**Marine & Estuarine Invertebrates**  
**Z561 (proposed new course)**

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<th><strong>Education Categories</strong></th>
<th><strong>Outcome Assessment (major distinctions between Z461 and Z561 are underlined)</strong></th>
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| **Content:** Graduate students will demonstrate understanding of fundamental biological knowledge and concepts. In particular, students will:  
  - **Describe** current systems of invertebrate classification and **discuss** strength and weaknesses of them.  
  - **List** newly discovered invertebrate phyla and their probable relationships, based on molecular and developmental evidence.  
  - **Explain** invertebrate phylogeny in an evolutionary context, **recognizing** and **illustrating** how embryonic development, larval type, segmentation, and other factors support this view.  
  - **State** major attributes of invertebrate phyla and classes.  
  - **Identify** and **describe** local representatives of marine and estuarine invertebrates.  
  - **List** and **describe** larval types and life histories of common invertebrates.  
  - **Explain** and **describe** salient examples of invertebrates that are models for education and/or research (e.g., for medicine, neurobiology, immunology, behavior, etc.) with emphasis on HMSC and OCA-related activities. | **Knowledge, Comprehension & Evaluation:** Graduate students will **demonstrate** (1) understanding and mastery of subject; (2) translate knowledge into new context; (3) **compare** and **discriminate** among ideas of differing classification. These skills will be assessed by:  
  - Lecture and lab exam with additional questions (relative to Z461) to extend knowledge to taxa never before seen by students and to evaluate differing classifications.  
  - Laboratory quizzes.  
  - Laboratory assignments (identifications and notebook).  

| **Technical Skills and Application:** Students will demonstrate technical skills in capturing, reproducing, and documenting species’ identities and key biological concepts. In particular students will:  
  - **Capture** and **edit** digital images of invertebrates, using computer technology. This will involve whole-animal and close-up documentation.  
  - **Document** key attributes of specimens (e.g., structure of snail teeth, stinging cells inside anemones tentacles, algal symbionts inside of host tissue), using drawings and computer-based digital imagery.  
  - **Search** for biological information using library sources, including computer technology. | **Skills and Application:** Graduate students will demonstrate the skills by producing three major products that will be assessed by instructor:  
  - **Create** group project on selected invertebrate topic which will involve students to identify species, **illustrate** key attributes, **label** biologically relevant structures, **highlight** and **discuss** crucial taxonomic features (e.g., gill type, tooth shape, etc.).  
  - **Present** group project to class as an audiovisual presentation.  
  - **Compile** a laboratory notebook in which each student will **document** and **record** all species observed as well as **describing** and explaining all demonstrations. |
**Interpersonal Skills:**
Graduate students will **collaborate** responsibly with others.

**Skills, Comprehension, & Application:**
Graduate students will (1) demonstrate mastery of subject, (2) apply knowledge to solve problems, and (3) demonstrate leadership:
- **Collaborate** with undergraduate team-mate in the joint-identification of species by sharing dichotomous keys and microscopes.
- **Identify** species, using dichotomous keys, and **facilitate** the identification activities of undergraduate group members.
- **Create** and **design** group computer project; **negotiate** and **revise** project until they reach group consensus.
- **Interact**, **assist**, and **facilitate** classmates during field trips.
- **Take** a leading role on field trips and projects with undergraduate group members.

**Communication Skills:**
Graduate students will **communicate** ideas and content effectively both orally and visually.

**Comprehension & Synthesis:**
Graduate students will (1) demonstrate mastery of subject and (2) synthesize their knowledge by:
- **Presenting** group project orally (using PowerPoint).
- **Presenting** review session (1-2 phyla/graduate student) for undergraduate students.

**Evaluation:**
Graduate students will **locate** unusual invertebrates in the field, **identify** them in the laboratory (using dichotomous keys), and **present** them to the class.

**Comprehension & Evaluation:**
Graduate students will **collect** unusual invertebrates, **compare** differing classifications of them, and **evaluate** the most appropriate classification.
- Discretionary assessment by instructor of the number of unusual invertebrates found in field and correctly identified in laboratory
- Laboratory notebook