COURSE: Spring 2012, FISH 6970, Special Topics in Fisheries and Allied Aquacultures

TOPIC: Meta-analysis: Concepts, Limitations, and Possibilities

LECTURE: TBD (2 hour block once per week), Swingle 303, 2 credit hours

OFFICE HOURS: Available by appointment

REQUIRED PREREQUISITES: Graduate level students, instructor approval

INSTRUCTOR: Dr. Alan Wilson, Swingle 321, wilson@auburn.edu, 334-844-9321

FIELD OF STUDY:
Meta-analysis is a quantitative approach for synthesizing results from diverse research studies that address a similar hypothesis. Effect sizes calculated from individual studies are combined to elucidate general patterns across studies. Like most approaches, meta-analysis has limitations (e.g., file drawer problem, dealing with varying publication quality). However, the technique can be a power option for identifying patterns in disciplines where the availability of large, underanalyzed datasets is common, such as ecology, psychology, medicine, and education.

COURSE OBJECTIVES & STUDENT LEARNING PHILOSOPHY:
The course objectives represent a variety of tasks and skills that I expect students to have developed and mastered by the end of the course. Through participating in this course, you will (1) practice and develop your critical thinking skills (through in-class group discussions and presentations), (2) learn how to read and interpret the scientific literature, (3) broaden your understanding of meta-analysis, and (4) conduct your own meta-analysis.

REQUIRED MATERIALS (PROVIDED BY INSTRUCTOR AND STUDENTS):
(1) Articles from the peer-reviewed literature (see complete list at end of syllabus)
(2) CMA software – 6 month license available for $65 (student) & 12 month license available for $95 (postdoc) or $195 (faculty) – see Alan for ordering info

GRADING:
Course grades are based on each student's cumulative performance for the following assignments:

Activity	**Points**	**Grading scale**
Participation	25	A = 90-100%
Paper discussion	25	B = 80-89%
Project presentation	25	C = 70-79%
Paper	25	D = 60-69%
		F = 0-59%
Total points	100	

STUDENT EXPECTATIONS:
The course grade will be based on participation in lecture, discussion leading of important papers in meta-analysis, and a final project presentation as described below:

(1) *PARTICIPATION*: Discussion is vital to an effective learning environment and participation grades will reflect student attendance and involvement during classroom activities. In order to participate, you need to be at class on-time and prepared (i.e., perused readings, practice with software).

(2) *PAPER DISCUSSION*: All students will be required to lead the discussion of a series of articles from the peer-reviewed literature during one class period.

(3) *PROJECT PRESENTATION*: All students will be required to present a 10-15 minute lecture describing a meta-analysis that they conduct during the course. Brief 1 page outlines of the project will be due by the third week of the course so that I can assist with project development. The students are expected to use the primary literature as references and data sources for this presentation. Students producing successful projects will be strongly encouraged to submit their papers to a peer-reviewed journal.

(4) *PAPER*: All students will be required to submit a 5-10 page paper associated with their meta-analysis project. The paper should be prepared with submission to a journal in mind. Formatting should be specific to the target journal.

FEEDBACK & EVALUATION:
This course is for you to learn important fundamental concepts and ideas on which to build your understanding of meta-analysis. Course evaluations will be completed by students at the end of the semester so that course changes can be made to enhance the learning experience for this class and future classes. Finally, students are always welcome to schedule a meeting with me to talk more about topics discussed in class.

COURSE CHANGES:
Although I expect to cover all the topics described in the syllabus, course changes will likely occur - especially based on feedback from the students. Consequently, I reserve the right to modify the course to enhance the learning experience where I deem appropriate. Course changes will be described verbally during class and/or in writing via email and/or handouts.

ACADEMIC HONESTY:
The Auburn University Oath of Honor (available at http://auburn.edu/tigercub/) clearly states "*In accordance with those virtues of Honesty and Truthfulness set forth in the Auburn Creed, I, as a student and fellow member of the Auburn family, do hereby pledge that all work is my own, achieved through personal merit and without any unauthorized aid. In the promotion of integrity, and for the betterment of Auburn, I give honor to this, my oath and obligation.*"

ACCOMMODATIONS FOR DISABILITIES:
If you have a disability and/or a special need that requires accommodations, please inform me immediately so that I can develop a plan to work with you and arrange an appointment with a campus disabilities counselor.

LECTURE SCHEDULE AND ASSOCIATED READINGS (CITATIONS FOLLOW):

Week	Lecture topic
1	**Introduction to meta-analysis; historical overview** Discussion leader – Alan Glass 1976; Gurevitch et al. 2001; Arnqvist and Wooster 1995, Cooper et al. 1990; Finney 1995; Osenberg and St. Mary 1998
2	**Limitations of meta-analysis** Discussion leaders – TBD Lecky et al. 1996; Møller and Jennions 2001; Marshall et al. 2004; Bailar 1997; Eysenck 1984; Eysenck 1994
3	**Where to find data? How to choose data?** Discussion leaders – TBD Kissling and Davis 2009; Nelson and Kennedy 2009; Neber et al. 2001; Englund et al. 1999; Slavin 1995
4	**Statistics and meta-analysis; (ir)relevance of null hypotheses & *P*-values** Discussion leaders – TBD Fernandez-Duque 1997; Borenstein et al. 2009 (chapter 16); Gurevitch and Hedges 1999; Johnson 1999
5	**How to choose an effect size metric? ***Student project proposal presentations* Discussion leaders – TBD Hedges et al. 1999; Osenberg et al. 1997; Osenberg et al. 1999
6	**Introduction to Comprehensive Meta-Analysis (CMA)** Discussion leader – Alan Borenstein et al. 2009
7	**Meta-analysis examples** Discussion leaders – TBD Benayas et al. 2009; Brett and Goldman 1996;
8	**Meta-analysis examples** Discussion leaders – TBD Downing et al. 1999; Halaj and Wise 2001;
9	**Meta-analysis examples** Discussion leaders – TBD Koricheva et al. 2004; Sarnelle 1992;

10 **Meta-analysis examples**
Discussion leaders – TBD
Schmitz et al. 2000; Shurin et al. 2002

11 **Project development**
none

12 **Project development**
none

13 **Project development**
none

14 **Final student presentations**
none

15 **Final student presentations; Final paper due;** *course evaluation*
none

READINGS:

Arnqvist, G., and D. Wooster. 1995. Meta-analysis - synthesizing research findings in ecology and evolution. Trends in Ecology and Evolution 10:236-240.

Bailar, J. C. 1997. The promise and problems of meta-analysis. New England Journal of Medicine 337:559-561.

Benayas, J. M. R., A. C. Newton, A. Diaz, and J. M. Bullock. 2009. Enhancement of biodiversity and ecosystem services by ecological restoration: a meta-analysis. Science 325:1121-1124.

Brett, M. T., and C. R. Goldman. 1996. A meta-analysis of the freshwater trophic cascade. Proceedings of the National Academy of Sciences of the United States of America 93:7723-7726.

Cooper, S. D., S. J. Walde, and B. L. Peckarsky. 1990. Prey exchange-rates and the impact of predators on prey populations in streams. Ecology 71:1503-1514.

Downing, J. A., C. W. Osenberg, and O. Sarnelle. 1999. Meta-analysis of marine nutrient-enrichment experiments: variation in the magnitude of nutrient limitation. Ecology 80:1159-1167.

Englund, G., O. Sarnelle, and S. D. Cooper. 1999. The importance of data-selection criteria: Meta-analyses of stream predation experiments. Ecology 80:1132-1141.

Eysenck, H. J. 1984. Meta-Analysis - an Abuse of Research Integration. Journal of Special Education 18:41-59.

Eysenck, H. J. 1994. Systematic Reviews - Metaanalysis and Its Problems. British Medical Journal 309:789-792.

Fernandez-Duque, E. 1997. Comparing and combining data across studies: Alternatives to significance testing. Oikos 79:616-618.

Finney, D. J. 1995. A Statistician Looks at Met-Analysis. Journal of Clinical Epidemiology 48:87-103.

Glass, G. V. 1976. Primary, secondary, and meta-analysis of research. Educational Researcher 5:3-8.
Gurevitch, J., P. S. Curtis, and M. H. Jones. 2001. Meta-analysis in ecology. Pages 199-247 Advances in Ecological Research, Vol 32.
Gurevitch, J., and L. V. Hedges. 1999. Statistical issues in ecological meta-analyses. Ecology 80:1142-1149.
Halaj, J., and D. H. Wise. 2001. Terrestrial trophic cascades: how much do they trickle? American Naturalist 157:262-281.
Hedges, L. V., J. Gurevitch, and P. S. Curtis. 1999. The meta-analysis of response ratios in experimental ecology. Ecology 80:1150-1156.
Johnson, D. H. 1999. The insignificance of statistical significance testing. Journal of Wildlife Management 63:763-772.
Koricheva, J., H. Nykänen, and E. Gianoli. 2004. Meta-analysis of trade-offs among plant antiherbivore defenses: are plants jacks-of-all-trades, masters or all? American Naturalist 163:E64-E75.
Lecky, F. E., R. A. Little, and P. Brennan. 1996. The use and misuse of meta-analysis. Journal of Accident and Emergency Medicine 13:373-378.
Møller, A. P., and M. D. Jennions. 2001. Testing and adjusting for publication bias. Trends in Ecology & Evolution 16:580-586.
Osenberg, C. W., O. Sarnelle, and S. D. Cooper. 1997. Effect size in ecological experiments: the application of biological models in meta-analysis. American Naturalist 150:798-812.
Osenberg, C. W., O. Sarnelle, S. D. Cooper, and R. D. Holt. 1999. Resolving ecological questions through meta-analysis: Goals, metrics, and models. Ecology 80:1105-1117.
Osenberg, C. W., and C. M. St. Mary. 1998. Meta-analysis: synthesis or statistical subjugation? Integrative Biology: Issues, News, and Reviews 1:37-41.
Rosenberg, M. S., D. C. Adams, and J. Gurevitch. 2000. METAWIN: statistical software for meta-analysis. Sinauer, Sunderland, MA.
Sarnelle, O. 1992. Nutrient enrichment and grazer effects on phytoplankton in lakes. Ecology 74:551-560.
Schmitz, O. J., P. A. Hambäck, and A. P. Beckerman. 2000. Trophic cascades in terrestrial systems: a review of the effects of carnivore removals on plants. American Naturalist 155:141-153.
Shurin, J. B., E. T. Borer, E. W. Seabloom, K. Anderson, C. A. Blanchette, B. Broitman, S. D. Cooper, and B. S. Halpern. 2002. A cross-ecosystem comparison of the strength of trophic cascades. Ecology Letters 5:785-791.
Slavin, R. E. 1995. Best evidence synthesis: an intelligent alternative to meta-analysis. Journal of Clinical Epidemiology 48:9-18.
Worm, B., H. K. Lotze, H. Hillebrand, and U. Sommer. 2002. Consumer versus resource control of species diversity and ecosystem functioning. Nature 417:848-851.