学	50
Multidisciplinary Internship	学際インターンシップ	51

Important Notice: Information contained on this syllabus may be subject to change at the decision of the course instructor.

For any inquiries, please contact the office of the student affairs section of the Faculty of Agriculture (email: agr-kyom@grp.tohoku.ac.jp).

Timetable 2023 授業時間割表 2023

General Education Subjects　Specialized Subjects

		8:50～10:20	10:30～12:00	13:00～14:30	14:40～16:10	16:20～17:50
2nd Semester 後期 Fall Semester	Mon.	(線形代数学 A) (Linear Algebra A)	物理学 A Physics A	(化学 B) (Chemistry B)	Basic Japanese Ⅰ	
	Tues.	社会学 Sociology	生命と自然 Life and Nature	物理学 A(未履修者クラス) Physics A(Beginner)	解析学概論 Foundations of Calculus	Basic Japanese Ⅰ
	Wed.	経済と社会 Economy and Society	化学A Chemistry A	(Laboratory Tour)		
	Thur.	情報とデータの基礎 Information and Data Literacy	Basic Japanese Ⅰ	地球物質科学 Mineralogy, Petrology & Geochemistry	生命科学 A Biology A	
	Fri.	(歴史学) (History)	生理・生態学概論 Introduction to Physiology and Ecology 【Kawauchi C305】	Basic Japanese Ⅰ	学問論 Introduction of Academic Learning	
	Intensive course	海外短期研修 A Study-abroad Program A				
3rd Semester 前期 Spring Semester	Mon.	生命科学 C Biology C				
	Tues.	Basic Japanese Ⅱ	(解析学 B) (Calculus B)	生命科学 B Biology B	線形代数学概論 Foundations of Linear Algebra	
	Wed.	(物理学 C) (Physics C)	Basic Japanese Ⅱ	化学 C Chemistry C		
	Thur.		(物理学 B) (Physics B)	自然科学総合実験 Introductory Science Experiments		Basic Japanese Ⅱ
	Fri.	~~水圏無脊椎動物学~~ (Next year) ~~Aquatic Invertebrate Biology~~ ~~【Seminar Room 1】 *1st Quarter*~~		現代における農と農学 Modern Agriculture and Agricultural Science	陸圏・水圏環境コミュニケーション論 Introduction to Aquatic Production / Introduction to Natural and Agricultural Production	
	Intensive course	臨海実習 Practice on Marine Bio-resources Science				
4th Semester 後期 Fall Semester	Mon.			水産遺伝育種学 Fish Genetics and Breeding science 【Lecture Room 8】 *3rd Quarter*		
	Tues.	数理統計学 Probability & Statistics	Intermediate Japanese	(常微分方程式論) (Ordinary Differential Equations)	日本の産業と科学技術 Science, Technology and Industry in Japan	キャリア教育特別講義 Special Lecture of Career Education
	Wed.	Intermediate Japanese	Intermediate Japanese			
	Thur.	海洋生物学 Marine Biology 【Lecture Room 8】 *4th Quarter*				
	Fri.		水産科学概論 Introduction to Fisheries Science 【Lecture Room 8】	スポーツ A Sports A	体と健康 Health	
5th Semester 前期 Spring Semester	Mon.	水圏植物学　Applied Aquatic Botany 【Lecture Room 8】 *1st Quarter* 資源動物生態学　Animal Ecology and Ethology 【Lecture Room 8】 *2nd Quarter*		学生実験 I・基礎化学実験・基礎生物学実験 Fishery Science Practice I/Basic Chemistry, Practice/Basic Biology, Practice 【Student Laboratory】		
	Tues.	水圏植物生態学　Aquatic Plant Ecology 【Lecture Room 8】 *1st Quarter* ~~水産化学　Marine Biochemistry~~ (Next year) ~~【Seminar Room 1】 *2nd Quarter*~~				
	Wed.		科学論文講読 I Reading of Scientific Paper I 【Each Laboratory】 *1st Quarter*			
		プランクトン学　Planktology 【Lecture Room 8】 *2nd Quarter*				
	Thur.		科学論文講読 II Reading of Scientific Paper II 【Each Laboratory】 *1st Quarter*			
		資源生物生理学　Physiology of Biological Resources 【Lecture Room 9】 *2nd Quarter*				
	Fri.	沿岸環境学　(Marine Coastal Ecology) 【Lecture Room 8】 *1st Quarter*				
		~~水産増殖学　Aquacultural Biology~~ (Next year) ~~【Seminar Room 1】 *2nd Quarter*~~				
	Intensive course	生産フィールド実習 Ⅰ　Field Practice of Marine Production I /　学際インターンシップ　Multidisciplinary Internship				

			8:50～10:20	10:30～12:00	13:00～14:30	14:40～16:10	16:20～17:50
6th Semester	後期 Fall Semester	Mon.	水産資源生態学 Fisheries Biology and Ecology 【Lecture Room 8】 ***3rd Quarter***		学生実験 II・基礎化学実験・基礎生物学実験 Fishery Science Practice II/Basic Chemistry, Practice/Basic Biology, Practice 【Student Laboratory】		
			沿岸生物学 Applied Genetics in Aquatic Organisms 【Lecture Room 9】 ***4th Quarter***				
		Tues.	生物生産情報処理概論 An Introduction to Bioindustrial Information Processing 【Lecture Room 9】 ***3rd Quarter***				
		Wed.	~~水産利用学 Marine Product Technology~~(Next year) ~~【Seminar Room 1】 *3rd Quarter*~~				
		Thur.	先端海洋生物工学 /先端海洋分子生物学 Current topics of Marine Biotechnology/ Current topics of Fish Molecular Biology 【Lecture Room 8】***3rd Quarter***				
		Fri.	生物海洋学 Biological Oceanography 【Lecture Room 9】 ***3rd Quarter***				
		Intensive course	実地研修 Practical Training				
7th Semester	前期 Spring Semester	Mon.					
		Tues.	先端プランクトン学 Current topics of Plankton Biology 【Lecture Room 9】 1st ***Quarter***				
		Wed.	水産食品管理学 Seafood Management 【Lecture Room 8】 ***1st Quarter***				
		Thur.	先端海洋生物生理学 Current topics of Shellfish Physiology 【Lecture Room 9】 ***1st Quarter***		資源環境経済学概論 Introduction to Resource and Environmental Economics 【Lecture Room 9】***1st Quarter***		
					先端沿岸生態学 Current topics of Coastal Ecology 【Lecture Room 9】 ***2nd Quarter***		
		Fri.			応用生物化学 Applied Biological Chemistry 【Lecture Room 9】 ***1st Quarter***		
			先端海洋生物生態学 Current topics of Fish Ecology 【Lecture Room 9】 ***2nd Quarter***		先端地球海洋生態学 (Current Topics in Global Marine Ecology) 【Lecture Room 9】 ***2nd Quarter***		
		Intensive course	生産フィールド実習 II Field Practice of Marine Production II				
8th Semester	後期 Fall	Mon. to Wed.	卒業論文 Graduation Thesis				
		Thur.					
		Fri.					
9th Semester	前期 Spring Semester	Mon.	卒業論文 Graduation Thesis				
		Tues.					
		Wed.					
		Thur.			資源環境経済学概論 Introduction to Resource and Environmental Economics 【Lecture Room 9】***1st Quarter***		卒業論文 Graduation Thesis
		Fri.			応用生物化学 Applied Biological Chemistry 【Lecture Room 9】 ***1st Quarter***		
		Intensive course					

The following subjects are available in 2024. 以下の科目は 2024 年度に開講します。

水産利用学 Marine Product Technology，水産化学 Marine Biochemistry，水圏無脊椎動物学 Aquatic Invertebrate Biology，水産増殖学 Aquacultural Biology，海洋応用生物化学 Marine Applied Biochemistry，先端植物生命科学 Current topics of Agricultural Plant Science,，応用動物・酪農科学概論 Introduction to Applied Animal and Dairy Science，食糧と化学 Food and Chemistry

AMB Course curriculum Taught in English　AMB 英語コースカリキュラム

Subjects	Instructors	year	Categories	Credits		Reference
				Obligatory	Elective	
Introduction to Academic Learning 学問論	Y.Watanabe	1st	Foundations Navigating Academia	2		
Sociology 社会学	J. Liu	1st	Foundations Humanities	2		
Economy and Society 経済と社会	J. Ryan	1st	Foundations Social Sciences	2		
Foundations of Linear Algebra 線形代数学概論	X. Dahan	2nd	Foundations Natural Sciences	2		
Foundations of Calculus 解析学概論	X. Dahan	1st	Foundations Natural Sciences	2		
Life and Nature 生命と自然	S. Katayama	1st	Foundations Transdisciplinary Subjects	2		国費学生必修
Introductory Science Experiments 自然科学総合実験	N. Nakamura et al.	2nd	Foundations Transdisciplinary Subjects	2		
Sports A スポーツA		2nd	Foundations Transdisciplinary Subjects Health Sciences	1		
Health 体と健康	R. Nagatomi	2nd	Foundations Transdisciplinary Subjects Health Sciences	2		
Information and Data Literacy 情報とデータの基礎	DAHAN Xavier	1st	Advanced Subjects Information Science and Technology Education	2		
Understanding International Issues 国際事情	TBA	1st	Advanced Subjects International Education		2	
PBL in Global Issues 国際教養PBL	M. TAKAHASHI	1st	Advanced Subjects International Education		2	
Special Topics on Global Issues 国際教養特定課題	C. SUEMATSU/ Y. WATABE	1st	Advanced Subjects International Education		2	
Understanding Culture 文化理解	T. FUJIMOTO	1st	Advanced Subjects International Education		2	
Exploring Culture and Society 文化と社会の探求	Y. SAKAMOTO/ N. KOJIMA/ M. MUSHIAKE	1st	Advanced Subjects International Education		2	
Multicultural Communication 多文化間コミュニケーション	HUJA BACKLEY	1st	Advanced Subjects International Education		2	
PBL in Multicultural Environment 多文化PBL	M. KOJIMA	1st	Advanced Subjects International Education		2	
Special Topics on Multicultural Society 多文化特定課題	TBA	1st	Advanced Subjects International Education		2	
Global Seminar グローバル学習	TBA	1st	Advanced Subjects International Education		2	
Global Career キャリア関連学習	K. TAKEUCHI/ Y. YONEZAWA	1st	Advanced Subjects International Education		2	
Global Leadership Development through PBL グローバルPBL	K. SUEMATSU/ Y. WATABE/ Y. WATANABE	1st	Advanced Subjects International Education		2	
Special Topics on Global Leadership グローバル特定課題	K. YAMAMOTO/ M. TASHIRO	1st	Advanced Subjects International Education		2	
Study-abroad Semester 海外長期研修	TBA	1st	Advanced Subjects International Education		1～6	
Study-abroad Program A 海外短期研修（基礎A）	D. Mott	1st	Advanced Subjects International Education		1～2	
Special Lecture of Career Education キャリア教育特別講義	T. Koike	2nd	Advanced Subjects Career Education		2	国費学生必修
Current Topics カレント・トピックス	TBA	1st	Advanced Subjects Current Topics		1～2	
Basic Japanese 1	N. Sugaya et al.	1st	Languages Japanese	4		
Basic Japanese 2	N. Sugaya et al.	1st	Languages Japanese	3		
Intermediate Japanese	A. Uchiyama et al.	2nd	Languages Japanese	3		You may instead select 3 subjects (3 credits) from the General Education

						Japanese A-J classes.
Probability & Statistics 数理統計学	R.Ohno	2nd	Basics of Discipline Basics of Mathematics	2		
Physics A 物理学A	T.Koike	1st	Basics of Discipline Basics of Physics	2		
Chemistry A 化学A	D. Mott	1st	Basics of Discipline Basics of Chemistry	2		
Chemistry C 化学C	D. Mott	1st	Basics of Discipline Basics of Chemistry	2		
Biology A 生命科学A		1st	Basics of Discipline Basics of Biology	2		
Biology B 生命科学B	T. Ichinose	1st	Basics of Discipline Basics of Biology	2		
Biology C 生命科学C	K. Inaba	1st	Basics of Discipline Basics of Biology	2		Substitute for Modern Scholarship 現代学問論読替
Mineralogy, Petrology & Geochemistry 地球物質科学	Breedlove	1st	Basics of Discipline Basics of Earth and Space Science	2		
Introduction to Aquatic Production 水圏環境コミュニケーション論	M. Ikeda	1st	Specialized Subjects Faculty Common Subjects	1		Joint class 日本人と共修
Introduction to Natural and Agricultural Production 陸圏環境コミュニケーション論	C. Yonezawa et al.	1st	Specialized Subjects Faculty Common Subjects	1		Joint class 日本人と共修
Modern Agriculture and Agricultural Science 現代における農と農学	The field of all Agriculture 全分野	1st	Specialized Subjects Faculty Common Subjects	2		Joint class 日本人と共修
Introduction to Physiology and Ecology 生理・生態学概論	Cheryl Ames	1st	Specialized Subjects Faculty Common Subjects	2		
An Introduction to Bioindustrial Information Processing 生物生産情報処理概論	Y. Sakai	3rd	Specialized Subjects Faculty Common Subjects		2	
Reading of Scientific Paper I 科学論文講読I	M. Aoki et al.	2nd	Specialized Subjects Faculty Common Subjects	1		Joint class 日本人と共修
Reading of Scientific Paper II 科学論文講読II	M. Aoki et al.	2nd	Specialized Subjects Faculty Common Subjects	1		Joint class 日本人と共修
Practice on Marine Bio-resources Science 臨海実習	M. Ikeda	1st	Specialized Subjects Faculty Common Subjects	1		Joint class日本人と共修 Intensive course 集中講義
Graduation Thesis 卒業論文	Instruction teacher 教授・准教授	4th	Specialized Subjects Faculty Common Subjects	10		
Physiology of Biological Resources 資源生物生理学	Cheryl Ames	2nd	Specialized Subjects Academic Common Subject	2		
Animal Ecology and Ethology 資源動物生態学	S. Katayama	2nd	Specialized Subjects Academic Common Subject		2	
Fish Genetics and Breeding science 水産遺伝育種学	M. Nakajima	2nd	Specialized Subjects Academic Common Subject		2	
Field Practice of Marine Production I 生産フィールド実習 I	M. Ikeda	2nd	Specialized Subjects Academic Common Subject	1		Joint class 日本人と共修 Intensive course 集中講義
Field Practice of Marine Production II 生産フィールド実習 II	M. Ikeda	3rd	Specialized Subjects Academic Common Subject	1		Joint class日本人と共修 Intensive course 集中講義
Fishery Science Practice I 学生実験 I	M. Aoki et al.	2rd	Specialized Subjects Academic Common Subject	4		Joint class 日本人と共修
Fishery Science Practice II 学生実験 II	M. Aoki et al.	3rd	Specialized Subjects Academic Common Subject	6		Joint class 日本人と共修
Basic Chemistry, Practice 基礎化学実験	M. Aoki et al.	2nd 3rd	Specialized Subjects Academic Common Subject	1		Joint class 日本人と共修
Basic Biology, Practice 基礎生物学実験	M. Aoki et al.	2nd 3rd	Specialized Subjects Academic Common Subject	1		Joint class 日本人と共修
Aquacultural Biology 水産増殖学	T. Unuma	2rd	Specialized Subjects Academic group Common Subject	2		available in 2024
Fisheries Biology and Ecology 水産資源生態学	S. Katayama	3rd	Specialized Subjects Academic group Common Subject	2		
Aquatic Plant Ecology 水圏植物生態学	M. Aoki	2rd	Specialized Subjects Academic group Common Subject	2		
Marine Biochemistry 水産化学	T. Nakano	2nd	Specialized Subjects Academic group Common Subject	2		available in 2024
Biological Oceanography 生物海洋学	W. Sato-Okoshi	3rd	Specialized Subjects Academic group Common Subject	2		
Applied Genetics in Aquatic Organisms 沿岸生物学	M. Ikeda	3rd	Specialized Subjects Academic group Common Subject	2		
Aquatic Invertebrate Biology 水圏無脊椎動物学	T. Unuma	1st	Specialized Subjects Technical field Subjects		2	available in 2024

Applied Aquatic Botany 水圏植物学	M. Aoki	2rd	Specialized Subjects Technical field Subjects		2	
Marine Product Technology 水産利用学	T. Nakano	3rd	Specialized Subjects Technical field Subjects		2	available in 2024
Seafood Management 水産食品管理学	Cheryl Ames	3rd	Specialized Subjects Technical field Subjects		2	
Planktology プランクトン学	G. Nishitani	2nd	Specialized Subjects Technical field Subjects		2	
Marine Coastal Ecology 沿岸環境学(2023.10入学者より) (Integrate Aquatic Biology) (水族生理生態遺伝学)	T. Fujii	2nd	Specialized Subjects Technical field Subjects		2	
Marine Applied Biochemistry 海洋応用生物化学	M. Nishikawa	3rd or 4th	Specialized Subjects Technical field Subjects		1	Every other year 隔年開講 Intensive course 集中講義
Related Subjects 関連科目			Specialized Subjects Technical field Subjects		4	
Introduction to Fisheries Science 水産科学概論	M. Ikeda et al	2nd	Specialized Subjects Current subject	2		
Practical Training 実地研修	M. Ikeda et al.	3rd	Specialized Subjects Current subject	1		
Marine Biology 海洋生物学	Cheryl Ames	2nd	Specialized Subjects Current subject	2		
Current topics of Agricultural Plant Science 先端植物生命科学	H. Takahashi et al.	3rd or 4th	Specialized Subjects Current subject	2		Every other year 隔年開講
Introduction to Resource and Environmental Economics 資源環境経済学概論	農業経済学コース代表	3rd or 4th	Specialized Subjects Current subject	2		Every other year 隔年開講
Introduction to Applied Animal and Dairy Science 応用動物・酪農科学概論	K. Sato et al.	3rd or 4th	Specialized Subjects Current subject	2		Every other year 隔年開講
Applied Biological Chemistry 応用生物化学	生物化学コース代表	3rd or 4th	Specialized Subjects Current subject	2		Every other year 隔年開講
Food and Chemistry 食糧と化学	M. Ishikawa et al.	3rd or 4th	Specialized Subjects Current subject	2		Every other year 隔年開講
Current topics of Shellfish Physiology 先端海洋生物生理学	K. Nagasawa	3rd	Specialized Subjects Current subject		1	
Current topics of Fish Ecology 先端海洋生物生態学	H. Murakami	3rd	Specialized Subjects Current subject		1	
Current topics of Marine Biotechnology 先端海洋生物工学(2023.10入学者より) (Current topics of Fish Biochemistry) (先端海洋生物化学)	H. Yokoi	3rd	Specialized Subjects Current subject		1	
Current topics in Global Marine Ecology 先端地球海洋生態学(2023.10入学者より) (Current topics of Genetics in Aquatic Organisms) (先端海洋生物遺伝学)	T. Fujii	3rd	Specialized Subjects Current subject		1	
Current topics of Coastal Ecology 先端沿岸生態学	H. Suzuki	3rd	Specialized Subjects Current subject		1	
Current topics of Fish Molecular Biology 先端海洋分子生物学	H. Yokoi	3rd	Specialized Subjects Current subject		1	
Current topics of Plankton Biology 先端プランクトン学	G. Nishitani	3rd	Specialized Subjects Current subject		1	

Free Elective Specialized Subjects (These two subjects do not count towards the 134 minimum credits for graduation.) 自由聴講科目

Subjects	Instructors	year	Categories	Credits		Reference
				Obligatory	Elective	
理工系学際基礎セミナー Fundamentals of Interdisciplinary STEM Seminar	X. Dahan et al.	1st	General Education Expansion Subjects		1	※国費学生は必修、私費学生は履修を強く推奨する
Science, Technology and Industry in Japan 日本の産業と科学技術	Y. Watanabe	2nd	Specialized Subjects		1	国費学生必修
Multidisciplinary Internship 学際インターンシップ	S. Katayama et al	2nd	Specialized Subjects		1	Intensive course 集中講義 国費学生必修

Graduation Requirements 卒業条件

The minimum number of credits required for graduation is 134. 134 単位以上

1. A minimum of 111 credits from obligatory subjects(Including 49 credits of general education subjects) 必修科目 111 単位以上（全学教育科目 49 単位を含む）
2. A minimum of 23 credits from elective specialized subjects 専門選択科目23単位以上

Minimum credits for graduation 卒業に要する最少単位

(1) General Education Subjects 全学教育科目

Subjects		Credits
Foundations 基盤科目	Introduction to Academic Learning 学問論	2
	Humanities 人文科学	2
	Social Sciences 社会科学	2
	Natural Sciences 自然科学	4
	Transdisciplinary Subjects 学際科目	7
	Subtotal	**17**
Advanced Subjects 先進科目	Information Science 情報教育	2
	International/Career/Current Topics 国際教育／キャリア教育／カレント・トピックス	4
	Subtotal	**6**
Languages 言語科目	Japanese 日本語	10
	Subtotal	**10**
Basics of Discipline 学術基礎科目	Basics of Mathematics 基礎数学	2
	Basics of Physics 基礎物理学	2
	Basics of Chemistry 基礎化学	4
	Basics of Biology 基礎生物学	6
	Basics of Earth and Space Science 基礎宇宙地球科学	2
	Subtotal	**16**
Total		**49**

Cooperative Innovation Program in Science, Engineering, and Agriculture for Leading Sustainable and Diverse Industry and Society by Digital Globalization

The FGL program has been selected by MEXT for a new program aimed at governmentsponsored students. As a result, starting in FY 2021, FGL will be able to accept 8 governmentsponsored students each year for three years. The objective of this program is to create an educational system based on cooperation between three undergraduate schools that will foster leaders in the field of global sustainable and diverse industry and society while driving innovation in university education.

Those who enter FGL as government-sponsored students will also belong to this new program. Therefore, in addition to the curricula of their undergraduate schools, the government-sponsored students will have to fulfill the requirements of this program as well. The program requirements (i.e. requirements for receiving government sponsorship) consist of nine or ten credits in the below six subjects. For details of each subject, please see the syllabus. (From 1. to 3. below are General Education subjects. In the above table, they are indicated by an asterisk (*) to the right of the subject names.)

1. Study Abroad Program A [1 credits] — General Education Subjects
2. Introduction to Academic Learning [2 credits] — General Education Subjects
3. Life and Nature (Study of Nature, Life and Technology) [2 credits] — General Education Subjects
4. Science, Technology, and Industry in Japan [1 credit] — Specialized Subjects
5. Multidisciplinary Internship [1 credit] — Specialized Subjects
6. Digital Entrepreneurship Seminar [2 credits] — General Education Subjects

(2) Specialized Subjects 専門教育科目

Subjects	Obligatory	Elective*	Total	Comments
Faculty Common Subjects 学部共通科目	19	(2)		*23 or more elective credits must be acquired from among the 30 elective credits listed in parentheses. 選択科目は、括弧の中から 23 単位以上修得すること。
Academic Common Subjects 学科共通科目	16	(4)		
Academic Group Common Subjects 学科目群共通科目	12			
Technical Field Subjects 専門領域科目	0	(17)		
Current Subjects カレント科目	15	(7)		
Total	**62**	**23**	**85**	

The credits acquired in each semester (example) 各セメスターの取得単位（例）

Semester		Credits
2nd -3rd Semester	Obligatory: Including Practice on Marine Bio-resources Science 臨海実習を含む	7
	Elective	2
4th -5th Semester	Obligatory: Including Field Practice of Marine Production 生産フィールド実習を含む	21
	Elective	10
6th -7th Semester	Obligatory: Including Field Practice of Marine Production 生産フィールド実習を含む	24
	Elective	14
8th-9th Semester	Obligatory: Graduation Thesis	10
Related Subjects		
Total		**88**

Subject	Introduction to Aquatic Production （水圏環境コミュニケーション論）	Day/Period	Fri./4th	Object	AMB
Instructor (Post)	M. Ikeda (Prof) T. Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	1st-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	3
Subject Numbering	AAL-APS202B			Language Used in Course	English/Japanese

1. Class subject

Biological productivity in aquatic zone and restoration from tsunami disaster

2. Object and summary of class

Onagawa Town was one of the most prosperous fishing ports in Japan. However, the 9.0- magnitude Tohoku-Pacific Ocean Earthquake generated a tsunami as high as 15 meters in Onagawa, which caused the town to subside by 1 meter, and completely destroyed its central area. The ria coast of Onagawa and coastal region along the Pacific Ocean had been severely stricken by the tsunami. Various coastal organisms have acclimated to tsunami perturbations and survived in the area. In order to promote reconstruction of tsunami-stricken areas such as Onagawa with respect to aquatic production (fish catching, aquaculture and fishery processing), it might be a promising measure to scientifically focus on the adaptability of coastal ecosystems in the area against tsunami perturbations, and to raise public awareness of the uniqueness of the costal ecosystems and biodiversity. This subject highlights tsunami damage and the circumstance of reconstruction in Onagawa Town including coastal ecosystems, and brings to understand the importance of constructing new relationship between natural biological productivity and human activity. Field lecture will be held on April in Onagawa Town with a two-day trip. Classroom lecture will be held on May or June at Aobayama Campus.

3. Keywords

marine biodiversity, fisheries, aquaculture, tsunami disaster, reconstruction,

4. Goal of study

At the end of the semester, students will
-understand about tsunami disaster.
-understand the importance of relationship between natural aquatic production and human activity.
-understand sustainable biological productivity and the application to reconstruction of human society.

5. Contents and progress schedule of class

- Introduction to studies of marine science, biological productivity and restoration
- Field lecture about tsunami damage, the restoration of coastal ecosystems, and the circumstance of reconstruction in Onagawa Town (including Onagawa Field Center)
- Class room lecture
- Group discussion

6. Preparation

For more information, note our announcement in the curriculum guidance during the first week of April.

7. Record end evaluation method

- Attendance: 40%
- Activeness: 20%
- Report: 40%

8. Textbook and references

Preparing textbook

9. Self study

None

10. Practical business

11. In addition

Contact e-mail address:

- Ikeda: minoru.ikeda.a6@tohoku.ac.jp

Subject	Introduction to Natural and Agricultural Production (陸圏環境コミュニケーション論)	Day/Period	Fri./4th	Object	AMB
Instructor (Post)	Professors of Field Science Center etc (Prof.)	Categories	Specialized Subjects	Preferable Participants	1st-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	3
Subject Numbering	AAL-OAG201B			Language Used in Course	English/Japanese

1. Class subject

Ecosystems including forest, grassland, farmland, paddy field and biological productivity

2. Object and summary of class

The purpose of the course is to get understanding of agronomical thinking and sustainable biological productivity through 1 day filed trip, classroom lectures and discussion time. Field trip will be held in May and the destination is the Integrated Terrestrial Field Station (Kawatabi in Naruko area). Classroom lecture will be held in May and June.

3. Keywords

agronomical science, integrated terrestrial field, ecosystem, environmental issues, animal waste treatment, grasslands, farmlands, soil science, forestry

4. Goal of study

At the end of the semester, students will

-experience about fundamental field science

-understand agronomical thinking

-understand sustainable biological productivity

5. Contents and progress schedule of class

1-5. Introduction to Agronomical science (Profs. of Field Science Center)

6. Field lecture about forest ecosystem (Profs. of Forest Ecology)

7. Field lecture about farmlands on hilly and mountainous area (Profs. of Environmental Crop Science)

8. Field lecture about grasslands, farm animals and environmental issues (Profs. of Land Ecology)

9.Field lecture about animal waste treatment, biogas production and recycling system (Profs. of Sustainable Environmental Biology)

10. Field lecture about andosol (volcanic ash soil) and environmental issues on farmland (Profs. of Environmental Crop Science)

11. Field lecture about management of animal feeding and animal welfare (Profs. of Land Ecology)

12. Field observations for integrated terrestrial field (Profs. of Field Science Center)

13. Group discussion (Profs. of Field Science Center)

14. Class room lecture about agriculture and ecosystem (Profs. of Field Science Center)

15. Class room lecture about spatial science and agronomy (Profs. of Field Science and Technology for Society)

6. Preparation

Read books related on agronomy, soil science, animal science, forest science and environmental science before the field trip.

7. Record end evaluation method

Attendance and participation for field trip (40%)

Attendance and participation for classes (30%)

Report about field trip (30%)

8. Textbook and references

URL: http://www.agri.tohoku.ac.jp/kawatabi/index.html

9. Self study

Write a report after the field trip. Write down what did you see, what did you feel. We welcome your consideration based on the group discussion.

10. Practical business

11. In addition

Field trip will be held in May (Fri.), 8:00 - 18:30. Gathering Spot is Aobayama Campus (Faculty of Agriculture Building).

Please carry rain cape, protection against cold weather, insurance card and lunch to field trip.

E-mail address: chinatsu@tohoku.ac.jp

Subject	Modern Agriculture and Agricultural Science（現代における農と農学）	Day/Period	Fri./3rd	Object	AMB
Instructor (Post)	K. Homma (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	1st-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	3
Subject Numbering	AAL-OAG203B			Language Used in Course	English/Japanese

1. Class subject

Grasp of problems according to water, foods, energy, biomaterials, environment and health

2. Object and summary of class

The purpose of the course is to let participants understand and grasp the many agricultural problems such as water, foods, energy, biomaterials, environment and health through the unique lecture with laboratory tours. Students can go to more than 30 laboratories (about 3/4 of all lab. of our faculty) in the course to know and understand the characteristics of each laboratory's state of education and research.

Students will increase knowledge step by step through explanation of stuffs and discussion with each other.

3. Keywords

4. Goal of study

At the end of the semester, students will

-have basic knowledge about the agricultural science including the academic field of plant science, animal science, fishery science, agricultural chemistry, food science at present stage in our faculty.
-have deeper understanding of the strategy for survival of humans in the future by utilizing the agriculture at high levels.

5. Contents and progress schedule of class

The education and research of our Faculty of Agriculture, and the Graduate School of Agricultural Science are operating in the six different fields of plant science, material environmental economy, applied animal science, marine bioscience, biochemistry and bioscience. In the lecture, we will explain the dairy situation in each laboratory including laboratory tours style.

Students will be separated into six groups and will take a lecture by stuffs of the lab. in the rotation system. Each student can visit one to four laboratories in one day.

1. Guidance "Introduction of agricultural sciences"
2-15. Visit to six courses of Plant Science, Resource Environmental Economics, Applied Animal Science, Applied Marine Biology, Biochemistry, and Biological Chemistry
16. Examination

6. Preparation

7. Record end evaluation method

Students must attend the laboratory tour more than 60% and take an examination (40%) of the last day.

8. Textbook and references

Textbook and references will be notified at the class.

9. Self study

10. Practical business

11. In addition

Students who have some questions can visit to ask to each laboratory until 18:00 after lecture time.
Contact persons will be notified at the class.
Contact: koki.homma.d6@tohoku.ac.jp

Subject	Introduction to Physiology and Ecology (生理・生態学概論)	Day/Period	Fri./2nd	Object	AMB
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	1st-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	2
Subject Numbering	ABS-APS235E			Language Used in Course	English

1. Class subject:
Introduction to Physiology and Ecology: **a general introduction to physiology and marine ecology.**

2. Object and summary of class:
A beginner course in the basics of writing about marine physiology and ecology. Through reading, writing and presentations, students will gain broad basic knowledge of the functional organization of animals (e.g., evolution, nervous systems) with an emphasis on the marine realm.

3. Keywords:
Nervous system, hormones, life functions, evolution, biodiversity, marine ecosystems, marine resources

4. Goal of study:
Master the basics of physiology and ecology for future application to Applied Marine Biology specialist topics and courses.

5. Course contents and class schedule
(1). Introduction. Basic principles of marine physiology, metabolism and ecology.
(2) Marine animal biodiversity: bathymetric distribution of marine animals.
(3) Phylogenetic and evolutionary adaptations of marine animals.
(4) The nervous system. 1. Neuron structure & function.
(5) The nervous system. 2. Sensory systems.
(6) The endocrine system. Cell signaling and hormones.
(7) Mid-term report and examination.
(8) Harvesting Living Marine Resources
(9) Estuaries
(10) Coastal Seas
(11) The Coral Reef Ecosystem
(12) The Open Sea
(13) The Deep-Sea Floor
(14) Polar Seas
(15) Final report, presentation and examination.

6. Preparation:
All students should complete weekly reading and writing assignments prior to each class. By identifying areas of difficulty, each student should aim to improve understanding of the course content.

7. Record and evaluation method:
Attendance and participation during lectures (25%); Reports/quizzes and end-of-term examination (75%)

8. Textbook and references:
Primary reading(s) (students can purchase or borrow a copy from campus library): Morrissey et al. (2018). Introduction to the Biology of Marine Life (Jones & Bartlett Includes Navigate 2 Advantage Access, 11th. ed.) ISBN-13: 978-1-284-09050-5. Secondary reading(s): Levinton, JS (2018). Marine Biology: Function, Biodiversity, Ecology (Oxford University Press 5th. ed.) ISBN-13: 978-0190625276; Moyes, C.D. & Schulte, P.M. (2016). Principles of Animal Physiology (Pearson, San Francisco, 3rd. ed.) ISBN-13: 978-0321838179.

9. Self-study:
There is much to learn about these topics. Students are encouraged to review their lecture notes soon after class. Each lecture will start with a discussion and/quiz of the previous lecture to ensure students have a fundamental grasp of the course content, which is required to pass the quizzes/examinations.

10. Practical business

11. In addition: This course covers a broad range of topics. Later courses will explore these topics more deeply. Questions should be addressed to the lecturer directly during or after lecture, or during office hours. ames.cheryl.lynn.a1@tohoku.ac.jp

Subject	An Introduction to Bioindustrial Information Processing (生物生産情報処理概論)	Day/Period	3rd quarter Tue./1st~2nd	Object	AMB
Instructor (Post)	Y. Sakai (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS336E			Language Used in Course	English

1. Class subject

Introduction to fundamentals of methods for processing biological sequence data

2. Object and summary of class

The first half deals with the methods for computing the similarity between two or more biological sequences, and the remaining half introduces various methods for other types of sequence processing.

3. Keywords

biological sequence, string, similarity, alignment, phylogenetic tree, gene mapping, short read assembly

4. Goal of study

The goal is to understand the theoretical background with respect to validity or limitation of computer processing of biological sequences.

5. Contents and progress schedule of class

1 Preliminaries
2 Similarity between sequences
3 Pairwise alignment (global alignment)
4 Pairwise alignment (local alignment and alignment with affine gap penalty)
5 Multiple alignment (star alignment)
6 Multiple alignment (progressive method)
7 Amino acid substitution matrix
8 BLAST
9 PSI-BLAST and HMM
10 Phylogenetic tree (ultra-metric tree and additive tree)
11 Phylogenetic tree (UPGMA and NJ method)
12 Gene mapping
13 Short read assembly (with reference sequence)
14 Short read assembly (de novo)
15 Suggested answers of the term paper

6. Preparation

Prepare for the next lesson by conducting a Web search on the topic words related to the lesson.

7. Record end evaluation method

Attendance: 20%
Term paper: 80%

8. Textbook and references

Recommended book:
Dan Gusfield, ‘‘Algorithms on Strings, Trees, and Sequences’’, Cambridge University Press (1997)

9. Self study

Review the previous lesson using the handout.

10. Practical business

11. In addition

Office hours: 16:30-18:00 Mon-Wed, and Fri at Room E410

E-mail address: yoshifumi.sakai.c7@tohoku.ac.jp

Subject	Reading of Scientific Paper I （科学論文講読 I）	Day/Period	1st Quarter Wed./2nd	Object	AMB
Instructor (Post)	M. Aoki (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	5
Subject Numbering	AAL-APS301B			Language Used in Course	English/Japanese

1. Class subject

Reading scientific papers in English

2. Object and summary of class

The purpose of the course is to let students understand the composition and critical reading of scientific paper.

3. Keywords

Critical reading, discussion

4. Goal of study

Students will
- have practical capability to read scientific paper in marine biology.
- have knowledge of technical terms on studying field of marine biology.

5. Contents and progress schedule of class

The course will be conducted by AMB laboratories.
- Students will take a class in each laboratory three to four times
- Scientific paper to read will be provided from each laboratory
- The format of a class follows an instruction of instructor of each laboratory

6. Preparation

Read the parts to be dealt in each class in advance.

7. Record end evaluation method

The academic achievement will be evaluated by attendance and understanding of class subject of each laboratory.

8. Textbook and references

Scientific paper to read will be provided by each laboratory in advance and students may be recommended to prepare well.

9. Self study

Read the related scientific articles in each field.

10. Practical business

11. In addition

Students may visit the instructor of each class anytime.

Subject	Reading of Scientific Paper II （科学論文講読 II）	Day/Period	1st Quarter Thur./2nd	Object	AMB
Instructor (Post)	M. Aoki (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	5
Subject Numbering	AAL-APS302B			Language Used in Course	English/ Japanese

1. Class subject

Reading scientific papers in English

2. Object and summary of class

The purpose of the course is to let students understand the composition and critical reading of scientific paper.

3. Keywords

Critical reading, discussion

4. Goal of study

Students will
- have practical capability to read scientific paper in marine biology.
- have knowledge of technical terms on studying field of marine biology.

5. Contents and progress schedule of class

The course will be conducted by AMB laboratories.
- Students will take a class in each laboratory three to four times
- Scientific paper to read will be provided from each laboratory
- The format of a class follows an instruction of instructor of each laboratory

6. Preparation

Read the parts to be dealt in each class in advance.

7. Record end evaluation method

The academic achievement will be evaluated by attendance and understanding of class subject of each laboratory.

8. Textbook and references

Scientific paper to read will be provided by each laboratory in advance and students may be recommended to prepare well.

9. Self study

Read the related scientific articles in each field.

10. Practical business

11. In addition

Students may visit the instructor of each class anytime.

Subject	Practice on Marine Bio-resources Science（臨海実習）	Day/Period	Intensive Course	Object	AMB
Instructor (Post)	M. Ikeda (Prof) T. Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	1st-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	3
Subject Numbering	AAL-APS410B			Language Used in Course	English/Japanese

1. Class subject

Observation of marine biodiversity and understanding the importance for sustainable productions.

2. Object and summary of class

To understand importance of marine biodiversity.

(1) Field trip to the rocky intertidal area and observation of the biodiversity.

(2) Observation of early development of marine invertebrates

3. Keywords

marine ecosystem, biodiversity, production, aquaculture

4. Goal of study

Students will be able to understand the importance for marine biodiversity through the observation of species diversity and development of marine organisms.

5. Contents and progress schedule of class

Four days in 2nd semester (August)

- Days 1-2:Field trip to the rocky intertidal area and survey the biodiversity.
- Days 3-4: Observation of early development of marine invertebrates.

6. Preparation

For more information, note our announcement on June or July.

7. Record end evaluation method

- Attendance: 40%
- Activeness: 20%
- Report: 40%

8. Textbook and references

Preparing textbook

9. Self study

None

10. Practical business

11. In addition

Contact e-mail address:

- Ikeda: minoru.ikeda.a6@tohoku.ac.jp

Subject	Physiology of Biological Resources (資源生物生理学)	Day/Period	2nd quarter Thur./1st~2nd	Object	AMB
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS338E			Language Used in Course	English

1. Class subject: **Physiology of Biological Resources**

2. Object and summary of class: This course provides a fundamental overview of the physiological requirements permitting marine animals to exist and reproduce within a host of environments often differing from their internal states.

3. Keywords: Neuroendocrinology, sensory systems, repair, sexual reproduction.

4. Goal of study: Develop an understanding of the varied ways and means by which cells in a multicellular organism communicate to maintain the organism's integrity and ensure the production of a new generation. Develop a solid grasp of the concept of homeostasis and its application in neuroendocrine regulation, sensory perception, repair and sexual reproduction. Gain a practical understanding of the differences between phylogenetics of gene trees (amino acid sequences) in comparisons with species trees (nucleotide sequences).

5. Course contents and class schedule
(1-4) Neurophysiology.
Neurophysiology and classification of chemical transmitters. Reception by target cells. Process of receptor cell receipt and information transmission. Action potentials. Origin of the nervous system. Neurons and support cells.
(5-7) Neuroendocrinology.
Hormones (e.g., thyroid hormone, growth hormone, and insulin), the organs and glands that secrete them, and their actions on different organ systems in the body.
(8). Mid-term report and examination.
(9-11). Sensory perception. Chemoreception, photoreception and mechanoreception. Comparisons between marine invertebrates and mammals. Sensory cells.
(13-14). Endocrinology of reproduction. Sex hormones. Reproduction and determination of sex. Gonad structure and the development of gametes. Sex, reproduction and the environment. Control of sex and maturity, courtship, and spawning. Comparisons between marine invertebrates and mammals.
(15). Final report, presentations, examination.

6. Preparation: All students should complete weekly reading and writing assignments prior to each class. By identifying areas of difficulty, each student should aim to improve understanding of the course content.

7. Record and evaluation method: Attendance and participation during lectures (25%); Reports/quizzes and end-of-term examination (75%)

8. Textbook and references: Primary reading(s) (students must purchase or borrow a copy from campus library): Moyes, C.D. & Schulte, P.M. (2015). Principles of Animal Physiology. (Pearson, San Francisco, 3rd. ed.). ISBN-13: 978-0321838179; Taiz, L et al. (2018). Fundamentals of Plant Physiology. ISBN-13: 978-1605357904. Secondary reading(s): Morrissey et al. (2016). Introduction to the Biology of Marine Life. 11th. ed. (Jones & Bartlett Includes Navigate 2 Advantage Access) ISBN-13: 978-1-284-09050-5. Ingrouille, M (2006). Plants: Diversity and Evolution. ISBN-13: 978-0521794336. Helfman, G (2009). The Diversity of Fishes: Biology, Evolution, and Ecology. ISBN-13: 978-1405124942. Brusca et al. (2016). The Invertebrates: A synthesis. 3rd Edition. (Sinauer Associates) ISBN-13: 978-1605353753.

9. Self-study: There is much to learn about these topics. Students are encouraged to review their lecture notes soon after class. Each lecture will start with a discussion and/quiz of the previous lecture to ensure students have a fundamental grasp of the course content, which is required to pass the quizzes/examinations.

10. Practical business

11. In addition: This course covers a broad range of topics. Later courses will explore these topics more deeply. Any questions should be addressed to the lecturer directly during or after lecture, or during office hours.
ames.cheryl.lynn.a1@tohoku.ac.jp

Subject	Animal Ecology and Ethology (資源動物生態学)	Day/Period	2nd Quarter Mon./1st-2nd	Object	AMB
Instructor (Post)	S. Katayama (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS239E			Language Used in Course	English

1. Class subject

Relationships among organisms and those between organisms and their environment as fundamental factors supporting biological production in nature.

2. Object and summary of class

More than 1500 thousand of organisms are recognized to live on the earth now. These numerous organisms maintain various interrelationships with surrounding organisms and its environmental factors, which may support biological production in nature.

The present subject addresses fundamental concepts of ecology necessary to understand mechanisms of nature in each category of population, community, and ecosystem.

3. Keywords

biological production, population, biological community, marine ecosystem, environment, interspecific relations

4. Goal of study

Students can understand the structure and function of biological nature, and find an outline of the relationships between organisms and its environment.

5. Contents and progress schedule of class

1. Species (binomial nomenclature, reproductive isolating, crossbreed)
2. Classification (five kingdoms, three domains) Biological production in each ecological category: producer, consumer, decomposer.
3. Divergent evolution, natural selection
4. Adaptation, Speciation, & Diversity
5. Niche, fitness, food selection
6. Interspecific relationships (competition, predation etc.), Gause's Law
7. Population; definition, mode of life, population growth models, r-K strategy
8. Competition, strategy and tactics, game theory, Lotka-Volterra model
9. Concept of ecological niche, relationship between niche and competition
10. Community theory, ecological succession, climax
11. Structure and function of ecosystem,
12-13. Biogeochemistry (Element ratios, Element Cycling, Energy Flow and Matter Recycling)
14. Biological and physical cycle in nature
15. Ecosystem service

6. Preparation

Many books are published on ecosystem, environment, and bio-diversity, from which it is required to obtain various information about contemporary ecological problems.

7. Record end evaluation method

Evaluation will depend on achievement of final examination. Furthermore, submissions of short term papers are required several times in the course.

8. Textbook and references

MJ Kaiser et al. “Marine Ecology -Processes, Systems, and Impacts-”, Oxford Univ. Press (2011)
M Begon et al. “Ecology: Individuals, Populations and Communities”, Wiley-Blackwell (1996)

9. Self study

Students should have concern over topics on nature and organisms shown in various media and consider their biological and ecological meanings.

10. Practical business

11. In addition

Office hour for inquiry about the course should be offered any time at the Laboratory of Fisheries Biology and Ecology.
E-mail: skata@tohoku.ac.jp

Subject	Fish Genetics and Breeding science （水産遺伝育種学）	Day/Period	3rd Quarter Mon./3rd, 4th	Object	AMB
Instructor (Post)	M. Nakajima (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	4
Subject Numbering	ABS-APS240E			Language Used in Course	English

1. Class subject

Understand the basic theory of inheritance and the application methods for the genetic improvement in aquatic organisms.

2. Object and summary of class

In the aquatic organisms, not only genetics in individual level but also population level is important. Because, the position of conservation in genetic resources has very important in this subject. In this class, the basic theory of inheritance in individual level, population level, the basic theory of genetic improvement and the conservation of genetic resources will be explained and discussed.

3. Keywords

Genetic improvement, Genetic variation, Linkage, Genetic marker, Quantitative trait, Heritability, Breeding value, Heterosis, Recombinant DNA

4. Goal of study

1) Understand the basic theory of genetics in both of individual and population level
2) Understand the theory of the application methods of genetics for the genetic improvement
3) Understand the basic theory of genetics for the conservation of genetic resources.

5. Contents and progress schedule of class

Basic theory of inheritance

1) Basic theory and various mode of inheritance
2) Genetic variations
3) Linkage and recombination
4) Basic theory of genetics in population
5) Genetic drift and inbreeding
6) Natural selection
7) Population structure and genetic diversity of population
8) Genetic markers for the analysis of populations and quantitative traits

Basic theory of genetic improvement

9) Basic theory of inheritance in quantitative traits
10) Heritability and breeding value
11) Basic theory of selection
12) Heterosis and hybrid vigor
13) Genetic improvement by recombinant DNA

6. Preparation

Please read a book about conservation and genetic improvement.

7. Record end evaluation method

Total results are evaluated by the final examination, reports and the results of the problems set at a lecture at each time.

8. Textbook and references

Introduction to quantitative genetics, D. S. Falconer, Longman Scientific & Technical, New York, 1989
Genetics for fish hatchery managers, D. Tave, An AVI Books, New York, 1992
Principles of population genetics, D. L. Hartl and A. G. Clark, Sinauer Associates, Inc., Massachusetts
Conservation and the Genetics of Populations, F. W. Allendorf and G. Luikart, Blackwell Publishing, Oxford, 2007

9. Self study

Ask me the things which are not understood. Please do preparations for lecture and a review used text book shown to the above.

10. Practical business

11. In addition

The office will be opened from 10:00 AM to 05:00 PM to receive the question. The question is also received by e-mail, masamichi.nakajima.b6@tohoku.ac.jp

Subject	Field Practice of Marine Production I・II （生産フィールド実習Ⅰ・Ⅱ）	Day/Period	Intensive Course	Object	AMB
Instructor (Post)	M. Ikeda (Prof.) T. Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5&7
Subject Numbering	ABS-APS406B			Language Used in Course	English/Japanese

1. Class subject

Practical field and experimental training for marine biodiversity.

2. Object and summary of class

To understand importance of marine biodiversity.

(1) Observation and analysis of marine biodiversity.
(2) Analysis of genetic diversity in marine organisms.
(3) Comparative observation of early development and morphogenesis of marine invertebrates.

3. Keywords

marine ecosystem, biodiversity, genetic diversity, early development, morphogenesis

4. Goal of study

Students will be able to understand the importance for biodiversity in marine ecosystems through the observation of species/genetic diversity and development of marine organisms.

5. Contents and progress schedule of class

Five days in 4th semester (August)

- Days 1-2: Quantitative and qualitative of marine biodiversity.
- Days 3-4: Observation of early development of marine invertebrates.
- Day 5: Presentation

Five days in 6rd semester (August)

- Days 1-2: Quantitative and qualitative of genetic diversity in marine organisms.
- Days 3-4: Observation of morphogenesis of marine invertebrates.
- Days 5: Presentation

6. Preparation

For more information, note our announcement on June or July.

7. Record end evaluation method

- Attendance: 40%
- Activeness: 20%
- Report: 40%

8. Textbook and references

Preparing textbook

9. Self study

None

10. Practical business

11. In addition

Contact e-mail address:

- Ikeda: minoru.ikeda.a6@tohoku.ac.jp

Subject	Fishery Science Practice I･II （学生実験Ⅰ・Ⅱ）	Day/Period	Mon.- Fri. /3rd & 4th	Object	AMB
Instructor (Post)	M. Aoki (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	10
				Semester	5 & 6
Subject Numbering	AAL-APS308E/AAL-APS309E			Language Used in Course	English

1. Class subject

Morphology, function and components of aquatic organisms, analysis of substances in environment

2. Object and summary of class

The purpose of the course is to let participants understand the taxonomy, constitution of body, function of aquatic organisms, the way to use analytical instruments and analysis of experimental data.

3. Keywords

Experiments, anatomy, microscopy, chemical analysis, statistics

4. Goal of study

Students will

- have basic knowledge for anatomical structure and components of aquatic organisms and analysis of environment.
- have deeper understanding of aquatic organisms and marine environment.

5. Contents and progress schedule of class

The course will be conducted by AMB laboratories.

- Anatomy of invertebrate and teleost
- Molecular biology and genetics
- Taxonomy of aquatic organisms
- Histology
- Physiology
- Analytical chemistry of environment and organisms
- Microbiology
- Ecology
- Statistic analysis

6. Preparation

Understand the materials and methods to be used in each class in advance.

7. Record end evaluation method

Students should attend every experiments and absence is not acceptable for any reason. Students should submit report of each by the deadline suggested in each experiment. The academic achievement will be evaluated by attendance and submitted report through entire period.

8. Textbook and references

Text for the course will be provided and students may be recommended to prepare well.

9. Self study

Refer to related books in the library for writing reports.

10. Practical business

11. In addition

Students may visit the instructor of each experiment anytime.

Subject	Basic Chemistry, Practice （基礎化学実験）	Day/Period	Mon.-Fri. /3rd & 4th	Object	AMB
Instructor (Post)	M. Aoki (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	5 & 6
Subject Numbering	AAL-APS310E			Language Used in Course	English

1. Class subject

Components of aquatic organisms, analysis of substances in environment

2. Object and summary of class

The purpose of the course is for students to understand the body components of organisms and the procedures to extract and analyze chemical components in the environment.

3. Keywords

Experiments, analysis, biogenic substances, chemical components

4. Goal of study

Students will

- have basic knowledge of biogenic substances from aquatic organisms and analysis of the environment.
- have knowledge of experimental procedures.

5. Contents and progress schedule of class

The course will be conducted by AMB laboratories

- Anatomy of fin fish
- Extraction and analysis of genetic material
- Analysis of components of seawater
- Evaluation of taste components
- Extraction and analysis of body components
-

6. Preparation

Understand the materials and methods to be used in each class in advance.

7. Record end evaluation method

Students should attend every experiment and absence is not acceptable for any reason. Students should submit a report on each theme by the required deadline. Academic achievement will be evaluated by attendance and grading of all reports submitted .

8. Textbook and references

Texts for the course will be provided.

9. Self study

Refer to related books in the library for writing reports. Prepare well before attending each practical.

10. Practical business

11. In addition

Students may visit the instructor of each experiment any time.

Subject	Basic Biology, Practice （基礎生物学実験）	Day/Period	Mon.-Fri./ 3rd & 4th	Object	AMB
Instructor (Post)	M. Aoki (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	5 & 6
Subject Numbering	AAL-APS311E			Language Used in Course	English

1. Class subject

Body plan and function of aquatic organisms

2. Object and summary of class

The purpose of the course is to let students understand body plan and function of aquatic organisms studying on morphology, genetics, cell biology, physiology and statistic analysis.

3. Keywords

Morphology, Genetics, Taxonomy, Cellular tissue

4. Goal of study

Students will

- have knowledge of basic biology
- have knowledge of experimental procedure

5. Contents and progress schedule of class

The course will be conducted by AMB laboratories.

- Anatomy of fin fish
- Genetics and analysis of polymorphism
- Cell biology of aquatic plant
- Histology of marine animals

6. Preparation

Read textbook before the class and understand an outline of experimental procedure in advance.

7. Record end evaluation method

Students should attend every experiments and absence is not acceptable for any reason. Students should submit report of each by the deadline suggested in each experiment. The academic achievement will be evaluated by attendance and submitted report through entire period.

8. Textbook and references

Text for the course will be provided and students may be recommended to prepare well.

9. Self study

Review the results of the experiment and summarize it in the report.

10. Practical business

11. In addition

Students may visit the instructor of each experiment anytime.

Subject	Aquacultural Biology（水産増殖学）	Day/Period	2nd Quarter Fri./1st & 2nd	Object	AMB
Instructor (Post)	T. Unuma (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS341E			Language Used in Course	English

1. Class subject

Underlying concept of aquaculture and overview of projects of representative aquaculture

2. Object and summary of class

Restoration of natural fishery resources and growth of fish products is an urgent issue to be resolved in aquaculture. The purpose of this class is to let students understand the concept of aquaculture and specific aquaculture projects.

3. Keywords

Teleost, Crustacea, Bivalve, Natural seed, Artificial seed

4. Goal of study

Students will

- cognize the importance of aquaculture for restoration and growth of fishery product.
- have knowledge of specific issues on aquaculture.

5. Contents and progress schedule of class

- Current state of world fisheries production
- Concept of aquaculture
- Salmon 1 (life cycle)
- Salmon 2 (artificial seed production and release)
- Yellowtail 1 (life cycle)
- Yellowtail 2 (natural seed collection and farming)
- Flounder 1 (life cycle)
- Flounder 2 (artificial seed production and release)
- Kuruma Prawn 1 (life cycle)
- Kuruma Prawn 2 (artificial seed production and farming)
- Scallop 1 (life cycle)
- Scallop 2 (natural seed collection and farming)
- Oyster (natural seed collection and farming)
- Others (Pearl oyster and Bluefin tuna cultivation)
- Chromosome manipulation and sex manipulation

6. Preparation

Read textbook and handout before the class and understand an outline of life cycle and aquaculture process of each animal in advance.

7. Record end evaluation method

The academic achievement will be evaluated by report assigned in each lecture.

8. Textbook and references

Modern methods of aquaculture in Japan Vol. 24, ed. by H. Ikenoue & T. Kafuku, Elsevier, 1992

9. Self study

Read again textbook based on the information learned at the class and review the knowledge of aquaculture.

10. Practical business

11. In addition

Students may visit the office or contact via Email (tatsuya.unuma.b8@tohoku.ac.jp) anytime.
URL of the lab “Aquacultural Biology”; http://www.agri.tohoku.ac.jp/zoshoku/english.html

Subject	Fisheries Biology and Ecology （水産資源生態学）	Day/Period	3rd quarter Mon./1st~2nd	Object	AMB
Instructor (Post)	S. Katayama (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS342E			Language Used in Course	English

1. Class subject

Life history of marine resources, biology, population dynamics and methodology of population analysis.

2. Object and summary of class

Characteristics of marine organisms are tempo-spacio fluctuations and reproduction. Especially marine resources are affected by not only environmental condition but also fishing pressure. In this lecture, after short review of world and Japanese fisheries production, life history traits and fluctuating patterns of populations are explained. Methodology of stock assessment and population are also mentioned for the fisheries management.

3. Keywords

Fish biology, life history strategy, Fisheries, Population analysis

4. Goal of study

To understand the biological characteristics of marine resources and to learn theoretical and technical methods for marine biology, stock assessment and fisheries management.

5. Contents and progress schedule of class

1. Status of world and Japanese fisheries production
2. Stock identification and population structure
3-4. Ichthyology (External and internal morphology)
5-8. Life history (Age and growth, life cycle, migration, maturing and spawning, early life history, mortality and survival)
9. Patterns of population dynamics
10-11. Data analysis and stock assessment
12-13. Surplus yield model and yield per recruit model
14. Cohort analysis
15. Fisheries management

6. Preparation

There are no particular prerequisites for this course. Basic biology capabilities will ease the learning.

7. Record end evaluation method

Score of an end-of-term exam and attendance

8. Textbook and references

Marine Fisheries Ecology, Jennings et al., 2001 Wiley-Blackwell
Fishes: An Introduction to Ichthyology, Moyle and Cech, 2004 Pearson Prentice Hall
Fisheries Biology, Assessment and Management, M. King, 2007 Wiley-Blackwell

9. Self study

Please do not lose teaching documents and your class note for the final exam.

10. Practical business

11. In addition

Contact: skata@tohoku.ac.jp

Subject	Aquatic Plant Ecology (水圏植物生態学)	Day/Period	1st quarter Tue./1st~2nd	Object	AMB/JYPE
Instructor	M. Aoki (Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year & JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS343E			Language Used in Course	English

1. Class subject
The ecology of giant kelp forests

2. Object and summary of class
This course provides the basic knowledge about the community ecology of marine kelps through the readings of some chapters related to the ecological topics in the book 'The biology and ecology of giant kelp forests' by Schiel & Foster (2015).

3. Keywords
Kelp forest, Sea urchin, Barren, Grazing, Population dynamics, Production, Rocky subtidal ecosystem, Phase shift Global warming

4. Goal of study
The goal is to understand the structure and function of marine kelp communities through the study of the ecology of giant kelp forests.

5. Contents and progress schedule of class
(1) Introduction
(2) The abiotic environment-1: Substratum and sedimentation
(3) The abiotic environment-2: Temperature, light and nutrient
(4) The abiotic environment-3: Water motion
(5) Dispersal and connectivity of populations-1: Demography and metapopulations
(6) Dispersal and connectivity of populations-2: Reproductive output and source of propagules
(7) Dispersal and connectivity of populations-3: Spore dispersal and recruitment windows
(8) Session review-1
(9) Grazing in kelp communities-1: Kelp-sea urchin interactions
(10) Grazing in kelp communities-2: Reversion of barrens to kelp habitat
(11) Grazing in kelp communities-3: Other grazers in giant kelp communities
(12) Predation and trophic cascades-1: Fish predation on grazers
(13) Predation and trophic cascades-2: Lobster predation on grazers
(14) Predation and trophic cascades-3: Sea otter predation on grazers
(15) Session review-2

6. Preparation
Read the relevant chapters in the textbook in advance.

7. Record and evaluation method
Report and attendance

8. Textbook and references
Reference texts:
Schiel DR and Foster MS (2015) The biology and ecology of giant kelp forests. University of California Press

9. Self study
Review is required.

10. Practical business

11. In addition
Office phone number: 022-757-4152
Mail address: masakazu.aoki.e6@tohoku.ac.jp

Subject	Marine Biochemistry（水産化学）	Day/Period	2nd Quarter Tue./1st-2nd	Object	AMB
Instructor (Post)	T. Nakano (Assoc. Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS244E			Language Used in Course	English

1. Class subject

Biochemical characterization of aquatic organisms and seafood

2. Object and summary of class

The organisms inhabiting in water have unique components to adapt to and survive in the environment. To understand their ways of life, it is essential to understand the chemical components of fish and other marine organisms. While marine organisms show beneficial effects on human health, some of them possess toxic substances and some microorganisms and parasites are responsible for food poisoning. The class deals with the biochemical, nutritional and functional properties of the components in the organisms and the mechanisms of development as well as adaptation to habitat environment. The other related topics will also be introduced.

3. Keywords

Aquatic organisms, chemical components, catabolic pathways, regulatory systems

4. Goal of study

To get the sufficient knowledge about the characteristics of marine organisms from a biochemical viewpoint.
To understand the mechanisms to survive in water.

5. Contents and progress schedule of class

1: Biochemical characteristics of marine organisms
2: Metabolism
3: Proteins
4: Lipids
5: Carbohydrates
6: Vitamins
7: Minerals
8: Enzymes
9: Bioactive components
10: Physical aspects of life
11: Functional substances
12: Natural toxins and food poisoning
13: Osmoregulation
14: Final presentations
15: Final report

6. Preparation

Collect the related information in the library and through the web

7. Record end evaluation method

Based on the final report and presentations (50%), homework (20%) and class attendance (30%).

8. Textbook and references

Nelson & Cox: Lehninger Principles of Biochemistry 8th edition (2021)

9. Self study

Read related papers published in recent years.

10. Practical business

11. In addition

Contact email: nakanot@tohoku.ac.jp

Subject	Biological Oceanography (生物海洋学)	Day/Period	3rd quarter Fri./1st~2nd	Object	AMB
Instructor (Post)	W. Sato-Okoshi (Professor)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS345E			Language Used in Course	English

1. Class subject

Review marine environment and adaptive ecology of pelagic and benthic organisms that evolved in the oceans.

2. Object and summary of class

Deepen understanding of plankton, nekton, and benthos that live in vast and deep ocean environment based on physical and chemical characteristics of the ocean.

3. Keywords

marine environment, ecosystem, biology, ecology, productivity, plankton, nekton, benthos

4. Goal of study

Understand pelagic and benthic environments of the oceans and adaptation of their inhabitants, regional differences, and biological oceanographic basis that support fish and other upper-level production

5. Contents and progress schedule of class

1-2: History of Biological Oceanography

3-4: Physical environment

5-6: Chemical environment

7-9: Marine plankton

10: Nekton

11-13: Marine benthos

14: Marine ecosystems

15: Current topics on Biological Oceanography

6. Preparation

Acquire basic knowledge on oceans and organisms living in them.

7. Record end evaluation method

term-end test

8. Textbook and references

Biological Oceanography: An Introduction, 2nd ed., Lalli and Parsons, 1997 Butterworth-Heinemann

9. Self study

Understand cause and effect of phenomena taught in class.

10. Practical business

11. In addition

mail address: wsokoshi@tohoku.ac.jp

Subject	Applied Genetics in Aquatic Organisms（沿岸生物学）	Day/Period	4th Quarter Mon./1st-2nd	Object	AMB
Instructor (Post)	M. Ikeda (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS347E			Language Used in Course	English

1. Class subject

Conservation and sustainable yield of marine bio-resources

2. Object and summary of class

A variety of marine bio-resources have inhabited in the coastal areas. These are important food resources and also reproductive resources. Considering a conservation and sustainable yield of them, though ecological and physiological studies are important, genetic studies should be quite important for future.

In the present lecture, I will explain the importance of applied genetics for future managements of marine bio-resources by using actual scientific research in my laboratory.

3. Keywords

marine organisms、genetics and breeding science、population structure、conservation, aquaculture

4. Goal of study

Understanding the present condition of marine production in coastal area of Japan. Also, through the lecture, ability of consideration and problem solving are required.

5. Contents and progress schedule of class

1. Introduction
2. Extinction
3. Quantification of Genetic Diversity (I)
4. Quantification of Genetic Diversity (II)
5. Quantification of Genetic Diversity (III)
6. Quantification of Genetic Diversity (IV)
7. Inbreeding & Outbreeding Depressions (I)
8. Inbreeding & Outbreeding Depressions (I)
9. Molecular Identification (VI)
10. Conservation Units (I)
11. Conservation Units (II)
12. Conservation Units (III)
13. Genetic Rescue
14. Translocations
15. Captive Breeding Program

6. Preparation

No need but you should survey the technical terms in the lecture and write on your note book.

7. Record end evaluation method

Examination and Reports

8. Textbook and references

Directing on the lecture

9. Self study

10. Practical business

11. In addition

When you have a question, please contact me by e-mail.

e-mail address: minoru.ikeda.a6@tohoku.ac.jp

Subject	Aquatic Invertebrate Biology （水圏無脊椎動物学）	Day/Period	1st quarter Fri./1st~2nd	Object	AMB
Instructor (Post)	T. Unuma (Prof.)	Categories	Specialized Subjects	Preferable Participants	1st year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	3
Subject Numbering	ABS-APS348E			Language Used in Course	English

1. Class subject

On the invertebrate animals distributed in aquatic environments, basic physiology, especially immunology and feeding behavior, digestive and circulatory systems and life history will be outlined.

2. Object and summary of class

To learn the innate immune systems in marine invertebrates involved in basic innate immune systems, molecular and cellular host defense and apoptosis of immune cells.

To learn trained immunity of aquatic invertebrates based on host-parasite coevolution.

To understand structures of digestive organs and feeding and digestive mechanisms of bivalve mollusks.

To understand structures of heart and vessels, and circulatory system of bivalve mollusks.

3. Keywords

Marine invertebrates, Bivalves, Oysters, Innate immunity, Bio defense, Digestive systems, Feeding systems

4. Goal of study

Understanding the basic sciences in relation to immunology, feeding behavior and life history of aquatic invertebrates.

5. Contents and progress schedule of class

1st: Guidance
2nd: Feeding mechanisms of bivalve mollusks 1
3rd: Feeding mechanisms of bivalve mollusks 2
4th: Feeding mechanisms of bivalve mollusks 3
5th: Digestion and nutrition in bivalve mollusks 1
6th: Digestion and nutrition in bivalve mollusks 2
7th: Circulatory system of bivalve mollusks 1
8th: Circulatory system of bivalve mollusks 2
9th: A thorough review and first examination (Exam 1) of the class in the first half
10th: Innate Immunity in Invertebrates 1: general theory
11th: Innate Immunity in Invertebrates 2: morphology and function of hemocytes
12th: Innate Immunity in Invertebrates 3: pathogen recognition receptors (PRRs) and PAMPs
13th: Innate Immunity in Invertebrates 4: host defense in mollusks
14th: Innate Immunity in Invertebrates 5: host defense in crustaceans
15th: Innate Immunity in Invertebrates 6: trained immunity of mollusks: model for host-parasite coevolution
16th: A thorough review and second examination (Exam 2) of the class in the second half

6. Preparation

You should study basic biology, especially immunology and molluscan biology, prior to class studying.

7. Record end evaluation method

Attendance point: 300 points (20 points per one lecture time; 15 times)
Examination point: 200 points (100 points per one exam)
AA=90-100%; A=80-89%; B=70-79%; C=60-69%; D=below 60%

8. Textbook and references

Brusca, R.C., 2016. Invertebrates, 1st Edition, Sinauer, Sunderland, MA.
Ruppert, E.E., , J.A. 2003. Invertebrate Zoology. A functional evolutionary approach. Brook/Cole, CA.
Murphy, K. 2016. Janeway's Immunobiology, 9th Edition. Garland Science, New York.

9. Self study

You can study by yourself using textbooks (shown as above) getting for general knowledge of this class. These textbooks are owned by the library of Tohoku University. You can use these one.

10. Practical business

11. In addition

E-mail: tatsuya.unuma.b8@tohoku.ac.jp
Office hour: 13:00-15:00 on Tuesday and Wednesday.

Subject	Applied Aquatic Botany （水圏植物学）	Day/Period	1st quarter Mon./1st~2nd	Object	AMB
Instructor (Post)	M. Aoki (Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS349E			Language Used in Course	English

1. Class subject

Concepts and methods for the study of marine plant life

2. Object and summary of class

Marine algae are the major primary producers at the marine coastal areas, but most of us know little about them. Object of the class is to understand the concepts and methods for the study of marine plants such as algae and seagrasses. In this series of lectures, firstly, we will try to understand the basic characteristics of marine plants. Second, the patterns in the geographical and vertical distributions of marine algae will be discussed. Next, we will overview the studies on the population and community aspects of marine plants. Analytical methods of population dynamics and the details of plant-animal interactions will also be discussed. In addition, some topics in seaweed mariculture and marine pollution will be shown. Finally, monitoring methods of marine plant communities and the actual application of them will be introduced.

3. Keywords

seaweed, kelp, *Sargassum*, plant-animal interactions, grazers, herbivores

4. Goal of study

For students to be able to understand the basic ideas and methods for the study of marine plants.

5. Contents and progress schedule of class

(1) At the beginning: all about WAKAME: *Undaria pinnatifida*
(2) Geographical distribution of marine algae
(3) Vertical distribution of marine algae: intertidal zone
(4) Vertical distribution of marine algae: subtidal zone
(5) Primary production of coastal marine plants
(6) Population analysis of marine plants
(7) Monitoring survey of marine plant communities
(8) Dispersal ability of marine plants
(9) Plant-animal interactions in benthic algae communities
(10) Epiphytic animals and tsunami impacts
(11) Grazing snails
(12) Field experiments
(13) Mariculture
(14) Pollution
(15) Session review

6. Preparation

7. Record and evaluation method

Attendance rates and test scores will be recorded and evaluated.

8. Textbook and references

Handouts will be available at the beginning of each lecture.

9. Self study

Review is required.

10. Practical business

11. In addition

Office phone number: 022-757-4152
Mail address: masakazu.aoki.e6@tohoku.ac.jp

Subject	Marine Product Technology （水産利用学）	Day/Period	3rd Quarter Wed./1st-2nd	Object	AMB
Instructor (Post)	T. Nakano (Assoc. Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS350E			Language Used in Course	English

1. Class subject

The biochemical characteristics and effective utilization of marine bioresources

2. Object and summary of class

The biochemical characteristics of marine organisms as foodstuffs will be explained. The attendees are supposed to understand the principle of seafood production and the processing methods. Accurate knowledge of the hygienic control of fish and shellfish will also be dealt to understand the roles of marine organisms as resources for food. The functions of seafood for human health and the characteristics of seafood for medicinal and industrial materials will be also discussed.

3. Keywords

Food preservation, Freezing and thawing techniques, Postmortem changes of fish and shellfish

4. Goal of study

To be able to understand the principals and methods of food processing, preservation and the control of seafood qualities and to get the knowledge for the effective utilization of marine resources.

5. Contents and progress schedule of class

1 Marine resources for food
2 Characteristics and variation of seafood
3 Nutritional aspects of seafood
4 Processing principals of typical seafood
5 Food poisonings related to seafood
6 Seafood allergy
7 Health-promoting functions of the substances from aquatic organisms
8 Biochemical substances from marine organisms for medicinal and industrial materials
9 Control of muscle protein quality
10 Report writing
11 Term-end exam

6. Preparation

Review the contents of the lectures on Marine Biochemistry

7. Record end evaluation method

The final grade will be calculated based on the mid-term reports (40%) and term-end examination (60%).

8. Textbook and references

Handbook of Marine Natural Products vol.1, vol.2 (Fattorusso, E. et al., ed.) Springer (2012)
Seafood Processing Technology, Quality and Safety (Bosiaris, I.S. ed) Wiley Blackwell (2014)
Food Physics Physical Properties-Measurement and Applications (Figura, L.O. and Teixeira, A.A. ed.) Springer (2007)
Assessment and management of seafood safety and quality Current practices and emerging issues ((Ryder, J., Iddya, K. and Ababouch, L. ed.) FAP Fisheries and Aquaculture Technical Paper 574 (2014)

9. Self study

Refer to the websites related to the topics and also to the related papers.

10. Practical business

11. In addition

Subject	Seafood management （水産食品管理学）	Day/Period	1st quarter Wed./1st~2nd	Object	AMB
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	7
Subject Numbering	ABS-APS351E			Language Used in Course	English

1. Class subject: **Seafood Management.**

2. Object and summary of class: This dynamic course, the contents of which keep changing with fluctuating fisheries resources, instructs on the features of seafood quality and its management with regards to maintaining the safety of seafood.

3. Keywords: Hygiene, HACCP, diseases, food safety, pandemic, disasters, aquaculture, legal and international issues, traceability, sustainability Blue Economy

4. Goal of study: Develop a solid understanding of methods for ensuring quality and hygiene management of seafood at each step, from harvest to the consumer's table. Describe the features of seafood quality. State the methods of maintaining quality in terms of safety. State relevant regulations and public laws for maintaining seafood quality and safety. Describe the essential points of quality management under the HACCP system, and necessity of the FERAT system.

5. Course contents and class schedule.
(1-2). Introduction. Seafood traceability, sustainability, Blue Economy. Seafood production and processing. FERAT: Fisheries Emergency Rapid Assessment Tool. Fisheries in light of natural disasters and pandemics.
(3-4). Chemistry: Components of seafood affecting color, taste and smell. Harmful chemical (e.g., histamine, etc.) and physical substances (foreign objects) affecting food safety.
(5-6). Harmful biological substances (1) Parasites. Bacterial & fungal infections, listeriosis, etc. Preservation of seafood products: Principles and methods. Fundamentals of hygienic practices.
(7-8). Ecology of Wild-caught and Aquaculture Fisheries. Students produce an outline of his/her selected target seafood species for final project
(9-10). Seafood management (1): Seafood handling regulations, legislation and public laws on seafood hygiene. Basic seafood handling: visit to Ishinomaki Fish Landing and Market* or Sendai City Fish Market. *
(11-12). Seafood management (2): Prerequisites to HACCP (Hazard Analysis and Critical Control Point). Seafood management (3): The HACCP system. Visit to food processing company. *
(13-14). Class debate on sustainable options to replace vital but unsustainable fisheries
(15). Final Presentations. Final Report Examination.
*In person or virtual.

6. Preparation: All students should complete weekly reading and writing assignments prior to each class. By identifying areas of difficulty, each student should aim to improve understanding of the course content.

7. Record end evaluation method: Attendance and participation during lectures (25%); Reports/quizzes and end-of-term examination (75%)

8. Textbook and references: Primary reading(s) (students can access all main material online):
Secondary Readings: FAO, Fisheries and Aquaculture Department (various publications) http://www.fao.org/fishery/publications/en ; Food and Agriculture Organization of the United Nations (2020) http://www.fao.org/3/a-i5555e.pdf ; US FDA HACCP Principles & Application Guidelines https://www.fda.gov/food/hazard-analysis-critical-control-point-haccp/haccp-principles-application-guidelines Seafood Health Facts by Seagrant Delaware: https://www.seafoodhealthfacts.org/ ; Fish and Fishery Products Hazards and Controls Guidance: https://www.fda.gov/media/80288/download ; Reference texts: Venugopal, V. (2006). Seafood processing. (Taylor & Francis). Hemminger (2000). Food safety: a guide to what you really need to know. (Blackwell). ISBN 978-0-8138-2482-6. McElhatton, A. & Marsall, R.J. (2007). Food safety. A practical and case study approach. (Springer). Boziaris, IS. (2014). Seafood Processing: Technology, Quality and Safety (IFST Advances in Food Science). ISBN-13: 978-1118346211.

9. Self-study: Weekly reports must be written by students in their own words. Reports will be assessed for their completeness, accuracy and unique writing style. Students will write in the context of demonstrating clearly what they have learned during lectures and readings assignments.

10. Practical business

11. In addition: Any questions should be addressed to the lecturer directly during or after lectures, or during office hours. ames.cheryl.lynn.a1@tohoku.ac.jp *The class will participate in one off-campus practical excursion as time and schedules permit.

Subject	Planktology（プランクトン学）	Day/Period	2nd Quarter Wed./1st~2nd	Object	AMB
Instructor (Post)	G. Nishitani (Associate Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS252E			Language Used in Course	English

1. Class subject

Systematics and biology of marine plankton

2. Object and summary of class

An introduction to systematics, physiology, and ecology of marine plankton

3. Keywords

Diatom, dinoflagellate, ciliate, copepod, krill, food chain, microbial food web, vertical migration

4. Goal of study

Understanding structure and role of plankton community in marine ecosystem

5. Contents and progress schedule of class

Marine ecological division (1)
Classification of marine plankton (1)
Characteristics of phytoplankton and zooplankton (2)
Food chain and food web in marine plankton (1)
Primary production by marine phytoplankton (1)
Material circulation (carbon and nitrogen cycles) (2)
Ecology and application of useful phytoplankton (2)
Ecology and biology of harmful phytoplankton (2)
Current topics in marine plankton (2)
Examination

6. Preparation

Basic knowledge of biology and ecology, basic understanding of marine ecosystem

7. Record and evaluation method

Presence/absence evaluation & examination

8. Textbook and references

Biological Oceanography: An Introduction, second edition
Lalli and Parsons, 1997, ELSEVIER Butterworth-Heinemann

9. Self study

10. Practical business

11. In addition

Contact email address: ni5@tohoku.ac.jp

Subject	Marine Coastal Ecology (沿岸環境学)	Day/Period	1st quarter Fri./1st-2nd	Object	AMB
Instructor (Post)	Toyonobu Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	5
Subject Numbering	ABS-APS353E			Language Used in Course	English

1. Class subject

The structure and functioning of marine coastal ecosystems and the impacts of human activities on them.

2. Object and summary of class

This class introduces the fundamentals of marine biology by examining the vibrant life in the oceans with particular reference to the coastal ecosystems. Students will study a range of coastal habitats including shelf seas, coral reefs, mangroves, estuaries and various shore types. This class covers a diverse set of topics ranging from structure and functioning of different coastal ecosystems, through adaptations of organisms for their particular living conditions, to issues relating to the sustainable management of marine coastal resources.

3. Keywords

marine coastal ecosystems, community ecology, biogeography, conservation, anthropogenic influences, sustainable resource management

4. Goal of study

Students are expected to enhance their skills in marine ecological research methods, reading scientific articles, critical thinking, communication and scientific writing.

5. Contents and progress schedule of class:

1. Introduction
2. An Introduction to Marine and Coastal Ecosystems: A Global Perspective
3. Estuaries and Muddy, Sandy & Rocky Shores
4. Seagrass Meadows and Kelp Forests
5. Mangroves and Coral reefs
6. Coastal Fisheries and Aquaculture
7. Issues Surrounding Anthropogenic Impacts and Marine Coastal Management
8. Essay Writing Skills Session
9. Case Studies in the Onagawa Bay Coastal Ecosystem: (I) Physical Components
10. Case Studies in the Onagawa Bay Coastal Ecosystem: (II) Biological Components
11. Case Studies in the Onagawa Bay Coastal Ecosystem: (III) Anthropogenic Components
12. Case Studies in the Onagawa Bay Coastal Ecosystem: (IV) Socio-Ecological System Dynamics
13. Revision Session
14. Final Exam
15. Final Exam

6. Preparation

None

7. Record end evaluation method

Attendance: 10 %

Essay writing: 30 % (Review essay on contemporary topic relating to marine and coastal management (~1500 words))

Final Exam: 60 % (The exam will consist of essay style questions. You will be asked to attempt 2 questions from a choice of 5 questions (2 hours duration))

8. Textbook and references

There is no dedicated textbook for this class. A list of key references will be provided in each lecture.

9. Self study

None

10. In addition

Contact e-mail address: toyonobu.fujii.a8@tohoku.ac.jp

Subject	Introduction to Fisheries Science (水産科学概論)	Day/Period	Fri./2nd	Object	AMB/JYPE
Instructor (Post)	M. Ikeda (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	2nd-year & JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	4
Subject Numbering	ABS-APS255E			Language Used in Course	English

1. Class subject

Introduction to Fisheries Science

2. Object and summary of class

This course provides an overview of fisheries science. Students will learn the fundamentals of fisheries science as it relates broadly to marine biology, from molecules to ecosystems.

3. Keywords

Fisheries science, fundamentals, overview

4. Goal of study

The goal is to understand the fundamentals of fisheries science from ecology, physiology, genetics, molecular biology and evolution, and to appreciate fisheries science as it relates to applied marine biology.

5. Contents and progress schedule of class

Topics on marine ecology and oceanography

1. “The ecology of floating seaweeds” (M. Aoki)
2. “Distributional pattern of seaweeds” (H. Suzuki)
3. “How to know the fish age” (S. Katayama)
4. “How to know the fish migration” (S. Katayama)
5. “Benthos adapted to marine environments” (W. Sato-Okoshi)
6. "Coastal ecosystem dynamics and fisheries resources" (T. Fujii)
7. “Plankton in the ocean” (G. Nishitani)

Topics on physiology, biochemistry and genetics of aquatic organisms

8. “Immunity in marine invertebrates” (T. Unuma)
9. “Manipulation of reproduction in bivalve mollusks” (T. Unuma)
10. “Food chemistry of fish and shellfish” (T. Nakano)
11. “Probiotics and bioactive substances in fish" (T. Nakano)
12. “Genetic conservation and sustainable use of resources in aquatic organisms” (M. Nakajima)
13. “Biological sequence comparison methods” (Y. Sakai)
14. "Evolution and fisheries resources" (M. Ikeda)
15. “Molecular phylogenetics: Tools and applications” (C. Ames)

6. Preparation

Refer to recent topics in each field.

7. Record end evaluation method

Attendance and paper. Papers in which the contents of each lecture are organized should be directly submitted to the “Classroom” by the next lecture. The final report should be submitted within a week of the final lecture.

8. Textbook and references

No textbook. References (books, articles, videos) will be provided

9. Self-study

Summarize the content of each class promptly.

10. Practical business

11. In addition

Questions, comments, and requests should be sent to the representative instructor,
Prof. Ikeda: minoru.ikeda.a6@tohoku.ac.jp

Subject	Practical Training (実地研修)	Day/Period	Intensive Course	Object	AMB
Instructor (Post)	M. Ikeda (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	6
Subject Numbering	ABS-APS456E			Language Used in Course	English

1. Class subject

Practical training at the points of fishery production and research

2. Object and summary of class

This course provides the tours at the point of fishery production and research.
Students will learn fisheries science practically.

3. Keywords

Field trip, investigative tour

4. Goal of study

The goal is to increase awareness of students to learn fisheries science.

5. Contents and progress schedule of class

This course provides the practical tours as below:
1. Aquaculture facility
2. Research institute of fishery
3. Seafood company
4. Fish market
5. Wildlife sanctuary etc.

6. Preparation

Collect information before starting each tour.

7. Record and evaluation method

Attendance and report.
The report should be submitted by the designated deadlines.

8. Textbook and references

No textbook. Reference books will be introduced by each professor.

9. Self study

Refer to related books in the library after each tour.

10. Practical business

11. In addition

Questions, comments, and requests are welcome.

Send them to the representative instructor, Prof. Ikeda: minoru.ikeda.a6@tohoku.ac.jp

Subject	Marine Biology（海洋生物学）	Day/Period	4th quarter Thu./1st~2nd	Object	AMB
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	4
Subject Numbering	ABS-APS257E			Language Used in Course	English

1. Class subject: Marine Biology: Systematics, biodiversity, phylogenetics, habitats and ecological niches of marine organisms.

2. Object and summary of class: Survey the different types of organisms in the sea in order to develop a fundamental understanding of marine biodiversity. Assess the effects of natural and anthropogenic disturbances on marine ecosystems and their inhabitants. Develop an understanding of Metazoa evolution and molecular phylogenetics.

3. Keywords: Marine Biodiversity, Plankton, Evolution, Phylogenetics, Systematics, Ecology

4. Goal of study: Develop an understanding of the main categories of marine animals (Metazoa), become familiar with the basic body plans and distinguishing features against the background of evolution, ecology and systematics.

5. Contents and progress schedule of class
Each lecture will provide an overview of the fundamentals of different groups of marine organisms. Students will gain an understanding of the field of systematics and dynamics of molecular phylogenetics. Practical components may be incorporated through “virtual” class excursions to public museums and aquariums.
(1-2). Introduction. Marine organisms and the food web; producers, consumers, detritivores; the major groups & their spatial and bathymetric distributions; solar-dependent and solar-independent (hydrothermal) systems.
(3-4). Marine animal (Metazoa) taxonomy, systematics and phylogenetics. Basic body plans (diploblasts versus triploblasts) and evo-devo (evolution of development). Evolution of the nervous system.
(5-6). Marine Invertebrates (non-bilaterians). Zooplanktonic forms.
(7-8). Bilateria. Deuterostomia and Protostomia. Chordata. Chaetognath, Urochordata, Cephalochordate. Hemichordate.
(9-10). Mid-term report and exam. Basics of fish systematics. Gnathostomes. Agnatha.
(11-12). Basics of fish systematics. Chondrichthyes. Osteichthyes.
(13-14). Marine mammals. Systematics. Comparison with closest relatives
(15). Final report, presentations and exam.

6. Preparation: All students should complete weekly reading and writing assignments prior to each class. By identifying areas of difficulty, each student should aim to improve understanding of the course content.

7. Record and evaluation method: Attendance and participation during lectures (25%); Reports/quizzes and end-of-term examination (75%)

8. Textbook and references: Primary reading(s) (students can purchase or borrow a copy from campus library): Morrissey et al. (2018). Introduction to the Biology of Marine Life (Jones & Bartlett Includes Navigate 2 Advantage Access, 11th. ed.) ISBN-13: 978-1-284-09050-5. Secondary reading(s): Levinton, JS (2018). Marine Biology: Function, Biodiversity, Ecology (Oxford University Press 5th. ed.) ISBN-13: 978-0190625276; Helfman, G et al. (2009). The Diversity of Fishes: Biology, Evolution, and Ecology (Wiley-Blackwell, 2nd. ed) ISBN-13: 978-1405124942. Brusca et al. (2016). The Invertebrates: A Synthesis (Sinauer Associates, 3rd. ed) ISBN-13: 978-1605353753.

9. Self-study: There is much to learn about these topics. Students are encouraged to review their lecture notes soon after class. Each lecture will start with a discussion and/quiz of the previous lecture to ensure students have a fundamental grasp of the course content, which is required to pass the quizzes/examinations.

10. Practical business: Student projects will contribute to the Tree of Life project.

11. In addition: Questions should be addressed to the lecturer directly during or after lecture, or during office hours. ames.cheryl.lynn.a1@tohoku.ac.jp *Taxa not covered during this course will be address in the courses *Life & Nature*, *Planktonology* and in *Basic Seminars*.

Subject	Introduction to Resource and Environmental Economics (資源環境経済学概論)	Day/Period	1st Quarter Thur./3rd, 4th	Object	AMB/JYPE
Instructor (Post)	K. Ishii, *et al*. (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd & 4th-year & JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	7&9
Subject Numbering	ABS-APS359E			Language Used in Course	English

1. Class subject

Resource and Environmental Economics

2. Object and summary of class

This class aims to understand the concepts of Resource and Environmental Economics. The teaching staff of agricultural economics will give the lectures weekly.

3. Keywords

Agricultural economics, Remote sensing, Food business, Environmental conservation, Agricultural ethics

4. Goal of study

The goal of this class is to obtain the background knowledge concerning Resource and Environmental Economics as well as the basic principles of Agricultural Economics, Farm Management Science, Remote Sensing and Life Cycle Assessment of Goods.

5. Contents and progress schedule of class

① **Guidance (Head of department)**

Agricultural policy and environmental issues (Prof. Keiichi ISHI)

This lecture will examine trends of agricultural policy integrating environmental problems.

② **Food & Agriculture for Human Society (Prof. Katsuhito FUYUKI)**

Poverty and socio-political unrest have deteriorated human security in developing countries. In this class, I will raise human security issues, especially food security and rural development for poverty alleviation.

③ **Trends of Japanese food consumption and consumer's behavior (Prof. Fusao ITO)**

In this class, recent characteristics of change in Japanese food consumption will be showed. Students will be able to learn some problems of Japanese future food market.

④ **Community farming in Japan (Prof. Tsuyoshi SUMITA)**

Recently, community farming has been established in Japan. In this class, the characteristics and functions of community farming will be explained.

⑤ **Compatibility between conservation of nature and tourism (Assoc. Prof. Tomoko IMOTO)**

With nature tourism, an appropriate balance between conservation and development can lead to economic growth. We explore possible ways to reduce the impact of tourism on nature using land-use classification and economic evaluation of nature.

⑥ **Spatial science in agriculture (Assoc. Prof. Chinatsu YONEZAWA)**

Introduction of remote sensing and geographical information science (GIS) for agricultural application. Spatial thinking is an important and powerful agricultural problem-solving tool.

⑦ **Social Dimensions of Biodiversity Conservation (Assistant Prof. Kota MAMENO)**

This lecture will introduce the importance of social dimensions, specifically economic, to biodiversity and

ecosystem conservation. How to address the social challenge in conservation will also be introduced in the lecture.

⑧ **Slash and Burn Agriculture: Environmental Degradation in India and Africa (Assistant Prof. Keeni MiINAKSHI, Assistant Prof. Eustadius Francis MAGEZI)**
This lecture will cover the introduction and evolution of slash and burn agriculture through time across the world. This will be followed by special emphasis on cases in India and Africa.

6. Preparation
nothing special

7. Record end evaluation method
Attendance to the lectures 50%, reports 50%

8. Textbook and references
Textbook and references will be introduced in class.

9. Self study
nothing special

10. Practical business

11. In addition

Subject	Applied Biological Chemistry (応用生物化学)	Day/Period	1st Quarter Fri./3rd-4th	Object	AMB/JYPE
Instructor (Post)	Professors and Associate Professors of Biochemistry Course	Categories	Specialized Subjects	Preferable Participants	3rd & 4th-year & JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	7&9
Subject Numbering	ABC-AGC261E			Language Used in Course	English

1. Class subject:
Life science for agricultural and industrial applications

2. Object and summary of class:
This class object is to study fundamentals and recent progress in the research fields of molecular biology, cell biology, and physiology with plants, animals, and microbes as well as chemistry of biologically active natural products. More than ten Professors and Associate Professors will give lectures weekly to introduce their specific research fields.

3. Keywords: Biochemistry, Molecular Biology, Chemistry

4. Goal of study
The goal of this class is to obtain the background knowledge concerning life science for agricultural and industrial applications as well as the basic principles of biochemistry and biotechnology.

5. Contents and progress schedule of class

1) **Mineral nutrients of higher plants**
1-1) Definition, classification, and function of nutrients 4/14
1-2) Roles of autophagy in nutrient recycling 4/14
2) **Genome and epigenetics**
2-1) The aging processes associated with genomic and epigenomic alterations 4/21
2-2) Hierarchical organization of the cell nucleus and application of synchrotron light 4/21
3) **Enzymes in pathophysiology and toxicology**
3-1) Enzymes and proteins in natural toxins 4/28
3-2) Proteases in Alzheimer's disease 4/28
4) **Synthesis and application of bioactive natural products**
5-1) Fundamental of natural product chemistry 5/12
5-2) Fundamental of natural product synthesis 5/12
5) Applied microbiology and fermentation technology
4-1) Principles of protein production technology by bacteria 5/19
4-2) Transport processes catalyzed by microbial solute transporters at cell membranes and metabolism 5/19
6) **Molecular basis of nitrogen metabolism in plants**
6-1) Nitrogen uptake and assimilation in plants 5/26
6-2) Transcriptional and post-transcriptional regulations of nitrogen metabolism in plants 5/26
7) **Molecular eukaryotic microbiology**
7-1) Introduction of fermentation 6/2
7-2) Microbial production of enzymes, antibiotics, and recombinant proteins 6/2

6. Preparation: Textbooks and references will be introduced by each instructor.

7. Record end evaluation method : Attendance to the lectures 50%, reports 50%

8. Textbook and references: Textbooks and references will be introduced by each instructor.

9. Self study: Textbooks and references will be introduced by each professor.

10. Practical business

11. In addition
Instructors: Profs. Tomohisa OGAWA, Masahiko HARATA, Keietsu ABE, Hiroyuki ISHIDA, Takahiro SHINTANI;
Associate Profs. Eugene FUTAI, Jun KANEKO, Masaru ENOMOTO, Toshihiko HAYAKAWA

Subject	Current topics of Shellfish Physiology (先端海洋生物生理学)	Day/Period	1st quarter Thu./1st~2nd	Object	AMB
Instructor (Post)	Kazue Nagasawa (Assistant Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	7
Subject Numbering	ABS-APS363E			Language Used in Course	English

1. Class subject

Recent research topics in aquatic animal physiology

2. Object and summary of class

Studies on aquatic animal physiology have contributed to not only aquaculture production, but also fundamental biology. In this course, some recent findings in aquatic animal physiology (mainly germ cell biology and neuroendocrinology) will be introduced.

3. Keywords

Germ cells, Reproduction, Neuropeptides, Fish, Shellfish

4. Goal of study

Learning recent findings, scientific interests with science impact, and further application.

5. Contents and progress schedule of class

1. Guidance & Introduction
2. Germ cell biology in aquatic animals 1 (germ cell classification)
3. Germ cell biology in aquatic animals 2 (germline stem cell)
4. Germ cell biology in aquatic animals 1 (germ cell transplantation 1)
5. Germ cell biology in aquatic animals 2 (germ cell transplantation 2)
6. Neuroendocrinology in aquatic animals 1
7. Neuroendocrinology in aquatic animals 2

6. Preparation

No need.

7. Record end evaluation method

Evaluation is based on class attendance and quiz after each class.

8. Textbook and references

Handouts will be provided.

9. Self study

Review the handouts.

10. Practical business

11. In addition

Students may visit to instructor office or contact by Email (kazue.magasawa.d6@tohoku.ac.jp).

Subject	Current topics of Fish Ecology （先端海洋生物生態学）	Day/Period	2nd quarter Fri./1st ~2nd	Object	AMB
Instructor (Post)	H. Murakami (Assistant Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	7
Subject Numbering	ABS-APS364E			Language Used in Course	English

1. Class subject
Current topics of Fish Ecology

2. Object and summary of class
This course covers the fish ecology and fish biodiversity in the marine ecosystem, using environmental DNA.

3. Keywords
Environmental DNA, Fish Ecology, Climate change, Marine ecosystem

4. Goal of study
Through this course, students will be able to understand fish ecology and the methods for ecological study, environmental DNA in particular.

5. Contents and progress schedule of class
1 Overview of fish ecology
2 The methods for ecological study
3 What is environmental DNA (eDNA)?
4 eDNA metabarcoding for biodiversity monitoring
5 Species-specific methods of eDNA for biomass estimation
6 Application of eDNA for ecosystem conservation
7 Application of eDNA for fisheries management

6. Preparation
No need.

7. Record and evaluation method
Attendance and participation during lectures (10%), assignments (30%), and reports (60%)

8. Textbook and references
Miya, M. (2022). Environmental DNA metabarcoding: a novel method for biodiversity monitoring of marine fish communities. Annual review of marine science, 14, 161-185.

9. Self study
No need.

10. Practical business
No need.

11. In addition
If you have any questions, contact Assistant Prof. Hiroaki Murakami by E-mail (hiroaki.murakami.d2@tohoku.ac.jp) or Prof. Satoshi Katayama by E-mail (satoshi.katayama.c5@tohoku.ac.jp).

Subject	Current topics of Marine Biotechnology （先端海洋生物工学）	Day/Period	3rd quarter Thur./1st~2nd	Object	AMB
Instructor (Post)	H. Yokoi (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	6
Subject Numbering	ABS-APS365E			Language Used in Course	English

1. Class subject
Techniques of molecular biology and marine biotechnology, genome editing

2. Object and summary of class
Students will learn about developmental biology of fish, molecular engineering in fish, and bioinformatics using computer and web sites.

3. Keywords
Fish development, genome, genome editing, positional cloning, bioinformatics

4. Goal of study
Students will understand the basic mechanisms and strategy of genetic engineering and genomics in fish, and bioinformatics necessary for future researches in the fields of marine biotechnology.

5. Contents and progress schedule of class

1: Reverse genetics (Knockout fish, CRISPR/Cas9)
2: Forward genetics (Mutant library, Positional cloning)
3: Other basic techniques essential for fish biotechnology
4: Fish genomes
5: Practical training using computer (BLAST search, Multiple alignment, Phylogenetic tree, Ensembl, PubMed)
6: Larval and metamorphic development
7: Transgenic fish

6. Preparation
TBA (Preparation will be notified at the class)

7. Record end evaluation method
Attendance, participation and test/report

8. Textbook and references
Reference Books:
Gene Cloning & DNA Analysis; An Introduction. By Brown TA. Willey-Blackwell
Recombinant DNA; Genes and Genomics – A Short Course. By Watson JD. W. H. Freeman and Company
Developmental Biology. By Gilbert SF. Sinauer Associates

9. Self-study
Students are recommended to read above textbooks.

10. Practical business
No

11. In addition
Office hour: Questions are accepted after class, or by e-mail.
E-mail address: hayato.yokoi.a4@tohoku.ac.jp

Subject	Current topics in Global Marine Ecology (先端地球海洋生態学)	Day/Period	2nd quarter Fri./3rd~4th	Object	AMB
Instructor (Post)	Toyonobu Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd -year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	7
Subject Numbering	ABS-APS366E			Language Used in Course	English

1. Class subject

The structure and functioning of large marine ecosystems and the impacts of global environmental change on them.

2. Object and summary of class

This class synthesizes the core concepts of marine ecosystem dynamics in relation to global environmental change and human impact. Students will go over a range of large marine habitats including coastal waters, polar regions, open oceans, and deep-sea environments. This class covers a diverse set of topics ranging from structure and functioning of different large marine ecosystems, through adaptations of organisms for their particular living conditions, to issues relating to the sustainable environmental management.

3. Keywords

Marine ecosystems, coastal waters, polar regions, deep-sea environments, community ecology, biogeography, adaptation, conservation, anthropogenic influences, environmental management

4. Goal of study

Students are expected to enhance their skills in marine ecological research methods, reading scientific articles, critical thinking, communication and scientific writing.

5. Contents and progress schedule of class

① An Introduction to Large Marine Ecosystems: A Global Perspective
② Coastal waters
③ Polar regions
④ Deep Sea Environments I
⑤ Deep Sea Environments II
⑥ Issues Surrounding Global Environmental Change and Human Impact on Marine Ecosystems
⑦ Oral Presentation Session

6. Preparation

None

7. Record end evaluation method

Attendance: 10 %
Oral presentation: 30 % (10-minute oral presentations will take place during the final lecture session)
Essay writing: 60 % (Review essay on contemporary topic relating to marine conservation (~1500 words))

8. Textbook and references

There is no dedicated textbook for this class. A list of key references will be provided in each lecture.

9. Self study

None

10. In addition

Contact e-mail address: toyonobu.fujii.a8@tohoku.ac.jp

Subject	Current topics of Coastal Ecology (先端沿岸生態学)	Day/Period	2nd quarter Thu./1st~2nd	Object	AMB
Instructor (Post)	H. Suzuki (Assistant Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	7
Subject Numbering	ABS-APS367E			Language Used in Course	English

1. Class subject

Ecology of temperate reef communities.

2. Object and summary of class

Some current topics in ecology of temperate reef communities will be introduced.

3. Keywords

seaweed, kelp bed, canopy-forming algae, turf algae, herbivore, sea urchin

4. Goal of study

To learn the factors affecting the complex networks in temperate reef communities.

5. Contents and progress schedule of class

1) Introduction
2) Introduction of recently published papers-1
3) Introduction of recently published papers-2
4) Introduction of recently published papers-3
5) Introduction of recently published papers-4
6) Introduction of recently published papers-5
7) Review

6. Preparation

Study relevant papers in advance.

7. Record end evaluation method

Report and attendance

8. Textbook and references

Recent papers are given within class.

9. Self study

Review is required.

10. Practical business

11. In addition

Office phone number: 022-757-4151
Mail address: haruka.suzuki.a6@tohoku.ac.jp

Subject	Current topics of Fish Molecular Biology（先端海洋分子生物学）	Day/Period	3rd quarter Thur./1st~2nd	Object	AMB
Instructor (Post)	H. Yokoi (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	6
Subject Numbering	ABS-APS368E			Language Used in Course	English

1. Class subject

Fish Molecular Biology -- Fish as a Model System

2. Object and summary of class

In recent decades, fish became more and more used as excellent model system to investigate fundamental questions not only in aquaculture, but also in basic biology, medicine, and environmental science. This class will discuss why they are favored and how the model system developed, by showing examples of fish and other animals used as experimental model system.

3. Keywords

Experimental model animal, genetics, developmental biology, non-conventional model animal

4. Goal of study

Students will understand the potential of fish and the reason why fish are used as an excellent experimental model in various fields. Some of learned strategies would be helpful for students to design their own research projects in any fields.

5. Contents and progress schedule of class

1. Introduction: Molecular biology as a tool for the research in biology and medicine
2. Advantage of nematode and fly as model system: development, genetics and mutagenesis
3. Advantage of fish as a model system: developmental genetics, genomics and mutagenesis
4. Advantage of frog and chicken as model system: development and micro-surgery
5. Advantage of mouse as a model system: development and stem cell technology
6. Advantage of using multiple model system: comparative approach and evolutionary biology
7. Experimental model system: past, present and future
8. Summary and final exam

6. Preparation

Review the previous classes. Please feel free to ask during the class, if you have any ambiguous points.

7. Record end evaluation method

Attendance, participation, quiz and final exam.

8. Textbook and references

Developmental biology (Scott F Gilbert)
Others will be introduced in the class.

9. Self study

Take a look at the Nature or Science magazine to see how model organisms are used in the latest biological research, and read some of the articles if you find them interesting.

10. Practical business

11. In addition

Office hours, 10:00 to 18:00, Monday to Friday, please make an appointment beforehand.
Contact, hayokoi@tohoku.ac.jp

Subject	Current topics of Plankton Biology (先端プランクトン学)	Day/Period	1st quarter Tue./1st~2nd	Object	AMB
Instructor (Post)	G. Nishitani (Asso. Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	7
Subject Numbering	ABS-APS369E			Language Used in Course	English

1. Class subject
Molecular Ecology and utilization of plankton

2. Object and summary of class
Plankton is a very small organism and its morphology cannot be observed without using a microscope. However, plankton is one of the most important components and significantly contributes to the marine ecosystem. In this class, several researches on utilization of plankton and its ecology using the latest molecular techniques will be introduced.

3. Keywords
Phytoplankton, Useful and harmful species, Molecular ecology

4. Goal of study
Students will learn that molecular methods are effective and are important tools for plankton research. Moreover, students will also understand the utilization of plankton for industry and human health.

5. Contents and progress schedule of class

Useful microalgae (phytoplankton) (2)
Harmful microalgae (2)
Research introduction (2)
Examination

6. Preparation
Understand an outline of each topic in advance

7. Record end evaluation method
Attendance and examination

8. Textbook and references
All handouts will be given within class

9. Self study

10. In addition
E-mail: ni5@tohoku.ac.jp

Subject	Multidisciplinary Internship （学際インターンシップ）	Day/Period	Intensive course	Object	AMB
Instructor (Post)	Profs. Katayama S., Ochiai Y, Fujii Y. (Faculty of Agriculture)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	1
				Semester	5
Subject Numbering	ABS-OAR970E			Language Used in Course	English

1. Class subject
Introduction of Japanese fisheries and aquaculture productions and seafood processing

2. Object and summary of class
Japan is well-known for fisheries and aquaculture production. The objective of the class is for international students to gain an understanding of fisheries production systems. Students taking this course will take interests in the traditional and recent art and technologies of fisheries, aquaculture, distributing, processing and eating fish and shellfish in Japan.

3. Keywords

4. Goal of study
Students will

- learn about the distribution system for raw marine organisms landed at the fish market.
- understand operations of the seafood processing industry.
- discover Japanese excellent techniques of fish aquaculture and its seedling production.

5. Contents and progress schedule of class

This class will consist of two site visits. Each half-day visit will take place at a fishery site in Miyagi Prefecture. (Two field trips on Saturdays of June.)

1. The tour to a factory of a representative company of sasa-kama (one of the delicacies in Sendai area) is scheduled to learn about the processing steps of kamaboko (salt-ground and heated fish paste products).

2. This field trip to the community in Matsushima where is renowned for a wealth of marine resources (oysters and seaweed aquaculture) will focus on the aquaculture industry, paying particular attention to the community notions of sustainability, in an attempt to understand some of the challenges faced by the coastal community amid climate change and disaster recovery.

– Please select the two topics that you are most interested in and submit your impressions as a report by Aug. 12th.

6. Preparation

7. Record end evaluation method
Attendance and reports

8. Textbook and references

9. Self study

10. In addition
skata@tohoku.ac.jp (Prof. Satoshi KATAYAMA)