

ECOLOGY, EVOLUTION AND NATURAL HISTORY OF BAJA CALIFORNIA

VERMILION SEA FIELD STATION

BAHÍA DE LOS ÁNGELES, BAJA CALIFORNIA, MEXICO

AUGUST 30 – SEPTEMBER 16, 2005

INSTRUCTORS

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SYNOPSIS OF COURSE

In this course, we will examine a rich and unique ecosystem—the Midriff Island Area in the Gulf of California—from several disciplinary perspectives. We hope to equip students with the basic background in local natural history, as well as the fundamental tools available from ecology and evolutionary biology, that will enable them to better understand the complex biological system they will engage each day. In lectures as well as readings, fundamental work in each discipline will be paired with primary literature related to ecosystems or organisms that the students will observe first hand. Our hope is that daily experience of this magnificent marine ecosystem will lend life and specificity to the foundations of several biological disciplines, while these disciplines permit a deeper, more careful, and more rigorous examination of the ecosystem.

In the Midriff Island Area, as in every marine ecosystem, there is a long and complex history of human impacts. Equipped with the basics from our intensive course, we will treat Bahía de Los Angeles as a case study in the challenges facing any effort to develop a sustainable relationship with marine ecosystems.

REQUIRED READING MATERIAL

Course Reader

Krutch JW (1961) *The Forgotten Peninsula*. The University of Arizona Press, Tuscon.
Steinbeck J (1941) *The Log from the Sea of Cortez*. Penguin Books, New York.

SYLLABUS

WEDNESDAY, AUGUST 31

Departure from San Diego; overnight camping in Cataviña.

THURSDAY, SEPTEMBER 1

Completion of travel from Cataviña to Bahía de los Ángeles.

Station orientation, check-out dive on station reef. Introduction to boats and boating safety.

Afternoon: INTRODUCTION TO THE BAJA PENINSULA AND THE GULF OF CALIFORNIA (VHV)

Evening: TRAVELS IN & AROUND BAJA – A DISCUSSION OF STEINBECK & RICKETTS, AND JOSEPH WOOD KRUTCH (AEH)

Steinbeck J (1941) *The Log from the Sea of Cortez*. Penguin Books, New York.

Krutch JW (1961) *The Forgotten Peninsula*. The University of Arizona Press, Tucson.

FRIDAY, SEPTEMBER 2

Afternoon: BAJA CALIFORNIA IN THE CONTEXT OF PLATE TECTONICS (SP)

Minch J, Minch E, Minch J (1998) Geology of Baja California. In: *Roadside Geology and Biology of Baja California*. John Minch and Associates, Inc., Mission Viejo.

Evening: PHYSICAL AND BIOLOGICAL OCEANOGRAPHY OF THE GULF OF CALIFORNIA

Guest Lecture: Physical Oceanography of the Midriff Island Area
Saúl Álvarez-Borrego, CICESE, Ensenada, Mexico

Álvarez-Borrego S (2002) Chapter 3. Physical Oceanography. In: *A New Island Biogeography of the Sea of Cortés*. (eds. Case TJ, Cody ML, Ezcurra E) Oxford University Press, New York.

Álvarez-Borrego S, Lara-Lara JR (1991) The physical environment and primary productivity of the Gulf of California. In: *The Gulf and Peninsular Province of the Californias*. (eds. Dauphin JP, Simoneit BRT) American Association of Petroleum Geologists, Tulsa.

Guest Lecture: Primary Productivity in the Midriff Island Area
J. Ruben Lara-Lara, CICESE, Ensenada, Mexico

SATURDAY, SEPTEMBER 3

Afternoon: BIOGEOCHEMISTRY IN THE GULF OF CALIFORNIA (SP)

Beman JM, Arrigo KR, Matson PA (2005) Agricultural runoff fuels large phytoplankton blooms in vulnerable areas of the ocean. *Nature* **434**, 211-214.

Redfield AC (1958) The biological control of chemical factors in the environment. *American Scientist*, 205-221.

Evening: INVERTEBRATE ZOOLOGY I (VHV)

SUNDAY, SEPTEMBER 4

Afternoon: NATURAL SELECTION AND ADAPTATION (AEH)

Darwin C (1872) Chapter 4. Natural Selection; or the Survival of the Fittest. Excerpts. In: *The Origin of Species (6th Edition)*.

Petren K, Case TJ (1997) A phylogenetic analysis of body size evolution and biogeography in chuckwalla (Sauromalus) and other Iguanines. *Evolution* **51**, 206-219.

Evening: PLANTS IN BAJA: WATER, NUTRIENT AND TEMPERATURE CONSTRAINTS ON LIFE IN THE DESERT (SP)

Anderson WB, Polis GA (1999) Nutrient fluxes from water to land: seabirds affect plant nutrient status on Gulf of California islands. *Oecologia* **118**, 324-332.

Stapp P, Polis GA, Piñero FS (1999) Stable isotopes reveal strong marine and El Niño effects on island foodwebs. *Nature* **401**, 467-469.

MONDAY, SEPTEMBER 5

Afternoon: no lecture

Evening: THE LIMITS TO ADAPTATION (AEH)

Gould SJ, Lewontin RC (1979) The spandrels of San Marco and the Panglossian paradigm: a critique of the adaptationist programme. *Proceedings of the Royal Society of London Series B Biological Sciences* **205**, 581-598.

Darwin C (1872) Chapter 6. Difficulties on Theory. In: *The Origin of Species (6th Edition)*.

TUESDAY, SEPTEMBER 6

Afternoon: INVERTEBRATE ZOOLOGY II (VHV)

Evening: no lecture

WEDNESDAY, SEPTEMBER 7

Afternoon: SEXUAL SELECTION (AEH)

Amundsen T, Forsgren E (2001) Male mate choice selects for female coloration in a fish. *Proceedings of the National Academy of Sciences of the United States of America* **98**, 13155-13160.

Petersen CW, Marchetti K (1989) Filial cannibalism in the Cortez Damsel fish *Stegastes rectifraenum*. *Evolution* **43**, 158-168.

Evening: *Guest Lecture:* Antonio Reséndiz, Campo Archelon, Sea Turtle Research Station

THURSDAY, SEPTEMBER 8

Afternoon: PHYLOGENETICS & CLASSIFICATION (VHV)

Giribet G (2002) Current advances in the phylogenetic reconstruction of metazoan evolution. A new paradigm for the Cambrian explosion? *Molecular Phylogenetics and Evolution* **24**, 345-357.

Shimamura M, Yasue H, Ohshima K, et al. (1997) Molecular evidence from retroposons that whales form a clade within the even-toed ungulates. *Nature* **388**, 666-670.

Evening: SPECIATION (AEH)

Bernardi G, Findley L, Rocha-Olivares A (2003) Vicariance and dispersal across Baja California in disjunct marine fish populations. *Evolution* **57**, 1599-1609.

Reed LK, Markow TA (2004) Early events in speciation: polymorphism for hybrid male sterility in *Drosophila*. *Proceedings of the National Academy of Sciences of the United States of America* **101**, 9009-9012.

FRIDAY, SEPTEMBER 9

Afternoon: INTERNATIONAL LAW IS NOT RULES (JM)

Higgins R (1995) Natural Resources and International Norms. In: *Problems & Process - International Law and How We Use It.*, pp. 129-136. Oxford University Press, Oxford.

Evening: FISHERIES I: ENVIRONMENTAL ECONOMICS (AEH)

Arvizu-Martinez J (1987) Fisheries activities in the Gulf of California, Mexico. *CalCOFI Report* **28**, 32-37.

Hanley N, Shogren JF, White N (1997) Chapter 10. Renewable Resource Economics. In: *Environmental Economics in Theory and Practice*. Oxford University Press, Oxford.

SATURDAY, SEPTEMBER 10

Visit to Mission San Borja.

Afternoon: no lecture

Evening: DVD: Ocean Oasis

SUNDAY, SEPTEMBER 11

Afternoon: FISHERIES II: ALTERNATIVE MANAGEMENT STRATEGIES (AEH)

Naylor R, Goldburg R, Primavera J, et al. (2000) Effect of aquaculture on world fish supplies. *Nature* **405**, 1017-1024.

Hastings A, Botsford LW (1999) Equivalence in yield from marine reserves and traditional fisheries management. *Science* **284**, 1537-1538.

Roberts CM, Bohnsack JA, Gell F, Hawkins JP, Goodridge R (2001) Effects of marine reserves on adjacent fisheries. *Science (Washington D C)* **294**, 1920-1923.

Arreguin-Sanchez F, Hernandez-Herrera A, Ramirez-Rodriguez M, Perez-España H (2004) Optimal management scenarios for the artisanal fisheries in the ecosystem of La Paz Bay, Baja California Sur, Mexico. *Ecological Modelling* **172**, 373-382.

Evening: IN THE WEST, TO WASTE WATER IS NOT TO CONSUME IT (JM)

Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande, Feb. 3, 1944, U.S.-Mex., 59 Stat. 1219.

Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River, IBWC Minute 242 (Aug. 30, 1973).

Arizona v. California, 373 U.S. 546 (1963). Excerpts.

MONDAY, SEPTEMBER 12

Afternoon: FISHERIES III: CASE STUDIES IN BAJA CALIFORNIA (VHV)

Pauly D, Christensen V, Dalsgaard J, Froese R, Jr. FT (1998) Fishing down marine foodwebs. *Science* **279**, 860-863.

Sala E, Aburto-Oropeza O, Reza M, Paredes G, López-Lemus LG (2004) Fishing down coastal food webs in the Gulf of California. *Fisheries* **29**, 19-25.

Cisneros-Mata MA, Montemayor-López G, Román-Rodríguez MJ (1995) Life history and conservation of the *Totoaba macdonaldi*. *Conservation Biology* **9**, 806-814.

Evening: ESCALERA NAUTICA (JM)

Dedina S (2000) Gray Whales and Mexican Politics. In: *Saving the Gray Whale*, pp. 65-77. University of Arizona Press, Tucson.

TUESDAY, SEPTEMBER 13

Afternoon: no lecture

Evening: Discussion with Grupo Marino

WEDNESDAY, SEPTEMBER 14

Afternoon: tba

Evening: Course Synthesis

THURSDAY, SEPTEMBER 15

Station & boat clean-up.

Dinner at Las Hamacas.

Drive to and overnight camping in Cataviña.

FRIDAY, SEPTEMBER 16

Completion of drive to San Diego.