Evolutionary Ecology - PCB 4673
Fall 2016 Syllabus & Schedule—*updated 8/22*

Your instructor: John Cozza
Contact: jcozza@fiu.edu (not by Blackboard; include "EVOL ECOL" in subject line)
Office Hours in OE 216: Mon 5-6+, Tues 1-3 & 5-6+, Weds 2-3 & 5-6+ (*but not evenings of 9/7, 10/5, 11/2*); after class, or by appointment. Office phone: 7-4932

Lecture and discussion time (required): MWF 4:00 – 4:50 pm
Room: 245 Green Library

Introduction:
We will explore the interface of ecology and evolution: how the interactions of organisms with each other and with their environment shape their change over time, and how that change in turn modifies the interactions. Some of the most basic and yet most elusive questions in biology—why are there so many kinds of organisms, how do they co-exist, what is the advantage of sex, what drives the birth and death of species—will be among our topics. We will employ active and interactive learning, and you will develop skills in interpreting and communicating scientific concepts.

Prerequisites:
PCB 3043 (Ecology) and PCB 3063 (Genetics)

Biology major distribution area: Ecology

Required materials:
1) **Text:** Mayhew, Peter 2006. *Discovering Evolutionary Ecology*. Oxford University Press.
2) Selections from the scientific literature and other sources, to be posted on Blackboard.
3) **I-clicker** (*device only*—not the app; earlier models OK), available at the bookstore.

Individual & group learning objectives: By the end of the course, you will be able to

- Review relevant concepts from ecology and genetics, add new information, and apply to hypotheses about evolutionary ecology.
- Read a scholarly book, and from it identify, explain, and discuss advanced concepts in evolutionary ecology; work with colleagues to clarify difficulties for all.
- Interpret, apply, evaluate, and synthesize results from the scientific literature, verbally and in writing—both individually and cooperatively in groups.
- Select a relevant scientific paper, present its main results clearly, and discuss with colleagues. Formulate and ask clarifying questions about colleagues' presentations.

Structure of the course:
We will cover one chapter in Mayhew each week. The typical schedule will be:

- Monday we discuss the new chapter—so you must ***read it before class!***
- Wednesday we discuss related papers or do an interactive activity, with some activities spanning two classes. For each discussion or activity, you will complete a (typically) 1-3 page individual or group **written assignment (7 total)** due at the end of class on the day of the activity, or as announced. Assignments not completed in

class will typically be due in one week, and must be handed in as a hard copy and also submitted digitally to turnitin.com. ***You must attend class prepared, and actively participate*** to get credit for the assignment. Assignments will vary; we will discuss in advance what is expected for each one.

- Friday and some other days (starting Week 5) is our **Evolutionary Ecology "Journal Club."** On those days, five people will *each* prepare a single Powerpoint slide of a relevant recent paper, present it to the class (5 min), and lead a short discussion (3 min). The paper you choose may be on any aspect of evolutionary ecology, and is not constrained by the topic of the week, but it must include results of primary research (or modeling). This will give us all a rich and varied view of the new and exciting research in the field!

  Please show me (or send me the citation for) your paper one week before you will present it. Plan to arrive early on the day you are presenting *to load your slide onto the classroom computer.*

- There will be **two midterm exams plus a final**. The final will focus on the last third of the material but it will also be cumulative. Exams will be all or mostly scantron questions, but there may be some written short answers too. Questions will stress your grasp of the concepts and your ability to synthesize and apply them. *If you miss an exam* for a university approved reason (medical emergency, death in the immediate family, jury or military duty, etc.) you must *officially document* it and let me know asap (beforehand if possible). This is the only way to receive any consideration other than a zero for a missed exam.
- We will use **clickers** to gauge your understanding of the concepts, and to stimulate discussion. You will earn extra credit by using the clickers. Clicker questions might appear *in any class meeting* (including Journal Club).

Grading:

Midterm exams (2@ 15%)	30%
Final exam:	20%
Written assignments (7 @ 5%)	35%
Journal Club slide & presentation	10%
Journal Club attendance & participation	5%
Extra credit (clickers)	up to 5% extra

Clicker extra credit will be calculated as follows. You will get 1 raw clicker point for participating in each question, and 1 additional point if you answer it correctly. At the end, your raw point total will be scaled to a maximum of 5% extra credit, with the highest total in the class scaling to the full 5%.

Grades: A = 93-100%, A− = 90-92%, B+ = 87-89%, B = 83-86%, B− = 80-82%, C+ = 77-79%, C = 70-76%, D = 60-69, F = 0-59%.

A grade of "C" or better is required to pass the course and earn credit in the biology major. Grades will be rounded up or down to the nearest 1%. There will be no curving, and no unearned points will be added to anyone's grade. The only extra credit available

will be that earned by using your clicker, or by participating in and writing about selected enrichment activities announced in class.

How to use turn-it-in:

On the "originality report" that turn-it-in provides, consider each highlight. If it's coincidental (something anyone could say, e.g. "hypotheses for the evolution of sex") then it's OK. But if it's the specific wording of your author or website, or another student, then you have to remove it. And you can't just change a few words—turn-it-in will still detect this—you must completely rewrite the highlighted sentence(s) in your own words. *If in doubt—rewrite! The best way to avoid plagiarism is simply not to have the source in front of you (or up on the screen) while you are writing! And you can never cut-and-paste an author's text into your document--ever!*

Honor and safe place policies:

As scientists and scholars, we hold ourselves to the highest standards of integrity. The FIU honor policy will apply fully to our work in this class. Any cheating on exams or plagiarism on written work will result in a grade of F for the assignment and, if warranted, the course. Using more than one clicker will result in temporary confiscation of the outlaw clicker, and permanent loss of clicker points for the owner and perpetrator. All course materials are for your use only—do not share, post, or sell (it's stealing). *Serious dishonor or cheating will result in academic misconduct charges.*

Likewise, as a progressive learning community, FIU does not tolerate sexual harassment or any other civil rights violation against any student or course personnel.

Academic misconduct definitions and procedures are detailed at: http://academic.fiu.edu/academicbudget/misconductweb/1acmisconductproc.htm.

FIU's student code of conduct, and policies on discrimination and sexual harassment, are available at: http://regulations.fiu.edu/regulation.

General expectations and how to succeed:

- **Read the text and assigned papers** thoughtfully, *before* the relevant class. The material is challenging-- you will need to read much of it more than once!
- **Attend every class** and *actively* participate in discussions, interactive questions, and activities. Research by Dr. Helen Young (Middlebury College) showed a 2% lower grade for each missed class in a similar course. Likewise, studies show that active, social engagement with the material produces meaningful, enduring learning.
- **Ask questions**; ask for clarification. There are no stupid questions!
- **Help your neighbor** and contribute to the group. If you help each other, everyone will do better including you!
- **Review concepts** ASAP after class, using the book and other resources to clarify any hazy areas. Try to find answers to your questions yourself, or in a study group.
- **Come to office hours** with any questions you are still unsure about.
- **Read all course emails** and announcements on Blackboard! You are responsible for all information in them, as well as anything announced or posted in class.

This syllabus may change at any time (see below).

Week	Date	Topic or graded activity/discussion	Reading due
1	22 Aug 24 26	Course information and introduction What is evolutionary ecology? Forming hypotheses in evolutionary ecology	 Mayhew ch. 1 Fox 2014
2	29 31 2 Sept	Major evolutionary transitions 1) Discussion: How did sex evolve? Sex discussion (*continued*)	Mayhew ch. 2 Hurst & Peck 1996 ALL: Gorelick 2010 Divided among group: Colegrave 2002, Hickey 1993, Misevic 2010
3	5 7 9	*Labor Day holiday—no class* Finish sex discussion + *Journal Club example* Major ecological transitions	 Mayhew ch. 3
4	12 14 16	Climate change discussion Life history evolution 2) Discussion: Explaining suicidal trees	AAS 2010 Mayhew ch. 4 J Read 2006, Poorter 2005
5	19 21 23	Sex allocation 3) Discussion: Sex change Journal club (#1-5)	Mayhew ch. 5 Vitt 2003, Kline 2011
6	26 28 30	Dispersal EXAM #1 on weeks 1-5 Journal club (#6-10)	Mayhew ch. 6
7	3 Oct 5 7	Behavior and plasticity 4) Activity: Invasive species assessment Invasive species activity (*continued*)	Mayhew ch. 7 Pheloung 1999
8	10 12 14	Population dynamics Journal club (#11-15) Journal club (#16-20)	Mayhew ch. 8
9	17 19 21	Generalization vs. specialization 5) Discussion: Specialization in *Nepenthes* Journal club (#21-25)	Mayhew ch. 9 ALL: Moran 2010 + divided among group: 3-4 papers *you* signed up to read (posted; also indicated in refs. below)
10	24 26 28	Antagonism vs. cooperation 6) Activity: Antbirds and army ants Antbird and army ant activity (*continued*)	Mayhew ch. 10 Angier 2012, Kuhlmann 2006
11	31 2 Nov 4	Co-evolution EXAM #2 on weeks 6-10 Journal club (#26-30)	Mayhew ch. 11
12	7 9 11	Speciation Journal club (#31-35) *Veterans' Day holiday—no class*	Mayhew ch. 12
13	14 16 18	Extinction 7) Discussion: How will we become sustainable? Journal club (#36-40)	Mayhew ch. 13 P Read 2009, Caldeira 2013, Burger 2012
14	21 23 25	Finish sustainability; Macroecology Journal club (#41-45) *Thanksgiving holiday—no class*	Mayhew **ch. 15** (←**note!**)
15	28 30 2 Dec	Macroevolution Journal club (#46-50) Journal club (#51-55) and course wrap-up	Mayhew **ch. 14** Mayhew ch. 16
Finals	5 Dec	FINAL EXAM on weeks 11-15 + cumulative; **2:15-4:15 PM in GL 245**	

This syllabus and schedule may change at any time *to better meet the needs of the group, or due to unforeseen circumstances.* All changes will be announced in class or via Blackboard. The most current version will be kept updated on Blackboard, so check there if in doubt.

Course readings and resources:

AAS (Australian Academy of Science) 2010. The science of climate change: questions and answers. Canberra. https://www.science.org.au/climatechange. Accessed 9/8/14.

Adam, J. (1997). Prey spectra of Bomean *Nepenthes* species (Nepenthaceae) in relation to their habitat. *Pertanika Journal of Tropical Agricultural Science*, *20*(2/3), 121-134. [activity 5: person #2]

Amagase, S., Mori, M., & Nakayama, S. (1972). Digestive enzymes in insectivorous plants IV. Enzymatic digestion of insects by *Nepenthes* secretion and *Drosera peltata* extract: proteolytic and chitinolytic activities. *Journal of biochemistry*, *72*(3), 765-767. [activity 5: person #5]

Angier, N. (2012). Feathered freeloaders at the ant parade. *New York Times*, September 24, Science section: D1. http://www.nytimes.com/2012/09/25/science/spotted-antbirds-feathered-freeloaders-at-the-ant-parade.html?pagewanted=all&_r=0. Accessed Fall 2013.

Bauer, U., Di Giusto, B., Skepper, J., Grafe, T., & Federle, W. (2012). With a flick of the lid: a novel trapping mechanism in Nepenthes gracilis pitcher plants. *PloS one*, *7*(6), e38951. [activity 5: person #1]

Bauer, U., Clemente, C., Renner, T., & Federle, W. (2011). Form follows function: morphological diversification and alternative trapping strategies in carnivorous *Nepenthes* pitcher plants. *Journal of Evolutionary Biology*, *25*(1), 90-102. [activity 5: person #1]

Bauer, U., Grafe, T., & Federle, W. (2011). Evidence for alternative trapping strategies in two forms of the pitcher plant, *Nepenthes rafflesiana*. *Journal of Experimental Botany*, *62*(10), 3683-3692. [activity 5: person #1]

Bauer, U., Willmes, C., & Federle, W. (2009). Effect of pitcher age on trapping efficiency and natural prey capture in carnivorous *Nepenthes rafflesiana* plants. *Annals of Botany*, *103*(8), 1219-1226. [activity 5: person #5]

Bonhomme, V., Gounand, I., Alaux, C., Jousselin, E., Barthélémy, D., & Gaume, L. (2011). The plant-ant *Camponotus schmitzi* helps its carnivorous host-plant *Nepenthes bicalcarata* to catch its prey. *Journal of Tropical Ecology*, *27*(01), 15-24. [activity 5: person #4]

Bonhomme, V., Pelloux-Prayer, H., Jousselin, E., Forterre, Y., Labat, J., & Gaume, L. (2011). Slippery or sticky? Functional diversity in the trapping strategy of *Nepenthes* carnivorous plants. *New Phytologist*, *191*(2), 545-554. [activity 5: person #2]

Buch, F., Rott, M., Rottloff, S., Paetz, C., Hilke, I., Raessler, M., & Mithöfer, A. (2012). Secreted pitfall-trap fluid of carnivorous *Nepenthes* plants is unsuitable for microbial growth. *Annals of Botany* 111(3): 375-383. [activity 5: person #5]

Burger, Joseph R., et al. (2012). The macroecology of sustainability. *PLoS Biology* 10(6): e1001345.

Caldeira, K., Bala, G., and Cao, L. (2103). The science of geoengineering. *Annual Review of Earth and Planetary Sciences* 41: 231–56.

Clarke, C., Bauer, U., Ch'ien, C., Tuen, A., Rembold, K., & Moran, J. (2009). Tree shrew lavatories: a novel nitrogen sequestration strategy in a tropical pitcher plant. *Biology Letters*, *5*(5), 632-635. [activity 5: person #3]

Colegrave, N. (2002). Sex releases the speed limit on evolution. *Nature*, *420*(6916), 664-666.

Dieckmann, U., & Ferrière, R. (2004). Adaptive dynamics and evolving biodiversity. *Evolutionary Conservation Biology*, 188-224.

Di Giusto, B., Bessière, J., Gueroult, M., Lim, L., Marshall, D., Hossaert-McKey, M., & Gaume, L. (2010). Flower-scent mimicry masks a deadly trap in the carnivorous plant *Nepenthes rafflesiana*. *Journal of Ecology*, *98*(4), 845-856. [activity 5: person #5]

Ferriere, R., & Legendre, S. (2013). Eco-evolutionary feedbacks, adaptive dynamics and evolutionary rescue theory. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *368*(1610), 20120081.

Fox, L. 2014. How to ask research questions (or frame hypotheses). Bioe 147/247 course website, University of California at Santa Cruz. http://courses.pbsci.ucsc.edu/eeb/bioe147/Assignments_files/Questions%20and%20Hypotheses_How%20they%20should%20be%20framed.pdf. Accessed 8/16/2014 and modified by JC.

Gordon, D., Onderdonk, D., Fox, A., Stocker, R., & Gantz, C. (2008). Predicting invasive plants in Florida using the Australian weed risk assessment. *Invasive Plant Science and Management*, *1*(2), 178-195.

Gorelick, R., & Heng, H. H. (2011). Sex reduces genetic variation: a multidisciplinary review. *Evolution*, *65*(4), 1088-1098.

Grafe, T., Schöner, C., Kerth, G., Junaidi, A., & Schöner, M. (2011). A novel resource–service mutualism between bats and pitcher plants. *Biology Letters*, rsbl20101141. [activity 5: person #3]

Hickey, D. (1993). Molecular symbionts and the evolution of sex. *Journal of Heredity*, *84*(5), 410-414.

Hurst, L. (1995). Selfish genetic elements and their role in evolution: The evolution of sex and some of what that entails. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, *349*(1329), 321-332.

Kline, R., Khan, I., & Holt, G. (2011). Behavior, color change and time for sexual inversion in the protogynous grouper (*Epinephelus adscensionis*). *PloS One*, *6*(5), e19576.

Kuhlmann, M. (2006). Do antbirds help or hinder army ants? Teaching Issues and Experiments in Ecology, Volume 4. Ecological Society of America.

Mallet, J. (2007). Hybrid speciation. *Nature*, *446*(7133), 279-283.

Mayhew, Peter (2006). *Discovering Evolutionary Ecology*. Oxford University Press. 215 pp.

Maynard Smith, J. & Szathmáry, E. (1995). Chapter 9: The origin of sex and the nature of species. *The Major Transitions in Evolution*. Oxford University Press. pp. 149-167.

Merbach, M., Zizka, G., Fiala, B., Merbach, D., Booth, W., & Maschwitz, U. (2007). Why a carnivorous plant cooperates with an ant-selective defense against pitcher-destroying weevils in the myrmecophytic pitcher plant *Nepenthes bicalcarata* Hook. *Ecotropica*, *13*, 45-56. [activity 5: person #4]

Misevic, D., Ofria, C., & Lenski, R. (2010). Experiments with digital organisms on the origin and maintenance of sex in changing environments. *Journal of Heredity*, *101*(suppl 1), S46-S54.

Moran, J., & Clarke, C. (2010). The carnivorous syndrome in Nepenthes pitcher plants. *Plant signaling & behavior*, *5*(6), 644-648.

Moran, J. (2006). Life and death in a pitcher. *Natural History* magazine, *115*(8), Oct: 56-62.

Moran, J., Clarke, C., & Hawkins, B. (2003). From carnivore to detritivore? Isotopic evidence for leaf litter utilization by the tropical pitcher plant *Nepenthes ampullaria*. *International Journal of Plant Sciences*, *164*(4), 635-639. [activity 5: person #2]

Moran, J., Merbach, M., Livingston, N., Clarke, C., & Booth, W. (2001). Termite prey specialization in the pitcher plant *Nepenthes albomarginata*—evidence from stable isotope analysis. *Annals of Botany*, *88*(2), 307-311. [activity 5: person #2]

Moran, J. (1996). Pitcher dimorphism, prey composition and the mechanisms of prey attraction in the pitcher plant *Nepenthes rafflesiana* in Borneo. *Journal of Ecology*, 515-525. [activity 5: person #3]

Ornstein, L. (2009). Replacing coal with wood: sustainable, eco-neutral, conservation harvest of natural tree-fall in old-growth forests. *Climatic Change*, *97*(3), 439-447.

Ornstein, L., Aleinov, I., & Rind, D. (2009). Irrigated afforestation of the Sahara and Australian Outback to end global warming. Climatic Change, 97(3-4), 409-437.

Pheloung, P., Williams, P., & Halloy, S. (1999). A weed risk assessment model for use as a biosecurity tool evaluating plant introductions. *Journal of Environmental Management*, *57*(4), 239-251.

Poorter, L., Zuidema, P. A., Peña-Claros, M., & Boot, R. (2005). A monocarpic tree species in a polycarpic world: How can *Tachigali vasquezii* maintain itself so successfully in a tropical rain forest community?. *Journal of Ecology*, 268-278.

Read, J., Sanson, G., Jaffré, T., & Burd, M. (2006). Does tree size influence timing of flowering in *Cerberiopsis candelabra* (Apocynaceae), a long-lived monocarpic rain-forest tree?. *Journal of Tropical Ecology*, *22*(06), 621-629.

Read, P. (2009). Reducing CO_2 levels—so many ways, so few being taken. *Climatic Change*, *97*(3), 449-458.

Thornham, D., Smith, J., Ulmar Grafe, T., & Federle, W. (2012). Setting the trap: cleaning behaviour of *Camponotus schmitzi* ants increases long-term capture efficiency of their pitcher plant host, *Nepenthes bicalcarata*. *Functional Ecology*, *26*(1), 11-19. [activity 5: person #4]

Vitt, P., Holsinger, K., & Jones, C. (2003). Local differentiation and plasticity in size and sex expression in jack-in-the-pulpit, *Arisaema triphyllum* (Araceae). *American Journal of Botany*, *90*(12), 1729-1735.

Waxman, D., & Gavrilets, S. (2005). 20 questions on adaptive dynamics. *Journal of Evolutionary Biology*, *18*(5), 1139-1154.

Wells, K., Lakim, M., Schulz, S., & Ayasse, M. (2011). Pitchers of *Nepenthes rajah* collect faecal droppings from both diurnal and nocturnal small mammals and emit fruity odour. *Journal of Tropical Ecology*, *27*(04), 347-353. [activity 5: person #3]