



ANNUAL PROGRAM REPORT

College	College of Science
Department	Biological Sciences
Program	Biological Sciences B.A., B.S., M.S.
Reporting for Academic Year	2018-2019
Last 5-Year Review	2018-2019
Next 5-Year Review	2022-2023
Department Chair	Brian A. Perry
Date Submitted	1 October 2019

I. **SUMMARY OF ASSESSMENT** *(suggested length of 1-2 pages)*

**A. Program Learning Outcomes (PLO)**

**Students graduating with a B.S. or B.A. in Biological Sciences from Cal State East Bay will be able to:**

1. Explain core biological concepts, including evolutionary processes, structure-function relationships across all levels of biological organization, homeostasis, information flow, matter and energy transformations, and the interactions and interconnectedness of living systems (ILO 6);
2. apply quantitative reasoning to explain biological phenomena and to address biological problems (ILO 1);
3. clearly communicate biological information in a variety of formats (written, oral, visual) using a style appropriate for the intended audience (ILO 1,2,6);
4. apply methods of scientific inquiry by formulating testable hypotheses, collecting and analyzing data, and reporting conclusions (ILO 1,6);
5. gather, interpret, and evaluate published scientific information (ILO 1,6).

**Students graduating with a M.S. in Biological Sciences from Cal State East Bay will be able to:**

1. Demonstrate a broad and sophisticated understanding that contributes to biological concepts and principles across all levels of biological organization, from ions to ecosystems (ILO 1,2,6);
2. demonstrate expertise in a specific area of biological science (ILO 6);
3. independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis (ILO 1,2,6);
4. clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation (ILO 1,2,6);

- gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions (ILO 1,6).

## **B. Program Learning Outcome(s) Assessed**

**B.S./B.A. Programs:** The department participated in University ILO assessment of Written Communication. No other program learning outcomes were assessed for these programs during AY 2017-18.

**M.S. Program:** We assessed PLO 2, 3, 4 and 5 (see above). These program learning outcomes were also assessed in AY 2017-18.

## **C. Summary of Assessment Process**

**Instrument(s):** For the University ILO assessment of Written Communication, Dr. Chris Kitting provided the final term paper for BIOL 469 - Conservation Biology to the members of the ILO Subcommittee. This course serves as the capstone experience for our Ecology and Evolutionary Biology concentration students.

For the M.S. program we used the "Inquiry and Analysis Rubric" and the "Oral Communication Rubric" to assess the oral defense, a capstone event in partial fulfillment of the Master of Science Degree. A copy of these rubrics is included in the Appendix (Fig. A7). These rubrics are based on the VALUE rubrics developed by teams of faculty experts representing colleges and universities across the United States. The Value Rubric Development Project was sponsored by the Association of American Colleges and Universities.

**Sampling Procedure:** The combined "Inquiry and Analysis" and "Oral Communication" rubric was applied to all 9 M.S. students that scheduled an oral defense in during AY 2018-19.

**Sampling Characteristics:** The oral defense is one of the final requirements that our M.S. students complete. By the time a student schedules the oral defense, the University Thesis has been written and submitted for format review.

**Data Collection:** In all cases the three committee members (including the thesis advisor) completed the combined "Inquiry and Analysis" and "Oral Communication" rubric just after the completion of the oral defense by the student. The thesis advisor collected the completed rubric forms and submitted these documents to the Graduate Coordinator. Upon receipt, the graduate coordinator forwarded a completion memo to the University Graduate Evaluator.

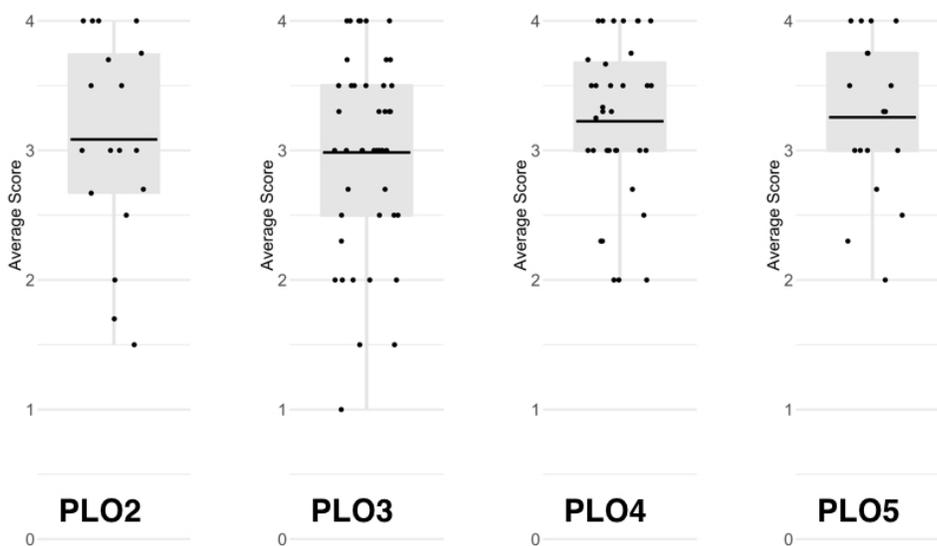
**Data Analysis:** The results shown in D (Summary of Assessment Results) include all individual data points (filled black circles). The black horizontal line represents the average. The gray boxes represent the first and third quartile and the vertical lines represent the minimum and maximum. Figures D1 through D3 below include data for all 9 students evaluated in AY 2018-19.

## D. Summary of Assessment Results

**Main Findings:** the department was very disappointed to learn that only four papers from our BIOL 469 course were used in the University ILO assessment of Written Communication. We were under the impression that the department would be provided with results for the entire class so that we could also make use of these assessments, but certainly understand the constraints and limitations of the ILO subcommittee members given the large number of papers they were tasked with evaluating. Moving forward to department will continue with our own PLO assessment of the B.A. and B.S. programs.

For the M.S. program, we hoped all of our students would score at 3 or above as 3=proficient (4=exemplary). Looking at the individual PLOs assessed (Figure D1), the average score was 3 or above for all four PLOs. However, it can be seen from this same graph that students also scored 2 (= basic) or 1 (=minimal) for several of the assessment criteria. A similar pattern can be observed in Figure D2, the average earned score for individual assessment criteria. In this graph we see that the average score for most criteria is 3 or higher, but for four of the criteria the average drops as low as 2.75. When comparing the performance of individual students (Fig. D3), three of the students (1, 5 and 6) scored 3 or above in all criteria, whereas the remaining six students had one or more criteria scores below 3. In the case of students 8 and 9, their assessment includes scores as low as 1 in several criteria.

### Average scores for AY 2018-2019 organized by PLO



#### PLO2 through PLO5:

2. Demonstrate expertise in a specific area of biological science.
3. Independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis.
4. Clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation.
5. Gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions.

**Figure D1.** Average rubric score for each PLO evaluated. Please note that PLOs were evaluated by more than one criteria (see rubric in Appendix).

# Average scores for individual categories in the rubric

**Scores:**

4 = Exemplary / Mastery,

3 = Proficient,

2 = Basic,

1 = Minimal.

**Organization:** The introduction, approach, results and conclusions are sequenced skillfully. Overall, the content of the presentation is cohesive with seamless transitions.

**Language:** Uses language appropriate to the discipline as well as the audience. Discipline specific jargon is minimized or clearly defined.

**Delivery:** Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling. Speaker is polished and confident.

**Supporting Material:** Supporting material (illustrations, analogies etc) are relevant to the presentation and central message and establish the presenter's authority on the topic.

**Central Message:** Main claim is clear and compelling (precisely stated, appropriately repeated, memorable, and supported with evidence).

**Hypothesis/Question:** Develops a creative, manageable and testable hypothesis or question related to a topic that is significant yet poorly understood.

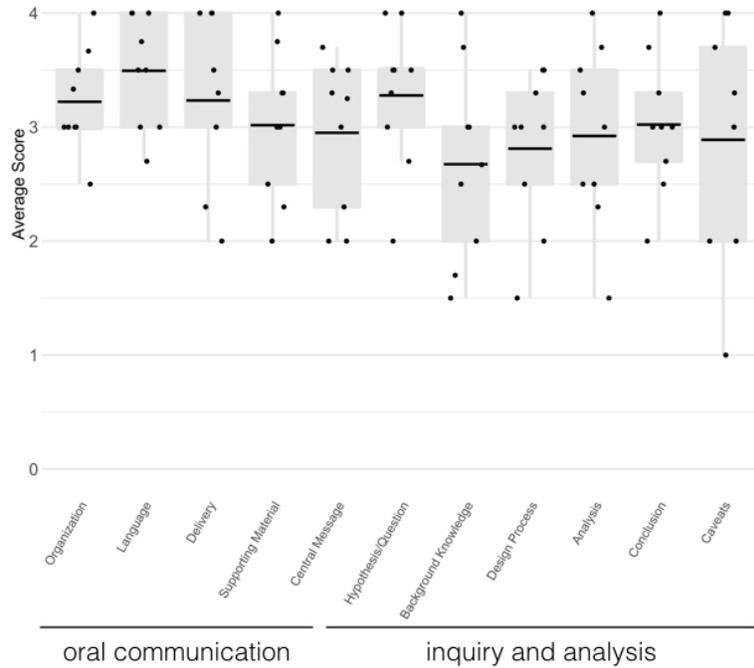
**Background Knowledge:** Synthesizes relevant information from reliable sources. Answers questions accurately.

**Design Process:** Develops methodology that is appropriate and clearly outlined. Includes proper controls.

**Analysis:** Performs an accurate analysis of the evidence to reveal the presence or absence of patterns related to the hypothesis/question.

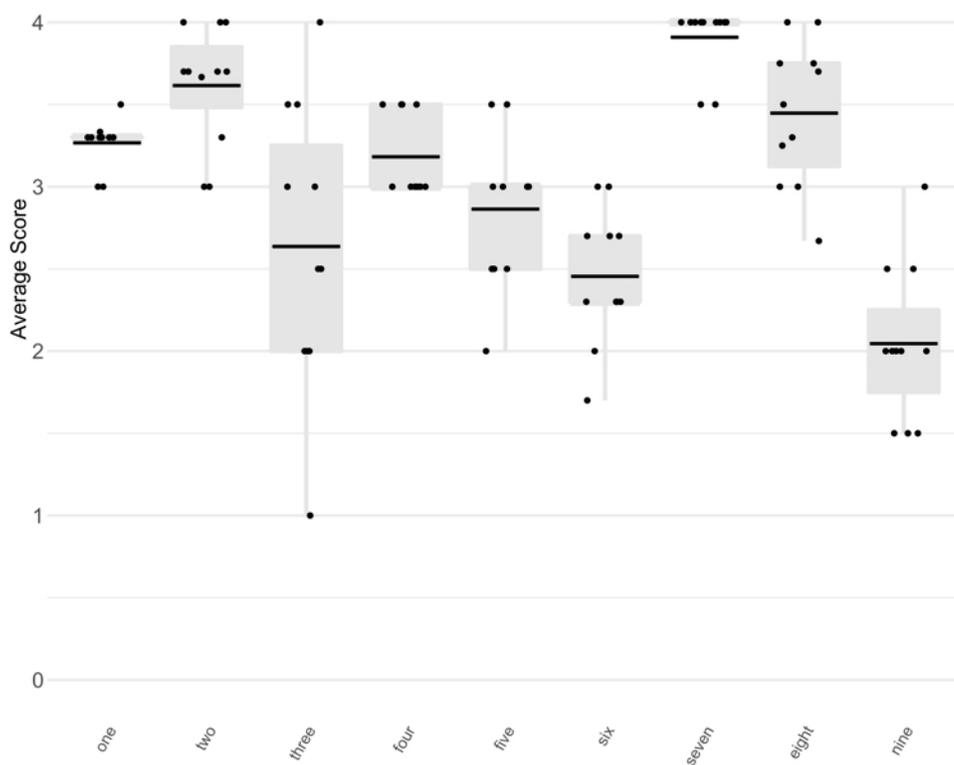
**Conclusion:** States a conclusion that is a logical extrapolation from the evidence outlined.

**Caveats:** Insightfully discusses relevant and supported (if possible) caveats, limitations and implications.



**Figure D2.** Average rubric score earned for each PLO criteria evaluated.

# Average score for individual students



**Figure D3.** Average rubric score earned for each PLO criteria for all 9 students evaluated in AY 2017-18.

**Recommendations for Program Improvement:** The faculty are aware of the areas in which our students require additional instruction and experience, and have decided upon steps that should be taken to improve student outcomes (see Next Step(s) below).

**Next Step(s) for Closing the Loop:** Our data suggests that our students need a formative assessment prior to the oral defense so that we can identify students that are struggling with specific program learning outcomes. In this way, we can attempt to address these issues before any such students are too far along in their thesis studies. The faculty have agreed to institute a departmental requirement that students must meet with the committee members on a per-semester basis to demonstrate significant progress towards the completion the degree courses and thesis research. Additionally, students are now also required to demonstrate adequate proficiency in the program learning outcomes by the end of the first year through the preparation and oral defense of a thesis research proposal, as well as participating in the department's annual research symposium. With the transition to semesters, our curriculum now includes a year-long course (1 unit/semester) designed to explicitly teach our graduate students how to perform an effective literature review, communicate science (oral and written), gather and evaluate scientific data, and identify assumptions, caveats and limitations of their proposed research.

**Other Reflections:** In general, the faculty continue to value the rubric as an effective measure for assessing if our students are meeting our program learning outcomes. We are also confident that the inclusion of a year-long course in the curriculum that specifically focuses on the PLOs of the program will have a significant, positive impact on the success of our M.S. students. Additionally, by using the same Rubric year after year, we will increase our statistical power and be able to evaluate if any of our programmatic changes make a difference in student outcomes.

## Appendix:

### Program Learning Outcomes:

1. Demonstrate a broad and sophisticated understanding that contributes to biological concepts and principles across all levels of biological organization, from ions to ecosystems.
2. Demonstrate expertise in a specific area of biological science.
3. Independently apply the scientific method to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of the analysis.
4. Clearly communicate the design and results of an observational or experimental analysis in a variety of formats, including the graduate thesis, scientific paper, scientific poster, and oral presentation.
5. Gather and evaluate primary scientific literature and judge the value of the information presented in relation to particular biological questions.

A description of an exemplary score is provided for each criteria listed below. An exemplary score is obtained for a given criteria when the description is true. A proficient score is obtained when the description is mostly true. A basic score is obtained when the description is somewhat true. \*Scores: 4 = Exemplary / Mastery, 3 = Proficient, 2 = Basic, 1 = Minimal. The rubrics below are modified from the VALUE RUBRICS.

### ORAL COMMUNICATION RUBRIC (PLOs 2,4,5):

Criteria	Capstone / Mastery	SCORE*	PLO
Organization of the Presentation	The introduction, approach, results and conclusions are sequenced skillfully. Overall, the content of the presentation is cohesive with seamless transitions.		4
Language	Uses language appropriate to the discipline as well as the audience. Discipline specific jargon is minimized or clearly defined.		2, 4, 5
Delivery	Delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation compelling. Speaker is polished and confident.		4
Supporting Material	Supporting material (illustrations, analogies etc) are relevant to the presentation and central message and establish the presenter's authority on the topic.		5
Central Claim(s)	Main claim is clear and compelling (precisely stated, appropriately repeated, memorable, and supported with evidence).		4

### INQUIRY AND ANALYSIS RUBRIC (PLO 3):

Criteria	Capstone / Mastery	SCORE*	PLO
Hypothesis/Question <small>(not used for Thesis Defense)</small>	Develops a creative, manageable and testable hypothesis or question related to a topic that is significant yet poorly understood.		3
Background Knowledge	Synthesizes relevant information from reliable sources. Answers questions accurately.		2
Experimental Design	Develops methodology that is appropriate and clearly outlined. Includes proper controls.		3
Accurate Analysis	Performs an accurate analysis of the evidence to reveal the presence or absence of patterns related to the hypothesis/question.		3
Logical Conclusions	States a conclusion that is a logical extrapolation from the evidence outlined.		3
Recognizes Limitations and Implications	Insightfully discusses relevant and supported (if possible) caveats, limitations and implications.		3

**Figure A7.** Rubrics used in assessment of M.S. student oral defense of thesis.