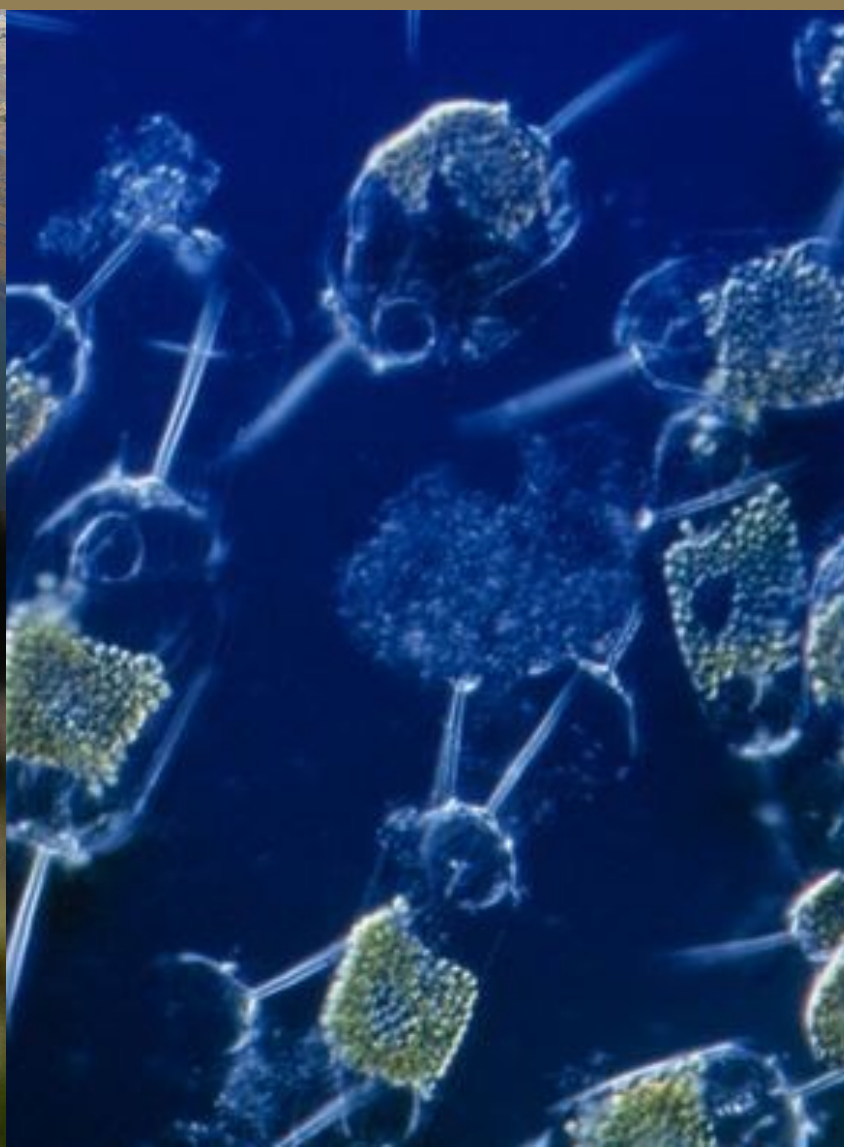
Environmental Literacy Report: Findings from a survey of freshman field trip participants from North Monterey County High School

Report Submitted to the Elkhorn Slough National Estuarine Research Reserve, the Elkhorn Slough Foundation, and North Monterey County High School

June 2019



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.

ELKHORN SLOUGH RESERVE

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Front Cover image sources: NOAA (Elkhorn slough landscape), Cosmic Birding (acorn woodpecker), Deep Green Resistance (plankton)

Environmental Literacy Report

Report of findings from a survey of freshman field trip participants

Overview

This research project included partners from the Elkhorn Slough National Estuarine Research Reserve, the Elkhorn Slough Foundation, North Monterey County High School (NMCHS), and California State University Monterey Bay. Each year, Elkhorn Slough Reserve staff provide a field trip experience to approximately 200 freshmen students at NMCHS. This report summarizes findings from a survey completed by 151 freshman from NMCHS who participated in this field trip from January to April 2019.

- The majority of students enjoyed the field trip, with a mean score of 4.0 on a 5.0 scale.
- There is a direct correlation between students' reporting of how "connected to nature" they feel, with level of field trip enjoyment and level of interest in learning about the environment.
- Similarly, there is a correlation between students' reporting of their "interest in learning about the environment" and their enjoyment of the field trip.
- Students were able to report a range of concepts they learned from the field trip, including the site's history, ecological changes that affect the slough, and a range of species (from plankton to leopard sharks) that live in the slough.
- Students own words for their experience include that it was fun, interesting, beautiful, cool, peaceful, and "really heckin' fun."
- Overall, these results are fairly similar to those from the 2018 field trip students. In 2018, mean scores were slightly higher for field trip enjoyment (4.2 in 2018 compared to 4.0), nature connectedness (3.9 in 2018 compared to 3.16). Mean scores for level of interest in learning about the environment were a slight fraction higher in 2019 (mean score of 3.57 in 2019 compared to 3.5 in 2018).

Background

As the second largest tidal salt marsh in California, the Elkhorn Slough is home to a diversity of resident and migratory birds, marine mammals, and fish. The Elkhorn Slough watershed provides habitat for threatened and endangered species, including the endangered Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*) and approximately 125 Southern sea otters (*Enhydra lutris nereis*). The wetland provides important ecological services to the region, filtering pollutants and serving as a carbon sequestration source (About Elkhorn Slough, n.d.). The Elkhorn Slough Foundation and Elkhorn Slough National Estuarine Research Reserve are dedicated to conserving and protecting the Elkhorn Slough and surrounding watershed and offer educational opportunities for local youth to learn about the environment of which they are a part.

This survey was established to assess students environmental literacy, as part of broader education and program goals. Environmental Literacy is defined as a combination of competencies, knowledge, and dispositions to support the environment and to ultimately demonstrate pro-environmental behaviors (NAAEE 2011). A person who is environmentally literate has the power to act individually or with others to support ecologically sound, economically prosperous, and equitable communities for present and future generations (CA DOE 2015).

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Methods

After the development and issuance of an environmental literacy survey of more than 800 students in the fall of 2017 (see November 2017 report), project partners developed a short survey for all freshman who attend the winter and spring field trips to Reserve. This short survey was designed to assess students' field trip enjoyment, their connection to nature, and their interest in learning about the environment. The bilingual English/Spanish survey included 3 questions on a 1-5 point Likert Scale:

- How did you feel about the field trip to Elkhorn Slough today?, with responses from "I did not enjoy it at all" (1) to "I loved it" (5)
- Me and Nature: Choose the Venn diagram that best describes how you see yourself and nature, with responses from "not at all connected" (1) to "completely connected" (5)
- What is your level of interest in learning about the environment?, with responses from "Not at all interested" (1) to "Very interested" (5).

The survey also asked students to respond to three fill-in-the-blank questions:

- List one thing you learned about the Elkhorn Slough today
- Write the names of 3 animals that depend on the Elkhorn Slough for their habitat
- List 3 words to describe the Elkhorn Slough.

Between January and April, surveys were administered via a Google Form in the computer lab at school approximately one day after the field trip. After all field trips were complete, the data were extracted from the Google Form, with a total of 140 respondents. The three Likert Scale questions were analyzed using Excel software. Mean scores and standard deviation were calculated for these 3 questions (Table 1). In addition, the correlations between these variables were depicted graphically (Figures 1-3). Scores also were compared to see the relationship between "Nature Connectedness" and field trip enjoyment and interest in learning (Table 2, Figure 4).

For the question which asked students to "list one thing" they learned on the field trip, responses were coded in Excel. For this question, responses were scored a 1 for short, basic responses that listed a name of an animal or one other generic responses that showed little scientific knowledge; a 2 for answers that show specific science knowledge or vocabulary; and a 3 for answers that demonstrate an understanding of ecological relationships within the slough. Sample codes include:

1— "I learned about the nature" -or- "woodpeckers"
2— "It is a mix of fresh and salt water" -or- "Elkhorn Slough is 'home' to many invasive species"
3— "Woodpeckers eat termites, and they eat at the dead trees." -or- "I learned that the chemicals for farms run off into the slough."

Word frequencies were calculated for the open-ended questions that asked students to list three names/words, and word clouds that depict these frequencies were generated in NVivo qualitative data software (Tables 3-5, Figures 5-6).

Results

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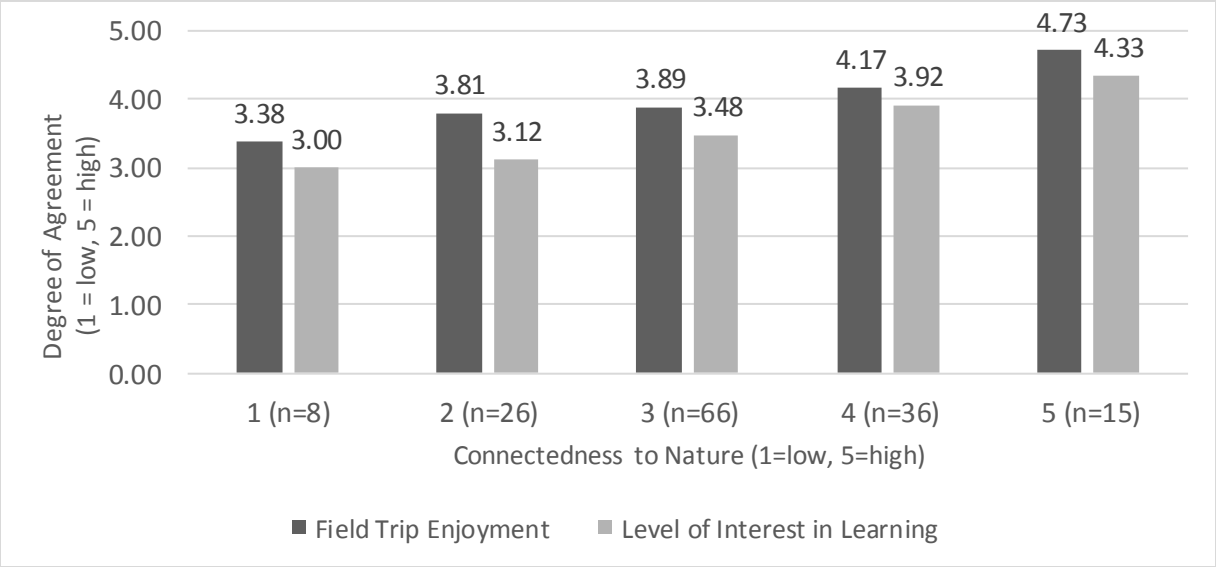
Results

Mean scores for all students showed positive enjoyment of the field trip (Table 1, Figure 1), average connection to nature (Table 1, Figure 2), and moderate to high interest in learning about the environment (Table 1, 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 (Table 1). Both enjoyment and interest in learning show correlation with the connectedness to nature.

Table 1. Field trip enjoyment, level of interest in learning about the environment, and coded scores for something learned on the field trip as compared to students level of connection to nature (where 1, is not at all connected, and 5 is very closely connected). Both enjoyment and level of interest are correlated with Nature Connectedness. (All scores are on a 5-point Likert scale.)

Connection to Nature	Field Trip Enjoyment	Level of Interest in Learning about the Environment
1 (n=8)	3.38	3.00
2 (n=26)	3.81	3.12
3 (n=66)	3.89	3.48
4 (n=36)	4.17	3.92
5 (n=15)	4.73	4.33
Mean score = 3.16	Mean score = 4.0	Mean score = 3.57

Figure 1. Student ratings of Field Trip Enjoyment and Level of Interest in Learning about the Environment, as compared to Connectedness to Nature scores.



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Results

Correlations between Question Items

Scatter plots were used to examine overall relationships between variables. Figure 2 shows the relationship between Connectedness to Nature and Field Trip Enjoyment. In general, students with higher connection to nature also enjoyed the field trip more, but many students who rated their connection to nature as low to medium (2-3), also showed a high degree of enjoyment of the field trip (Figure 2). Similarly, Nature Connectedness is generally correlated with Level of Interest in Learning about the Environment (Figure 3).

Figure 2. Field Trip Enjoyment scatter plot as compared to Connectedness to Nature. (The darker and fuller the bubble, the more responses in this score.)

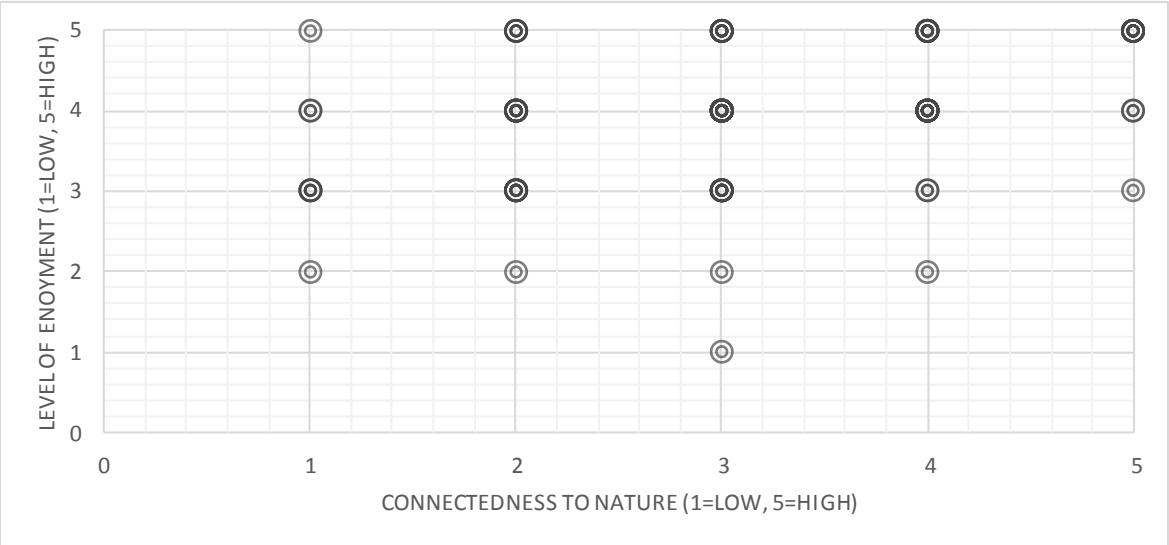
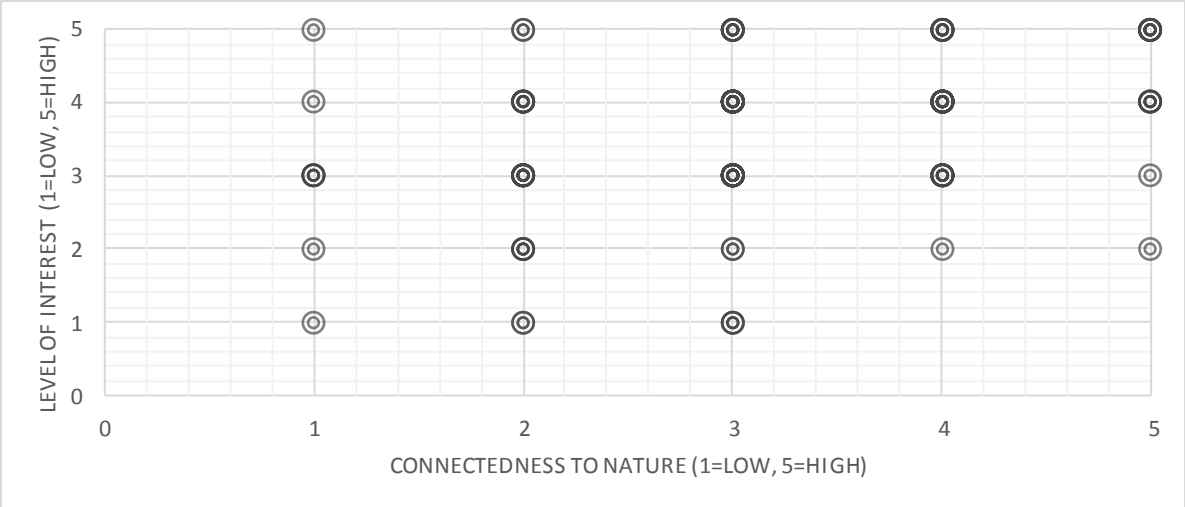


Figure 3. Level of Interest in Learning about the Environment scatter plot as compared to Connectedness to Nature. (The darker and fuller the bubble, the more responses in this score.)



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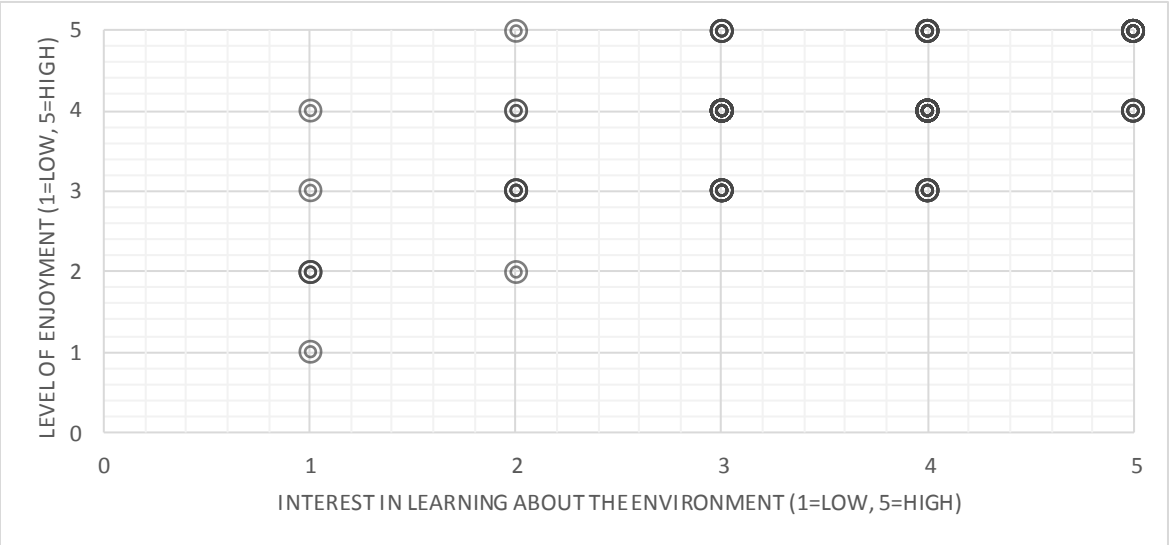
Correlations between Question Items (Continued)

Interest in learning about the environment appears to be tightly more correlated with Field Trip Enjoyment (Table 2, Figure 4) than Nature Connectedness (see also Table 1, Figure 2).

Table 2. Field Trip Enjoyment and Nature Connectedness as compared to Level of Interest in Learning about the Environment. Both enjoyment and connectedness are correlated with field trip enjoyment. (All scores are on a 5-point Likert scale.)

Level of Interest in Learning about the Environment	Field Trip Enjoyment	Nature Connectedness
1 (n=6)	2.33	2.33
2 (n=9)	3.33	2.67
3 (n=53)	3.91	2.85
4 (n=57)	4.04	3.33
5 (n=26)	4.73	3.77
Mean Score = 4.0	Mean Score = 3.57	Mean Score = 3.16

Figure 4. Field Trip Enjoyment scatter plot as compared to Interest in Learning about the Environment. (The darker and fuller the bubble, the more responses in this score.)



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Ideas Learned on the Field Trip

Qualitative responses to "list 3 animals that rely on Elkhorn Slough for habitat" show a range of responses (Table 3). These ideas reflect the cultural history, biological history, and ecological relationships and understanding of human impacts.

Animals that Rely on Elkhorn Slough

Qualitative responses to "list 3 animals that rely on Elkhorn Slough for habitat" show a range of responses that reflect some of the most common animals found in the Slough (Table 4, Figure 5). There is a wide diversity of types of species reported, including plankton, insects and ticks, diverse birds, fish, rays, and sharks, and mammals.

Words to Describe Elkhorn Slough

Students' responses to the question to "list 3 words to describe Elkhorn Slough" show a range of responses that reflect some of the most common animals found in the Slough were highly positive (Table 5, Figure 6).

Table 3. Response to the question "List one thing you learned at Elkhorn Slough"

Code	Number of Responses	Sample Responses
1 Basic knowledge or experience expressed	46 (29%)	"It used to have a dairy farm" "I learned about birds" "Animals come in different size" "Wildlife" "There are many small creatures"
2 Some scientific vocabulary or knowledge demonstrated	84 (54%)	"There are endangered species at Elkhorn Slough." "It has over 300 species of birds visiting each year." "A woodpecker's tongue can go around its head." "There are little animals in the ocean you can't see unless you have a microscope." "There is red algae there." "The Elkhorn Slough is brackish." "I learned that some salamanders are invasive." "They cut eucalyptus down." "It connects to the Pajaro Valley." "The Elkhorn Slough got its name because it used to be densely populated with elk." "The watershed is an important part of our ocean and ways of water flows."
3 Understanding of ecological relationships or human impacts demonstrated	22 (14%)	"Most of the local reservoirs are affected by human impacts (pollution, farm animal excrement)." "Humans have changed the slough for over 10,000 years." "The Elkhorn Slough has a lot of fertilizer from nearby farms." "Otters rely on the marsh to have their babies." "They remove eucalyptus trees because those trees make sure others won't grow by them." "The fields around it are causing algae to grow, rapidly killing native plants." "That long ago, animals were being killed for their oils."

Table 4. Response to the question "List 3 Animals that rely on the Elkhorn Slough for their habitat"

Animal	Count	Percentage	Similar Words
birds	61	12%	bird, birds
sea otters	56	11%	Sea otters, otters
woodpeckers	33	7%	woodpecker, woodpeckers
salamanders	31	6%	salamander, salamanders
plankton	30	6%	plankton
turkeys	16	3%	turkey, turkeys
snakes	15	3%	snake, snakes
Multiple species	14	3%	crab, crabs, fish, fishes, lizards, squirrels
Multiple species	8-11	2%	Frog, frogs, rabbits, ducks, owl, bunny, bunnies, mountain lions
Multiple species	3-7	1%	Hawk, blue heron, fox, elk, sharks, coyotes, deer, spiders, bobcat, egrets, gophers, leopard shark, seals
Multiple species	1-2	<1%	Bass, California tiger salamander, crickets, ground squirrels, hummingbird, insect, plants, red shouldered hawk, ticks, worms, arthropods, California quail, Canada goose, falcon, halibut, innkeeper worm, rays, reptiles, sea creatures, sea spiders, sole fish, stingray, urchins

Figure 5. Response to the question "List 3 Animals that rely on the Elkhorn Slough for their habitat"

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Table 5. Response to the question "List 3 Words to Describe the Elkhorn Slough"

Word	Count	Percentage	Similar Words
Fun	44	9.8%	-
Interesting	36	8%	-
Beautiful	27	6%	-
Nature	25	5.6%	Nature, natures, natural
Cool	21	4.68%	Cool, chill
Green	17	3.8%	-
Multiple words	15	3%	snake, snakes
Multiple words	9-12	2%	Adventurous, exploring, environmental, alive, lively, nice, big, great, large, pretty, good, safe, secure, educational, muddy, water
Multiple words	<5	0-1%	Native, quiet, calm, wildlife, protect, protected, breezy, windy, exciting, helpful, habitat, knowledgeable, moist, plants, research, reserve, scientific, slough, home, boring, entertaining, friendly, mud, open, relaxing, smelly, trails, water, wonderful, enchanting, fascinating, intriguing, estuary, endangered, flourishing, epic

Figure 6. Response to the question "List 3 Words to Describe the Elkhorn Slough"

Discussion

The results show that overall, students' experiences and gains in knowledge were positive, with the majority of students enjoying their field trip experience (with a mean score of 4.0 on the 5-point Likert Scale). Students who felt connected to nature or interested in learning about the environment were more likely to have enjoyed the field trip (Figures 1-4). The majority of students (68%) were able to demonstrate scientific vocabulary, site specific scientific facts, or ecological relationships (Table 3). These results also reflect student responses immediately following a field trip. We do not know the extent that these responses in attitudes or knowledge might be maintained over time. Instituting the pre– and post-survey (already developed through this partnership) would provide valuable information about how students' learning and interest changes over time.

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