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Special Report

A SURVEY OF UNDERGRADUATE ORNITHOLOGY COURSES IN NORTH AMERICA

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ABSTRACT.—The Committee on Undergraduate Education of the Wilson Ornithological Society conducted a survey of ornithology courses in North America as a service for teachers of ornithology. Our survey of 26 responses uncovered 26 creative approaches to teaching ornithology. Nonetheless, a number of commonalities exist. Courses at small colleges and large universities include both lecture and laboratory components and usually extend into the spring. Most courses emphasize anatomy and physiology, nesting, evolution of birds, ecology, and flight, with other topics receiving few or no lectures. Almost 60% of the courses include student dissection or faculty demonstration. Some courses use preserved birds, others use birds that died accidentally, and one uses roasted chickens that are eaten as part of the skeleto-muscular dissection. Laboratory sessions emphasize taxonomy and identification of local and, often, world birds. Most schools have at least a small collection of specimens available for student use. Courses usually include an extensive project and written work. We hope the results of the survey will stimulate discussion among teachers of ornithology as we seek to develop new ideas for our courses. *Received 29 Sept. 1997, accepted 8 Jan. 1999.*

The Wilson Ornithological Society's Committee on Undergraduate Education seeks to increase the quality of teaching of ornithology at the undergraduate level and to foster communication among ornithology teachers about successful and unsuccessful aspects of their courses. With these goals in mind, we prepared a questionnaire that was sent to all ornithology faculty who responded to a request printed in the Ornithological Societies of North America newsletter. The following is a synthesis of the information provided by the 26 ornithologists who completed the questionnaire in 1993 and 1994. Some respondents left one or more questions unanswered, thus our analysis of some questions is based on fewer than 26 responses.

The questionnaire included demographic and course content questions. Copies of all completed responses are available from the Van Tyne Library at the University of Michigan. We first describe the demographics of our sample, then summarize the quantitative data, and close with a discussion of successful and unsuccessful aspects of the courses.

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DEMOGRAPHICS OF THE RESPONDENTS' INSTITUTIONS

Our small sample is not amenable to multivariate analysis. Furthermore, because it is based on only 26 respondents, our survey may be biased. Our intent is to document the diversity of approaches and stimulate discussion.

The 26 responses to the survey came from ornithology teachers in 18 states and 1 Canadian province. Thirteen of the respondents teach at schools in the Eastern Time zone, 11 at schools in the Central Time zone, and 2 in schools in the Mountain Time zone. We received no data from faculty teaching at schools in the Western Time zone. Of the 24 schools in the Eastern and Central Time zones, 5 are in southern states. Fifteen of the colleges and universities are located in small towns, whereas 11 have suburban or urban campuses. Sixteen of the respondents teach at state-supported, public institutions; 7 teach at privately supported, non-denominational colleges or universities; and 3 teach at church-affiliated colleges. Twelve of the schools offer the Ph.D., 4 the M.Sc. as their highest degree, and the remaining 10 offer only bachelors' degrees. Twelve schools have more than 10,000 undergraduates, hereafter referred to as large schools, and 14 schools have fewer than 10,000 (small schools); 7 of these have 2,000 or fewer.

TABLE 1. Quantitative comparison of enrollment as affected by prerequisites for ornithology courses taught at large and small schools.

Prerequisites	Large schools (>10,000) No. of schools	Large schools (>10,000) Mean class size (±SD) (1988–1993)	Small schools (≤10,000) No. of schools	Small schools (≤10,000) Mean class size (±SD) 1988–1993)
None	1	50.8 ± 6.8	2	21.3 ± 2.7
1 semester biology	7	30.9 ± 20.0	8	12.6 ± 4.5
2+ semesters biology	4	26.6 ± 25.7	4	17.0 ± 12.5
Overall class size	12	31.4 ± 21.7	14	14.9 ± 8.1

THE COURSE

Goals.—The generally stated goal of the classroom portion of the course was to provide students with a broad overview of ornithology, and to use birds as examples of fundamental concepts of biology and, to a lesser extent, cognate disciplines. A second goal was to use birds to illustrate the scientific process, which includes hypothesis testing and stimulation of new ideas through debate between scientists with different interpretations of the data. A third goal, emphasized by three respondents, was to build a genuine admiration of the many adaptations of birds, thereby promoting the life-long study and enjoyment of birds.

Goals for the laboratory portion of the course were more varied. Most faculty saw field identification by sight and song as a primary goal. Family and order names were considered part of identification by most respondents. Providing students with a working knowledge of topography and anatomy, particularly of feathers, was another common goal. Six respondents sought to instill appreciation of behavior and ecology through field experiences. Another six respondents indicated that a goal of the laboratory was to introduce students to field (e.g., banding, censusing, recording of vocalizations, etc.) or museum (e.g., preparation and measurement of study skins) techniques.

Structure.—One semester of introductory biology or zoology was a common prerequisite although no prerequisite and two or more prerequisites also occurred. Class size varied significantly with the number of prerequisites at both large ($F_{2, 53} = 4.71$, $P < 0.05$) and small ($F_{2, 49} = 4.05$, $P < 0.05$) colleges and universities (Table 1). Ornithology classes with a single prerequisite had smaller enrollments in schools of both sizes (large: $t = 3.78$, df = 38, $P < 0.001$; small: $t = 3.74$, df = 35, $P < 0.001$) than courses with no prerequisite. Enrollment did not decline further with a second or third prerequisite (Table 1). Overall, class size at small schools was significantly less ($t = -5.67$, df = 106, $P < 0.001$) than at large schools (Table 1).

Faculty at large schools were more likely ($\chi^2 = 6.09$, df = 1, $P < 0.05$) to offer ornithology annually than those at small schools, but the duration of the courses varied similarly among schools of different sizes (Table 2). All but three of the courses were taught in the

TABLE 2. Quantitative comparison of some characteristics of ornithology courses taught at large and small schools (based on number of students enrolled).

Characteristics	Large schools (>10,000)	Small schools (≤10,000)
Frequency		
Annually	10	5
Biannually	2	8
2–3 yr interval	0	1
Duration		
14–16 wks	10	11
13 wks	1	1
10 wks	0	1
7–8 wks	1	1
Lecture h/wk		
4	0	1
3	3	10
2	7	3
1	1	0
Use of primary literature		
Assigned to students	6	10
Not assigned to students	6	4
Labs/wk/student		
0	1	0
1	6	11
2	4	3
3	1	0

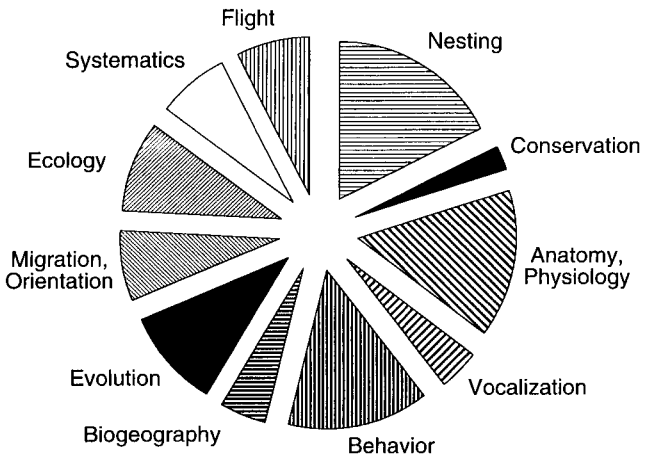

FIG. 1. The proportion of the "consensus" ornithology course devoted to the subjects indicated.

spring semester beginning in January when students learn to identify waterfowl, raptors, and relatively few winter residents. Later in the course, as their field skills improve, students are exposed to an increasing diversity of spring migrants and summer residents.

Twenty-four courses included both lecture-discussion and laboratory. Lecture-discussion sections met twice weekly for 75 min/meeting in 12 courses, three times/week for 50 min/meeting in 8 courses, and as 1 three-hour seminar in 3 courses. Faculty at small schools provided more hours of lecture-discussion/week ($\chi^2 = 6.75$, df = 1, $P < 0.01$, Table 2) than those at large schools. Faculty expressed satisfaction with the longer class period and with occasions when lecture and laboratory could be integrated.

The typical class period was what one respondent characterized as a "loose lecture," a mix of lecture and discussion, illustrated with specimens, slides and video tapes, and punctuated with questions from the teacher. Several faculty indicated plans to incorporate software in the future, but none were using computers in the classroom in 1993 and 1994 when the survey was completed.

Content.—Two courses used only the primary literature, 24 courses required texts, 9 of these required two texts, and 1 required three. Gill's (1990; the survey was completed just before the second edition) Ornithology was the preferred text by a wide margin (Appendix), but other texts were used. In addition to a text, 15 respondents assigned their students readings from the primary literature. No difference in use of the primary literature was evident among schools of different sizes (Table 2).

Each respondent was asked to provide a syllabus of his or her course. We assigned the lectures to 11 broadly defined topics. The mean proportion devoted to each topic by all respondents is shown in Fig. 1. Some error was unavoidable as we tried to categorize lectures into the eleven topics. Nevertheless, this figure represents the "consensus" course of the surveyed teachers.

Most courses had one laboratory session/student/week (Table 2) and in most courses it was a mix of indoor and outdoor sessions. Laboratory schedules were similar at large and small schools (Table 2).

Nineteen courses devoted one or more laboratories to dissection of birds. Of these, two courses had demonstration dissections by faculty only. Eight faculty provided their own dissection guide (Appendix), but others relied on Pettingill (1990) or Faaborg and Chaplin (1988b). Preserved pigeons (*Columba livia*) were used for dissection by 13 of 19 respondents. One person used fresh pigeons. Chickens (*Gallus gallus*), Japanese Quail (*Coturnix coturnix*), European Starlings (*Sturnus vulgaris*), House Sparrows (*Passer domesticus*), and birds killed in accidents were used in the remaining courses or for comparison with pigeons. One ornithologist brought a roasted

chicken to laboratory for dissection and subsequent consumption.

Most instructors required students to own a field guide. The appropriate Peterson guide [eastern (1980) or western (1984) North America] was the most popular choice (Appendix).

Twenty-three of 25 respondents who taught a course with a laboratory component required students to learn to identify species of birds by sight, usually of the local avifauna. The number of birds students had to learn varied from fewer than 50 to over 200, with 101–150 being typical.

Seventeen of the 23 also required their students to learn to identify some birds by song. The number of species each student had to learn ranged from 21 to 100 with 41–60 being typical. To help students learn vocalizations, respondents identified the Peterson tapes, the Birding by Ear tapes, and the National Geographic Society tapes as particularly useful. One respondent had prepared an audiotape specific to the birds that students had to learn in the course. A few respondents taped songs with students and had the students analyze the songs themselves. This not only taught students recording and analytical techniques, but also gave them a thorough knowledge of the characteristics of the songs they recorded. To test students' abilities to identify birds by sight and sound, 87% of the respondents gave laboratory examinations and 35% gave examinations in the field.

The amount of taxonomy students had to learn varied. Twenty of 25 instructors required students to learn order names and know the distinguishing features of each order. Family names were required for students in 16 of the courses. Few instructors required that genera (two courses) and species (one course) names be learned.

Most courses required a long written report, and a few also required one or more short written assignments. Long written assignments included the following:

- detailed field journal based on 20 hours or more of fieldwork in addition to the regular laboratory field trips;
- term paper based on original field or laboratory research or a literature review covering some aspect of avian biology;
- joint paper by several students working on limited and local research topics. The teacher did the literature search. The students added their own data and synthesized the material;
- paper based on observations of a bluebird box on campus. Students monitored the assigned box from late March until the young fledged;
- paper based on the social behavior of a particular species with monitoring of the species over the course of the semester;
- research paper that usually involved field research, data analysis, and literature review in which the teacher and classmates reviewed a rough draft before the final draft was submitted;
- paper based on field research on the behavior, ecology, or migration of a local bird species. One instructor disallowed references to encourage the creativity and the observational and analytical skills of each student;
- paper based on a census of the birds of a site that has been censused annually since 1971;
- an account of a local bird in the style used by the Birds of North America;
- paper based on the analysis of a large sample of banding data for Yellow Warblers (*Dendroica petechia*). The students could analyze site fidelity as a function of age and sex, arrival dates as a function of age and sex, etc.;
- analysis of the population dynamics of a species based on Christmas Bird Count data.

Short written assignments included the following:

- one page summary of a published article;
- computer spreadsheet assignments on energetics of flight and thermoregulation;
- three critiques of a set of three or four papers with contradictory views on a particular issue. Each student summarized each paper and then offered critical comment on each, taking a position on one side of the controversy;
- weekly 5–10 minute essays written in class on specific ornithological questions;
- two critiques of recent ornithological articles written in the format of the Recent Literature section of the Journal of Field Or-

nithology. The critiques had to be rewritten until they reach "A" quality.

SUPPORT FOR UNDERGRADUATE ORNTIHOLOGY

Avian specimens were equally available to respondents at large and small schools. Faculty used collections to illustrate taxonomic principles, avian systematics, and less often to illustrate morphological, ecological, and behavioral adaptations. In five courses, students were required to prepare one or more study skins. Skin preparation was optional in six other courses.

Collections available at small and large schools were similar in size with 9 of 23 collections having fewer than 1,000 specimens, some with fewer than 300. Eighteen of the 23 collections had a regional focus, two had broad North American representation, and three had large collections representing birds of the world. All collections included study skins, most included mounts and skeletons, and some included eggs, nests, and alcoholic specimens.

Fifteen schools owned some of the natural areas visited by the class. Use of these areas varied from carefully scheduled, multi-year censusing of an arboretum managed by the university, to intermittent visits to unmanaged areas for "birding." Here as with use of museum collections, faculty might benefit from sharing ideas on how university-owned natural areas could be used in conjunction with an ornithology course.

MOST SUCCESSFUL PARTS OF THE COURSE

Respondents were asked to describe the most successful parts of their courses. Fifteen listed some aspect of field trips as the most successful portion of the course. Interestingly, one respondent found that some students loved the laboratory/field portion of the course while others hated it. Listed below are the teaching aids and activities instructors found most successful:

- audiotapes and CDs of bird songs to facilitate vocal identification of birds;
- breakfast with the class before or after morning field trips;
- color slides, whether the instructor's own or supplemented from VIREO. One instructor provided detailed notes on each slide so that students could devote full attention to the slides;
- demonstration or experiment that gets students involved in active learning;
- field trips to build enthusiasm for learning species identification and understanding the biology of birds;
- laboratory and lecture sessions on the same day to encourage integration of the material;
- lectures on ecology and behavior;
- list of mnemonic devices generated by students for learning vocalizations;
- lecture demonstrations, for example use of parachutes, gliders, ornithopters, and mounted wings in a wind tunnel to illustrate principles of flight;
- mist-netting and bird-banding to excite students' interest, particularly early in the course or in conjunction with ongoing research in which the students could participate;
- morphological, ecological, and behavioral adaptations of birds;
- study specimens before field trips;
- videotapes, especially those from the Nature series on Public Broadcasting: for example Marathon Bird, Rulers of the Wind, Master Builders, the Bee Team (on social behavior in White-fronted Bee-eaters), and Jewels (hummingbirds);
- use of the Macintosh software SoundEdit (MacRecorder). Annotated vocalizations of 40 species were provided on departmental hard disks. Students could play vocalizations of species they found confusing. The software also allowed students to make sonograms and spectrograms of vocalizations;
- laminated color photographs of birds to sharpen identification skills, most useful for institutions with a limited teaching collection;
- students were provided with essay questions a week in advance of the test and could return outlines of their answers at least 48 hours before the test for comments by the teacher;
- use of the "Gone Birding" game to introduce students to identification. The game helped promote the goals of enjoyment and group learning as well as improving iden-

tification skills and knowledge of species–habitat associations.

LEAST SUCCESSFUL PARTS OF THE COURSE

Each respondent was asked to identify the least successful portions of his or her course. Fellow ornithology teachers can offer little help with three common complaints: insufficient time, cold weather, and conclusion of the semester before the arrival of many spring migrants. Lecture was most often listed as the least successful part of the course. The least successful lecture topics included systematics and physiology and anatomy, despite the fact that each occupied a substantial part of the "consensus" course (Fig. 1). Additional areas that some faculty listed as least successful included using study skins to teach identification and taxonomy, using tapes to learn bird vocalizations, and teaching students field techniques, especially how to quantify behavior in the field. We hope that this list can stimulate ideas that will improve these portions of the courses.

TEACHING MATERIAL NOT PRESENTLY AVAILABLE

When asked to identify teaching aids that do not appear to be commercially available, most respondents indicated a preference for interactive software. Most would use such software to help students learn identification of birds. Specific needs are listed below. If any readers know of such aids, please notify us or a member of the Wilson Ornithological Society Committee on Undergraduate Education.

- good video, laser disk, or CD-ROM that deals only with ordinal characteristics;
- good video, laser disk, or CD-ROM that deals only with familial characteristics;
- software that illustrates the principles of taxonomy;
- video or computer disks illustrating field characteristics of birds and their vocalizations accompanied by sonograms. Such material would allow students to learn at their own pace;
- software simulations of population dynamics and evolution;
- simple, user-friendly manual on field techniques in ornithology, directed toward students.

CONCLUSION

Ornithology is part of the curriculum at large and small, public and private, graduate and undergraduate schools throughout North America. The responses to our survey confirmed our sense that ornithology is an exciting, interactive subject taught by men and women with a genuine enjoyment of birds. The desire to engender that same life-long enjoyment in others was a common theme running throughout all the responses. Beyond this common theme we were impressed with the diversity of creative ideas contained within the courses. We hope that our respondents' ideas as we have presented them will stimulate others to introduce new ideas into their ornithology courses and to bring those ideas and their reception by students to ornithological meetings for discussion by all who teach the biology of birds. Finally the Wilson Ornithological Society's Committee on Undergraduate Education would be glad to work with any ornithologist who has ideas or suggestions related to the teaching of ornithology. The Committee is eager to promote increased public discussion of teaching philosophies and ideas. We hope this paper marks the beginning of that public discussion.

ACKNOWLEDGMENTS

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APPENDIX

Texts used for lecture, dissection, and fieldwork are listed alphabetically by author (number of courses using the text are in parentheses).

Primary lecture text: Faaborg and Chaplin 1988a (2), Gill 1990 (18), Pettingill 1990 (5), Welty and Baptista 1988 (1);

Supplementary lecture text: Mock 1991 (2), Perrins and Middleton 1985 (1);

Dissection text: Faaborg and Chaplin 1988b (1), instructor's own (8), Pettingill 1990 (5);

Field guide: National Geographic 1983 (3), Peterson 1980, 1984 (11), Pettingill 1990 (3), Robbins et al. field guide 1983 (4).