

Environmental Literacy Report: Overall Findings from the 2017-2018 Year

*Report Submitted to the Elkhorn Slough Foundation and
North Monterey County High School*

July 2018



California State University
MONTEREY BAY





The mission of the *Environmental Studies Program at California State University Monterey Bay* is to develop students and communities with the knowledge, skills, and compassion to promote social and environmental justice and sustainable communities.



The mission of the *Elkhorn Slough Foundation* is to conserve and restore Elkhorn Slough and its watershed.

The Mission of the *Elkhorn Slough National Estuarine Research Reserve* is to ensure the perpetual health of ecosystems in *Elkhorn Slough* and the surrounding watershed through preservation, restoration, research, information exchange and education with particular emphasis on the Research Reserve.



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Environmental Literacy Final Report, 2017-2018

Overview

This research set out to understand environmental literacy—attitudes, knowledge, and behaviors—of students at North Monterey County High School. The project included partners from the Elkhorn Slough Foundation, North Monterey County High School (NMCHS), and California State University Monterey Bay. This report summarizes findings from three surveys issued to students at North Monterey County High School:

- A pre-survey issued to 861 science students, freshman through seniors, within the first few weeks of the academic year (2017-2018) that included attitude, behavior, knowledge, and qualitative questions
- An interim survey issued to 140 freshman from NMCHS who participated in a field trip to Elkhorn Slough between January to April 2018. This short survey included attitude, knowledge, and interest questions.
- A post-survey issued to 398 science students, freshman through seniors, in the final weeks of the academic year that was identical to the pre-survey with the addition of a question asking how participation in Elkhorn Slough-related activities influenced student interest in a range of variables

A summary of the fall 2017 survey results was reported in November 2017. A second report issued in May 2018 provided results from the survey of freshman field trip participants. This final report identifies key lessons from analysis of all three surveys. All survey questions are provided in the appendix of this report, and all reports are archived at this website: <https://toriderr.weebly.com/environmental-education.html>.

Top Lessons

Lesson 1. Freshman students had very positive associations and learning from the field trip to the Elkhorn Slough Reserve. Of those who attended, 87.8% rated it a 4 or 5 on a 5-point scale, and 69.9% said they felt positively connected to nature just following the field trip.

Lesson 2. Nature connectedness appears to have the strongest relationship with any factor—attitudes, knowledge, behaviors, and influence of Elkhorn Slough programming. This means that taking students outside and fostering an interest and appreciation for nature could lead to more students having higher attitudes, knowledge, and behaviors as well.

Lesson 3. Overall, there were few detectable differences between beginning- and end-of-year surveys. Attitudes and knowledge both went up marginally, while behavior stayed consistent. The lack of discernable change could be due to a number of factors, including little effect was made or sustained, flaws in survey questions, or the large difference in sample sizes (pre: 861, post: 398). Consistent sampling at pre- and post-intervals with a clear student-identifier (their student id) would allow us to compare individual changes over the year and to analyze results with greater meaning and certainty.

Lesson 4. There were very few differences between Slough Crew responses and non-Slough Crew responses. Nature connectedness appears to be a bigger factor than participation in Slough Crew in how students responded to attitude, knowledge, behaviors, or influence of Elkhorn Slough programming questions. The three areas where Elkhorn Slough programming seems to influence Slough Crew participants the most are: i) contributing to service projects; ii) reducing environmental impact; iii) spending more time in nature; iv) someday obtaining a university degree; and v) someday working in an environmentally-related profession. For non-Slough Crew students, Elkhorn Slough programming had an impact on students appreciating the beauty of nature more than any other impact. This is a step in developing a nature connection (Lesson 1).

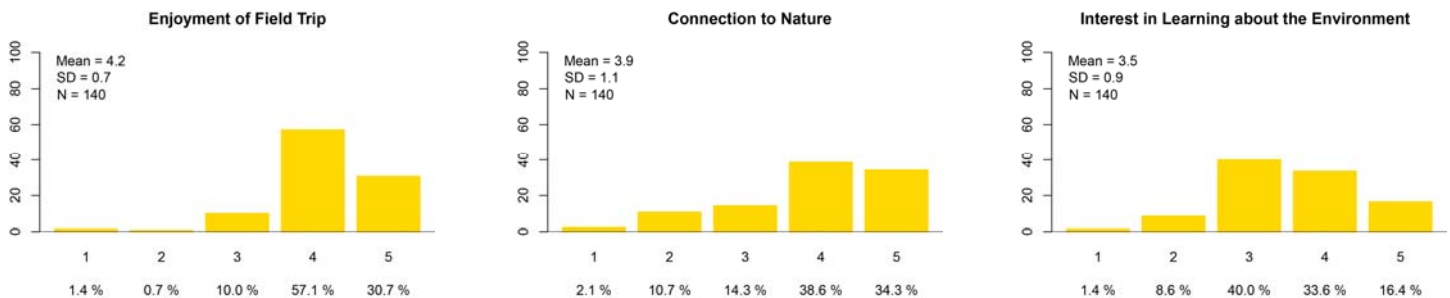
Lesson 5. Word cloud frequency analysis shows some changes in knowledge or experience of the slough.

Lesson 6. Revisions to knowledge questions that can more closely reflect on NMCHS curriculum content could be more beneficial to teachers. A survey that includes “nature connectedness,” knowledge questions, and the suite of “interest in” questions that were included in the post-survey may provide the most useful constructs for future surveys.

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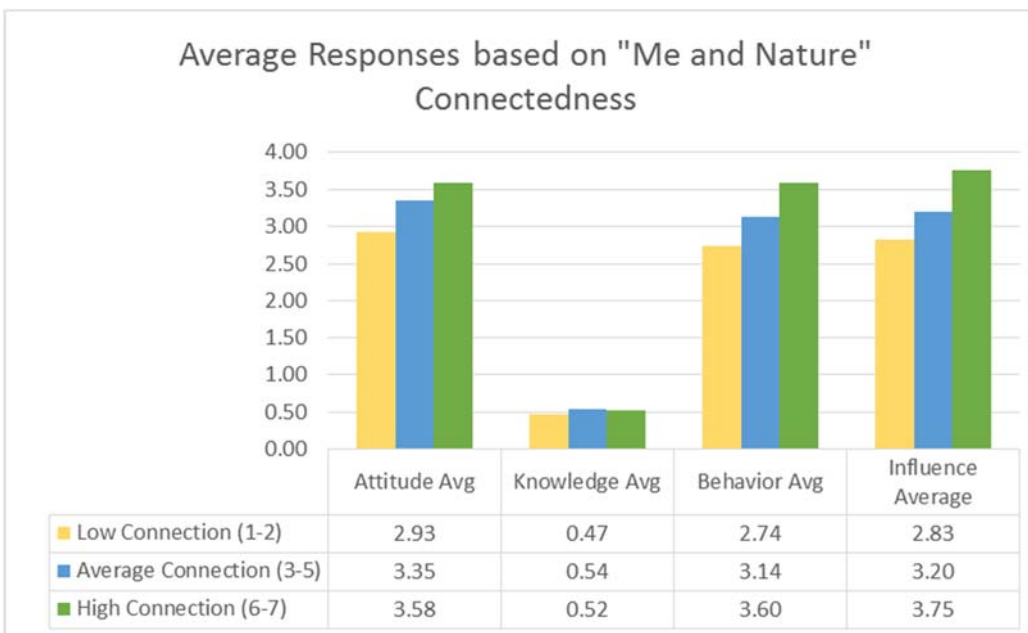
Lesson 1: Freshman Field Trip has Positive Effects

Freshman students at North Monterey County High School attended a day-long field trip to Elkhorn Slough in the winter and early spring of 2018. The survey was issued one to a few days after each class field trip. Mean scores for all freshman students who attended showed positive enjoyment of the field trip (Figure 1), middle to high connection to nature (Figure 2), and moderate interest in learning about the environment (Figure 3). Students ranked their enjoyment of the field trip higher than either their connection to nature or their interest in learning about the environment (Figures 1-3).



Figures 1-3. Mean scores of students enjoyment of field trip (Figure 1, left), connection to nature (Figure 2, middle), and interest in learning about the environment (Figure 3, right).

Lesson 2: Nature Connectedness is related to student responses in attitudes, knowledge, behaviors, and influence of Elkhorn Slough



Nature connectedness appears to have the strongest relationship with any factor—attitudes, knowledge, behaviors, and ability to be influenced by Elkhorn Slough Foundation programming (Figure 4). Students with a low connection to nature scored lowest on all variables. Students with an average to high connection scored similarly, with highest behavior and influence of Elkhorn Slough Foundation programming among highly nature connected students.

Figure 4. Relationship between nature connectedness scores in attitudes, knowledge, behaviors, and influence of Elkhorn Slough Foundation programming.

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Lesson 2. Nature Connectedness (continued)

Across all questions regarding whether Elkhorn Slough Foundation programming influenced students, students with low connection to nature also had low responses to the influence. Students with average to high nature connectedness were associated with stronger influences by the programming (Table 1). Two of the biggest areas of influence, regardless of nature connectedness, include “appreciating the beauty of nature” and “reducing my environmental impacts at home” (Table 1, Figure 5).

	Learning more about science	Learning more about the environment	Contributing to service projects to improve the environment at school or in my community	Participating in the Slough Crew	Reducing my environmental impacts at home, such as by recycling or reducing litter	Reducing my environmental impact by walking or biking more	Spending more time in nature during my free time	Appreciating the beauty of nature	Someday obtaining a university degree in an environmental subject	Someday working in an environmentally-related career
Low (1-2)	3.02	2.88	2.97	2.43	2.91	2.93	2.81	3.10	2.62	2.59
Avg. (3-5)	3.36	3.27	3.33	2.83	3.45	3.15	3.34	3.69	2.82	2.78
High (6-7)	3.70	3.90	3.66	3.33	4.13	3.67	3.98	4.07	3.49	3.60

Table 1. Student responses to how much the Elkhorn Slough Foundation programming influenced their interest in a range of variables, as compared to nature connectedness.

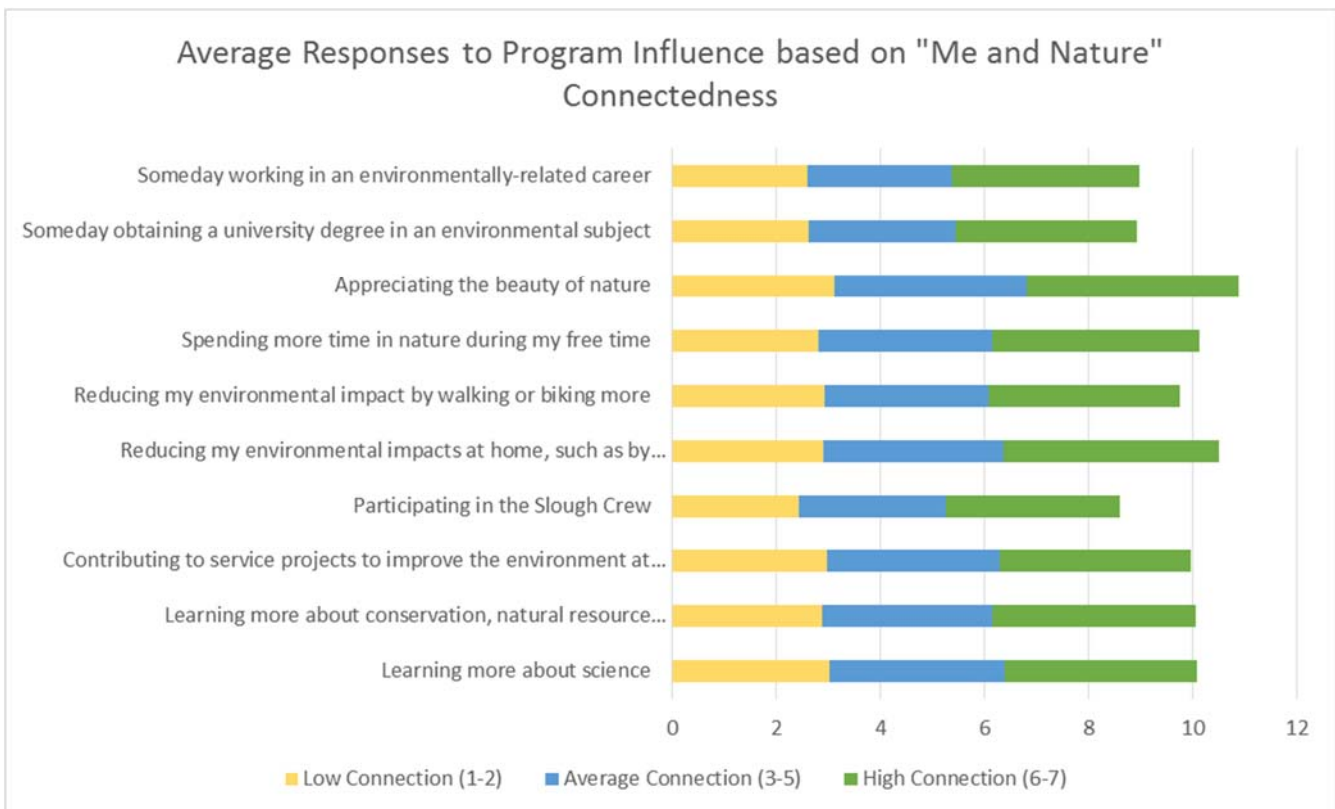


Figure 5. Influence of Elkhorn Slough Programming on students with low, average, or high connection to nature.

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Lesson 3. Few Detectable Differences between Pre- and Post-Year Survey

The pre- and post-year surveys showed very moderate, and likely statistically insignificant, increases in attitudes and knowledge, and a consistent response to behaviors (Table 2). Attitude questions that went up slightly include “it is important to recycle to protect the environment” and “nature makes me feel relaxed and free from the world.” The knowledge question that showed the biggest difference was the fill-in-the-blank question: “what watershed is your school in?” For this question, 18% answered correctly in the fall survey whereas 43% responded correctly in the spring survey. Only one behavior question, “In my school I learn how to protect the environment,” increased slightly (from 2.95 pre- to 3.08 post-) while all others decreased slightly or stayed the same.

Table 2. Pre- and post-year survey results showing mean scores for all students across attitudes, knowledge, and behaviors.

	Pre	Post
Attitudes	3.29	3.32
Knowledge	0.50	0.59
Behavior	3.15	3.15

Lesson 4. Few Detectable Differences between Slough Crew and Non-Slough Crew Responses

There were very few differences between Slough Crew responses and non-Slough Crew responses. In fact, attitude and knowledge scores in the post-year survey were higher for non-Slough Crew members than for Slough Crew members (Table 3). Behaviors were higher for Slough Crew members (Table 3).

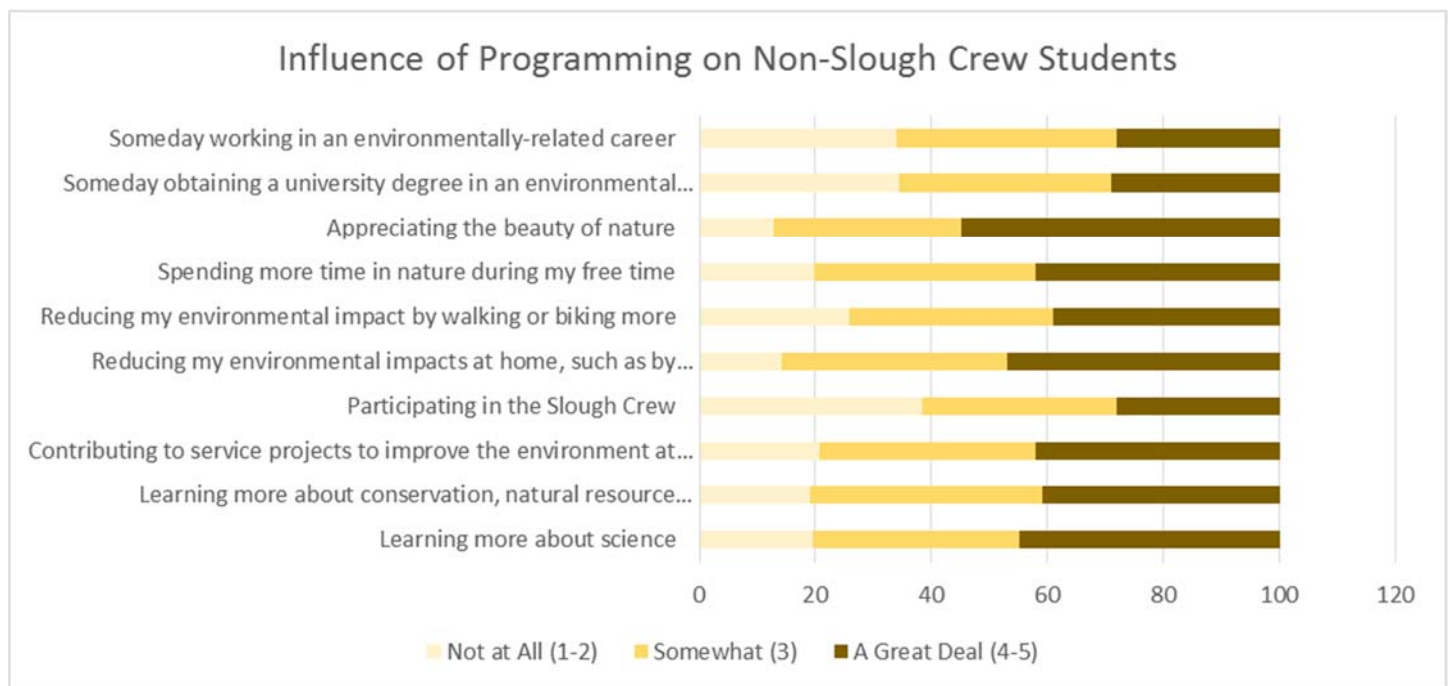
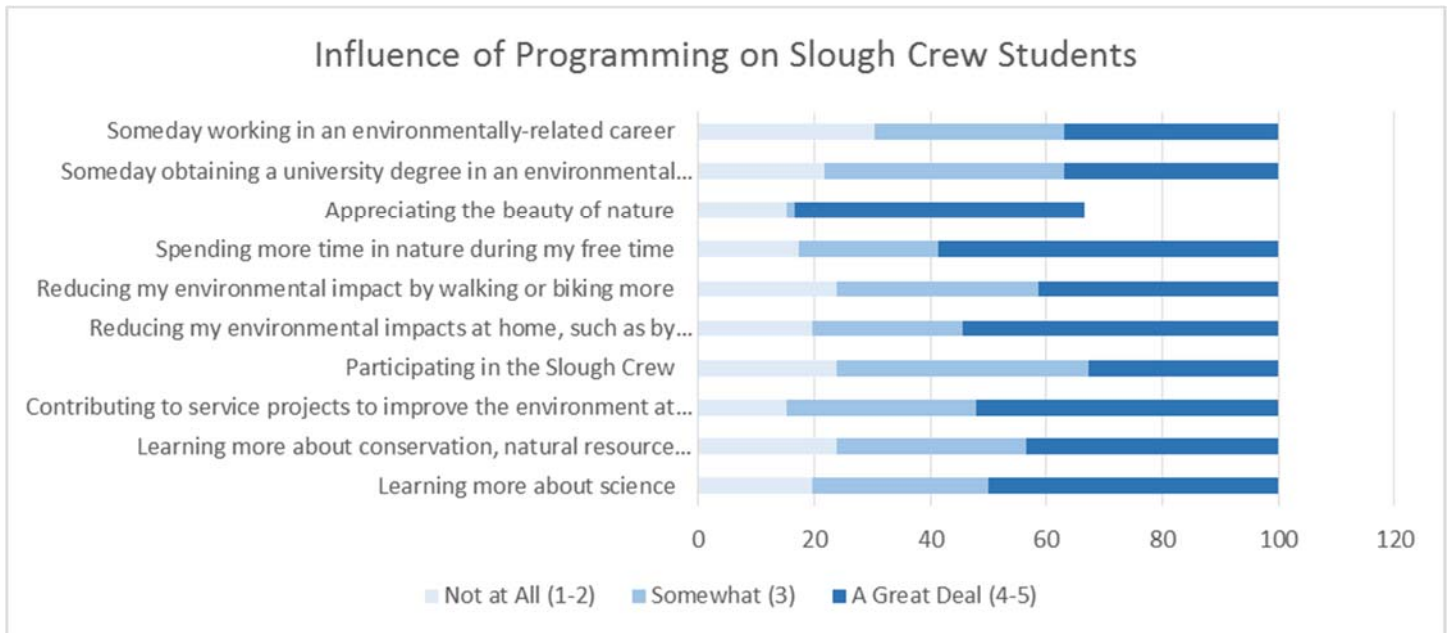
The three areas where Elkhorn Slough programming seems to influence Slough Crew participants the most are in: i) contributing to service projects; ii) reducing environmental impact; iii) spending more time in nature; iv) someday obtaining a university degree; v) someday working in an environmentally-related profession (Figure 6, next page). For non-Slough Crew members, Elkhorn Slough programming had the biggest impact on appreciating nature and reducing environmental impacts (Figure 7, next page).

Table 3. Comparison between Slough Crew and Non-Slough Crew members' responses to post-year survey questions.

	Non Slough Crew	Slough Crew
Attitudes	3.33	3.29
Knowledge	0.53	0.45
Behavior	3.13	3.30

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Lesson 4. Few Detectable Differences between Slough Crew and Non-Slough Crew Responses (continued)



Figures 6-7. Influence of programming on Slough Crew members (Figure 6, top), and non-Slough Crew members (Figure 7, bottom)

Lesson 5. Word Clouds more Nuanced



Figures 8-10. Frequencies of words to describe animals that depend on Elkhorn Slough for their habitat, pre- (left) and post- (right), and freshman field trip (bottom).

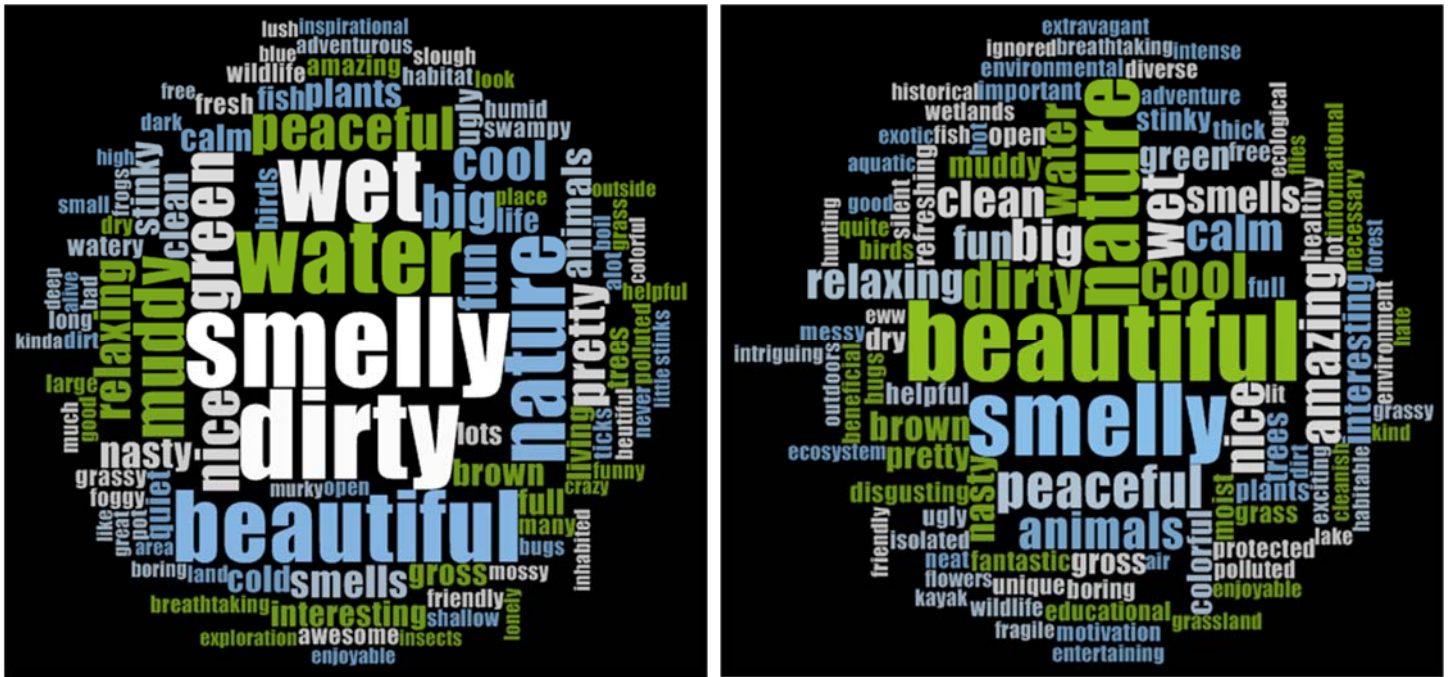


For the survey of freshman that followed the field trip, 16.94% listed sea otters, 15% birds, 10% salamanders, and 5% fish (Figure 10). In comparison to either the pre – or post-year surveys, only 5% listed salamanders. This word frequency analysis showed the greatest level of species-specific identification, including students who listed birds of prey, long-toed salamander, tiger salamander, red tail hawk, and skeleton shrimp (Figure 10). It is unclear if this knowledge was retained in the post-year survey because not all students completed the post-year survey. However, the increase in frequency of “salamander” (Figure 9) suggests that this may have been knowledge gained and retained during the year.

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Lesson 5. Word Clouds more Nuanced (continued)

Overall, respondents described the Elkhorn Slough as “beautiful,” “smelly,” and “dirty” in the pre- and post-survey (Figures 11-12). In the post-survey, 7.4% listed the slough as beautiful compared to 4% in the pre-survey. Ten percent listed the slough as dirty or smelly in the post-survey compared to 11% in the pre-. In the post-survey, 9% described the slough as peaceful, calming, or “chill” compared to only 2% in the pre-survey. Some of the comments also became more negative, such as “I hate it” or “it is really gross” in the post-survey, but this was only for a few students overall. Of significance, for the same question to describe the slough after the freshman field trip, the top 10 most frequent words were all positive, including fun (11%), natural (10%), beautiful (8%), interesting (6%), awesome (5%), and peaceful (2.4%) (Figure 13).



Figures 11-13. Frequencies of words to describe Elkhorn Slough, pre- (left) and post- (right), and freshman field trip (bottom).



Environmental Literacy Final Report: Appendix

Survey Questions issued in fall and spring (pre– and post-)

Attitude Questions

- A1. It is important to recycle to protect the environment. / Es importante reciclar para proteger el medio ambiente. (1-5 Likert Scale, Strongly Disagree to Strongly Agree)
- A2. Me and Nature. Choose the answer that best fits how you see yourself and nature. / Yo y la Naturaleza. Elige la respuesta que mejor se adapte a cómo te ves en relación con la naturaleza. (Venn Diagram A-G Scale, See Figure 1.)
- A3. I feel connected to my school. / Me siento conectado con mi escuela. (1-5 Likert Scale, Strongly Disagree to Strongly Agree)
- A4. Nature makes me feel free and relaxed from the world. / La naturaleza me hace sentir libre y relajado del mundo. (1-5 Likert Scale, Strongly Disagree to Strongly Agree)
- A5. The people at my school understand how their actions impact the environment. / Las personas de mi escuela entienden cómo sus acciones afectan el medio ambiente. (1-5 Likert Scale, Strongly Disagree to Strongly Agree)
- A6. There are places on the school grounds where I can enjoy nature. / Hay lugares en la escuela donde puedo disfrutar de la naturaleza. (1-5 Likert Scale, Strongly Disagree to Strongly Agree)

Knowledge Questions

- K1. Flooding on a river renews the environment. / Las inundaciones en un río renuevan el medio ambiente. (True/False)
- K2. What is a watershed? / ¿Qué es una cuenca hidrográfica? (Multiple choice)
- The level below which the ground is saturated with water. / El nivel bajo el cual el suelo está saturado con agua.
 - An area of land where all the water flows to the same place. / Un área de tierra donde toda el agua fluye al mismo lugar.
 - A tank where water is stored. / Un tanque donde se almacena el agua.
 - A building where water pumps are. / Un edificio donde están las bombas de agua.
 - An underground water supply. / Una fuente de agua subterránea.
- K3. What watershed is your school in? / ¿En qué cuenca hidrográfica está tu escuela? (Write in response)
- K4. Wetlands are good for water quality. / Los humedales son buenos para la calidad del agua. (True/False)
- K5. Water quality is harmed by (check all that apply) / La calidad del agua se ve perjudicada (marque todos los que apliquen):
- Trash and debris / Basura y escombros
 - Fishing / Pesca
 - Recycling / Reciclaje
 - Agricultural runoff / Escorrentía agrícola

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Behavior Questions

- B1. I believe I have the ability to improve my school and community. / Creo que tengo la capacidad de mejorar mi escuela y comunidad. (1-5 Likert Scale, always true to never true)
- B2. In my school I learn how to protect the environment. / En mi escuela aprendo cómo proteger el medio ambiente. (1-5 Likert Scale, always true to never true)
- B3. I participate in projects, groups or programs that help the environment. / Participo en proyectos, grupos o programas que ayudan al medio ambiente. (1-5 Likert Scale, always true to never true)
- B4. When possible, I recycle at my school. / Cuando sea posible, reciclo en mi escuela. (1-5 Likert Scale, always true to never true)

Demographics and Prior Experience Questions

- D1. Have you ever visited the Elkhorn Slough Reserve (the visitor center and walking trails on Elkhorn Road)? / ¿Alguna vez ha visitado la Reserva Elkhorn Slough (el centro de visitantes y senderos para caminar en el Camino Elkhorn)? (Yes/No)
- D2. Have you participated in Slough Crew? / ¿Has participado en Slough Crew? (Yes/No)
- D3. What grade are you in? / ¿En que grado estás? (Freshman, Sophomore, Junior, Senior)
- D4. What is your gender? / ¿Cuál es su género? (Male, Female, Non-Binary)

Survey Questions added to spring (post-) survey

- D5. Are you or have you ever been a Slough Crew leader? / ¿Eres o has sido alguna vez un líder de Slough Crew? (Yes/No)

I1-I10. How much do you think participation in activities related to the Elkhorn Slough have influenced your interest in the following? / ¿Cuánto cree que le interesa su participación en actividades relacionadas con Elkhorn Slough? (Response Options: A great deal (5), 4, 3, 2, Not at all (1))

- Learning more about science
- Learning more about conservation, natural resource management, or the environment
- Contributing to service projects to improve the environment at school or in my community
- Participating in the Slough Crew
- Reducing my environmental impacts at home, such as by recycling or reducing litter
- Reducing my environmental impact by walking or biking more
- Spending more time in nature during my free time
- Appreciating the beauty of nature
- Someday obtaining a university degree in an environmental subject
- Someday working in an environmentally-related career

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Survey Questions issued to freshman after field trip

1. How did you feel about the field trip to Elkhorn Slough today? / ¿Cómo te sentiste con respecto a la excursión a Elkhorn Slough hoy? [I did not enjoy it at all (1), 2, 3, 4, I loved it! (5)]
2. Me and Nature. Choose the answer that best fits how you see yourself and nature. / Yo y la Naturaleza. Elige la respuesta que mejor se adapte a cómo te ves en relación con la naturaleza. (1-5 Likert Scale)
3. What is your level of interest in learning about the environment? / ¿Cuál es su nivel de interés en aprender sobre el medio ambiente? [Not at all interested (1), 2, 3, 4, Very interested (5)]
4. List one thing that you learned about the Elkhorn Slough today / Enumera una cosa que aprendiste sobre el Elkhorn Slough hoy. (write in response)
5. Write the names of 3 animals that depend on the Elkhorn Slough for their habitat / Escriba los nombres de 3 animales que dependen de Elkhorn Slough para su hábitat. (write in response)
6. List three words to describe the Elkhorn Slough / Enumere tres palabras para describir el Elkhorn Slough. (write in response)