Marine Science - BS
2017 - 2018 Assessment Plan

Currently status is: Report Accepted

I. ANNUAL REPORT FOR 2016 - 2017

Mission Statement

The mission of the USC School of the Earth, Ocean and Environment's Marine Science (MSCI) degree program is to facilitate a holistic understanding of the interdisciplinary nature of Marine Science through integration of teaching, research, and outreach. MSCI emphasizes critical thinking, research-based learning, and hands on technical and field training at both the graduate and undergraduate levels. Students develop skills which allow them to pursue careers in industry, government, and academic settings. As a multidisciplinary unit, the MSCI program fosters the building of bridges between disciplines to emphasize its unique goals as a research and academic entity.

Goal 1.

The School of the Earth, Ocean and Environment Marine Science degree program expects that by graduation students will understand the scientific process by discerning observation from inference and by writing testable hypotheses.

Curriculum

Completion of upper division MSCI lab courses, including MSCI 399, 505, and 599R

Demonstrate a level of competency on a final lab report in Marine Science Courses with laboratories (e.g. MSCI 311, MSCI 312, and MSCI 460)R

Participation as a Research Assistant in a faculty member’s laboratory or internship opportunities at other institutions (e.g. REU programs)NR

Participation and attendance at scientific meetings and seminarsNR

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate that they understand the scientific process by testing hypotheses related to Marine Science in an inquiry based, hands on setting.

Measures and Criteria

To assess the understanding of the scientific process, all students will complete at least one research project requiring the formulation of a specific hypothesis, and analysis and critical interpretation of the results. To assess this goal, 90% of MSCI majors must minimally demonstrate:

A competency level of knowledge by completing a report or project with the elements above, in at least one of the following (this is not meant as an exhaustive list, rather as courses are added to the MSCI curriculum, other evidence required to meet this goal will be added):

- MSCI 311 (Biology of Marine Organisms) - 'Assimilation' Laboratory report
- MSCI 399 (Independent Study) - Final Report (and Credit Awarded)
- MSCI 460 (Field and Laboratory Investigations) - Final Laboratory Report
- MSCI 496-499 (Research in MSCI) - Final Report (and Credit Awarded)
- MSCI 599 (Data Collection and Analysis Methods in MSCI) - Data Analysis Project
- Final report for the Magellan or Howard Hughes Research Programs
- SC Honors College thesis project
- Research-based internship outside of USC (competency demonstrated by transfer of major credit and/or

submission of a copy of final report to the Undergraduate Studies Director - the MSCI program allows students to substitute research internships conducted outside of USC in lieu of MSCI 460 - this is currently at the discretion of the Undergraduate Studies Director and requires documentation and a report on the research experience.)

Methods

Faculty will report to the Undergraduate Director or the undergraduate coordinator, the percentage of students who demonstrate their understanding of this goal at the mastery, excellence, proficiency and competency level of knowledge in one or more of the classes above. Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

The Undergraduate Director also receives copies of the final report submitted by students who participate in a research-based internship outside of USC and notifies the undergraduate student coordinator of the knowledge level for tracking purposes. This data may also be used for this assessment

*All data will be kept in the SEOE Student Services Office.

Results

Learning Outcome 1 Goal 1 provides for all students to complete a research project that demonstrates that they understand the scientific process by testing hypotheses related to Marine Science in an inquiry based, hands on setting. Students complete this goal through various courses during their program and to assess our student's ability to demonstrate this Learning Outcome, we evaluated the competency level of knowledge by determining the percentage of students completing required reports that they were able to perform at various competency levels. In as much as all students will take MSCI 311 or MSCI 460 (or research in lieu of MSCI 460) prior to graduation, a project within any of these options can be used as a means to evaluate the student's competency level for this learning outcome. Therefore, rather than evaluating the students at graduation, the student's abilities are evaluated at the time that they complete projects in either MSCI 311, 460 or 599 and at which time their level of competency related to understanding the scientific process by formulating and testing hypotheses can be evaluated. Last year, this evaluation occurred primarily based on results of research completed for MSCI 311. This year, evaluations were conducted on the research project reports that students submitted for research experiences in lieu of MSCI 460. Twenty-five students between July 2016 and May 2017 submitted research reports for approval for their required MSCI field research experience and another four received either a Magellan Scholar or Magellan Apprentice award. Additionally during the summer of 2017, 25 students completed, or are in the process of completing, MSCI 460 - A field experience course at Baruch Institute. This assessment will be based on the reports from the 25 students that completed an alternate field research experience and submitted reports. The level of competency in formulating and testing hypotheses is:

Mastery level - 4 students; 16%

Excellence - 11 students; 44%

Proficient - 8 students; 32%

Competent - 2 students; 8%

Not Proficient - 0 students; 0%

Use of Results

In research papers reviewed this year, 100% of the students were at a minimum of the competency level of understanding the scientific process by formulating and testing hypotheses. This year, 92% were judged at the proficiency level or above, which is higher than the last two years when 82% were judged at the proficiency level or above. Reviewing this data with time will allow us to determine whether our students need additional instruction or practice to improve this learning outcome. Given that we have been benchmarking the Marine Science students for this learning outcome for some time, we will continue to evaluate our students and strive for continued higher percentages of our students at the proficiency or greater level of understanding. Given the history of the assessment and the variation in proficiency

percentages, (less than 30% proficient 3 years ago), it is apparent that the assessment will benefit from the review of different classes so that we will have a better understanding of the need to increase our student's conceptualization of hypothesis formulation. When students were evaluated in MSCI 311, a normal sophomore level course, the competency levels were much lower than those evaluated this year based on research conducted primarily between the student's Junior and Senior year. This suggests that students are increasing in their competency in this area as they progress through the degree. We will continue to evaluate to see if this trend continues.

Learning Outcome 2.

Students will demonstrate critical thinking skills using the scientific method.

Measures and Criteria

Criteria: To assess the student's ability for critical thinking, all students will complete at least one research project requiring the formulation of a specific hypothesis, and analysis and critical interpretation of the results. To assess this learning outcome, at least 90% of MSCI majors must minimally demonstrate the successful integration of the scientific process into the interpretation of results. This report will be assessed specifically for critical thinking to determine whether the student demonstrates a competency level of knowledge in the report or project completed in at least one of the following (this is not meant as an exhaustive list, rather as courses are added to the MSCI curriculum, other evidence required to meet this goal will be added):

- MSCI 311 (Biology of Marine Organisms) – 'Assimilation' Laboratory Report
- MSCI 399 (Independent Study) – Final Report (and Credit Awarded)
- MSCI 460 (Field and Laboratory Investigations in Marine Science) - Final Laboratory Report
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- MSCI 599 (Data Collection and Analysis Methods in Marine Science) - Data Analysis Project
- Final report for the Magellan or Howard Hughes Research Programs
- SC Honor's College thesis project
- Completion of a research based internship outside of USC (evidence of competency includes transfer of major credit and/or submission of a copy of the final report to the Undergraduate Studies Director – the MSCI program allows students to substitute research internships conducted outside of USC in lieu of MSCI 460 – this is currently at the discretion of the Undergraduate Studies Director and requires a report on the research experience)

Methods

Faculty will report to the Undergraduate Director or the undergraduate coordinator, the percentage of students who demonstrate their understanding of this goal at the mastery, excellence, proficiency and competency level of knowledge. Data are presented annually to MSCI Undergraduate Committee to monitor progress.

Undergraduate Director also receives copies of final reports for external internships and reports the level of knowledge to the undergraduate secretary for tracking purposes. This information may also be used for this assessment.

*All data will be kept in the SEOE Student Services Office.

Results

Goal 1 Learning Outcome 2 of the MSCI Assessment plan assesses the student's ability to demonstrate critical thinking skills using the scientific method. The level of knowledge was determined by evaluating the percentage of students completing required reports performed at various competency levels. In as much as students take MSCI 311- Biology of Marine Organisms, prior to graduation, a project within this course has previously been used primarily as a means to evaluate the student's competency level for this learning outcome. However, this year, the student reports submitted to petition for their research experience to count in lieu of MSCI 460 were evaluated for critical thinking skills. . Therefore, this year's assessment reviews and evaluates the student's abilities when they complete their research report and at which time their level of competency related to demonstrating critical thinking skills using the scientific method will be assessed.

Twenty-five students between July 2016 and May 2017 submitted research reports for approval for their

required MSCI field research experience and another four received either a Magellan Scholar or Magellan Apprentice award. Additionally during the summer of 2017, 25 students completed, or are in the process of completing, MSCI 460 - A field experience course at Baruch Institute. This assessment will be based on the reports from the 25 students that completed an alternate field research experience and submitted reports. The level of competency in critical thinking is:

	Mastery	Excellence	Proficient	Competent	Not-Proficient
# of students	2	5	10	8	0
% of students	8	20	40	32	0

Use of Results

For the students evaluated this year, 100% of the students were at a level of competency or greater for demonstrating critical thinking skills using the scientific method and 68% were evaluated at higher than the competency level. None was considered Not Proficient. The level of student improvement is variable from year to year - only 50% were at the proficient level in 2015 (MSCI 599) compared to 77% 2016 (MSCI 311), and 68% in 2017. Reviewing this data with time will allow us to determine whether our students need additional instruction or practice to improve this learning outcome. We will continue to evaluate our students and consider more effective methods to increase our student's ability to think critically. We may need to review whether trying to incorporate more laboratory experiments or projects that incorporate critical thinking skills earlier in their curriculum and, therefore, provide students with the opportunity to practice and perfect these skills over a longer period of time, may improve the results from this learning outcome.

Goal 2.

The Marine Science Program expects that by graduation students will have the technical and investigative skills to conduct independent research in marine science.

Curriculum

Completion of MSCI 311, 312, & 505 (Core courses) and MSCI 399 & 499 (Independent research)R.

Completion of MSCI 460 (Capstone Field Course)R

Participation as a Research Asst. in a faculty member's laboratoryNR

Participation in research or internship opportunities at other institutions (e.g. REU programs)NR

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate the ability to conduct independent research

Measures and Criteria

At least 80% of students will participate in undergraduate research within Marine Science or related field by graduation and will conduct independent research.

75% students will have completed an independent research project that requires students to work independently, demonstrate critical thinking skills, and analyze results (participation in MSCI 399, 460, or 499 or other research experience) by graduation.

Methods

Faculty will evaluate the student's ability to conduct independent research and report their evaluation to the Undergraduate student services coordinator under the supervision of the Undergraduate Director for Marine Science students enrolled in MSCI 460, independent research courses (MSCI 399 and MSCI 499), and those awarded Magellan, Howard Hughes Fellowships, and other independent research fellowships. Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

Faculty will report to the Undergraduate student services coordinator under the supervision of the Undergraduate Director the level of independence of research of Marine Science students who participate in undergraduate research both at USC and elsewhere. Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

Faculty will report to the Undergraduate student services coordinator under the supervision of the Undergraduate Director the number and level of independence of Marine Science students who present their research. Information may be obtained via regular email requests, Marine Science travel requests, USC Discovery Day (abstracts published annually), and abstracts listed on annual Faculty evaluations (in conjunction with Marine Science Director). Data are presented annually to faculty at Faculty Meeting to monitor progress.

*All data will be kept in the SEOE Student Services Office.

Results

This year we reviewed this learning outcome by reviewing our student's success in research. While many of our undergraduates participate in a research laboratory experience with a MSCI faculty member (20% in 2015 and) and the majority of faculty reported the research as independent with the slight minority reporting participation in faculty-devised research. The last three years also saw significant increases in our student's ability to conduct independent research. This was recognized through the increased number of student awards:

Rhodes Scholarship – 1
NOAA Hollings Scholarships (2016-17: 8 students from USC and 5 from MSCI; 2017-18: 3 from USC and 1 MSCI),
Goldwater scholarship – 1
Marine Technology Remotely Operated Vehicle Scholarship – 1
Udall Scholar- 1
NSF GRF- 1 to a 2011 graduate and 2 honorable mentions (2011 and 2016 MSCI graduates).

Magellan awards: 2 Magellan Scholars and 2 Magellan Apprentices from MSCI in research.

Peer Reviewed journal co-authors: 2 reported

Students also presented at Discover Day (7 MSCI award winners), 4 Graduated with Leadership Distinction (3 in Research). Therefore, we feel our students are continuing to improve in this area.

Students also completed independent research in MSCI 460 and all students complete either MSCI 460 or an independent research experience.

Use of Results

Our students' success in obtaining national scholarships, participating in Discover Day, working in faculty research labs are one way to assess our student's ability to conduct independent research. We will continue to foster and direct all of our students to become engaged in some aspect of research.

Goal 3.

The Marine Science Program expects that by graduation all students will effectively communicate Marine Science topics in both oral and written format.

Curriculum

Participation in MSCI 311, 312, and 460 R

Participation in upper division Marine Science courses R

Presentation (both oral and written) at Discovery Day or a scientific meeting NR.

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate effective oral communication of Marine Science topics by giving an oral presentation

Measures and Criteria

80% of students will present a well-crafted scientific talk in an MSCI 390 or other upper division courses

where appropriate. A well crafted talk will demonstrate: 1- a clear understanding of the topic including presentation of the hypothesis, methodology, results and conclusions; 2- the effective use of visual aids, if necessary. In addition, more than 20% of the graduating class will give an oral presentation at a scientific meeting or conference. Attendance and presentation of a seminar or poster at a recognized local (i.e. Discovery Day), national or international meeting will adequately demonstrate oral communication effectiveness for the student under this criterion.

Methods

The undergraduate student services coordinator under supervision of the Undergraduate Director, based on information provided by faculty who teach those courses, collects data on oral presentations in MSCI 390 or other courses. Students who present their research at local, national or international meetings will be tracked via regular email requests to faculty and students, Marine Science travel requests, USC Discovery Day (abstracts published annually), and abstracts listed on annual Faculty evaluations (in conjunction with Marine Science Director).

Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

Results

MSCI 390 was not taught last year. Therefore, to evaluate this Learning Outcome ("Students will demonstrate effective oral communication of Marine Science topics by giving an oral presentation"), the program measured effective oral communication by presentation of research before an independent audience. There were at least 5 public forums at which MSCI students presented research findings. These included the International ASLO (Assoc for the Sciences of Limnology and Oceanography) meeting, Sustainability Showcase, Discover Day, SEOE Freshman Drop-In, and Magellan awards.

Numbers of MSCI Students giving Oral presentations:	
Sustainability Showcase:	4
SEOE Freshman Drop In	6
Discover Day (award winners)	7
Magellan awards	4
ASLO meeting	1
total presentations outside of class	22
37 graduates: % of total presenting	59.5

Our goal is 50% of the graduating class will give a presentation, and we met our goal this year. In addition, many of the students who graduated in May 2017 are also giving presentations in classes

Use of Results

We will continue to evaluate our students and strive for continued higher percentages of our students participating at Discover Day and we will continue to track presentations in other forums. However, our staff time to request and collect such data is limited and we need additional personnel to continue to track the data in a meaningful way. We were encouraged by the number of students that presented at SEOE Freshman Drop-In, Discover Day and Sustainability Showcase and will continue to strive to make opportunities available for our students to make research presentations. We are encouraged that a number of our national fellowship award winners are presenting thier work in various settings.

Learning Outcome 2.

Students will communicate and summarize their research findings effectively in writing (such as on a poster or in an abstract) on Marine Science topics

Measures and Criteria

Faculty will review and document the level of mastery of effective communication and summary of research results in the following courses(this is not meant as an exhaustive list, rather as courses are added to the MSCI curriculum, other evidence required to meet this goal will be added):

- MSCI 311 (Biology of Marine Organisms) – 'Assimilation' Laboratory Report
- MSCI 399 (Independent Study) – Final Report (and Credit Awarded)
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- Final abstract of the report for the Magellan or Howard Hughes Research Programs
- SC Honor's College thesis project with specific emphasis on the abstract. - Completion of a research based internship outside of USC and submission of a copy of the final report with abstract to the Undergraduate Studies Director – the MSCI program allows students to substitute research internships conducted outside of USC in lieu of MSCI 460 – this is currently at the discretion of the Undergraduate Studies Director and requires a report on the research experience). After faculty review, greater than 25% of the senior class will submit a poster or submit an abstract to a scientific meeting or conference.

Methods

The faculty to whom poster presentations or abstracts are submitted as above, will communicate the level of competency of the students to the undergraduate student services coordinator under supervision of the Undergraduate Director each semester for the specific projects listed above, via email correspondence from the faculty teaching those courses; faculty evaluation of students participating in Discovery Day, abstracts, and website; Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

Results

To evaluate this Learning Outcome ("Students will communicate and summarize their research findings effectively in writing (such as on a poster or in an abstract)"), the program measured effective written research communication by presentation of a research poster before an independent audience. There were at least 4 public forums at which MSCI students presented research findings. These included the International ASLO (Assoc for the Sciences of Limnology and Oceanography) meeting, Sustainability Showcase, Discover Day, and Magellan awards.

Numbers of Students creating posters for research communication:

Sustainability Showcase:	4
Discover Day (posters)	10
Magellan awards (report)	4
ASLO meeting	1
total outside of class	19
37 graduates - %	51.4

Use of Results

In prior years, we evaluated this written communication of research results from various classes; MSCI 311 and MSCI 599. The numbers of students that were deemed to be successful at the competency level was low. However, by evaluating our students that make public written research posters available at various public forums (and given that 70% of the MSCI students that presented a poster at Discover Day received an award), our students are improving. While this method of evaluation may not fully evaluate the graduating class as a whole, it may be a better representation. We will attempt to work with the undergraduate committee to improve ways of measuring this learning outcome.

II. FUTURE ASSESSMENT PLAN FOR 2017 - 2018

Mission Statement

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Goal 1.

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Curriculum

Completion of upper division MSCI lab courses, including MSCI 399, 505, and 599R

Demonstrate a level of competency on a final lab report in Marine Science Courses with laboratories (e.g. MSCI 311, MSCI 313, MSCI 314 and MSCI 460)R

Participation as a Research Assistant in a faculty member's laboratory or internship opportunities at other institutions (e.g. REU programs)NR

Participation and attendance at scientific meetings and seminarsNR

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate that they understand the scientific process by testing hypotheses related to Marine Science in an inquiry based, hands on setting.

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Methods

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*All data will be kept in the SEOE Student Services Office.

Learning Outcome 2.

Students will demonstrate critical thinking skills using the scientific method.

Measures and Criteria

Criteria: To assess the student's ability for critical thinking, all students will complete at least one research project requiring the formulation of a specific hypothesis, and analysis and critical interpretation of the results. To assess this learning outcome, at least 90% of MSCI majors must minimally demonstrate the successful integration of the scientific process into the interpretation of results. This report will be assessed specifically for critical thinking to determine whether the student demonstrates a competency level of knowledge in the report or project completed in at least one of the following (this is not meant as an exhaustive list, rather as courses are added to the MSCI curriculum, other evidence required to meet this goal will be added):

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Methods

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Undergraduate Director also receives copies of final reports for external internships and reports the level of knowledge to the undergraduate secretary for tracking purposes. This information may also be used for this assessment.

*All data will be kept in the SEOE Student Services Office.

Goal 2.

The Marine Science Program expects that by graduation students will have the technical and investigative skills to conduct independent research in marine science.

Curriculum

Completion of MSCI 311, 313, & 314 (Core courses) and MSCI 399 & 499 (Independent research)R.

Completion of MSCI 460 (Capstone Field Course)R

Participation as a Research Asst. in a faculty member's laboratoryNR

Participation in research or internship opportunities at other institutions (e.g. REU programs)NR

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate the ability to conduct independent research

Measures and Criteria

At least 80% of students will participate in undergraduate research within Marine Science or related field by graduation and will conduct independent research.

75% students will have completed an independent research project that requires students to work independently, demonstrate critical thinking skills, and analyze results (participation in MSCI 399, 460, or 499 or other research experience) by graduation.

Methods

Faculty will evaluate the student's ability to conduct independent research and report their evaluation to the Undergraduate student services coordinator under the supervision of the Undergraduate Director for Marine Science students enrolled in MSCI 460, independent research courses (MSCI 399 and MSCI 499), and those awarded Magellan, Howard Hughes Fellowships, and other independent research fellowships. Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

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Goal 3.

The Marine Science Program expects that by graduation all students will effectively communicate Marine Science topics in both oral and written format.

Curriculum

Participation in MSCI 311, 313, 314 and 460 R

Participation in upper division Marine Science courses R

Presentation (both oral and written) at Discover Day or a scientific meeting NR.

NR=Non-Required Course, R=Required Course

Learning Outcome 1.

Students will demonstrate effective oral communication of Marine Science topics by giving an oral presentation

Measures and Criteria

80% of students will present a well-crafted scientific talk in an MSCI 390 or other upper division courses where appropriate. A well crafted talk will demonstrate: 1- a clear understanding of the topic including presentation of the hypothesis, methodology, results and conclusions; 2- the effective use of visual aids, if necessary. In addition, more than 20% of the graduating class will give an oral presentation at a scientific meeting or conference. Attendance and presentation of a seminar or poster at a recognized local (i.e. Discovery Day), national or international meeting will adequately demonstrate oral communication effectiveness for the student under this criterion.

Methods

The undergraduate student services coordinator under supervision of the Undergraduate Director, based on information provided by faculty who teach those courses, collects data on oral presentations in MSCI 460 or other courses. Students who present their research at local, national or international meetings will be tracked via regular email requests to faculty and students, Marine Science travel requests, USC Discovery Day (abstracts published annually), and abstracts listed on annual Faculty evaluations (in conjunction with Marine Science Director).

Data are presented annually to the MSCI Undergraduate Committee to monitor progress.

Learning Outcome 2.

Students will communicate and summarize their research findings effectively in writing (such as on a poster or in an abstract) on Marine Science topics

Measures and Criteria

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