



**MARINE AND COASTAL ECOLOGY OF THE INDO-PACIFIC:  
THAILAND AND MALAYSIA**

**Winter 2024  
JANUARY 23 – MARCH 6**

**ACADEMIC SYLLABUS**

**Faculty:**

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**Contact Hours:** We will all be in close contact, meeting every day throughout the course. There will be a number of “check-in days” where we will schedule student-faculty meetings. If you would like to have a meeting outside of those times, you can certainly make an appointment or find an appropriate available time, we are happy to oblige.

**Class Meetings:** This Wildlands Studies Program involves seven days per week of instruction and field research. Class activities are planned for every day of the program, with a half-day break every 7-10 days. Faculty and staff work in close contact with students for 6-10+ hours a day and are available for tutorials and coursework discussion before and after scheduled activities. Typically, scheduled activities begin at 8:30am and finish at dusk. Most evenings, students are expected to review class material or work independently on class projects. We may have scheduled activities some evenings. When in the backcountry or at a field site, our activities may start as early as 4am or end as late as 10pm (e.g., for wildlife observation). It is necessary to be flexible and able to accommodate learning activities that may take place at any time of the day or night.

**Course Credit:** Wildlands Studies Program students receive credit for three undergraduate courses. These three courses have distinct objectives and descriptions, and we integrate teaching and learning through both formal learning situations (i.e., lectures and seminars) and field surveys. Academic credit is provided by Western Washington University. Extended descriptions follow in the course description section of this syllabus.

1. **ESCI 497T, Environmental Wildlands Studies (5 quarter units / 3.35 semester credits)** – Field study of environmental problems affecting the natural and human-impacted ecosystems of our study region, including the role of human interactions.
2. **ESCI 497U, Environmental Field Survey (5 quarter units / 3.35 semester credits)** – In this field-based course we conduct on-site examinations and analyses of environmental problems affecting wildlands and wildlife in our study region.
3. **ESCI 497V, Wildlands Environment and Culture (5 quarter units / 3.35 semester credits)** – On-site field studies concerning the relationship between local culture groups and the environment. Using region- and culture-specific case studies, students assess ways in which local people utilize natural resources, according to both local tradition and modern ‘developed’ norms. Course examines the social and biological consequences of environmental and wildland/wildlife management policies.

**Readings:** We’ve compiled a Course Reader for this program. It will be available to students a couple weeks before the class starts. Readings include selections from academic primary literature, investigative journalism, book excerpts, and environmental working papers. Field guides and texts are used to supplement the field activities that are an integral part of the program. We will carry a shared reference library of field guides throughout the program.

**Contents of this syllabus:**

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**I. Program Overview**

The Indo-Pacific region supports the highest diversity of tropical marine life on Earth. Hundreds of species of reef-building corals form the substrate for an ecosystem that is spatially complex, dynamic, and accessible. The number of fish and other animal species that are resident on the reef seems nearly uncountable, and many are highly co-evolved with one another.

Our time spent in the water and along the shoreline will enable us to observe cycles of predation, competition, and cooperation that push the limits of ecological credibility. Examples include sit-wait-predators like moray eels and mantis shrimp, the 'wall of mouths' supplied by voracious surgeonfish's that confront plankton at the reef edge, filter-feeding soft corals and crinoids, amphibious mudskipper fish and vividly colored fiddler crabs of the mangrove forest, and bump-head parrotfish whose feeding program involves pulverizing the coral with a head-butt, then consuming the debris.

Stresses on tropical near-shore habitats are also evident, the result of processes that are local (coastal runoff, over-fishing), regional (coral bleaching), or global (plastics, marine acidification). An important part of our program is to discuss and monitor change on the reef, to learn about processes of disturbance and recovery, and strategies that may help forestall the degradation of coastal habitat. For example, one of our field sites, the Surin Islands, lost much coral due to thermal bleaching in 2010. Since that time, colonies of *Acropora* and other branching corals have established themselves and are growing well. We are eager to measure their growth since last winter, and to see how substrate changes resulting from ecosystem recovery are affecting the abundance of fish and other invertebrates.

Maritime Southeast Asia has long been a cultural crossroads where traders from China, India, and Arabia have mingled with indigenous people. This rich cultural context enables us to focus on human ecology as we pursue our studies. Several of the places we'll visit support ethnically distinct local populations, including indigenous groups like the Moken and the Urak Lawoi, whose animistic traditions foster a worldview different from the cultural norms of the Thai and Malay people. Our field studies will include visits to coastal communities that fish for a living, using gear that ranges from small-scale cast nets to large commercial trawlers. The depth of their indigenous knowledge about the sea is remarkable and will enrich our program.

As we travel overland through southern Thailand and onward to the Perhentian Islands in Malaysia, we will discover that the coastal ecosystem is utilized in many ways. In some places, appropriate, small-scale harvesting of marine resources provides a sustainable lifestyle; in other places, the human enterprise seems disruptive and unsustainable. Often, coastal communities become vulnerable to exploitation and tourism and infrastructure develops. Even within national parks and marine reserves, there are challenges to maintaining healthy marine biodiversity and ecosystem function. For example, shrimp farms coexist uneasily with the mangrove forests, which are recognized for their value as a critical buffer between land and sea, protecting the land from storms and tsunamis, and filtering sediment eroded from the land. Fish trapping for commercial purposes threatens the marine diversity and the economic base in some coral reef areas, as does sloppy tourism development. With all these environmental challenges surrounding us, we will be able to include shoreline ecosystem management as another key focal area for the program.

We'll divide our time between marine national parks on the mainland, protecting habitats that include mangrove forest and sea-grass estuaries, and offshore islands that support well-developed fringing coral reefs. Accommodations in these places range from national park bungalows to tent camping on the beach.

After a two day cultural orientation in Bangkok, we will fly to Phuket Island for an instruction to Thailand's coastal habitats, then move to Ko Surin Marine National Park, a group of islands located off the Andaman Coast of Southern Thailand. The Surin islands support some of Thailand's best protected coral reefs, which have shown a strong recovery from a bleaching event in 2010 that damaged the reefs severely. Since we have 'before' and 'after' data, monitoring the recovery process at Surin is an important field activity for our group. Surin is also the homeland of the Moken, an indigenous group of nomadic seafarers who have been struggling for cultural recognition. From Surin, we'll visit Trang Province, where small-scale fishing communities use traditional methods to harvest marine life from a productive estuary. Here, the coastline includes mangrove forest, headlands of weathered limestone and sea grass communities that support a small population of dugongs, a vegetarian marine mammal that used to be widespread in the tropical Indo-Pacific. After several days on the mainland, we'll travel to Tarutao National Park, Thailand's first marine protected area. Our field site at Tarutao is the Adang-Rawi archipelago, where Wildlands Studies has a long-term monitoring project that's brought us firsthand experience with cycles of coral destruction and recovery. The project of managing Tarutao National Park has been a challenging one, with numerous stakeholders whose agendas are at times hard to reconcile. Consequently, it is a good place to learn about the practicalities of sustainable resource management in the tropical marine environment. After we return from the Adang-Rawi archipelago, we will travel to the town of Hat Yai where we'll have an opportunity to discuss, analyze, and synthesize our field data. Then, from Hat Yai, we will travel to the Perhentian Islands, off the east coast of peninsular Malaysia, where we will revisit fields sites that we explored during previous visits in 2010-2016. During this phase of the program, we intend to conduct surveys to monitor change over an 8 year interval.

After field studies at the Perhentian Islands, we will return to southern Thailand to finish the program in Hat Yai.

## I. Learning Objectives

Following this program, students should have working-knowledge of and experience in:

1. **Identification and functional ecology of tropical marine organisms, with emphasis on taxonomic groups like corals, echinoderms, and fishes that are abundant, apparent, and have an important role in ecosystem dynamics.** Learning will consist of field observation supplemented by presentations and readings. Part of each day will focus on field observation, with focal groups selected according to location. Coral reef ecosystems in particular offer the best opportunity on Earth to view in real time ecological interactions like predation, competition, and symbiosis.
2. **Taxonomic relationships among the organisms that constitute a coral reef ecosystem.** Because diversity is so exceptionally high at the phylum level, our field studies, in conjunction with readings and presentations on evolution and physiology, will expand students' understanding of comparative zoology.
3. **Ecology of coastal habitats in the Indo-Pacific region, particularly mangrove, estuarine, and coral reef ecosystems.** We will consider processes that structure these ecosystems, the role of keystone species and disturbance, and the 'services' that these ecosystems provide.
4. **Artisanal fishing methods and traditional subsistence activities as practiced by coastal communities in the Indo-Pacific region.** During our program, we will become acquainted with several ethnic groups that have a tradition of subsistence on marine resources. With the help of local specialists and a bilingual course instructor, students will have the opportunity to interview and learn from Moken, Urak Lawoi, Thai, and Malay fisherfolk.
5. **Threats to the tropical marine ecosystem.** Rapid economic development, uneven regulation, and misunderstanding of impact have degraded Indo-Pacific coastal and marine habitats significantly. Carbon-related problems like thermal bleaching and marine acidification, imposed at a global-scale, add to the uncertainty. During the program, we will have ample opportunity to observe and discuss the scope and severity of threats that include over-fishing, inappropriate tourism development, industrial shrimp farming, and coastal impacts of increasing atmospheric CO<sub>2</sub> concentrations.

6. **Management strategies for conserving tropical marine habitat in the Indo-Pacific region.** We will examine firsthand how strategies are developed through education, exclusion, remediation, and restoration. We will look critically at the role played by various stakeholders, including local people, small businesses, commercial fisheries, non-government and government organizations.
7. **Techniques for collecting data and monitoring coastal ecosystems in the tropics.** Our course will consist of several group field activities. These include replicate photography to compare the state of the reef in 2024 to its state in past years, and photographic documentation of recovering *Acropora* colonies in areas that have been subjected to bleaching. We also census indicator species along 20-meter transects, including echinoderms, corals, and important fish species.

These topics will be addressed through classroom lecture and discussion, course readings, field activities, visits with local experts, exposure to ongoing research, and field research projects. The course generally progresses from faculty-led instruction in the beginning (i.e., more lectures and readings) to student-led critical evaluation, analysis, and synthesis at the end of the course. Our overarching goal is to have students leave the course with an extensive knowledge of our region, a set of broader skills, and an understanding of ecological, geological, and social sciences that allow students to critically evaluate information in other settings in their future lives and careers.

### III. Course Descriptions

We teach these three courses in an integrated format in the field. However, students will receive transcript credit for the following three courses (these were introduced on page 1):

**ESCI 497T, Environmental Wildlands Studies (5 quarter units / 3.35 semester credits)** – Ecological field study of selected Indo-Pacific marine and coastal habitats that are subject to varying degrees of human disturbance. We will devote attention to understanding the dynamics of the system, and we will focus on how human impacts may be affecting the system on a variety of scales.

Experiences/Activities: Students will become familiar with the ecology and biological diversity of the major coastal ecosystems of Southern Thailand and peninsular Malaysia, including mangrove, estuarine, littoral, and coral reef ecosystems. They will be instructed in methods of field observation, and how to recognize important taxonomic groups in this hyper-diverse part of the world. In the mangrove, there will be some emphasis on physiological methods of adaptation to the saline intertidal. Community level interactions (predation, competition, and symbiosis) are emphasized on the coral reefs. Instructors will teach the students through structured presentations, and students will also learn much through direct observation and experience.

Outcomes: Students will demonstrate knowledge of ecosystems, natural history, key organisms and proficiency with keys and manuals. Students will also keep a list of fish species encountered at the four main coral reef sites we will visit on this program.

Evaluation and Assessment: Students will receive two examinations and two short quizzes and will each give an oral presentation to the group. Success will require consistent attendance and participation in class activities.

**ESCI 497U, Environmental Field Survey (5 quarter units / 3.35 semester credits)** – Field-based examination and critical analysis of how human activities at both local and global scales are affecting the landscapes and wildlife populations of selected marine and coastal habitats in the Indo-Pacific region.

Experiences/Activities: Wildlands Studies students have been collecting field data in the marine national parks of Thailand for more than twenty years, generating data that holds modest but significant value for understanding ecosystem processes at work in this part of the world. Students contribute to this ongoing effort by monitoring the coral reef ecosystem in two specific ways. First, students use GPS to locate specific observation stations to make and analyze replicate photographs, tracking the establishment and demise of specific coral colonies.

Second, students establish 20-meter transects on reef flats to compare the abundance of grazing and predatory echinoderms (sea cucumbers and sea urchins) on various islands with different management histories. We know from experience that both of these projects are interesting for students and suitable for those who are still learning the fundamentals of tropical marine ecology. Other monitoring activities include an ongoing study of beach erosion and deposition at Laem Son on Adang Island.

***Outcomes:*** Students gain practical experience with the logistics of sampling, data collection, and GPS navigation in a marine environment. They learn methods of data analysis, including basic statistical methods for comparing results of transect surveys, and image processing and interpretation of underwater photographs. Beyond technical experience collecting data in a marine environment, this course gives students a practical understanding of ecosystem processes and how they are affected by the many disturbances that occur on coral reefs, including both 'natural' and anthropogenic. These practical insights will be used as a platform to facilitate discussion about future trends, especially how ongoing change in atmospheric composition is likely to affect the coral reef ecosystem through changes in sea water chemistry and surface temperature.

***Evaluation and Assessment:*** Students conduct structured fieldwork including data collection and analysis as described above. This will require participation in instructional presentations, a mastery of equipment and techniques commonly employed by ecologists working in the marine environment, and an overall understanding of the relevance of the task. Students will work together in teams to complete this part of the course, but each student will have specific responsibilities.

**ESCI 497V, Wildlands Environment and Culture (5 quarter units / 3.35 semester credits)** – Human ecology of coastal environments in the Indo-Pacific region.

***Experiences/Activities:*** This course considers the human component of the Indo-Pacific coastal environment, as manifested through traditional cultural institutions, anthropogenic impacts on the ecosystem, and environmental management practices. Students will learn about two localized indigenous coastal communities, the Moken and the Urak Lawoi of Thailand, as well as the cultures of the majority Thai and Malay fishers who inhabit southern Thailand and Malaysia. Local environmental impacts are manifold. Examples include conversion of mangrove to shrimp farms, unsustainable fishing practices at both artisanal and industrial levels, inappropriate tourism development, and mismanagement of national parks and protected areas. We will also consider global impacts and their effect on the coastal environment of the Indo-Pacific region. These include four manifestations of increased atmospheric CO<sub>2</sub>: sea level changes (expected to be especially severe in SE Asia); marine acidification (another direct consequence of CO<sub>2</sub> increase); coral bleaching due to warmer sea surface temperatures; and changes in the timing and intensity of the Asian monsoon. We hope that students will have the opportunity to meet with community leaders of the Urak Lawoi and Moken to discuss issues of concern. Local national park managers and members of the onshore business community (shrimp farmers and 'eco-tour' concessionaries) will also provide their insights to the students.

***Outcomes:*** Students will gain a practical understanding as to how disenfranchised ethnic minority groups perceive the efforts of outsiders to influence their future. Methods for identifying and assessing the impact of coastal development, especially tourism development, are emphasized. Students will achieve an understanding of the mechanisms that underlie threats to the coastal ecosystem, threats that manifest themselves locally and globally. Students will gain an in-depth understanding of one aspect of global climate change: its effect on coastal ecosystems due to warming, sea level rise, and ocean acidification. Students will become familiar with the notion of marine fisheries as an iconic manifestation of the 'tragedy of the commons.' Students will grasp principles involved in restoring mangrove and 'seeding' colonies of *Acropora* coral.

***Evaluation and Assessment:*** Structured learning will derive from presentations by course instructors supplemented by discussions with local experts, national park managers, and stakeholders in the coastal communities that we visit. Students will also read extensively from the peer-reviewed literature on the local impacts of both local and global sources of anthropogenic disturbance. Students are required to be engaged during the discussions, to do the readings, observe the purported impacts with a critical eye and learn skills of field appraisal.

## II. Assessment

The following is an overview of the academic requirements for the program. Some of the assignments are ongoing (student presentations, course readings, field studies); others have specific dates (midterm and final examinations). Due dates will be reconfirmed (or may be adjusted) once the course begins. Final grades for each course listed above will be based on the following items:

Course Number	Assessment Item	Date Due	Percent of Grade
ESCI 497T	Mid-Term Quiz 1	7 February	15
	Mid-Term Quiz 2	20 February	15
	Practical Quiz	22 February	15
	Final Quiz	5 March	15
	Oral Presentation	Variable*	20
	Individual Field Projects	4 March	20
ESCI 497U	Mid-Term Quiz 1	7 February	15
	Mid-Term Quiz 2	20 February	15
	Practical Quiz	22 February	15
	Final Quiz	5 March	15
	Participation in group field project	22 February	30
	Participation in data analysis	22 February	10
ESCI 497V	Mid-Term Quiz 1	7 February	20
	Mid-Term Quiz 2	15 February	20
	Final Quiz	5 March	20
	Participation/Engagement in interviews and class discussions	variable	40

\*Dates of each student's oral presentation will be assigned at the beginning of the program

Examinations are based mainly on presentation material, including presentations by course instructors, guest lecturers, and students. An understanding of material from the readings is also required for full credit. Examinations are 'closed-book' and consist mainly of objective questions, with a few longer, more subjective questions, in which students are asked to evaluate an issue. Students are not time-limited on the exams. Exams are graded anonymously.

Individual field studies projects will be conducted at the Perhentian Islands in Malaysia, and students will give short presentations in which they summarize their findings. Students will also submit reports with references, sketches, and quantitative data if applicable.

The group project will consist of replicate underwater photography of coral colonies that we have monitored and try to revisit annually, and 20-meter transects in shallow reef-edge habitat. Data will be collected by students who will work in small teams, and the data will be analyzed and presented collaboratively. We intend to conduct group projects at two sites: the Surin islands and the Adang island group, and to re-survey some sites at the Perhentian Islands as well. The product will be a display presentation of comparative photographs with a narrative-based comparison to previous years. The transect data is analyzed quantitatively and compared to previous years.

#### IV. Grading Scheme

To convert final grade percentages to letter grades for each course that will appear on your transcript, we will use the following grading scheme:

Letter grade	Percentage
A	92.5- 100+
A-	90.0- 92.4
B+	87.5- 89.9
B	82.5- 87.4
B-	80.0- 82.4
C+	77.5- 79.9

Letter grade	Percentage
C	72.5- 77.4
C-	70.0- 72.4
D+	67.5- 69.9
D	62.5- 67.4
D-	60.0- 62.4
F	< 60.0

#### V. General Reminders

*Academic Integrity* is as relevant during our field course as it is at your home institution. Plagiarism, using the ideas or materials of others without giving due credit, cheating, or putting forth another student's work as your own will not be tolerated. Any plagiarism, cheating, or aiding another to cheat (either actively or passively) will result in a zero for the assignment. Cases of academic dishonesty may be reported to your home institution.

*Assignment deadlines* are established out of fairness to other students and to allow enough time for instructors to grade student work. Therefore, deadlines are firm and late assignments will be penalized. If you believe that extenuating circumstances have prevented you from completing your work on time, make sure to discuss this with your instructor as soon as possible and certainly before the work is due.

*Participation and attendance* are crucial throughout this program. Because of the demanding schedule and limited time, all components of the program are mandatory (unless indicated) and missing even one lecture may affect your final grade. Hence, it is important to be prompt and prepared with the needed gear for all activities.

Students with special needs should meet with the lead faculty member as soon as possible to discuss any special accommodations that may be necessary.

#### VI. Course Reader *The Course Reader will be updated and revised and emailed in January 2024.*