Applied Marine Biology (AMB) Course Timetable & Syllabus 2025~2026

(Updated on April 1, 2025)

Faculty of Agriculture Tohoku University

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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 student affairs office of the Faculty of Agriculture (email: agr-kyom@grp.tohoku.ac.jp).

Timetable 2025 授業時間割表 2025

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
	後期 Fall Set	Mon.			(化学 B) (Chemistry B)	Basic Japanese I	
		Tues.		生命と自然 Life and Nature	物理学 A Physics A	解析学概論 Foundations of Calculus	Basic Japanese I
2n		Wed.	経済と社会 Economy and Society	化学A Chemistry A		(Laboratory Tour)	
d Semes		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	
ster	nester	Fri.	歷史学 History	生理•生態学概論 Introduction to Physiology and Ecology 【Kawauchi C204】	Basic Japanese I	学問論 Introduction of Academic Learning	
		Intensive course		海外	短期研修 A Study-abroad Prog	aram A	
		Mon.	生命科学 C Biology C				
	前間	Tues.	Basic Japanese II	生命科学 B Biology B	(解析学 B) (Calculus B)	線形代数学概論 Foundations of Linear Algebra	
3rd	Spi	Wed.	化学 C Chemistry C	Basic Japanese II	(物理学 C) (Physics C)		
Seme	ing S	Thur.		(物理学 B) (Physics B)	自然科学 Introductory Scie	総合実験 ence Experiments	Basic Japanese II
ester	semester	Fri.	水圈無脊 Aquatic Invert 【Lecture Roon	椎動物学 ebrate Biology a 8] <i>1st Quarter</i>	現代における農と農学 Modern Agriculture and Agricultural Science	陸圏・木圏環境コミュニケーション論 Introduction to Aquatic Production / Introduction to Natural and Agricultural Production	
		Intensive		臨海実習	Practice on Marine Bio-resourc	es Science	
		Mon.			水産遺(Fish Genetics and 【Lecture Room	云育種学 l Breeding science a 8】 <i>3rd Quarter</i>	
4	後期	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
4th S	Fal	Wed.	Intermediate Japanese	Intermediate Japanese			
emester	l Semeste	Thur.	海洋生 Marine 【Lecture Room	生物学 Biology 8】 <i>4th Quarter</i>			
	r	Fri.		水産科学概論 Introduction to Fisheries Science 【Lecture Room 8】	スポーツ A Sports A		
		Intensive course					
			水圈植物学 Applie 【Lecture Room	ed Aquatic Botany 18] 1st Quarter			
		Mon.	資源動物生態学 Anima 【Lecture Room	Ecology and Ethology 8] 2nd Quarter			学際インターンシップ Multidisciplinary Internship 2nd Quarter
		Tues.	水圈植物生態学 Aq 【Lecture Room 水産化学 Marin 【Lecture Room	uatic Plant Ecology a 8] <i>1st Quarter</i> the Biochemistry 8] <i>2nd Quarter</i>			
5th S	前期 Spri	Wed.	ゴランカトング	科学論文講読 I Reading of Scientific Paper I 【Each Laboratory】 <i>Ist Quarter</i>	学生実験 I・基礎化学 Fishery Science Pract Practice/Basic F	実験・基礎生物学実験 ice I/Basic Chemistry, Biology Practice	
eme	s Bu		【Lecture Room	8] 2nd Quarter	[Student I	Laboratory]	
ster	emester	Thur.		科学論文講読 II Reading of Scientific Paper II 【Each Laboratory】 <i>Ist Quarter</i>			
			資源生物生理学 Phys Reso 【Lecture Room	iology of Biological urces 9] 2nd Quarter			
		Fri.	沿岸環境学 Marine 【Lecture Room	e Coastal Ecology 10] <i>Ist Quarter</i>			
		Tet	【Lecture Room	10] 2nd Quarter			
		intensive course		生産フィール	ド実習 I Field Practice of Marin	ne Production I	

			8:50~10:20	10:30~12:00	13:00~14:30	14:40~16:10	16:20~17:50
		Mon.	水産資源生態学 Fisherie 【Lecture Room 沿岸生物学 Applied Genet	8 Biology and Ecology 8] <i>3rd Quarter</i> ics in Aquatic Organisms 9] <i>4th Quarter</i>			
6	後期 Fall Semester	Tues.	生物生産情 An Introduction to Bioindus 【Lecture Room	9】 4th Quarter 報処理概論 trial Information Processing 9】 3rd Quarter	学生実験 Ⅱ・ 基礎化学		
th Semes		Wed.	水産利用学 Marine Produc 【Lecture Room	et Technology 9] <i>3rd Quarter</i>	Fishery Science Practi Practice/Basic E [Student L	ice II/Basic Chemistry, Biology, Practice aboratory]	
ster		Thur.	先端海洋生物工学 / Current topics of Ma Current topics of Fis Lecture Room	先端海洋分子生物学 rine Biotechnology/ 1 Molecular Biology 8】 <i>3rd Quarter</i>			
		Fri.	生物海洋学 Biologi 【Lecture Room	cal Oceanography 9] <i>3rd Quarter</i>			
		Intensive course					
		Mon.					
		Tues.	先端プラ: Current topics of 【Lecture Room	/クトン学 Plankton Biology 9】 1st <i>Quarter</i>			
7th Seme	前期 Spring S	Wed.	水産食品 Seafood M 【Lecture Room <u>先端沿岸生態学(A</u>	a管理学 anagement 8] <i>1st Quarter</i> vailable in 2026)			
			Current topics of Lecture Room	Coastal Ecology 9] 2nd Ouarter			
		Thur	先端海洋生物生理学 Current topics of Shellfish Physiology 【Lecture Room 9】 <i>1st Quarter</i>		資源環境維 Introduction to Resource an 【Lecture Roon	至済学概論 d Environmental Economics n 9] <i>1st Quarter</i>	
ter	mester	Thui.	先端海洋4 Current topics o 【Lecture Room 1	=物生態学 of Fish Ecology 0】 <i>2nd Quarter</i>			
		Fri			応用生物化学 Applied Bi 【Lecture Room	ological Chemistry Science 9] <i>1st Quarter</i>	
		rn.			先端地球 Current Topics in Gl 【Lecture Room		
		Intensive course		生産フィールド実習	II Field Practice of Marin	ne Production II	
8ti	14	Mon.					
h Se	後 期	to Wed.			卒業論文		
mest	Fal	Thur.			Graduation Thesis		
er	1	Fri.					
		Mon.			卒業論文 Croduction Theorie		
	前期	Tues. Wed			Graduation Thesis		
9th Seme	Spring S	Thur.	卒業 Graduatic	論文 on Thesis	卒業論文 Graduation Thesis		
ster	emeste	Fri.			応用生物化学 Applied Bic 【Lecture Room		
		Intensive course					

The following subjects are available in 2026. 以下の科目は 2026 年度に開講します。

先端沿岸生態学 Current topics of Coastal Ecology, 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

				Cre	edits	
Subjects	Instructors	year	Categories	Obligatory	Elective	Reference
Introduction to Academic Learning 学問論	T. Koike	1 st	Foundations Navigating Academia	2		
History 歷史学	G. Clinton	1 st	Foundations Humanities	2		
Economy and Society 経済と社会	J. Ryan	1 st	Foundations Social Sciences	2		
Foundations of Linear Algebra 線形代数学概論	Y. Chen	2 nd	Foundations Natural Sciences	2		
Foundations of Calculus 解析学概論	Y. Chen	1 st	Foundations Natural Sciences	2		
Life and Nature 生命と自然	S. Katayama	1 st	Foundations Transdisciplinary Subjects	2		国費学生必修
Introductory Science Experiments 自然科学総合実験	I. Nakamura et al.	2 nd	Foundations Transdisciplinary Subjects	2		
Sports A スポーツA		2 nd	Foundations Transdisciplinary Subjects Health Sciences	1		
Health 体と健康	T. MURATSUBAKI	2 nd	Foundations Transdisciplinary Subjects Health Sciences	2		
Information and Data Literacy 情報とデータの基礎	Mohammad Samy Baladram	1 st	Advanced Subjects Information Science and Technology Education	2		
Understanding International Issues 国際事情	TBA	1 st	Advanced Subjects International Education		2	
PBL in Global Issues 国際教養PBL	M. TAKAHASHI	1 st	Advanced Subjects International Education		2	
Special Topics on Global Issues 国際教養特定課題	C. SUEMATSU/ Y. WATABE	1 st	Advanced Subjects International Education		2	
Understanding Culture 文化理解	T. FUJIMOTO	1 st	Advanced Subjects International Education		2	
Exploring Culture and Society 文化と社会の探求	Y. SAKAMOTO/ N. KOJIMA/ M. MUSHIAKE	1 st	Advanced Subjects International Education		2	
Multicultural Communication 多文化間コミュニケーション	HUJA BACKLEY	1 st	Advanced Subjects International Education		2	
PBL in Multicultural Environment 多文化PBL	М. КОЈІМА	1 st	Advanced Subjects International Education		2	
Special Topics on Multicultural Society 多文化特定課題	TBA	1 st	Advanced Subjects International Education		2	
Global Seminar グローバル学習	TBA	1 st	Advanced Subjects International Education		2	
Global Career キャリア関連学習	K. TAKEUCHI/ Y. YONEZAWA	1 st	Advanced Subjects International Education		2	
Global Leadership Development through PBL グローバルPBL	K. SUEMATSU/ Y. WATABE/ Y. WATANABE	1 st	Advanced Subjects International Education		2	
Special Topics on Global Leadership グローバル特定課題	K. YAMAMOTO/ M. TASHIRO	1 st	Advanced Subjects International Education		2	
Study-abroad Semester 海外長期研修	TBA	1 st	Advanced Subjects International Education		1~6	
Study-abroad Program A 海外短期研修(基礎A)	DAHAN Xavier	1 st	Advanced Subjects International Education		1~2	
Special Lecture of Career Education キャリア教育特別講義	T. Koike	2 nd	Advanced Subjects Career Education		2	国費学生必修
Current Topics カレント・トピックス	ТВА	1 st	Advanced Subjects Current Topics		1~2	
Basic Japanese 1	N. Sugaya et al.	1 st	Languages Japanese	4		
Basic Japanese 2	N. Sugaya et al.	1 st	Languages Japanese	3		
Intermediate Japanese	A. Uchiyama et al.	2 nd	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	DAHAN Xavier	2 nd	Basics of Discipline Basics of Mathematics	2		
Physics A 物理学A	T.Koike	1 st	Basics of Discipline Basics of Physics	2		
Chemistry A 化学A	ТВА	1 st	Basics of Discipline Basics of Chemistry	2		
Chemistry C 化学C	ТВА	1 st	Basics of Discipline Basics of Chemistry	2		
Biology A 生命科学A	TBA	1 st	Basics of Discipline Basics of Biology	2		
Biology B 生命科学B	T. Ichinose	1 st	Basics of Discipline Basics of Biology	2		
Biology C 生命科学C	K. Inaba	1 st	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	1 st	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	1 st	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.	1 st	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	1 st	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	1 st	Specialized Subjects Faculty Common Subjects	2		
An Introduction to Bioindustrial Information Processing 生物生産情報処理概論	Y. Sakai	3 rd	Specialized Subjects Faculty Common Subjects		2	
Reading of Scientific Paper I 科学論文講読I	T. Unuma et al.	2 nd	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	T. Unuma et al.	2 nd	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	1 st	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	4 th	Specialized Subjects Faculty Common Subjects	10		
Physiology of Biological Resources 資源生物生理学	Cheryl Ames	2 nd	Specialized Subjects Academic Common Subject	2		
Animal Ecology and Ethology 資源動物生態学	S. Katayama	2 nd	Specialized Subjects Academic Common Subject		2	
Fish Genetics and Breeding science 水産遺伝育種学	M. Nakajima	2 nd	Specialized Subjects Academic Common Subject		2	
Field Practice of Marine Production I 生産フィールド実習 I	M. Ikeda	2 nd	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	3 rd	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	T. Unuma et al.	2 rd	Specialized Subjects Academic Common Subject	4		Joint class 日本人と共修
Fishery Science Practice II 学生実験Ⅱ	T. Unuma et al.	3 rd	Specialized Subjects Academic Common Subject	6		Joint class 日本人と共修
Basic Chemistry, Practice 基礎化学実験	T. Unuma et al.	2 nd 3 rd	Specialized Subjects Academic Common Subject	1		Joint class 日本人と共修
Basic Biology, Practice 基礎生物学実験	T. Unuma et al.	2 nd 3 rd	Specialized Subjects Academic Common Subject	1		Joint class 日本人と共修
Aquacultural Biology 水産増殖学	T. Unuma	2 rd	Specialized Subjects Academic group Common Subject	2		
Fisheries Biology and Ecology 水産資源生態学	S. Katayama	3 rd	Specialized Subjects Academic group Common Subject	2		
Aquatic Plant Ecology 水圈植物生態学	M. Aoki	2 rd	Specialized Subjects Academic group Common Subject	2		
Marine Biochemistry 水産化学	T. Nakano	2 nd	Specialized Subjects Academic group Common Subject	2		
Biological Oceanography 生物海洋学	W. Sato-Okoshi	3 rd	Specialized Subjects Academic group Common Subject	2		
Applied Genetics in Aquatic Organisms 沿岸生物学	M. Ikeda	3 rd	Specialized Subjects Academic group Common Subject	2		
Aquatic Invertebrate Biology 水圈無脊椎動物学	K. Nagasawa	1 st	Specialized Subjects Technical field Subjects		2	

Applied Aquatic Botany 水圈植物学	M. Aoki	2 rd	Specialized Subjects Technical field Subjects		2	
Marine Product Technology 水産利用学	T. Nakano	3 rd	Specialized Subjects Technical field Subjects		2	
Seafood Management 水産食品管理学	Cheryl Ames	3 rd	Specialized Subjects Technical field Subjects		2	
Planktology プランクトン学	G. Nishitani	2 nd	Specialized Subjects Technical field Subjects		2	
Marine Coastal Ecology 沿岸環境学(2023.10入学者より)	T. Fujii	2 nd	Specialized Subjects Technical field Subjects		2	Previous subject title: (Integrate Aquatic Biology 水族生理生態遺伝学)
Marine Applied Biochemistry 海洋応用生物化学	M. Nishikawa	3^{rd} or 4^{th}	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	T. Unuma et al	2 nd	Specialized Subjects Current subject	2		
Practical Training 実地研修	T. Unuma et al.	3 rd	Specialized Subjects Current subject	1		
Marine Biology 海洋生物学	Cheryl Ames	2 nd	Specialized Subjects Current subject	2		
Current topics of Agricultural Plant Science 先端植物生命科学	植物生命科学コース代表	3^{rd} or 4^{th}	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	3 rd or 4 th	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	動物生命科学コース代表	3 rd or 4 th	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	3 rd or 4 th	Specialized Subjects Current subject	2		Every other year 隔年開講
Food and Chemistry 食糧と化学	生命化学コース代表	3^{rd} or 4^{th}	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	3 rd	Specialized Subjects Current subject		1	
Current topics of Fish Ecology 先端海洋生物生態学	H. Murakami	3 rd	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)	H. Yokoi	3 rd	Specialized Subjects Current subject		1	Previous subject title: (Current topics of Fish Biochemistry 先端海洋生物化学)
Current topics in Global Marine Ecology 先端地球海洋生態学(2023.10入学者より)	T. Fujii	3 rd	Specialized Subjects Current subject		1	Previous subject title: (Current topics of Genetics in Aquatic Organisms 先端海洋生物遺伝学)
Current topics of Coastal Ecology 先端沿岸生態学	H. Suzuki	3 rd	Specialized Subjects Current subject		1	available in 2026
Current topics of Fish Molecular Biology 先端海洋分子生物学	H. Yokoi	3 rd	Specialized Subjects Current subject		1	
Current topics of Plankton Biology 先端プランクトン学	G. Nishitani	3 rd	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	vear	Categories	Credits		Reference
54690015	monuctors	your	Cutegorites	Obligatory	Elective	iterenere
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. Kasukabe	2 nd	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	2 nd	Specialized Subjects		1	Intensive course 集中講義 国費学生必修

Graduation Requirements A mathematical Sector

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

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

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

Life and Nature (Study of Nature, Life and Technology) [2 credits] — General Education Subjects
 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 音科目

-)	Specialized Bubjects \$130141				
	Subjects	Obligatory	Elective*	Total	Comments
	Faculty Common Subjects 学部共通科目	19	(2)		* $\underline{23}$ or more elective credits
	Academic Common Subjects 学科共通科目	16	(4)		must be acquired from among
	Academic Group Common Subjects 学科目群共通科目	12			the 30 elective credits listed in
	Technical Field Subjects 専門領域科目	0	(17)		選択科目は、括弧の中から23単位以上修得
	Current Subjects カレント科目	15	(7)		すること。
	Total	62	23	85	
	The credits acquired in each semester (exampl				
	Semester				Credite

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	Day/Period	Fri./4th	Object	AMB				
Instructor (Post)	(小園泉境コマエニク・ション論) M. Ikeda (Prof.) T. Fuiji (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	1st-year students				
			Budjeets	Credits	1				
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	3				
Subject Numbering AAL-APS202B					English/Japanese				
1. Class s Biologica	1. Class subject Biological productivity in aquatic zone and restoration from tsunami disaster								
2. Object Onagawa Pacific Ocea 1 meter, and Ocean had b and survive aquatic proo scientifically public awar damage and understand activity. Fie June at Aob 3. Keywo marine bi 4. Goal o At the o -unders -unders	 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 coastal ecosystems and biodiversity. This subject highlights tsunami damage and the circumstance of reconstruction in Onagawa Town with a one-day trip. Classroom lecture will be held in May in Onagawa Town with a one-day trip. Classroom lecture will be held in June at Aobayama Campus. More details will be announced through the Google Classroom. 3. Keywords marine biodiversity, fisheries, aquaculture, tsunami disaster, reconstruction, 4. Goal of study At the end of the semester, students will -understand about the tsunami disaster. 								
-unders 5. Conter • • reconstr • •	itand sustainable biological productivity a its and progress schedule of class Introduction to studies of marine sci Field lecture about tsunami damage, uction in Onagawa Town (including Onag Class room lecture Group discussion ation	nd the applica ence, biologic the restoration gawa Field Cer	tion to reconstruction to reconstruction to reconstruction and the second	id restoration of the storation of the storage of t	n society.				
For more	information, note our announcement in th	ne curriculum	guidance during	the first week	of April.				
7. Record	l end evaluation method Attendance: 40% Activeness: 20% Report: 40%								
8. Textbo Preparing	ok and references g textbook								
9. Self stu	ıdy								
10. Practi	cal business								
11. In add Contact	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	1 st-year students			
D		1 6 4 1 1		Credits	1			
Position	Faculty of Agriculture (Graduate Scho	ol of Agricul	tural Science)	Semester	3			
Subject Numbering	AAL-OAG201B			Language Used in Course	English/Japanese			
1. Class su Ecosyste 2. Object a The purpo through 1 da the Integrate	 Class subject Ecosystems including forest, grassland, farmland, paddy field and biological productivity 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. Keywor agronomi grasslands	ds cal science, integrated terrestrial field, ecc farmlands, soil science, forestry	osystem, envir	onmental issues,	animal waste	treatment,			
4. Goal of At the en- -experien -understa -understa 5. Contents 1-5. Intro 6. Field la 7. Field la	grassiands, 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)							
8. Field le 9.Field le (Profs. o 10. Field (Profs. of 11. Field 12. Field 13. Group 14. Class 15. Class	ecture about grasslands, farm animals and cture about animal waste treatment, bioga f Sustainable Environmental Biology) lecture about andosol (volcanic ash soil) a Environmental Crop Science) lecture about management of animal feedi observations for integrated terrestrial field o discussion (Profs. of Field Science Cent room lecture about agriculture and ecosys room lecture about spatial science and agr	environmenta s production a and environme ng and animat l (Profs. of F er) stem (Profs. o ronomy (Prof	l issues (Profs. or and recycling systematic issues on far welfare (Profs. ield Science Cent of Field Science (s. of Field Science)	f Land Ecolog tem mland of Land Ecol ter) Center) ce and Techno	gy) ogy) blogy for Society)			
6. Preparat Read boo field trip.	ion ks related on agronomy, soil science, anim	nal science, fo	rest science and e	environmenta	l science before the			
7. Record of Attendand Attendand Report ab	end evaluation method ce and participation for field trip (40%) ce and participation for classes (30%) pout field trip (30%)							
8. Textboo URL: http	k and references p://www.agri.tohoku.ac.jp/kawatabi/index.	. <u>html</u>						
Write a re based on the	eport after the field trip. Write down what e group discussion.	did you see, w	hat did you feel.	We welcome	your consideration			
10. Practic	al business							
11. In addi Field trip Please ca E-mail a	tion will be held in May (Fri.), 8:00 - 18:30. C rry rain cape, protection against cold weat ddress: chinatsu@tohoku.ac.jp	Gathering Spo her, insurance	t is Aobayama Ca card and lunch to	ampus (Aoba o field trip.	yama Commons) .			

Subject	Modern Agriculture and Agricultural Science (現代における農と農学)	Day/Period	Fri./3 rd	Object	AMB		
Instructor (Post)	K. Sato (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	1st-year students		
				Credits	2		
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	3		
Subject Numbering Language Subject Used in Course English/Japan							
1. Class su Grasp of	bject problems according to water, foods, end	ergy, biomate	erials, environm	ent and healt	h		
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. Keyword	ds						
4. Goal of At the end	study d of the semester, students will						
-have bas fishery s -have dee levels.	ic knowledge about the agricultural science cience, agricultural chemistry, food science per understanding of the strategy for survi	the including the eat present sival of human	e academic field tage in our facult s in the future by	of plant scier y. utilizing the a	ace, animal science, agriculture at high		
5. Contents The educat operating in bioscience, I laboratory to Students w student can	s and progress schedule of class tion and research of our Faculty of Agricul the six different fields of plant science, m biochemistry and bioscience. In the lecture ours style. till be separated into six groups and will ta visit one to four laboratories in one day.	lture, and the aterial enviro e, we will exp ke a lecture b	Graduate School nmental econom lain the dairy situ y stuffs of the lat	of Agricultur; y, applied anir uation in each p. in the rotatio	al Science are nal science, marine laboratory including on system. Each		
 Guidano 2-15. Visit Marine Biol 16. Exami 	ce "Introduction of agricultural sciences" t to six courses of Plant Science, Resource ogy, Biochemistry, and Biological Chemis nation	Environment stry	al Economics, A	pplied Anima	l Science, Applied		
6. Preparat	ion						
7. Record of Students m	end evaluation method nust attend the laboratory tour more than 6	0% and take a	n examination (4	40%) of the la	st day.		
8. Textbool Textbook a	k and references nd references will be notified at the class.						
9. Self stud	ly						
10. Practical	l business						
11. In additi Students w Contact pe Contact: ka	on ho have some questions can visit to ask to rsons will be notified at the class. an.sato.d8@tohoku.ac.jp	each laborato	ory until 18:00 af	ter lecture tim	e.		

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		
Desition	Faculty of A migulture (Creducto School	l of A originalities	al Saianaa)	Credits	2		
Position	Faculty of Agriculture (Graduate School	I of Agricultur	al Science)	Semester	2		
Subject Numbering	ABS-APS235E			Language Used in Course	English		
1. Class su Introducti	ubject: on to Physiology and Ecology: a general in t	troduction to	physiology and	marine ecology	у.		
2. Object a A beginne presentation systems) wit	and summary of class: er course in the basics of writing about marin s, students will gain broad basic knowledge h an emphasis on the marine realm.	e physiology a of the function	and ecology. The al organization	rough reading, w of animals (e.g.,	riting and evolution, nervous		
3. Keywor Nervous s	rds: ystem, hormones, life functions, evolution, l	biodiversity, m	arine ecosystem	ns, marine resour	rces		
4. Goal of Master the courses.	study: basics of physiology and ecology for future	e application to	Applied Marin	e Biology specia	alist topics and		
(1) Information (2) Marine (3-4) Phyl (5-6) The (7-8) The (9) Mid-te (10-11) The (12) Harve (13) The C (14) Final (15) Final	e animal biodiversity: bathymetric distribution logenetic and evolutionary adaptations of main nervous system. 1. Neuron structure & func- nervous system. 2. Sensory systems. erm report and examination. he endocrine system. Cell signaling and horr esting Living Marine Resources Coral Reef Ecosystem report, presentation examination.	y, inclusions in on of marine a rrine animals. tion. nones.	nimals.				
6. Prepara All studen difficulty, ea	tion: its should complete weekly reading and writ ch student should aim to improve understand	ing assignmen ding of the cou	ts prior to each ourse content.	class. By identify	ying areas of		
7. Record Attendanc	and evaluation method: ee and participation during lectures (25%); R	eports/quizzes	and end-of-terr	n examination (7	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-stu There is n lecture will s content, whi	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. Practi	cal business ition: This course covers a broad range of to	pics. Later con	irses will explor	e these tonics m	ore deeply Questions		
should be ad	dressed to the lecturer directly during or after	er lecture, or d	uring office hou	rs. ames.cheryl.l	ynn.a1@tohoku.ac.jp		

Subject	An Introduction to Bioindustrial Information Processing (生物生産情報処理概論)	Day/Period	3 rd Quarter Tue./1 st -2 nd	Object	AMB			
Instructor (Post)	Y. Sakai (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students			
D. St		(Credits Credits						
Position Faculty of Agriculture (Graduate School of Agricultural Science)				Semester	6			
Subject Numbering	ABS-APS336E			Language Used in Course	English			
1. Class su Introduc	bject tion to fundamentals of methods for pro	cessing biolo	ogical sequence	data				
2. Object a The first l the remainir	nd summary of class half deals with the methods for computing ng half introduces various methods for othe	the similarity er types of see	v between two or quence processir	r more biologi ng.	cal sequences, and			
3. Keyword biological	ds l sequence, string, similarity, alignment, pl	nylogenetic tr	ee, gene mappin	ig, short read a	ssembly			
4. Goal of The goal biological se	study is to understand the theoretical background equences.	d with respec	t to validity or li	mitation of co	mputer processing of			
5. Contents 1 Prelimit 2 Similari 3 Pairwise 4 Pairwise 5 Multiple 6 Multiple 7 Amino a 8 BLAST 9 PSI-BL 10 Phylog 11 Phylog 12 Gene 1 13 Short 1 14 Short 1 15 Sugget	 5. Contents and progress schedule of class Preliminaries Similarity between sequences Pairwise alignment (global alignment) Pairwise alignment (local alignment and alignment with affine gap penalty) Multiple alignment (star alignment) Multiple alignment (progressive method) Amino acid substitution matrix BLAST PSI-BLAST and HMM Phylogenetic tree (ultra-metric tree and additive tree) Phylogenetic tree (UPGMA and NJ method) Gene mapping Short read assembly (with reference sequence) Short read assembly (de novo) Suggested answers of the term paper 							
6. Preparat Prepare fo	ion or the next lesson by conducting a Web sea	arch on the to	pic words related	d to the lesson				
7. Record e Attendand Term pap	end evaluation method ce: 20% er: 80%							
 8. Textbool Recomme Dan Gusf 9. Self stud Review th 	 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	l business							
11. In additi Office ho E-mail ad	on urs: 16:30-18:00 Mon-Wed, and Fri at Roo ldress: yoshifumi.sakai.c7@tohoku.ac.ip	om E410						
	,							

Subject	Reading of Scientific Paper I (科学論文講読 I)	Day/Period	1st Quarter Thu./2nd	Object	AMB		
Instructor (Post)	T. Unuma (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	2nd-year students		
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Credits	1		
Position	raculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5		
Subject Numbering	AAL-APS301B			Language Used in Course	English/ Japanese		
1. Class sub Learning h	ject ow to search and read scientific articles	in English					
2. Object an By reading 1 Ecology, Ma specific exp search meth	d summary of class English articles in the fields of Aquacultur arine Biochemistry, Biological Oceanogra ressions of scientific articles and acquire r ods so that they will be able to find article	e Biology, Fis phy, and Fish eading compr s of interest.	sheries Biology a Genetics, studen rehension skills. I	nd Ecology, Mar ts will learn the s in addition, stude	ine Plant tructure and nts will learn		
3. Keyword Scientific En	s nglish, scientific article, literature database	e, literature se	arch				
4. Goal of st Students with	tudy II be able to find, read, and understand scie	entific articles	in English neces	ssary for their ow	n research.		
 5. Contents and progress schedule of class As Reading of Scientific Paper I and II are offered in the same week, they will be conducted and evaluated as a series of lectures with the following class contents. 1. Structure of scientific articles, How to use literature databases 2. Practice of searching literature 3-4. Group reading of articles related to Marine Biochemistry 5-6. Group reading of articles related to Fisheries Biology and Ecology 9-10. Group reading of articles related to Aquaculture Biology 9-10. Group reading of articles related to Biological Oceanography 13-14. Group reading of articles related to Fish Genetics 15. Group presentation of literature search results All students in the Applied Marine Biology Course including Japanese students will be divided into 5 groups, and the above 3-14 will be taken in a different order depending on the group. 6. Preparation Students should read and understand the articles assigned as teaching materials by the laboratory in charge of the class in advance. Note that students will not be able to keep up with the class if they do not prepare well enough. 							
7. Record en Evaluation v	nd evaluation method will be based on attendance and comprehe	nsion during g	group reading.				
8. Textbook Articles des	and references ignated by each laboratory as teaching ma	terials.					
9. Self study It is recomm	nended that students read scientific articles	s in the resear	ch field you wish	to pursue in the	future.		
10. Practical	l business						
11. In additi If students h his/her avail E-mail: tatsu	on have questions about a lecture, they can as lability in advance. hya.unuma.b8@tohoku.ac.jp (T. Unuma).	k the instructo	or by e-mail or vis	sit his/her office a	after asking for		

Subject	Reading of Scientific Paper II (科学論文講読Ⅱ)	Day/Period	1st Quarter Fri./4th	Object	AMB			
Instructor (Post)	T. Unuma (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd-year students			
Desition	Fooulty of Agriculture (Graduate School	of Agricultur	al Sajanaa)	Credits	1			
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5			
Subject NumberingAAL-APS302BLanguage Used in CourseEnglish/ Japanese								
1. Class sub Learning h	ject ow to search and read scientific articles	in English						
2. Object an By reading Ecology, Ma specific exp search meth	d summary of class English articles in the fields of Aquacultur arine Biochemistry, Biological Oceanogra ressions of scientific articles and acquire r ods so that they will be able to find article	e Biology, Fis phy, and Fish eading comp s of interest.	sheries Biology a Genetics, studen rehension skills. I	nd Ecology, Mar ts will learn the s In addition, stude	ine Plant tructure and nts will learn			
3. Keyword Scientific En	s nglish, scientific article, literature database	e, literature se	earch					
4. Goal of st Students wi	tudy Il be able to find, read, and understand scie	entific articles	in English neces	ssary for their ow	n research.			
 S. Contents As Reading of lectures v 1. Structure 2. Practice c 3-4. Group r 5-6. Group r 7-8. Group r 9-10. Group r 11-12. Group r 13-14. Group r 15. Group p All students above 3-14 r 6. Preparation 	 5. Contents and progress schedule of class As Reading of Scientific Paper I and II are offered in the same week, they will be conducted and evaluated as a series of lectures with the following class contents. 1. Structure of scientific articles, How to use literature databases 2. Practice of searching literature 3-4. Group reading of articles related to Marine Biochemistry 5-6. Group reading of articles related to Fisheries Biology and Ecology 7-8. Group reading of articles related to Marine Plant Ecology 9-10. Group reading of articles related to Aquaculture Biology 11-12. Group reading of articles related to Biological Oceanography 13-14. Group reading of articles related to Fish Genetics 15. Group presentation of literature search results All students in the Applied Marine Biology Course including Japanese students will be divided into 5 groups, and the above 3-14 will be taken in a different order depending on the group. 							
Students sho	build read and understand the articles assig Note that students will not be able to keep	ned as teachir up with the c	ng materials by th class if they do no	ne laboratory in cl ot prepare well en	harge of the class ough.			
7. Record en Evaluation v	nd evaluation method will be based on attendance and comprehe	nsion during	group reading.					
8. Textbook Articles des	and references ignated by each laboratory as teaching ma	terials.						
9. Self study It is recomm	9. Self study It is recommended that students read scientific articles in the research field you wish to pursue in the future.							
10. Practica	l business							
11. In additi If students h his/her avail E-mail: tatsu	on have questions about a lecture, they can as lability in advance. hya.unuma.b8@tohoku.ac.jp (T. Unuma).	k the instructo	or by e-mail or vi	sit his/her office :	after asking for			

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	l st-year students				
D		1 6 4 1 1		Credits	1				
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)				3				
Subject Numbering	AAL-APS410B			Language Used in Course	English/Japanese				
1. Class su Observat	bject tion of marine biodiversity and understa	anding the im	portance for su	stainable pro	oductions.				
 2. Object a To unders (1) Field tri (2) Observa 	nd summary of class stand the importance of marine biodiversit ip to the rocky intertidal area and observat ation of early development of marine inver	y. ion of the bio rtebrates	diversity.						
3. Keywo marine ec	ords cosystem, biodiversity, production, aquacu	lture							
4. Goal of Students diversity and	f study will be able to understand the importance : d development of marine organisms.	for marine bio	odiversity through	h the observat	ion of species				
5. Conten Three da ●	 5. Contents and progress schedule of class Three days in 2nd semester (September) Days 1-2:Field trip to the rocky intertidal area and survey the biodiversity. Days 3: Observation of early development of marine invertebrates. 								
6. Prepara More deta	ation ails will be announced through the Google	Classroom.							
7. Record ● ●	 7. Record end evaluation method Attendance: 40% Activeness: 20% Report: 40% 								
8. Textbo Preparing	ok and references g textbook								
9. Self stu None	9. Self study None								
10. Practical business									
11. In add Contact e	 11. In addition Contact e-mail address: Ikeda: minoru.ikeda.a6@tohoku.ac.jp 								

Subject	Physiology of Biological Resources (盗酒仕枷仕理学)	Day/Period	2 nd quarter	Object	AMB			
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	2 nd -year students			
			1 5	Credits	2			
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)				5			
Subject Numbering	ABS-APS338E			Language Used in Course	English			
1. Class sub	oject: Physiology of Biological Resources							
2. Object an marine anim	nd summary of class: This course provides a als to exist and reproduce within a host of er	fundamental on the fundamental of the fundamental of the function of the fundaments of the fundamental of th	overview of the pł ften differing from	nysiological requ n their internal s	uirements permitting tates.			
3. Keyword	ls: Neuroendocrinology, sensory systems, re	pair, sexual re	production.					
4. Goal of s communicat the concept of reproduction in compariso	study: Develop an understanding of the varie e to maintain the organism's integrity and en of homeostasis and its application in neuroer a. Gain a practical understanding of the differ ons with species trees (nucleotide sequences)	ed ways and m sure the produ- ndocrine regula- rences between o.	eans by which cel action of a new gen ation, sensory pero n phylogenetics of	ls in a multicell neration. Develo ception, repair a f gene trees (am	ular organism op a solid grasp of nd sexual ino acid sequences)			
5. Course c (1-4) Neurop Neurophysic information (5-7) Neuroe Hormones (c on different c (8). Mid-terr (9-11). Sense invertebrates (13-14). End development Comparisons (15). Final re	 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. (15) Final report presentations examination 							
6. Preparati areas of diffi	on: All students should complete weekly reaction of the student should aim to improve un	nding and writi nderstanding c	ing assignments proof the course conte	rior to each clas ent.	s. By identifying			
7. Record a examination	nd evaluation method: Attendance and partic (75%)	cipation during	g lectures (25%);]	Reports/quizzes	and end-of-term			
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-stud class. Each l of the course	y: There is much to learn about these topics. ecture will start with a discussion and/quiz of content, which is required to pass the quizz	Students are of the previous es/examination	encouraged to rev lecture to ensure ns.	iew their lecture students have a	e notes soon after fundamental grasp			
10. Practica 11. In additio	l business on: This course covers a broad range of topic	cs. Later cours	es will explore the	ese topics more	deeply. Any			

11. In addition: This course covers a broad range of topics. Later courses will explore these topics more deeply. A 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	2 nd Quarter Mon./1 st -2 nd	Object	AMB		
Instructor (Post)	S. Katayama (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students		
Desition	Equilty of A graviture (Creducte School	of A grigultur	al Saianaa)	Credits	2		
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5		
Subject Numbering ABS-APS239E Language Used in Course English							
1. Class su Relations	bject ships among organisms and those betwe ng biological production in nature.	en organisms	and their envir	onment as fu	indamental factors		
2. Object a More that various ir productio The prese each cate	and summary of class n 1500 thousand of organisms are recogniz nterrelationships with surrounding organis on in nature. ent subject addresses fundamental concep gory of population, community, and ecosy	zed to live on ms and its en ts of ecology stem.	the earth now. Th vironmental fact necessary to un	nese numerou ors, which ma derstand mec	s organisms maintain ay support biological hanisms of nature in		
3 Keywor	de						
biologica	l production, population, biological comm	unity, marine	ecosystem, envir	ronment, inter	specific 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 Species (binomial nomenclature, reproductive isolating, crossbreed) Classification (five kingdoms, three domains) Biological production in each ecological category: producer, consumer, decomposer. Divergent evolution, natural selection Adaptation, Speciation, & Diversity 							
 Niche, Intersp. Popula Compe Concep Concep Concep Concep Struct Struct	ecific relationships (competition, predation tion; definition, mode of life, population g etition, strategy and tactics, game theory, L pt of ecological niche, relationship between nunity theory, ecological succession, clima ture and function of ecosystem, ogeochemistry (Element ratios, Element C gical and physical cycle in nature ystem service	n etc.), Gause' rowth models otka-Volterra n niche and co x Cycling, Energ	's Law , r-K strategy model ompetition y Flow and Matt	er Recycling)			
6. Preparat Many boo information	tion oks are published on ecosystem, environm on about contemporary ecological problen	ent, and bio-d	iversity, from wł	nich it is requi	red to obtain various		
7. Record e Evaluatio	end evaluation method on will depend on achievement of final exa	mination.					
8. Textboo MJ Kaise M Begon	k and references er et al. "Marine Ecology -Processes, Syste et al. "Ecology: Individuals, Populations a	ms, and Impa and Commun	cts-", Oxford Un ities", Wiley-Blac	iv. Press (201 ckwell (1996)	1)		
9. Self stud Students biologica	dy should have concern over topics on nature l and ecological meanings.	and organism	s shown in vario	ous media and	consider their		
10. Practica	l business						
11. In additi Office ho Ecology (E-mail: sl	ion ur for inquiry about the course should be c (E-311). kata@tohoku.ac.jp	offered any tin	ne at the Laborat	ory of Fisheri	es Biology and		

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	Feaulty of Agriculture (Graduate Sale	ol of Agricul	tural Sajanaa)	Credits	2
rosition	Faculty of Agriculture (Oraduate Scho	of of Agricul	lural Science)	Semester	4
Subject Numbering	ABS-APS240E			Language Used in Course	English
1. Class su Under	bject stand the basic theory of inheritance and t	he application	methods for the	genetic impro	vement in aquatic
organisms.	sund the busic theory of information and the	ne application	i incuitous for the	genetic impro	venient in aquatie
2. Object a	nd summary of class				
In aqu	atic organisms, not only genetics at the ind	dividual level	but also populati	on level is im	portant. Because,
the position	of conservation in genetic resources is ver	ry important i	n this subject. In	this class, the	basic theory of
inheritance i	in individual level, population level, the ba	asic theory of	genetic improvei	ment and the c	conservation of
3 Keyword	de				
Genetic i	nprovement Genetic variation Linkage (Genetic marke	er Quantitative tr	ait Heritabili	ty Breeding value
Heterosis, R	ecombinant DNA		en, Quantitative ti		ty, Dieeding vulue,
4. Goal of	study				
1) Uno	derstand the basic theory of genetics in bo	th of individu	al and population	level	
2) Uno	derstand the theory of the application meth	nods of geneti	cs for the genetic	improvement	t
3) Uno	derstand the basic theory of genetics for th	e conservatio	n of genetic resou	arces.	
5. Contents	s and progress schedule of class				
Basic the	bry of inheritance				
1) Basic 2 Const	ineory and various mode of inneritance				
2) Geneti 3) Linka	te and recombination				
4) Basic	theory of genetics in population				
5) Genet	ic drift and inbreeding				
6) Natura	al selection				
7) Popula	ation structure and genetic diversity of pop	oulation			
8) Genet	ic markers for the analysis of populations	and quantitati	ve traits		
Basic t	heory of genetic improvement				
9) Basic	theory of inheritance in quantitative traits				
10) Herit	ability and breeding value				
11) Basic	c theory of selection				
12) Heter	tic improvement by recombinant DNA				
6. Preparat	ion				
Please	read a book about conservation and gener	tic improveme	ent.		
7. Record e	end evaluation method	•			
Total re	esults are evaluated by the final examination	on, reports an	d the results of th	e problems se	t at a lecture at each
time.					
8. Textbool	k and references	- ~			1 4000
Introducti	on to quantitative genetics, D. S. Falconer	r, Longman S	cientific & Techn	ical, New Yor	k, 1989
Genetics :	for fish hatchery managers, D. I ave, An A	VI BOOKS, Ne	W YORK, 1992	Ino Maggaol	augotta
Concern	ation and the Genetics of Populations F V	. O. Clark, Sl V Allendorf a	nauer Associates, and G I mikart R	lackwell Publ	ishing Oxford 2007
9 Self stud	v		ind G. Luikart, D		isining, Oxioid, 2007
Ask m	e the things which are not understood. Pl	lease do prepa	arations for lectur	e and a reviev	v used text book
shown to the	e above.				
10. Practic	al business				
11. In addi	tion				
The of	tice will be opened from 10:00 AM to 05:	00 PM to rece	eive the question.	The question	is also received by
c-man, masa	аппени.пакајппа.оо(<i>ш</i> иопоки.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				
D		1 6 4 1		Credits	2				
Position	Faculty of Agriculture (Graduate Scho	ool of Agricul	tural Science)	Semester	5&7				
Subject Numbering	ABS-APS406B			Language Used in Course	English/Japanese				
1. Class s Practica l	1. Class subject Practical field and experimental training for marine biodiversity.								
2. Object To unders (1) (2) (3)	 2. Object and summary of class To understand the importance of marine biodiversity. (1) Observation and analysis of marine biodiversity. (2) Analysis of genetic diversity in marine organisms. (3) Analysis of marine environments. 								
3. Keywo marine eo	rds cosystem, biodiversity, genetic diversity, e	arly developn	nent, morphogene	esis					
4. Goal o Students ecological, s	f study will be able to understand the importance species, genetic diversities of marine organ	for biodiversi nisms.	ty in marine ecos	systems throug	gh the observation of				
5. Conter	ts and progress schedule of class								
Five days	s in 4 th semester (August) Days 1-2: Quantitative and qualitativ Days 3-4: Study about adaptation of Day 5: Presentation	ve of marine b marine inver	biodiversity. tebrates to their c	environment.					
Five day ● ●	rs in 6rd semester (June) Days 1-2: Quantitative and qualitativ Days 3-4: Quantitative and qualitativ Days 5: Presentation	ve of genetic o ve of marine e	liversity in marin nvironments.	e organisms.					
6. Prepar	ation	CI							
7. Record	end evaluation method	e Classroom.							
	Attendance: 40%								
	Report: 40%								
8. Textbo Preparing	8. Textbook and references Preparing textbook								
9. Self stu None	9. Self study None								
10. Practi	cal business								
11. In add Contact e	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)	T. Unuma (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students			
			· · · · · · · · · · · · · · · · · · ·	Credits	10			
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5&6			
Subject Numbering	AAL-APS308E/AAL-APS309E			Language Used in Course	English			
1. Class sub Morpholog	ject y, function and components of aquatic (organisms, ai	nalysis of substar	nces in environn	nent			
2. Object an The purpose organisms, t	d summary of class e of the course is to let participants und the way to use analytical instruments and a	erstand the ta analysis of ex	ixonomy, constitu perimental data.	ution of body, fu	nction of aquatic			
3. Keyword Taxonomy, 1	s morphology, genetics, molecular biology,	genetics and l	breeding, chemica	al analysis, statis	tics			
4. Goal of st Students wi - hav env - hav	 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 The course y - Ana - Mo - Tax - His - Phy - Ana - Mic - Ecc - Star	 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 Read "Texth	on book of Student Experiments" and underst	and the purpo	ose and outline of	each experiment				
7. Record en Attendance submitted by	nd evaluation method is required for all experiments and absence y the due date. Evaluation will be based or	ces will not be n the overall p	e permitted. After performance of ea	each experimen ch experiment.	t, reports must be			
8. Textbook and references "Textbook of Student Experiments" will be provided.								
9. Self study If you are interested in the details of the experiment, check the literature to gain a deeper understanding.								
10. Practical	l business							
11. In additi If students h for his/her a	11. In addition If students have questions about an experiment, they can ask the instructor by e-mail or visit his/her office after asking for his/her availability in advance.							

a.b8(*a)*tonoku.ac ·JΡ la).

Subject	Basic Chemistry, Practice (基礎化学実験)	Day/Period	MonFri. /3rd & 4th	Object	AMB			
Instructor (Post)	T. Unuma (Prof.) et al	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students			
Desidien	E-mite of A - minute of Constructs Colored	- f A	-10	Credits	1			
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5&6			
Subject Numbering	AAL-APS310E			Language Used in Course	English			
1. Class sub Component	ject ts of aquatic organisms, analysis of subs	tances in env	vironment					
2. Object an The purpose extract and a	d summary of class of the course is for students to understand analyze chemical components in the enviro	d the body cor onment.	mponents of orga	nisms and the pro	ocedures to			
3. Keywords Experiments	s s, 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 The course v - Ana - Ext - Ana - Eva - Eva	and progress schedule of class will be conducted by AMB laboratories atomy of fin fish raction and analysis of genetic material alysis of components of seawater iluation of taste components raction and analysis of body components							
6. Preparation Read "Textb	on book of Student Experiments" and underst	and the purpo	se and outline of	each experiment				
7. Record er Attendance submitted by	7. Record end evaluation method Attendance is required for all experiments and absences will not be permitted. After each experiment, reports must be submitted by the due date. Evaluation will be based on the overall performance of each experiment.							
8. Textbook and references "Textbook of Student Experiments" will be provided.								
9. Self study If you are in	9. Self study If you are interested in the details of the experiment, check the literature to gain a deeper understanding.							
10. Practical	l business							
11. In additi If students h for his/her a E-mail: tatsu	11. In additionIf students have questions about an experiment, they can ask the instructor by e-mail or visit his/her office after asking for his/her availability in advance.E-mail: tatsuya.unuma.b8@tohoku.ac.jp (T. Unuma).							

Subject	Basic Biology, Practice (基礎生物学実験)	Day/Period	MonFri./ 3rd & 4th	Object	AMB			
Instructor (Post)	T. Unuma (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	2nd & 3rd-year students			
Desition	Ecoulty of A griculture (Creducto School	of A grigultur	ml Saianaa)	Credits	1			
Position	raculty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	5&6			
Subject Numbering	AAL-APS311E			Language Used in Course	English			
1. Class sub Body plan a	ject and function of aquatic organisms							
2. Object an The purpose morphology	d summary of class e of the course is to let students understand g, genetics, cell biology, physiology and sta	l body plan ar ntistic analysis	nd function of aqu s.	atic organisms s	tudying on			
3. Keyword Morphology	s ⁄, Genetics, Taxonomy, Cellular tissue							
 4. Goal of st Students wit hav hav 	 4. Goal of study Students will have knowledge of basic biology have knowledge of experimental procedure 							
5. Contents The course y - And - Gen - Cel - His	and progress schedule of class will be conducted by AMB laboratories. atomy of fin fish netics and analysis of polymorphism l biology of aquatic plant tology of marine animals							
6. Preparation Read "Texth	on book of Student Experiments" and underst	and the purpo	ose and outline of	each experiment				
7. Record en Attendance submitted by	nd evaluation method is required for all experiments and absence y the due date. Evaluation will be based or	es will not be n the overall p	permitted. After operformance of ea	each experiment, ch experiment.	, reports must be			
8. Textbook "Textbook o	8. Textbook and references "Textbook of Student Experiments" will be provided.							
9. Self study If you are interested in the details of the experiment, check the literature to gain a deeper understanding.								
10. Practica	l business							
11. In addition If students have questions about an experiment, they can ask the instructor by e-mail or visit his/her office after asking for his/her availability in advance. E-mail: tatsuya.unuma.b8@tohoku.ac.jp (T. Unuma).								

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		
		1 6 4 1		Credits	2		
Position	Faculty of Agriculture (Graduate Schoo	of Agricult	Iral Science)	Semester	5		
Subject Numbering	ABS-APS341E			Language Used in Course	English		
1. Class sub Basic conce	ject pts of aquaculture including seed prod	luction, resto	cking, cultivation	ı, and fish diseas	e control		
2. Object an Aquaculture concepts of	d summary of class is playing an increasingly significant ro aquaculture by studying practical examp	le in the fishe les of comme	ries industry. In thi rcially valuable sp	is course, students ecies.	s will learn basic		
3. Keywords Seed produc	s etion, restocking, cultivation, pathology, 1	fish, invertebr	ate				
 4. Goal of study Students will understand the importance of aquaculture in maintaining fisheries resources and increasing production of marine products. acquire concrete knowledge of practical examples. 							
5. Contents a - Bas - Salı - Rec - Flou - Yell - Eel - Patl - Invo - Tern	 5. Contents and progress schedule of class Basic concept of aquaculture Salmon Red seabream Flounder Yellowtail Eel Pathology Invertebrate Term-end examination 						
6. Preparation Students are	on e encouraged to review high school biolog	gy textbooks a	and supplemental 1	readings prior to t	he class.		
7. Record en Term-end ex	nd evaluation method xamination (70%) and attendance (30%).						
8. Textbook The followin Modern met	8. Textbook and references The following book may be helpful. Modern methods of aquaculture in Japan Vol. 24, ed. by H. Ikenoue & T. Kafuku, Elsevier, 1992						
9. Self studyIn order to deepen understanding, practice questions related to the lecture content will be given in each lecture.Students are expected to solve them before the next lecture.							
10. Practical	l business						
11. In addition Students are contact the of E-mail: tatsu	 11. In addition Students are welcome to visit the office at any time if they have any questions about the lecture content, but should contact the office by e-mail in advance since the office is often not open. E-mail: tatsuya.unuma.b8@tohoku.ac.jp / hayato.yokoi.a4@tohoku.ac.jp 						

Subject	Fisheries Biology and Ecology (水産資源生態学)	Day/Period	3 rd quarter Mon./1 st ~2 nd	Object	AMB	
Instructor (Post)	S. Katayama (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students	
				Credits	2	
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	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. Ichthyology (External morphology and sense organs)
- 4. Ichthyology (Function of gill and feeding)
- 5. Life history (Spawning and annual cycle)
- 6. Life history (Migration)
- 7. Life history (Age and growth)
- 8. Life history (Early life history)
- 9. Life history (Maturation)
- 10. Population analysis (Survey method)
- 11. Population analysis (Delury method)
- 12. Population analysis (Yield per recruit model)
- 13. Population analysis (Cohort analysis)
- 14. Population analysis (MSY)
- 15. Fisheries management

6. Preparation

There are no	particular	prerequisites for	or this course.	Basic biology	capabilities will	ease the learning.
7. Record end	evaluation	method				

7. R	ecord	end	eva	aluatic	on me	etł
a	c		1	C .		

Score of an end-of-term exam

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

Office hour for inquiry about the course should be offered any time at the Laboratory of Fisheries Biology and Ecology (E-311).

Contact: skata@tohoku.ac.jp

Subject	Aquatic Plant Ecology (水圈植物生態学)	Day/Period	1 st quarter Tue./1 st ~2 nd	Object	AMB/JYPE				
Instructor	M. Aoki (Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year & JYPE students				
.		C.A 1. 1		Credits	2				
Position	Faculty of Agriculture (Graduate School o	f Agricultural	Science)	Semester	5				
Subject Numbering	ABS-APS343E			Language Used in Course	English				
1. Class su The ecol o	1. Class subject The ecology of giant kelp forests								
2. Object a This cours some chap & Foster (nd summary of class se provides the basic knowledge about the co oters related to the ecological topics in the ba 2015).	ommunity eco ook 'The biol	blogy of marine ogy and ecolog	kelps throug y of giant kel	h the readings of p forests' by Schiel				
3. Keyword Kelp fore Global wa	ds st, Sea urchin, Barren, Grazing, Population o arming	dynamics, Pro	oduction, Rocky	y subtidal eco	system, Phase shift				
4. Goal of The goal i giant kelp	study s to understand the structure and function of forests.	f marine kelp	communities th	rough the stu	dy of the ecology of				
5. Contents (1) Intro (2) The a (3) The a (4) The a (5) Disp (6) Disp (7) Disp (8) Sessi (9) Graz (10) Gra (11) Gra (12) Pred (13) Pred (14) Pred (15) Sessi	 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-2: Lobster predation on grazers (14) Predation and trophic cascades-3: Sea otter predation on grazers 								
6. Preparat Read the	ion e relevant chapters in the textbook in advanc	e.							
7. Record a Report an	and evaluation method d attendance								
8. Textbool Reference Schiel DF	 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 stud Review is	ly s required.								
10. Practical	l business								
Office ph	on one number: 022-757-4152								
Mail address: masakazu.aoki.e6@tohoku.ac.jp									

Subject	Marine Biochemistry (水産化学)	Day/Period	2 nd Quarter Tue./1 st -2 nd	Object	AMB			
Instructor (Post)	T. Nakano (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students			
				Credits	2			
Position	Faculty of Agriculture (Graduate Schoo	l of Agricultu	ral Science)	Semester	5			
Subject Numbering	ABS-APS244E			Language Used in Course	English			
1. Cla	ss subject							
Biochemi	ical characterization of aquatic organisms	s and seafood	l					
2. Object The organ understand t organisms. V and some m nutritional a as adaptation 3. Keywo	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.							
Aquatic o	rganisms, chemical components, catabolic p	oathways, regi	ulatory systems					
4. Goal of To get the To unders	f study sufficient knowledge about the characterist tand the mechanisms to survive in water.	ics of marine	organisms from	a biochemical	viewpoint.			
J. Bioche	5. Contents and progress schedule of class							
1: Bioche 2: Metabo 3: Protein 4: Lipids 5: Carboh 6: Vitamin 7: Minera 8: Enzym 9: Bioacti 10: Physic 11: Functi 12: Nature 13: Osmo 14: Final 15: Final	 Biochemical characteristics of marine organisms Metabolism Proteins Proteins Lipids Carbohydrates Vitamins Vitamins Minerals Enzymes Bioactive components Physical aspects of life Functional substances Natural toxins and food poisoning Osmoregulation Final presentations Final report 							
Collect th	e related information in the library and thro	ugh the web						
7. Record	end evaluation method							
Based on	the final exam (70%), class attendance (20%	6) and lecture	notes (10%).					
8. Textboo	ok and references	_						
Nelson &	Cox: Lehninger Principles of Biochemistry	8 th edition (2	021)					
9. Self stu	ıdy							
Read relat	ted papers published in recent years.							
10. Practi	cal business							
11. In add Contact er	lition mail: nakanot@tohoku.ac.jp							

Subject	Biological Oceanography (生物海洋学)	Day/Period	3 rd quarter Fri./1 st ~2 nd	Object	AMB			
Instructor (Post)	W. Sato-Okoshi (Professor)	Categories	Specialized Subjects	Preferable Participants	3rd-year students			
D			· · · · · · · · · · · · · · · · · · ·	Credits	2			
Position	Faculty of Agriculture (Gradu:	ate School of A	gricultural Science)	Semester	6			
Subject Numbering	ABS-APS345E			Language Used in Course	English			
1. Class s Review ma	subject rine environment and adaptiv	e ecology of pe	lagic and benthic org	ganisms that ev	olved in the oceans.			
2. Object Deepen u physical and	and summary of class inderstanding of plankton, nekto d chemical characteristics of the	n, and benthos ocean.	that live in vast and de	eep ocean enviro	onments based on			
3. Keywo Marine e	ords nvironment, Ecosystem, Biology	y, Ecology, Proc	ductivity, Plankton, Ne	ekton, Benthos				
4. Goal o Understa and biologic	f study nd pelagic and benthic environn cal oceanographic basis that sup	nents of the oce port fish and ot	ans and adaptation of her upper-level produc	their inhabitants	s, regional differences,			
5. Conter 1-2: Histo 3-4: Phys 5-6: Cher 7-9: Mari 10: Nekto 11-13: M 14: Marin 15: Curre	 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. Prepara Acquire l	ation basic knowledge on oceans and o	organisms livin	g in them.					
7. Record Term-end	l end evaluation method l test							
8. Textbo Biologica	8. Textbook and references Biological Oceanography: An Introduction, 2nd ed., Lalli and Parsons, 1997 Butterworth-Heinemann							
9. Self str Understa	9. Self study Understand cause and effect of phenomena taught in class.							
10. Pract	ical business							
11. In add mail addı	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					
Desition	Early of Assistant (Carling to the Cal	1	·	Credits	2					
Position	Faculty of Agriculture (Graduate Scho	ool of Agricul	tural Science)	Semester	6					
Subject Numbering	ABS-APS347E			Language Used in Course	English					
1. Class su Conserva	1. Class subject Conservation and sustainable yield of marine bio-resources									
2. Object a A variety reproductive studies are i In the pre resources by	 2. Object and summary of class A variety of marine bio-resources have inhabited 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 the future. In the present lecture, I will explain the importance of applied genetics for future management of marine bio-resources by using actual scientific research in my laboratory. 									
3. Keywor marine or	ds ganisms, genetics and breeding science, p	opulation stru	cture, conservation	on, aquacultur	e					
4. Goal of Understan of considera	study nding the present condition of marine prod ntion and problem solving are required.	luction in coa	stal area of Japan	. Also, throug	h the lecture, ability					
 Introdu Extinct Quanti Quanti Quanti Quanti Quanti Quanti Quanti Inbreed Inbreed Inbreed Molect Conse No need 	 5. Contents and progress schedule of class Introduction Extinction Quantification of Genetic Diversity (I) Quantification of Genetic Diversity (II) Quantification of Genetic Diversity (III) Quantification of Genetic Diversity (IV) Inbreeding & Outbreeding Depressions (I) 6 Preparation 6 Preparation									
announced t 7. Record o Examin	announced through the Google Classroom. 7. Record end evaluation method Examination and Reports									
8. Textboo Directin	8. Textbook and references Directing on the lecture									
9. Self stud	ły									
10. Practic	al business									
11. In addi When you e-mail ad	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	1 st quarter Fri./1 st ~2 nd	Object	AMB
Instructor (Post)	K. Nagasawa (Associate prof)	Categories	Specialized Subjects	Preferable Participants	1 st year students
Desition		- 1 - C A		Credits	2
Position	Faculty of Agriculture (Graduate Scho	ol of Agricult	tural Science)	Semester	3
Subject Numbering	ABS-APS348E			Language Used in Course	English
Numbering1. Class sTo triggeraquatic inver2. ObjectMuch of tthese vertebgeneral underinvertebratecommercialaquatic invertebratecommercialaquatic invertebratecommercialaquatic invertebratecommercialaquatic invertebratecommercialaquatic invertebratecommercialaquatic invertebratecommercialaquatic invertebrateStudents aTo acquirTo acquirTo acquirTo acquirTo acquirTo acquirTo acquirInduct to ea5. Conten1st: Orien2nd: The3rd: Proto4th: Molf5th: Deut6th: Loph7th: Feed8th: Mech9th: Resp10th: Exc11th: Def12th: Rep13th: Dev14th: Corr15th: Rev16th: Final6. PreparaNone7. RecordThe finalas a "B", 808. Tortho	ABS-APS348E ubject understanding and scientific interest in ac rtebrates in evolution, morphology, embry and summary of class the biology we have studied consists of kn rates represent only 4% of all animal spec erstanding of animals. On the other hand, y s, which represent the remaining 96%. In p species as seafood, their biological inform rtebrates that inhabit the sea, where life w cs of each animal phylum to understand th rds nvertebrates, biodiversity, morphological effect f study are expected to achieve the following learner e a basic knowledge of the morphology ar e a systematic understanding of the mecha ch phylum, and to understand what is esset ts and progress schedule of class tation and introduction Evolutional history and Phylogeny of the pzoa, sponges, flatworms, Worms uses erostomes ophorates, Arthropods ing nanics and Movement (Locomotion) iration retion, Ionic and Osmotic Regulation, and ense roduction and Life Cycle relopment trol System iew and supporting explanation of all lect al examination ation end evaluation method examination is graded on a 100-point scal points or more as an "A", and 90 points or	quatic invertel vology, physio owledge of ve- ies, and our kr we have too for particular, alth nation is poorl as born, and la e aquatic inve- evolution, dev ning objective ad ecology of unisms that are ential and what Invertebrates	prates, students w logy, ecology, an ertebrates such as nowledge of then ew opportunities nough many mari ly understood. In earn about their d ertebrates system elopment and phy s. each phylum of a e common system it is specialized common system the system of a common system the system of a common system of a common system the system of a common sy	Used in Course vill learn about d fisheries in mammals and is too limited to learn about ne invertebrat this lecture, w liverse lifestyl atically. ysiology quatic inverte to all animal omponents in	English t each phylum of these animals. d fish. However, d to be considered a the biology of es are known as //e will focus on the es and the brates. s and those that are each animal. ', 70 points or more
The Inver	tebrates: A Synthesis (R. S. K. Barnes, 20	001, Wiley-Bl	ackwell) ISBN	978-06320476	511
Review le	ecture handouts and answer questions in ea cal business	ach lecture.			
11. In add Questions E-mail: k	lition about the lecture content may be submitt azue.nagasawa.d6*tohoku.ac.jp (replace *	ed by e-mail a to @)	at any time.		

Subject	Applied Aquatic Botany (水圏植物学)	Day/Period	1^{st} quarter Mon./ $1^{st} \sim 2^{nd}$	Object	AMB			
Instructor (Post)	M. Aoki (Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year students			
				Credits	2			
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	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. Keywor seaweed, k	as elp, Sargassum, plant-animal interactions,	, grazers, herb	vores					
4. Goal of For stude	study nts to be able to understand the basic ideas	s 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 plants (8) Dispersal ability of marine plants (9) Plant-animal interactions in benthic algae communities (10) Epiphytic animals and tsunami impacts (12) Field experiments (13) Mariculture (14) Pollution (15) Session review (6. Preparation 								
7. Record a Attendan	and evaluation method ce rates and test scores will be recorded ar	nd evaluated.						
8. Textboo Handouts	k and references will be available at the beginning of each	lecture.						
9. Self stud Review is	ly							
10. Practica	l business							
11. In additi Office ph Mail addr	11. In addition Office phone number: 022-757-4152 Mail address: masakazu aoki e6@tohoku ac in							

Subject	Marine Product Technology (水産利用学)	Day/Period	3 rd Quarter Wed./1 st -2 nd	Object	AMB			
Instructor (Post)	T. Nakano (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students			
		1 0 4 1 1	Credits	2				
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	6			
Subject Numbering	Subject NumberingLanguage Used in CourseEnglish							
1. Class su The bioc	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. Keyword Food pres	ds servation, Freezing and thawing technique	s, Postmorten	n changes of fish	and shellfish				
4. Goal of s To be able qualities and	study e to understand the principals and methods d to get the knowledge for the effective uti	s of food proc ilization of ma	essing, preservat arine resources.	ion and the co	ntrol of seafood			
5. Contents 1 Marine 2 Charact 3 Nutritio 4 Process 5 Food pc 6 Seafood 7 Health- 8 Biocher 9 Control 10 Repor 11 Term- 6 Preparat	 5. Contents and progress schedule of class Marine resources for food Characteristics and variation of seafood Nutritional aspects of seafood Processing principals of typical seafood Food poisonings related to seafood Seafood allergy Health-promoting functions of the substances from aquatic organisms Biochemical substances from marine organisms for medicinal and industrial materials Control of muscle protein quality Report writing Term-end exam 							
Review th	ne contents of the lectures on Marine Bioc	hemistry						
7. Record e Based on	end evaluation method the final exam (70%), class attendance (2	0%) and lectu	ure notes (10%).					
 Based on the final exam (70%), class attendance (20%) and lecture notes (10%). 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 stud Refer to t	ly he websites related to the topics and also t	to the related j	papers.		_			
10. Practic	al business							
11. In addi	tion							

Subject	Seafood management (水産食品管理学)	Day/Period	1st quarter Wed./1 st ~2 nd	Object	AMB				
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students				
D :/:		Credits	2						
Position	Faculty of Agriculture (Graduate School	l of Agricultura	Il Science)	Semester	7				
Subject NumberingABS-APS351ELanguage Used in CourseEnglish									
1. Class sub	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. Keyword traceability, s	s: Hygiene, HACCP, diseases, food safety, p sustainability Blue Economy	oandemic, disa	sters, aquaculture	, legal and intern	national issues,				
 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 chemicals (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). Ecolog species for fi (9-10). Seafo seafood hand (11-12). Seaf management (13-14). Clas (15). Final Pu *In person	y of Wild-caught and Aquaculture Fisheries nal project ood management (1): Seafood handling regui lling: visit to Ishinomaki Fish Landing and N ood management (2): Prerequisites to HACC (3): The HACCP system. Visit to a food pro- ss debate on sustainable options to replace vi- resentations. Final Report Examination.	E. Students prod lations, legisla Market* or Sen CP (Hazard Ar processing compa- ital but unsusta	luce an outline of tion and public lav dai City Fish Man alysis and Critica any. * inable fisheries	his/her selected ws on seafood hy ket. * 1 Control Point).	target seafood ygiene. Basic . Seafood				
6. Preparati areas of diffi	on: All students should complete weekly rea culty, each student should aim to improve u	ding and writi nderstanding o	ng assignments pi f the course conte	rior to each class nt.	s. By identifying				
7. Record en	nd evaluation method: Attendance and partic	cipation during	; lectures (25%); I	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. 									
ompleteness learned durin	s, accuracy and unique writing style. Studen g lectures and readings assignments.	ts will write in	the context of der	monstrating clea	rly what they have				
11. In additic ames.cheryl.	on: Any questions should be addressed to the lynn.a1@tohoku.ac.jp *The class will partic	e lecturer direc cipate in one of	tly during or after ff-campus practics	lectures, or duri al excursion as ti	ng office hours. ime and schedules				

Subject	Planktology(プランクトン学)	Day/Period	2 nd Quarter Wed./1 st ~2 nd	Object	AMB				
Instructor (Post)	G. Nishitani (Associate Professor)	Categories	Specialized Subjects	Preferable Participants	2nd-year students				
Desition	E-milter of A - minutes of Constructs Salarah	- f A - u i - u i 1 - u i	-1 (- :	Credits	2				
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)				5				
Subject Numbering	Subject NumberingLanguage Used in CourseEnglish								
1. Class su Systema	1. Class subject Systematics and biology of marine plankton								
2. Object a	and summary of class								
An introd	luction to systematics, physiology, and eco	ology of marin	ne plankton						
3. Keywor	ds								
Diatom, o	dinoflagellate, ciliate, copepod, krill, food	chain, microb	bial food web, ver	rtical migratio	n				
4. Goal of	study								
Understa	nding structure and role of plankton comm	unity in mari	ne ecosystem						
5. Content	s and progress schedule of class								
M C C Pr M E E C C	larine ecological division (1) lassification of marine plankton (1) haracteristics of phytoplankton and zoopla ood chain and food web in marine plankto rimary production by marine phytoplankto laterial circulation (carbon and nitrogen cy cology and application of useful phytoplar cology and biology of harmful phytoplank urrent topics in marine plankton (2) xamination	ankton (2) n (1) on (1) vcles) (2) nkton (2) tton (2)							
6. Preparat	tion								
Basic kno	owledge of biology and ecology, basic und	lerstanding of	marine ecosystem	m					
7. Record	and evaluation method								
Presence	absence evaluation & examination								
8. Textboo	k and references								
Biological Oceanography: An Introduction, second edition Lalli and Parsons, 1997, ELSEVIER Butterworth-Heinemann									
9. Self stud	dy								
10. Practica	10. Practical business								
11. In addit	ion								
Contact e	Contact email address: ni5@tohoku.ac.jp								

Subject	Marine Coastal Ecology (沿岸環境学)	Day/Period	1 st quarter Fri./1 st -2 nd	Object	AMB
Instructor (Post)	Toyonobu Fujii (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students
Desition	Faculty of Agriculture (Graduate Sake	Credits	2		
Position	Faculty of Agriculture (Graduate Scho	of of Agricun	lural Science)	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)	T. Unuma (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	2nd-year & JYPE students			
Position	Faculty of Agriculture (Graduate School	of Agricultur	al Science)	Credits	2			
TOSITION	Tacunty of Agriculture (Graduate School	of Agricultur	al Science)	Semester	4			
Subject Numbering	ABS-APS255E			Language Used in Course	English			
1. Class subject Introduction to Fisheries Science								
2. Object an This course relates broad	d summary of class provides an overview of fisheries science. Ily to marine biology, from molecules to e	. Students will ecosystems.	l learn the fundar	nentals of fisherio	es science as it			
3. Keyword Fisheries sci	s ience, fundamentals, overview							
4. Goal of st The goal is t and evolution	udy to understand the fundamentals of fisherie on, and to appreciate fisheries science as it	s science fron relates to app	n ecology, physic lied marine biolo	ology, genetics, m ogy.	olecular biology			
The followin 1. "How to a 2. "Reprodu 3. "How to b 4. "How to b 5. "Ecology 6. "Ecology 7. "Food cha 8. "Probiotia 9. "Southerr 10. "Plankta 11. "Flatfish 12. "Genetic 13. "Evoluti 14. "Coastal 15. "Molecu 6. Preparation	 5. Contents and progress schedule of class The following lectures will be given, but the order is yet to be determined. 1. "How to cultivate quality sea urchins" (T. Unuma) 2. "Reproductive physiology of bivalves" (K. Nagasawa) 3. "How to know the fish age" (S. Katayama) 4. "How to know the fish migration" (S. Katayama) 5. "Ecology of herbivorous crustaceans" (M. Aoki) 6. "Ecology of floating seaweeds" (M. Aoki) 7. "Food chemistry of fish and shellfish" (T. Nakano) 8. "Probiotics and bioactive substances in fish" (T. Nakano) 9. "Southern ocean research and Antarctic environment" (W. Sato-Okoshi) 10. "Plankton in the ocean" (G. Nishitani) 11. "Flatfish metamorphosis and aquaculture" (H. Yokoi) 12. "Genetic conservation and sustainable use of resources in aquatic organisms" (M. Nakajima) 13. "Evolution and fisheries resources" (M. Ikeda) 14. "Coastal ecosystem dynamics and fisheries resources" (T. Fujii) 15. "Molecular phylogenetics: Tools and applications" (C. Ames) 							
None in part	ticular.							
Evaluation v	will be based on the quality of the reports s	submitted in r	esponse to the le	ctures given by th	ne instructor.			
8. Textbook None in par	and references ticular.							
9. Self-study tudent shoul	d review the lecture contents thoroughly u	using the hand	louts.					
10. Practical	l business							
11. In additi If students h his/her avail E-mail: tatsu	on have questions about a lecture, they can as ability in advance. aya.unuma.b8@tohoku.ac.jp (T. Unuma).	k the instructo	or by e-mail or vi	sit his/her office	after asking for			

Subject	Practical Training (実地研修)	Day/Period	Intensive Course	Object	AMB			
Instructor (Post)	T. Unuma (Prof.) et al.	Categories	Specialized Subjects	Preferable Participants	3rd-year students			
Desition					1			
Position	Solution Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	6			
Subject Numbering	Subject NumberingABS-APS456ELanguage Used in CourseEnglish							
1. Class subject Practical training at the points of fishery production and research								
2. Object an This course Students wi	2. Object and summary of classThis course provides the tours at the point of fishery production and research.Students will learn fisheries science practically.							
3. Keyword Field trip, ir	s nvestigative tour							
4. Goal of st The goal is	tudy to increase awareness of students to learn fis	sheries science	e.					
 5. Contents This course 1. Fish mark 2. Tidal flat 3. Aquarium 4. Salmon h 5. Nature ex 	and progress schedule of class provides the practical tours as below: cet atchery chibition hall							
6. Preparation Collect info	on rmation before starting each tour.							
7. Record an Attendance	nd evaluation method and report. The reports must be submitted b	y the due date	2.					
8. Textbook No textbook	and references x. Reference books will be introduced by eac	ch professor.						
9. Self study Refer to rela	y ated books in the library after each tour.							
10. Practica	l business							
11. In additi If students h his/her avail E-mail: tatsu	 11. In addition If students have questions about tours, they can ask the instructor by e-mail or visit his/her office after asking for his/her availability in advance. E-mail: tatsuya.unuma.b8@tohoku.ac.jp (T. Unuma). 							

	Marine Biology (海洋生物学)	Day/Period	4^{th} quarter Thu./ $1^{\text{st}} \sim 2^{\text{nd}}$	Object	AMB			
Instructor (Post)	Cheryl L Ames (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year students			
D ''		1 6 4 1 1		Credits	2			
Position	Faculty of Agriculture (Graduate Schoo	of of Agricultural	Science)	Semester	4			
Subject Numbering	ABS-APS257E			Language Used in Course	English			
1. Class su organisms.	ubject: Marine Biology: Systematics, bioc	liversity, phyloge	enetics, habitats	and ecological	l niches of marine			
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. Keywo	rds: Marine Biodiversity, Plankton, Evolu	tion, Phylogenet	ics, Systematic	s, Ecology				
4. Goal of with the ba	f study: Develop an understanding of the n sic body plans and distinguishing features	main categories of against the back	of marine anima ground of evol	lls (Metazoa), b ution, ecology	become familiar and systematics.			
incorporate (1-2). Intro spatial and (3-4). Mari triploblasts (5-6). Mari (7-8). Bilat Hemichord (9-10). Mic (11-12). Ba (13-14). M (15). Final 6. Prepara identifying 7. Record	and evaluation method: Attendance and evaluation method: Attendance and example of the result of the section of	annes of molecular iblic museums ar web; producers, c at and solar-indep ics and phylogen it). Evolution of t inktonic forms. ordata. Chaetogn atematics. Gnathor Osteichthyes. a with closest relation y reading and wr m to improve un	ad aquariums. consumers, detr bendent (hydrot etics. Basic boo he nervous syst ath, Urochorda ostomes. Agnath atives iting assignmer derstanding of ng lectures (25)	itivores; the ma hermal) system dy plans (diplot tem. ta, Cephalocho na. hts prior to each the course cont %); Reports/qu	ajor groups & their as. blasts versus rdate. n class. By ent.			
 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.al@tohoku.ac.jp *Taxa not covered during this course will be address in the courses <i>Life & Nature</i>, <i>Planktonology</i> and in <i>Basic Seminars</i>. 								

Subject	Introduction to Resource and Environmental Economics (資源環境経済学概論)	Day/Period	1 st Quarter Thur./3rd, 4th	Object	AMB/JYPE		
Instructor (Post)	H. Sekine, <i>et al.</i> (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd & 4th-year & IVPE students		
(101)					2		
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	7&9		
Subject Numbering	t ABS-APS359E				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 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

Information will be shared in Google Classroom. Class code: ivis4ib

1) Guidance (Head of department) April 10th.

How are royalties on wheat varieties collected? A comparison between Japan, Germany, and Australia (Prof. Hisako SEKINE)

Wheat growers can use farm saved seed, so it is difficult for breeders to collect royalties which are necessary to develop new varieties. This class explains how to collect royalties on wheat varieties in Japan, Germany, and Australia.

2) Recent Situation of Japanese Agriculture and Agribusiness (Prof. Katsuhito FUYUKI) April 17th.

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) Agricultural policy and environmental issues (Prof. Keiichi ISHI) April 24th. This lecture will examine trends of agricultural policy integrating environmental problems.

4) Community farming in Japan (Prof. Tsuyoshi SUMITA) May 1st. Recently, community farming has been established in Japan. In this class, the characteristics and functions of

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

5) Spatial science in agriculture (Assoc. Prof. Chinatsu YONEZAWA) May 8th.

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

6) Food consumption and consumer behavior (Assoc. Prof. Asato MIZUKI) May 15th.

In this class, the recent characteristics of change in food consumption and consumer behavior will be shown. Students will be able to learn about some problems of the future Japanese food market.

7) Slash and Burn Agriculture: Balancing Tradition, Environment and Sustainability with a focus on India (Assistant Prof. Keeni MINAKSHI) May 22nd.

This lecture will examine the ecological, social, and economic aspects of slash-and-burn agriculture, focusing on its global use, environmental impacts like deforestation and carbon emissions, and specific cases in India.

8) Sustainable Agricultural Intensification of Smallholder Farms in Africa (Assistant Prof. Eustadius Francis MAGEZI) May 29th.

This presentation will cover recent environmentally friendly innovations aimed at increasing cereal yields for smallholder farmers in Africa. Students will learn about promising agricultural practices that could help ensure food security on the continent.

6. Preparation nothing special

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

8. Textbook and references Textbooks 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			
				Credits	2			
Position	Faculty of Agriculture (Graduate Scho	ol of Agricult	ural Science)	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 and industrial 								
 5. Conten 1) Miner: 1-1) Defin 1-2) Photo 2) Genon 2-1) The a 2-2) Hiera 3) Enzym 3-1) Enzy 3-2) Prote 4) Applie 4-1) Princ 4-2) Antile 5) Synthe 5-1) Fund 5-2) Appl 6) Molect 6-1) Nitro 7-2) Micr 6. Prepara 	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 and photosynthesis in higher plants (4/11) 1-1) Definition, classification, functions, and recycling of nutrients 1-2) Photosynthesis: carbon uptake by photoautotrophs 2) Genome and epigenetics (4/18) 2-1) The aging processes associated with genomic and epigenomic alterations 2-2) Hierarchical organization of the cell nucleus and application of synchrotron light 3) Enzymes in pathophysiology and toxicology(4/25) 3-1) Enzymes and proteins in natural toxins 3-2) Proteases in Alzheimer's disease 4) Applied microbiology and formentation technology (5/9) 4-1) Principles of protein production technology (5/9) 4-1) Principles of protein production technology (5/16) 5-1) Fundamental of organic chemistry and introduction of natural products 5-2) Application of useful natural products to agrochemicals, fragrances, and medicines 6) Molecular basis of nitrogen metabolism in plants (5/23) 6-1) Nitrogen uptake and assimilation in plants 7) Molecular eukaryotic microbiology (5/30) 7-1) Introduction of enzymes, antibiotics, and recombinant proteins							
7. Record	and evaluation method : Attendance to th	e lectures 50%	%, reports 50%					
8. Textbo	ok and references: Textbooks and referenc	es will be intr	oduced by each i	nstructor.				
9. Self stu	dy: Textbooks and references will be intro	oduced by eac	h professor.					
10. Practi	cal business							
11. In add Instructors:	ition Profs. Masaru ENOMOTO, Masahiko HA	RATA, Toshi	hiko HAYAKAW	A, Hiroyuki I	SHIDA, Jun			

KANEKO, Tomohisa OGAWA, Takahiro SHINTANI; Associate Profs. Eugene FUTAI, Chihiro HORIGOME, Shinya WADA

Subject	Current topics of Shellfish Physiology (先端海洋生物生理学)	Day/Period	1 st quarter Thu./1 st ~2 nd	Object	AMB				
Instructor (Post)	Kazue Nagasawa (Associate Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students				
Desition	Equilty of A an automa (Curchaste Sake	al of A amout	truel Caise as)	Credits	1				
Position	Faculty of Agriculture (Graduate Scho	ol of Agricul	tural Science)	Semester	7				
Subject Numbering	ABS-APS363E			Language Used in Course	English				
1. Class subject Introduction to Recent Research in Aquatic Animal Physiology									
 2. Object and summary of class Basic research in aquatic animal physiology has contributed much to basic biology as well as aquaculture production. In this course, I will introduce some of the recent findings in aquatic animals, focusing on research in germ cell biology and neuroendocrinology. Students will gain an understanding of research trends in the field of aquatic animal physiology and how these have been accumulated through direct exposure to original papers. 									
3. Keywo Germline	rds stem cells, Reproductive physiology, Neu	ropeptides, F	ish, Shellfish						
4. Goal of Students physiology.	f study will gain an understanding of the scientific Students will also learn about applied rese	c interest and earch using th	importance of rec ese findings.	ent findings i	n aquatic animal				
5. Conten Face-to-fa Progress v 1. Germ c 2. Germ c 3. Germ c 4. Germ c 5. Neuroe 6. Neuroe 7. Discuss	ts and progress schedule of class ace classes will be held in the lecture hall. will be made in one session on one of the cell biology in aquatic animals 1 (germ cel cell biology in aquatic animals 2 (germline cell biology in aquatic animals 3 (germ cel cell biology in aquatic animals 4 (germ cel cell biology in aquatic animals 1 endocrinology in aquatic animals 1 endocrinology in aquatic animals 2 sion and follow up	following top 1 classificatio 2 stem cell) 1 transplantat 1 transplantat	ics. n) ion 1) ion 2)						
6. Prepara Not requi	red								
7. Record Grades ar	end evaluation method based on attendance and quiz scores in e	each class.							
8. Textboo Handouts	ok and references and original research papers will be provi	ided.							
9. Self stu Review w	9. Self study Review with provided handouts.								
10. Practi	cal business								
11. In add Questions E-mail: ka	lition s about the lecture content may be submitt azue.nagasawa.d6*tohoku.ac.jp (replace *	ed by e-mail a to @)	at any time.						

Subject	Current topics of Fish Ecology (先端海洋生物生態学)	Day/Period	2nd quarter Thur. 1st ~2nd	Object	AMB				
Instructor (Post)	H. Murakami (Assistant Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students				
		1 6 4 1		Credits	1				
Position	Faculty of Agriculture (Graduate Scho	ool of Agricul	tural Science)	Semester	7				
Subject Numbering	Subject NumberingLanguage Used in CourseEnglish								
1. Class su Current to	1. Class subject Current topics of Fish Ecology								
2. Object This cours	and summary of class se covers the fish ecology and fish biodive	ersity in the m	arine ecosystem,	, using environ	mental DNA.				
3. Keywo Environm	rds ental DNA, Fish Ecology, Climate chang	e, Marine eco	system						
4. Goal of Through t environment	f study his course, students will be able to unders tal DNA in particular.	stand fish ecol	ogy and the meth	nods for ecolog	gical study,				
5. Conten 1 Overvie 2 The met 3 What is 4 eDNA n 5 Species 6 Applica 7 Applica	 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. Prepara No need.	tion								
7. Record Attendanc	and evaluation method ce and participation during lectures (10%)	, assignments	(30%), and repo	rts (60%)					
8. Textboo Miya, M. communities	ok and references (2022). Environmental DNA metabarcodi s. Annual review of marine science, 14, 10	ing: a novel m 61-185.	ethod for biodiv	ersity monitori	ing of marine fish				
9. Self stu No need.	9. Self study No need.								
10. Practio No need.	cal business								
11. In add If you hav (hiroaki.mur	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	3 rd quarter Thur./1 st ~2 nd	Object	AMB
Instructor (Post)	H. Yokoi (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
D. VI		1 6 4 1		Credits	1
Position	Faculty of Agriculture (Graduate Scho	ool of Agricul	tural Science)	Semester	6
Subject Numbering	ABS-APS365E Language Used in English Course				
1. Class s Technique	ubject es of molecular biology and marine biotec	hnology, geno	ome editing		
2. Object Students computer ar	and summary of class will learn about developmental biology of d websites.	fish, molecul	ar engineering in	fish, and bioi	nformatics using
3. Keywo Fish deve	rds lopment, genome, genome editing, positic	onal cloning, b	oioinformatics		
4. Goal of Students bioinformat	f study will understand the basic mechanisms and ics necessary for future research in the fiel	strategies of lds of marine	genetic engineeri biotechnology.	ng and genom	ics in fish, and
5. Conten	ts and progress schedule of class				
2: Forwar 3: Other b 4: Fish ge 5: Practic 6: Larval 7: Transg	 Reverse genetics (Knockout fish, CRISPR/Cas9) Forward genetics (Mutant library, Positional cloning) Other basic techniques essential for fish biotechnology Fish genomes Practical training using computer (BLAST search, Multiple alignment, Phylogenetic tree, Ensembl, PubMed) Larval and metamorphic development Transgenic fish 				
6. Prepara TBA (wi	ation Il be announced in the class)				
7. Record Attendance	end evaluation method ce, participation and test/report				
8. Textbo	8. Textbook and references				
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-stu Students a	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	2 nd quarter Fri./3 rd ~4 th	Object	AMB
Instructor (Post)	Toyonobu Fujii (Associate Prof.)CategoriesSpecialized Subjects		Preferable Participants	3 rd -year students	
Desition Examples of Assistant (Care has to Cale at a f Assistant to a logic as a)			Credits	1	
Position Faculty of Agriculture (Graduate Scho		of of Agricultural Science)		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 Deep Sea Environments I
- 4 Deep Sea Environments II
- 5 Hydrothermal Vents and Polar Regions
- 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	2^{nd} quarter Wed./1 st ~2 nd	Object	AMB	
Instructor (Post)	H. Suzuki (Assistant Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students	
D. St		1 6 4 1 1		Credits	1	
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	7	
Subject Numbering	ABS-APS367E			Language Used in Course	English	
1. Class s Ecology (1. Class subject Ecology of temperate reef communities.					
2. Object Some cur	and summary of class rent topics in ecology of temperate reef co	ommunities w	ill be introduced.			
3. Keywo seaweed,	rds kelp bed, canopy-forming algae, turf alga	e, herbivore, s	sea urchin			
4. Goal of To learn t	f study he factors affecting the complex networks	in temperate	reef communities	s.		
 1) Introdu 2) Introdu 3) Introdu 4) Introdu 5) Introdu 6) Introdu 7) Review 	 Introduction Introduction of recently published papers-1 Introduction of recently published papers-2 Introduction of recently published papers-3 Introduction of recently published papers-4 Introduction of recently published papers-5 Review 					
6. Prepara Study rele	evant 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 add Office pho Mail addr	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	3^{rd} quarter Thur./1 st ~2 nd	Object	AMB	
Instructor (Post)	H. Yokoi (Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students	
				Credits	1	
Position	Position Faculty of Agriculture (Graduate School of Agricultural Science)			Semester	6	
Subject Numbering	ABS-APS368E			Language Used in Course	English	
1. Class s Fish Mol	ubject <mark>ecular Biology Fish as a Model Syster</mark>	n				
2. Object In recent not only in a they are fave experimenta	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.					
5. Keywo Experime	ntal model animal, genetics, development	al biology, no	on-conventional m	odel animal		
4. Goal of Students in various fi any field.	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 the learned strategies would be helpful for students to design their own research projects in any field.					
5. Conten	ts and progress schedule of class					
 Introduction: Molecular biology as a tool for the research in biology and medicine Advantage of nematode and fly as model system: development, genetics and mutagenesis Advantage of fish as a model system: developmental genetics, genomics and mutagenesis Advantage of frog and chicken as model system: development and micro-surgery Advantage of mouse as a model system: development and stem cell technology Advantage of using multiple model system: comparative approach and evolutionary biology Experimental model system: past, present and future Summary and final exam 						
6. Prepara Review th	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 stu Take a loo research, an	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						

			4.4		
Subject	Current topics of Plankton Biology (先端プランクトン学)	Day/Period	1 st quarter Tue./1 st ~2 nd	Object	AMB
Instructor (Post)	G. Nishitani (Asso. Prof.)	Categories	Specialized Subjects	Preferable Participants	3rd-year students
Desition	Feaulty of Agriculture (Creducto Sch				1
Position	Faculty of Agriculture (Graduate Sch	oor of Agricul	lural Science)	Semester	7
Subject Numbering	ABS-APS369E			Language Used in Course	English
1. Class su Molecula	ubject r Ecology and utilization of plankton				
2 Object	and summary of class				
Plankton is c several resea	is a very small organism and its morpholo one of the most important components an urches on utilization of plankton and its e	ogy cannot be d significantly cology using t	observed without contributes to th he latest molecula	t using a micro e marine ecos ar techniques v	scope. However, ystem. In this class, vill be introduced.
3. Keywor Phytoplan	rds kton, Useful and harmful species, Molec	ular ecology			
4. Goal of Students v students will	study vill learn that molecular methods are effe also understand the utilization of plankte	ective and are on for industry	important tools fo y and human heal	or plankton res th.	earch. Moreover,
5. Content	ts and progress schedule of class				
Useful mi	croalgae (phytoplankton) (2)				
Harmful n	nicroalgae (2)				
Research	introduction (2)				
Report					
6. Prepara	tion				
Understa	nd an outline of each topic in advance				
7. Record	7. Record end evaluation method				
Attendance and examination					
8. Textbook and references					
All handouts will be given within class					
9. Self study					
10. In add	ition				
E-mail: ni	E-mail: ni5@tohoku.ac.jp				

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

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)

Syllabus of "Science, Technology, and Industry in Japan" in Fall 2024 (SB4792, TB14141, ABG3041)

<u>Time & Classroom</u>: Tuesday 4th period (14:40-16:10), **in A204** Most of the classes will be conducted in person in the classroom above.

Google Classroom: "2024 Science, Technology, and Industry in Japan (**for 3 FGL undergraduate courses**)" URL: https://classroom.google.com/c/NzEwNDQ1MjM0NjMw?cjc=ikyjunk Class Code: ikyjunk

<u>Course coordinator</u>: Yoshitaka Kasukabe (<u>yoshitaka.kasukabe.c3@tohoku.ac.jp</u>) at Global Learning Center.

<u>Office:</u> "Room Number 319 on the third floor in the Education and Student Support Center-West-wing Building at Kawauchi-Kita campus (A01on the Kawauchi campus map)

Course Title: Science, Technology, and Industry in Japan

<u>Course Subject</u>: The past, present, and future of industry, science, and technology and their relationships and integration in Japan

Language: English

Aim and outline:

This specialized subject course (**one credit**) is a multidisciplinary course that has been organized by the faculties of science, engineering, and agriculture since 2016. Except for the first class, each class will feature a lecture by a specialist in his field. The topic of each lecture will be related to the science, technology, and industry, and their relationships in Japan and the globe". The topics also include issues and efforts in specific fields of industry to implement the 17 SDGs (Sustainable Development Goals) announced by the United Nations in 2016.

Students will learn how science, technology, and industry in different fields were integrated and developed, and how they contributed, contribute, and will contribute to our society with different cultures, and in diverse circumstances.

MEXT scholarship students in FGL courses are expected to apply what they learn from this course in another course titled "Multidisciplinary Internship" which will be offered in the spring/summer of 2025.

<u>Goal</u>: The goal of this course is to give students a multidisciplinary perspective and open-minded attitude in a diverse group of people with different cultural and academic backgrounds.

Schedule of the course

#1 Guidance will be given by Y. Kasukabe at GLC on October 1, 2024.

#2-8 lectures by guest speakers will be given as listed in the table below.

0ct. 1	粕壁 善隆	東北大学・GLC
	(Yoshitaka KASUKABE)	
Oct. 8	富田二三彦氏	(国研)情報通信研究機構
	(Fumihiko TOMITA)	(NICT: Info. & Comm. Tech.)
Oct. 15	山田 幹也氏	(株)みずほ証券
	(Mikiya YAMADA)	(Mizuho Securities)
Oct. 22	佐藤 實氏	東北大学名誉教授・(株)スマートハンドレッド
	(Minoru SATO)	Emeritus Professor at Tohoku University • COE of Smar100
Oct. 29	藤森俊郎氏	(株) IHI
	(Toshiro FUJIMORI)	(IHI, Corp.)
Nov. 5	蛯名 武雄氏	(国研)産業技術総合研究所
	(Takeo EBINA)	(AIST: Advanced Industrial Science & Tech.)
Nov. 12	佐藤 陽一氏	(株)理研食品
	(Yoichi SATO)	(Riken Food)
Nov. 19	野田 智之氏	(株)国際電気通信基礎技術研究所
	(Tomoyuki NODA)	(ATR: Advanced Telecommunications Research Institute
		International)

Evaluation method:

✤ Attendance, active participation during the class including the submission of a reflection paper on each lecture (70%)

The length of the short reflection paper is expected to be approximately one A4 page (\sim 500 words) using 12-point 'Times New Roman font. You may want to write what you learned from the lectures and the situation of the lecture topic in your home country.

Please save your file with a name including your **student ID** and the **date** of the class **in "docx" or "doc" format**. This rule applies to the final report as well.

C2SBxxxxDATE (e.g., 1008 for DATE of October 8) C2TBxxxxDATE C2ABxxxxDATE

The deadline for submitting an essay to the classroom is **noon (JST) every next Monday after the class**.

 Submit a paper (~1,000 - 1,200 words) about the most important matter in achieving sustainable development in your home country or any specific region in the globe you learned from this series of lectures. (30%)

The deadline for this paper is noon (JST) on Wednesday, December 4, 2024.

Note: Late submission of a paper may result in a lower score on your work. A long delay (more than 1 week) without a reasonable reason will be considered to be a failure of the submission, and no scores will be given.

Misc.: If you cannot attend a class for any reason, please email the coordinator of this course (<u>yoshitaka.kasukabe.c3@tohoku.ac.jp</u>) as soon as you know you will be absent.