

MSL 612: Early Life-Histories of Marine Invertebrates Fall 2025

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Meetings: T/Th 9:45 –11:15
Location: 214 O’Neil
Office hours: by appointment

Course Description

This course will provide advanced students in marine science with an in-depth look at the reproductive biology and ecology of marine organisms, focusing on the invertebrate phyla. We will investigate the biology of invertebrate reproduction, from the production of eggs and sperm to the successful transformation into the juvenile form, and all steps in between. Throughout this course, we will consider environmental constraints on reproduction and larval ecology, and their effects on the evolution of early life-history strategies in the marine environment. The production, movement, and survival of larval forms is a central theme in many current issues in marine ecology, including invasive species, establishment of marine reserves, and impacts of climate change on marine communities. This course thus aims to provide students with a solid understanding of reproductive processes, and an opportunity to critically examine current research in the field.

Learning Objectives

1. Recognize some of the most frequently encountered larval forms of invertebrate taxa, and understand the classification schemes for larvae and life-history modes.
2. Understand the role of larval forms in defining invertebrate taxonomic relationships, and explore the ongoing debate on the origins of complex life-history modes.
3. Understand the basic biological processes of gamete production, fertilization, embryogenesis, and larval development in marine invertebrates, and the environmental constraints on these processes.
4. Examine the influence of environmental variables on reproduction, larval development, dispersal and recruitment, and consider the potential effects of these variables on the evolution of marine life-history strategies.
5. Explore relationships between processes affecting early life stages and adult population dynamics of marine invertebrates.
6. Critically evaluate and discuss current research topics in which marine life-history strategies play an important role.

Course Format and Requirements

This course is lecture-based, but will also include group discussions of the scientific literature. Copies of all slides will be distributed to assist with note-taking and review for exams. All announcements and course materials will be distributed via **Canvas**.

Readings

There is no required text book for this course. For some lecture topics, **supporting readings** will be distributed, including review papers from scientific journals and/or book chapters.

A **reference list** is provided, and will be updated throughout the semester. This list contains full citations for all references cited in lectures, as well as additional relevant articles. *You are not expected to read all*

the papers on this list! It is merely provided as a resource, and you may find it useful as a reference in the future.

A NOTE ABOUT READINGS: You are young professional scientists, and as such, a command of the classical and current literature is essential. Here are some guidelines to help you determine how best to spend your time on readings:

- Concepts presented in readings are fair game on exams, but pay particular attention to topics emphasized in lectures.
- Group discussions of the scientific literature will be held during class, as described below. You are expected to come to discussion having read these assigned readings carefully, and will be called upon to take the lead in discussion of at least one paper during each discussion session. With respect to exams, you ARE expected to be familiar with the general concepts presented in these readings.
- Lectures will include examples from the scientific literature, and will include citations for sources. The reference list provides the full citations so you can look up the paper on your own if you missed something or want to take a closer look.

Group Discussions (10 pts each for participation; 25 pts each for leading)

We will discuss as many as three readings from the primary literature at each discussion session. Discussions are an important part of this course and generally cannot be made up; however, your lowest discussion grade will be dropped. If you must miss multiple discussions, e.g. for field work, please talk to the instructor about an alternative assignment.

Points will be awarded according to the following rubric:

Score	Criteria
5 pts	Actively engaged, asking questions and speaking multiple times during discussions, demonstrating thorough reading of the material
4 pts	Engaged, speaking during discussion, demonstrating some familiarity with the reading materials
3 pts	Somewhat engaged, speaks only when called upon during discussion, demonstrates only cursory reading of the material
2 pts	Not engaged, mostly silent, difficulty answering questions when called upon, has not read all material
1 pts	Present, but silent during discussion; unprepared
0	Absent

Graduate students are expected to take on a leadership role and make substantive contributions to group discussions, including presenting a brief summary of readings and/or offering insights or questions to help stimulate further group discussion. In addition, each graduate student will **lead one discussion**, including identifying a topic or theme, selecting two to three readings, and facilitating the in-class discussion.

Essay Questions (50 pts each)

At least two homework assignments consisting of an essay question will be assigned during the semester to help stimulate further thought and reading on the course material, and help students to

develop better understanding of key concepts in preparation for exams. Students will synthesize key literature on a particular topic and prepare a short essay (~2 – 3 pages), including citations of literature used in preparing the essay. Additional details will be provided in class. Late assignments will not be accepted unless prior approval is obtained from the instructor.

Exams

Two **midterms (100 pts)** and one **final exam (125 pts)** will be given during the course. These exams will be written, closed-book, short-answer and/or essay exams that must be completed during the normal class period. The final exam will include material presented throughout the semester, but will be weighted more heavily toward material covered after the second midterm.

Research Project (75 points)

All students will give an oral presentation in class. More details will be provided in class.

Grading

Final semester grades will be assigned according to the following scale (fractions will be rounded up to the nearest whole number):

A+ 98-100%	A 93-97%	A- 90-92%
B+ 87-89%	B 83-86%	B- 80-82%
C+ 77-79%	C 73-76%	C- 70-72%
D+ 67-69%	D 63-66%	D- 60-62% F <60%

Course Policies

Attendance: You are unlikely to be successful in this class if you do not attend lectures, but attendance will not be recorded. For legitimate unplanned absences (e.g., illness, family emergency), please contact the instructor as soon as possible and make arrangements to make up any missed work. A zoom link can be provided if you need to attend lecture from home or other remote location, and lectures can be recorded upon request.

General UAF policies and expectations can be viewed on the UAF Governance webpage (<https://www.uaf.edu/uafgov/faculty-senate/curriculum/syllabus-addendum.php>).

Course Schedule

Week	Date	Lecture Topic
1	8/26	Course overview; Classification of life history modes
	8/28	Embryology and Evolution of Complex Life Cycles
2	9/2	Embryology continued
	9/4	DISCUSSION
3	9/9	Evolutionary transitions; Survey of life-history modes
	9/11	Survey of life-history modes, continued

4	9/16	Egg size and maternal investment
	9/18	DISCUSSION
5	9/23	Gametogenesis and spawning
	9/25	<i>Guest lecture: Katrin Iken, macroalgal life cycles</i>
6	9/30	DISCUSSION
	10/2	Midterm 1
7	10/7	Fertilization & Sexual Selection
	10/9	Larval swimming and orientation behavior
8	10/14	<i>Guest lecture: Jenn Questel, copepod life cycle and mating strategies</i>
	10/16	DISCUSSION
9	10/21	Larval feeding and nutrition
	10/23	Mortality & Defense
10	10/28	DISCUSSION
	10/30	Larval dispersal and connectivity
11	11/4	Larval transport modeling
	11/6	Midterm 2
12	11/11	Settlement and recruitment processes
	11/13	Reproduction in the Deep Sea
13	11/18	Deep-sea continued
	11/20	DISCUSSION
14	11/25	NO CLASS
	11/27	NO CLASS (Thanksgiving)
15	12/2	Climate change
	12/4	DISCUSSION
	12/11	FINAL EXAM: 10:15 - 12:15