MAR 210 AQUARIUM BIOLOGY

TR 2:00-3:50 p.m. lec + 4:00-4:50 lab; M 3:00-4:50 p.m. lab

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and by appointment

Prerequisite: None

Required Text:

Tullock, J. H. 1999. Natural Reef Aquariums: Simplified Approaches to Creating Living Saltwater Microcosms. (~$30)

Escobal, P.R. 1996. Aquatic Systems Engineering: Devices and how they function. 2nd edition. Dimension Engineering Press: Oxnard, CA. (~$20)

Required reading - assigned material from required texts and handouts from:

(1) Spotte, S. 1992. Captive seawater fishes: science and technology. John Wiley & Sons, Inc., New York.

(2) Delbeek, J. C., & J. Sprung. 1994. The Reef Aquarium: A comprehensive guide to the identification and care of tropical marine invertebrates. Ricordea Publishing: coconut Grove Florida.

Web resources:

APU Marine Biology program page http://marine.alaskapacific.edu/marine/
The Program page contains links to those listed below and other web resources.

APU Aquarium Biology course page http://marine.alaskapacific.edu/courses/Mar210.php
Course description, links to the syllabus and Internet resources.

Course Description: Fundamentals of aquarium science for the hobbyist or professional. Topics include basic lab techniques, chemistry of sea water, nitrogen cycle & biological filtration, aquarium design, engineering, theory and practice, and care and culture of marine life. Laboratory work includes water quality monitoring, care and maintenance of cold-water and tropical systems and organisms, and an aquarium systems project. Includes lab. Lab fee required. Satisfies laboratory science GUR.

Course Objectives: This course will provide student hands-on experience in:

- introduction to the fundamentals of laboratory science, including record keeping, hypotheses & experimental control, and laboratory technique;
- the operation, maintenance, and theory of marine aquarium keeping;
- the theory and practice of aquarium ecosystems;
- the biology, care and keeping of marine life;

Assignments:

For each assigned chapter, make up a **Discussion Question** about an aspect of the reading that interests you, that you wanted more information on or did not understand. Questions cannot be made up if missed, are not accepted late, and are collected at the start of each class.

Lab notebook. Keep a detailed record of results of all your lab activities, tests and procedures. For each activity, briefly note the meaning of your results, whether you are satisfied with the outcome of the activity, what your results indicate about the aquarium, and what action (if any) the Aquarist should take. Your notebooks will be collected and graded three times (for the following assignments):

Chemistry labs I/II - Complete: (1) the Analysis of an Artificial Ecosystem exercise (handout) and (2) the indicated water chemistry tests (see Schedule) as described in the kit instructions (follow the example sheets in Tullock (p. 139-140) modified as needed for each activity); and (3) design and evaluate a simple bacteria & nitrogen cycle experiment with appropriate control.

Systems Analysis (Quantitative aspects) - Complete and turn in the assigned worksheets: (1) Chemistry problem set; (2) Skimmers & hydraulics problem set; (3) Photosynthesis lab; and (4) Model of an Artificial Ecosystem.

Systems Management (Practical aspects) - Each year the class will conduct some aspect of system work, ranging from stocking of a system to replacing or repairing major system components. You will be asked to chose a project or portion of a project from a list of work to be completed; and given the materials and time in class to complete the work. Document your work in your lab notebook, note any problems that occurred and how you solved them. Grade will be based on successful resolution of problems and completion as well as notebook content. In other words, getting the job done well matters.

Organism survey - Examine 20 or so different marine aquarium systems (tanks) at an aquarium store. Be sure to include as many community ("display") tanks as possible rather than just examining holding tanks. Note the numbers and types of organisms found in each (invertebrates by Phylum and Class at least; fishes by Family if possible; trophic levels). Note symptoms (if any) of distress, disease or aggression among tank mates. Examine & tabulate your records carefully to answer the questions on the organisms survey worksheet.

Enrichment challenge: Design and build a device for octopus behavioral enrichment. Provide a written description of your device, including construction materials, size, diagrams, etc. Describe the stimuli the device is designed to present, the senses the animal uses to perceive the stimuli, and the animal's reaction to the device, including (if any) reduction in stereotypic behaviors. Demonstrate in an aquarium test that your device occupies an octopus' attention. Record and report how long the octopus is occupied on the first period of presentation; the second, the third, etc. and indicate the level of attenuation (if any). If you wish, you may design your device for an animal other than an octopus, provided you have an opportunity to test it in the allotted time for the assignment.

Grading:

Discussion questions	(10%)
Chemistry I/II lab notebook	(20%)
Systems Analyses worksheets & Management lab notebook (5% ea)	(25%)
Organismal survey lab notebook	(20%)
Enrichment challenge	(25%)

Minimum grades: A- for $\geq$ 90%; B- for $\geq$ 80% but <90%; C- for $\geq$ 70% but < 80%; D for $\geq$ 65% but <70%; F for <65%; use of - and + grades at the instructors discretion.

Course Expenses:
A course fee of $75.00 was collected when you registered. This fee contributes to the purchase or collection of live organisms for the Marine Biology lab. These costs exceed $1000 per year which are split among student fees, Marine Biology program funds, and departmental funds.

Material Discussions

TOPIC	READING ASSIGNMENT	Lab
1. Introduction: Marine environment & aquarium equipment; model systems		
2. Water chemistry	Spotte, Ch. 1 p 1-41, Tullock Ch. 5	Chem 1
3. Biological processes	Spotte, Ch. 2 p 53-79, Tullock Ch. 3	Chem 2
4. Aquarist philosophy, planning, equipment	Tullock Ch. 1-2; Escobal Ch. 8-9	Installation 1
5. Pumps	Escobal Ch. 10-11	Installation 2
6. Light & algae control	Tullock Ch. 4, Delbeek & Sprung Ch. 9	Lights
7. Tropical marine habitats & organisms	Tullock Part 2 (Ch. 6-9) Anderson 1997 Octopus husbandry	Survey
8. Marine fish	Tullock Ch 10, Spotte Ch. 6 p 312-318	
9. Nutrition	Tullock Ch. 12	
10. Exhibition & Behavior	Spotte Ch. 10 p 555-588 Anderson & Wood 2001 Enrichment	Enrichment Challenge
11. Aquarium health & disease	Tullock Ch. 11 Spotte Ch. 9 p 446-474 Delbeek & Sprung Ch. 10 p 283-307, 328-345	
12. Captive propagation & species of concern	Tullock Part 3 (Ch. 13-14)	

SCHEDULE

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Week 0:
Thurs, 23 Sep - Introduction to marine systems
4:00 p.m.: Model systems & System models I: Aquarium Ecosystem analysis

Week 1: Seawater chemistry I
Mon lab 27 Sep - Chemistry 1: clean lab technique, salinity, temperature & density, tank maintenance.
Read: Spotte, Ch 1. Chemical Processes, p 1-41; Tullock Ch. 5
Tues 28 Sep - Disc. 2 Water chemistry
Thurs 30 Sep - Design & set up bacteria & N cycle experiment.
Read: Tullock, Ch. 3

Week 2: Seawater chemistry II
Mon lab 4 Oct - Chemistry II Biological effects: N cycle, alkalinity, pH, calcium.
Read: Spotte, Ch 2. Biological Processes, p 53-79.
Tues 5 Oct - Disc. 3 Biological properties of seawater
Thurs 7 Oct - Aquarist philosophy, planning & equip. Introduction to System monitoring.
Read: Tullock Ch. 1-2. **Due**: Chemistry lab notebook

Week 3: Systems Analysis & Management
Mon lab 11 Oct - Systems I.
Read: Escobal, Ch. 8-9
Due: Problem set 1-Chemistry
Tues 12 Oct - Systems, cont. (salinity).
Handout: Problem set 4, Models.
Thurs 14 Oct - Protein skimmers

Week 4: Systems, cont.
Mon lab 18 Oct - Systems, cont
Tues 19 Oct - Fluid pumps & hydraulics
Thurs 21 Oct - Systems, cont. (substrate & overflow)
Read: Escobal, Ch. 10-11.

Week 5: System lighting
Mon lab 25 Oct - Lights & photosynthesis
Due: Problem set 2: Skimmers
Tues 26 Oct - Light in marine environments
Read: Tullock, Ch. 4, Delbeek & Sprung Ch. 9
Thurs 28 Oct - Algae. Systems, cont. (Live rock).

Week 6: Aquarium animals
Mon lab 1 Nov - Marine organisms 1
Read: Tullock Part 2, Ch. 6-9, Anderson 1997.
Due: Photosynthesis lab
Tues 2 Nov - Survey of organisms, invertebrates.
Aquarium store field trip reserve van or meet at store
Thurs 4 Nov - Marine organisms 2. Systems, cont. Live rock. Discuss Model problem set.

Week 7: Aquarium animals, continued.
Mon lab 8 Nov - Survey of organisms, Fishes
Tues 9 Nov - Marine organisms: fishes
Thurs 11 Nov - Systems, cont. (coral, etc.)
Due: Organisms lab notebook

Week 8: Enrichment & Nutrition
Mon lab 15 Nov -Enrichment Challenge
Due: Problem set 4-Model
Tues 16 Nov - Enrichment
Read: Spotte, Ch. 6 Behavior: 312-318; and Anderson & Wood Enrichment.
Thurs 18 Nov - Nutrition. **Due**: System lab notebook
Read: Tullock, Ch. 12

Week 9: Behavior
Mon lab 22 Nov -Enrichment Challenge, cont. Lab cleanup.
Tues 23 Nov - Designing for exhibition
Read: Spotte, Ch. 10 Exhibition p. 555-588.
Read: Tullock Ch. 13-14.
Thurs 25 Nov - **No class**. Happy Thanksgiving

Week 10: Health
Mon lab 29 Nov - Final cleanup.
Due: Enrichment report
Tues 30 Nov - **No class**. Sr. Project presentations
Thurs 2 Dec - Fish Health
Read: Spotte, Ch. 9 Health, p 446-474

Week 11: Health & Species of concern
Mon lab 6 Dec - Blue Planet-Coral Seas
Tues 7 Dec - Coral Health
Read: Delbeek & Sprung Ch. 10 Diseases, p 283-307, 328-345
Thurs 9 Dec - Selecting & collecting
Read: Tullock Ch. 13-14