

KIDS for the BAY

Watershed Action Program 2008-09 Evaluation Report

Executive Summary

Introduction

This evaluation of the Watershed Action Program (WAP) was conducted to assist KIDS for the BAY (KftB) staff and constituents with determining the impact and effectiveness of their in-depth watershed education and action program on teacher and student participants. The evaluation also serves as an invaluable tool in informing future programming and future program evaluation. Thirty-six elementary school teachers and over 1,000 students participated in the WAP during the 2008-09 school year. This executive summary focuses on highlights of and conclusions from the evaluation results. A full report follows the summary.

- 1) 1,150 students become stewards of their local watershed and take action to address watershed environmental health and justice issues.
- 2) 36 teachers learn to use the local watershed as an educational resource to stimulate students' learning and empower students to become watershed stewards.
- 3) The Watershed Action Program is integrated into the curriculum and culture of our target schools involving principals, teachers, students and their families.

During the 2008-09 school year, KIDS for the BAY (KftB) also implemented WAPs that had special funding and an additional thematic focus.

Marine Sanctuaries Watershed Action Program (12 programs)

In the Marine Sanctuaries WAP, students and teachers learned about the three National Marine Sanctuaries located off the coast of Northern California: Cordell Bank, Gulf of the Farallones, and Monterey Bay. Through hands-on activities, discussions, field trips, and special presentations, classes learned the history and significance of these protected marine environments. Students also learned about the various plant and animal organisms that inhabit these protected areas and how our neighborhoods are connected to these habitats through the storm drain system.

Student Objectives: Students will be able to:

- describe their local watershed and how it is directly connected to the larger San Francisco Bay Area watershed and three National Marine Sanctuaries.
- describe some of the organisms that live in their local watershed ecosystem and their local National Marine Sanctuaries.
- explain what a food chain is and why toxins accumulate in top predators.
- name at least three types of urban run-off pollution found in their own neighborhood and explain how this pollution enters their creeks, bays, and National Marine Sanctuaries.

- name three things they and their families can do to prevent pollution from entering these water bodies.
- explain the process of testing a hypothesis.
- select, plan, and implement a watershed action project to improve the watershed environment.

Teacher Objectives: Teachers will:

- increase their knowledge of watershed ecology and how their local watersheds connect to the greater San Francisco Bay Area watershed, including the Gulf of the Farallones, Monterey Bay, and Cordell Bank National Marine Sanctuaries.
- increase their knowledge of the Gulf of the Farallones, Monterey Bay, and Cordell Bank National Marine Sanctuaries.
- increase their confidence to use the local watershed environment as a learning resource.
- increase their confidence to teach environmental science lessons in the classroom and in the field.
- increase their confidence to facilitate an environmental action project with their students.

Toxins Reduction Watershed Action Program (6 programs)

In the Toxins Reduction WAP, students learned about the San Francisco Bay watershed, sources of pollution to the watershed and how pollutants impact bay food chains. Students then educated their families and the school community in hands-on demonstrations and informational meetings for family members and peer students. They also interviewed people fishing from bay piers about safe bay food consumption and distributed informational flyers that were translated into seven different languages about the human-health risks associated with eating San Francisco Bay fish.

Student Objectives:

- 1) 155 students learn about the San Francisco Bay watershed and the pollutants impacting Bay health and human health.
- 2) 155 students become toxin reduction educators and help their communities raise awareness about how to reduce intake of toxins from Bay fish.
- 3) 155 students take action to help reduce pollution to and become stewards of the San Francisco Bay.
- 4) 6 teachers learn to teach the KIDS for the BAY Safe Bay Food Consumption Curriculum and Watershed Action Program to future classes of students.
- 5) More than 650 people are educated in safe Bay food consumption through students and teachers who will participate in the KftB Watershed Action Program.

The 2008-09 school year evaluation plan focused on assessing whether a few key student and teacher objectives were achieved. In addition to this, evaluation focused on analyzing whether a few of the questions in the Evaluation Goals section were achieved. Questions within the Evaluation Goals section apply to the impact of the program on students and teachers and on the evaluation process itself.

Quantitative and qualitative evaluation tools were administered to student and teacher participants between September 2008 and June 2009. The Watershed Action Program (WAP) (intervention) consisted of five in-class workshops, an environmental action project, and a field trip to a creek, bay, or ocean habitat. Thirty-six 3-5th grade classroom teachers and over 1,000 students participated in the WAP during the 08-09 school year. Some evaluation data was collected from the entire pool of WAP

participants, and some data was specifically collected from those participants in the Marine Sanctuaries WAP (310 students and 12 teachers) and Toxins Reduction WAP (155 students and 6 teachers).

Results: Highlights and Conclusions

Results from the 2008-09 school year evaluation process indicate that the goals of the Watershed Action Program were achieved. The WAP provided meaningful watershed experiences for elementary school students, and also provided professional development to classroom teachers in environmental education. In particular, evaluation results show that the WAP had an extremely positive impact on both students and teacher participants.

Program Impact on Students

One hundred percent of teachers agreed that participation in the WAP increased their students' concern for their watershed and increased their students' interest in learning. These survey results show that teachers perceive the program to have had an extremely positive impact on their students' learning experiences. Teachers also reported that their students became more aware of the environment around them in their written evaluation reports. Many teachers also cited positive environmental attitude and behavior changes in their students due to their participation in the WAP.

Students showed a statistically significant overall increase in knowledge of the program content through results from the pre- and post-program surveys. The individual survey item results reveal that students learned about their local watershed and its connection to the larger bay and ocean watersheds. Students also learned about their neighborhood's connection to their local creek, the San Francisco Bay, and the ocean through the storm drain system. Students increased their awareness about the storm drain system and potential pollutants that can enter the system and affect the local creek, the bay, and the ocean. Students also increased their knowledge about food chains and the biomagnification of pollution in food chain systems. They showed knowledge about how toxins, such as pesticides, move up the food chain and can negatively impact the health of top predators such as humans.

Students who participated in the Marine Sanctuaries WAP showed an increase in knowledge about the names and locations of the three local National Marine Sanctuaries, the reasons why the marine sanctuaries are important, and ways that they can help protect the marine sanctuaries.

Students who participated in the Toxins Reduction WAP showed an increase in knowledge about how mercury enters the San Francisco Bay and how they and their families can reduce their exposure to and intake of mercury through eating fish. Students also increased their knowledge about food chains and the biomagnification of pollution in food chain systems. They showed knowledge about how toxins, such as pesticides, move up the food chain and can negatively impact the health of top predators such as humans.

Program Impact on Teachers

Survey results from teachers participating in the WAP show that the program had an extremely positive impact on teachers in many different areas. Overall, teachers enjoyed the WAP; received adequate training, resources, and support to feel confident teaching the program themselves; and felt that their participation in the WAP was worthwhile and worth recommending to others. Most teachers increased their confidence in teaching environmental science, facilitating an environmental action project with their class, and using the local environment as a learning resource. Half of the teachers expressed an increase in confidence for leading an outdoor field trip with their students. This finding is consistent with evaluation data from previous school years, and further acknowledges the need for

support from KftB staff for the field trip portion of the WAP during the second follow-up year of the program.

Results from the teachers' written evaluation forms show that teachers were grateful for the professional development opportunities gained from participation in the program. Teachers thought that having the WAP in their classroom benefited them (e.g. it increased their confidence to integrate science in their classroom) and their students (e.g. students became more engaged in science). A few teachers mentioned excitement in teaching the program lessons and activities themselves. This is fully supported by the survey results that show that at the end of the program 100% of teachers felt prepared to teach the program to their students the next school year.

Teachers have shown through their survey responses and written feedback that the WAP has been beneficial to them in many different aspects. One hundred percent of teachers would recommend the WAP to other classroom teachers, with 92% of teachers marking "strongly agree" for this statement. These response results indicate a high level of enjoyment of the program and a feeling that the program was worthwhile.

Summary

Evaluation results show that the specific program objectives we measured for the 2008-09 evaluation process were met. KftB recommends continuing to provide classroom teachers with high-quality professional development opportunities through the WAP: in-class training and modeling of the program, resources such as a comprehensive curriculum guide and program equipment, and support so teachers feel confident teaching the program themselves in future years. Through this evaluation process, it was identified that teachers need more support to feel comfortable leading an outdoor environmental field trip with their students. KftB recommends identifying what additional support teachers need to feel comfortable in this area. KftB should also continue to provide hands-on, engaging environmental science lessons focused around the local watershed and to elementary school students. Lastly, program administrators should continue to improve the evaluation plan and the evaluation tools used to assess the impact of the program on teacher and student participants.

Watershed Action Program 2008-09 Evaluation Report

Project Overview

Project Summary

The Watershed Action Program (WAP) provides 1) meaningful watershed experiences for elementary school students and 2) professional development in the area of environmental education for elementary school teachers. Our specific program objectives for the 2008-09 school year were as follows:

- 1) 1,150 students become stewards of their local watershed and take action to address watershed environmental health and justice issues.
- 2) 36 teachers learn to use the local watershed as an educational resource to stimulate students' learning and empower students to become watershed stewards.
- 3) The Watershed Action Program is integrated into the curriculum and culture of our target schools involving principals, teachers, students and their families.

During the 2008-09 school year, KIDS for the BAY (KftB) also implemented WAPs that had special funding and an additional thematic focus. These thematic WAPs are listed below, along with any program objectives that were specific to these programs.

Marine Sanctuaries Watershed Action Program (12 programs)

In the Marine Sanctuaries WAP, students and teachers learned about the three National Marine Sanctuaries located off the coast of Northern California: Cordell Bank, Gulf of the Farallones, and Monterey Bay. Through hands-on activities, discussions, field trips, and special presentations, classes learned the history and significance of these protected marine environments. Students also learned about the various plant and animal organisms that inhabit these protected areas and how our neighborhoods are connected to these habitats through the storm drain system.

Student Objectives: Students will be able to:

- describe their local watershed and how it is directly connected to the larger San Francisco Bay Area watershed and three National Marine Sanctuaries.
- describe some of the organisms that live in their local watershed ecosystem and their local National Marine Sanctuaries.
- explain what a food chain is and why toxins accumulate in top predators.
- name at least three types of urban run-off pollution found in their own neighborhood and explain how this pollution enters their creeks, bays, and National Marine Sanctuaries.
- name three things they and their families can do to prevent pollution from entering these water bodies.
- explain the process of testing a hypothesis.
- select, plan, and implement a watershed action project to improve the watershed environment.

Teacher Objectives: Teachers will:

- increase their knowledge of watershed ecology and how their local watersheds connect to the greater San Francisco Bay Area watershed, including the Gulf of the Farallones, Monterey Bay, and Cordell Bank National Marine Sanctuaries.
- increase their knowledge of the Gulf of the Farallones, Monterey Bay, and Cordell Bank National Marine Sanctuaries.
- increase their confidence to use the local watershed environment as a learning resource.
- increase their confidence to teach environmental science lessons in the classroom and in the field.
- increase their confidence to facilitate an environmental action project with their students.

Toxins Reduction Watershed Action Program (6 programs)

In the Toxins Reduction WAP, students learned about the San Francisco Bay watershed, sources of pollution to the watershed and how pollutants impact bay food chains. Students then educated their families and the school community in hands-on demonstrations and informational meetings for family members and peer students. They also interviewed people fishing from bay piers about safe bay food consumption and distributed informational flyers that were translated into seven different languages about the human-health risks associated with eating San Francisco Bay fish.

Student Objectives:

- 1) 155 students learn about the San Francisco Bay watershed and the pollutants impacting Bay health and human health.
- 2) 155 students become toxin reduction educators and help their communities raise awareness about how to reduce intake of toxins from Bay fish.
- 6) 155 students take action to help reduce pollution to and become stewards of the San Francisco Bay.
- 7) 6 teachers learn to teach the KIDS for the BAY Safe Bay Food Consumption Curriculum and Watershed Action Program to future classes of students.
- 8) More than 650 people are educated in safe Bay food consumption through students and teachers who will participate in the KftB Watershed Action Program.

Program Description

The Watershed Action Program includes five two-hour workshops at the school site and a full day field trip to a local creek, bay, or ocean habitat. In addition, each class selects a watershed action project, which the students plan, develop and implement with guidance from their teacher and support and resources from KIDS for the BAY (KftB).

Teachers and students participate in all program activities together. Teachers learn the programs alongside their students, attend planning and evaluation meetings with KftB Instructors, and teach preparation and follow-up activities from the WAP Curriculum Guide. Each team of teachers receives an equipment kit to continue teaching the program in following years. KftB follows up with teachers in the year after their training to provide additional support and to evaluate success as the teacher teaches the program to his/her students.

Evaluation Goals

KIDS for the BAY's program evaluation process is both summative and formative. The evaluation data collected from student and teacher participants during the 2008-09 school year enables us to assess 1) the impact of the program on students and teachers, 2) the effectiveness of the program content and delivery, and 3) how we can improve our teaching methods and curricula for future programming. An added benefit to the evaluation process is being able to assess the effectiveness of the evaluation tools themselves in gathering the desired data from program participants. Information on the types of responses we received, the quality of the responses, and the amount of data we collected from each evaluation tool we administered in 2008-09 will allow us to improve the tools themselves as well as the overall evaluation plan.

In addition to assessing whether the program met its objectives, the Watershed Action Program evaluation plan sought to answer additional questions that are identified in this Evaluation Goals section. The evaluation plan for the 2008-09 school year focused on only the bolded questions.

Program Effectiveness and Improvement

- **Are we reaching our stated program goals and objectives for teacher and student participants?**
- How can we improve the Watershed Action Program based on the feedback collected from teachers and the results of the evaluation process?

Student Participants

- What was the students' overall experience of the program?
- **Was there any increase in student knowledge due to participation in the program?**
- **Were there any changes in students' attitudes, abilities, or behaviors due to participation in the program?**

Teacher Participants

- **Overall, were teachers satisfied with the program?**
- What suggestions do they have to improve the program content and delivery?
- **Were there any increases in teachers' comfort level and perceived ability in:**
 - **teaching environmental science concepts?**
 - **using the local environment as a learning resource?**
 - **facilitating an environmental action project with their students?**
 - **leading an outdoor environmental field trip with their students?**
- **Do teachers feel prepared to teach the program next year?**
- **How useful were the various program components (in-class training, curriculum guide, equipment kit) in providing teachers with what they need to teach the program?**

In the 2008-09 school year, the WAP evaluation process focused on acquiring evaluation data from both student and teacher participants. Student surveys that test for changes in knowledge are administered every other school year, and were administered during the 2008-09 school year. Teachers provided survey and written feedback to KftB that gave insight on the experience of the program for themselves, their students, and the school community.

Methods

Quantitative and qualitative evaluation tools were administered to student and teacher participants between September 2008 and June 2009. The Watershed Action Program (WAP) (intervention) consisted of five in-class workshops, an environmental action project, and a field trip to a creek, bay, or ocean habitat. Thirty-six 3-5th grade classroom teachers and over 1,000 students participated in the WAP during the 08-09 school year. Twelve of these programs had a special focus on the three local National Marine Sanctuaries (Marine Sanctuaries WAP), and six of these programs had a special focus on reducing exposure to toxins through consuming local seafood (Toxins Reduction WAP). Therefore, some evaluation data was collected specifically from those participants in the Marine Sanctuaries WAP (310 students and 12 teachers), and some evaluation data was collected specifically from those participants in the Toxins Reduction WAP (155 students and 6 teachers). The methodology behind each evaluation tool varies and is described separately for each tool below.

Student Pre- and Post-Program Surveys:

A sample of students completed a pre-survey before the first classroom workshop, and completed an identical survey within one month of the completion of the classroom workshops. Out of the thirty-six Watershed Action Programs, we randomly selected four classes of students to complete the surveys, with a total sample size of ninety-nine students. Eleven of these students, or 11% of the student sample, were reported to be English Language Learners by their classroom teachers. Due to a variety of grade levels participating in the WAP during the 2008-09 school year, we were not able to select only classes at the fourth grade level. Therefore students who completed surveys were at the third and fourth grade level.

Based on the results and feedback from administering and analyzing the student surveys during the 2006-07 school year, we made significant changes to the number of survey items and the survey items themselves. KftB improved the language and pictures used in the items to make the items more accessible and more easily understandable to the students. In this way, students could more fully focus on how to respond to each item and not on whether they knew what the item was asking them to respond to. We also changed how the survey was scored. The survey items were not weighted; each item stood alone and was not relative to the other items in the survey. Most items were worth one point, although a few items had higher total point values because they contained multiple items within one item. Additionally, we added "I don't know" as a response option to every multiple choice item to allow students the option to give this response instead of having to choose from a list of potential valid responses to the item question.

The educational objectives for and concepts covered in each classroom workshop were used as the basis for developing each question on the survey. The surveys were designed to show whether the lesson objectives were met and whether there were any changes in students' knowledge as a result of participating in the WAP. The surveys contained mostly multiple choice items and a few fill-in-the-blank items that are appropriate and suitable for the age of the student participants (9-11 year olds). Pictures and graphics were incorporated into the items as much as possible to further help students understand the item questions. A variety of questioning strategies were used. Some questions simply checked for knowledge while others required critical thinking strategies and/or more depth of knowledge.

Each classroom teacher administered the surveys using a script to introduce and facilitate the survey administration process. Teachers read each survey question aloud, and students were asked to follow

along and answer each question. Students used identification numbers instead of their names to identify themselves on their surveys. The anonymity of the surveys helped students to understand that this was not a “test” that would be included in their school grades.

Student Pre- and Post-Program Surveys: Additional Marine Sanctuaries WAP Questions

Eight classes who participated in the Marine Sanctuaries WAP completed three additional survey questions that focused on testing for changes in knowledge about the three local National Marine Sanctuaries. One-hundred-seventy-five students completed the additional Marine Sanctuaries questions. Sixty-one of these students, or 35% of the student sample, were reported to be English Language Learners by their classroom teachers.

Student Pre- and Post-Program Surveys: Additional Toxins Reduction WAP Questions

Seven classes who participated in the Toxins Reduction WAP completed two additional multiple-choice survey items that tested for changes in knowledge about mercury in the San Francisco Bay and reducing exposure to mercury. One-hundred-thirty-five students in third-fifth grade completed the additional mercury questions. Ninety-three of these students, or 69% of the student sample, were reported to be English Language Learners by their classroom teachers.

Teacher Pre- and Post-Program Surveys:

Each of the twelve teachers participating in the Marine Sanctuaries WAP completed a short pre-program survey in September-October 2008, before the program began. They then completed a longer post-program survey that contained the same questions as the pre-program survey, plus additional questions. This survey was administered at the completion of all program activities, including the field trip and action project. The pre- and post-survey statements contained standard Likert-scale response options and asked teachers to mark the response that best matched their feelings about program-related statements, including their confidence level (self-efficacy) in leading an environmental field trip with their students and teaching environmental science concepts. The additional statements included in the post-survey asked about the impact of the program on their students and how the resources and the program structure prepared them to teach the program themselves. The response options were: “strongly disagree”, “disagree”, “neutral”, “agree”, and “strongly agree”.

Results for the pre- and post-program surveys reflect the data collected from any Marine Sanctuary WAP teacher participants who completed and turned in both surveys. All twelve teachers who participated in the Marine Sanctuaries WAP completed both surveys. For the purposes of this evaluation report, only data from these teachers is included.

Teacher Written Evaluation Forms:

Each teacher participant completed written evaluation forms that asked open-ended questions about their overall impressions of the program, program highlights, suggestions for program improvement, and how the program has impacted them, their students, the students’ families, and the school community. Teachers completed one written evaluation form at the completion of the classroom workshops, and completed another at the close of all program activities. The open-ended questions allowed teachers to be insightful in their responses and also allowed them to be detailed in their answers. Only the results from the Marine Sanctuaries WAP teacher participants are included in this report. All twelve Marine Sanctuaries WAP teachers completed the written evaluation form.

Data Analysis

Student Pre- and Post-Program Surveys:

Each student within each class that completed the surveys was given a unique student identification number. We then compiled the pre-program and post-program surveys for each student using their identification numbers and discarded any surveys that did not have both a pre- and a post-match. Each pair of surveys was then given a new identification code. This code was recorded on both the surveys and the Microsoft Excel spreadsheet. The pre-surveys were graded and the results for each question were recorded in an Excel spreadsheet. The post-surveys were graded and the results were entered into a separate Excel spreadsheet. We also calculated the total point score for each student on the pre- and post- surveys and put this information in a separate column.

Using the software program XLSTAT by Addinsoft, we compared the pre-survey results to the post-survey results using a paired t-test. The survey results were compared to see if there was a significant increase in students' knowledge due to participation in the Watershed Action Program.

Teacher Pre- and Post-Program Surveys:

The pre-survey and post-survey responses from each teacher were put into a spreadsheet and each question was compared to see what, if any, changes occurred as a result of the intervention. The changes in responses were put into a separate table and displayed in Table 1 (p.11) in the Results section. The items that were only posed to teachers in the post-program survey were compiled into a separate table along with the teachers' responses. The results from these statements are shown in Table 2 (p.12). The mean rating for each statement was also calculated and shown in Table 3 (p.13) in the Results section. To calculate this, response choices were given a number 1-5, with 1 being "strongly disagree" and 5 being "strongly agree". Results are shown for all Marine Sanctuaries WAP teacher participants who completed and turned in both pre- and post-program surveys. All twelve teachers completed both surveys.

Teacher Written Evaluation Forms:

The qualitative data from teachers' written evaluation forms was coded and quantified. The fifteen questions posed on the evaluation forms were reviewed and two key questions were selected to formally analyze. The two chosen questions were the strongest in providing the most relevant and pertinent feedback to this school year's focused evaluation goals. Responses to these two questions were read and re-read, until common themes and categories emerged from the data. As the responses were repeatedly reviewed, some categories were merged and some were separated out as needed. Once the list of categories was set, code words were assigned to identify each category. This information was put into a table for each question, and includes the category code word, the frequency of the response category, and sample data from the teachers' written responses that supports each category. The results from the written evaluation forms are displayed in Tables 4 and 5 (pp.14 & 15).

Results

Student Pre- and Post-Program Survey Results

Whole Test Results: Watershed Action Program Survey

Results Summary: Paired t-test results from 99 students determined that there was a statistically significant increase in knowledge after experiencing the Watershed Action Program intervention ($t_{(98)} = 12.37$, $p < 0.0001$). The total possible score for the entire test, consisting of fifteen items, was 20 and the mean score increase between pre- and post-tests was 4.63 points.

Pre-Test Mean Score	Post-Test Mean Score	Mean Score Increase
11.68	16.31	4.63

Whole Test Results: Marine Sanctuary Watershed Action Program Survey

Results Summary: Paired t-test results from 175 students who completed the additional Marine Sanctuaries questions determined that there was a statistically significant increase in knowledge after participating in the Marine Sanctuaries Watershed Action Program intervention ($t_{(174)} = 13.79$, $p < 0.0001$). The total possible score was 8 for three items, and the mean score increase between the pre- and post-tests was 2.42 points.

Pre-Test Mean Score	Post-Test Mean Score	Mean Score Increase
3.02	5.44	2.42

Whole Test Results: Toxins Reduction Watershed Action Program Survey

The additional mercury survey items tested for changes in knowledge around mercury in the San Francisco Bay and how to minimize exposure to mercury from eating seafood.

Results Summary: Paired t-test results from 135 students who completed the additional mercury questions determined that there was a statistically significant increase in knowledge after participating in the Watershed Action Program intervention ($t_{(134)} = 7.32$, $p < 0.0001$). The total possible score was 2 for two items, and the mean score increase between the pre- and post-tests was 0.42 points.

Pre-Test Mean Score	Post-Test Mean Score	Mean Score Increase
0.99	1.41	0.42

Individual Question Results: Watershed Action Program Survey

Questions 1, 2, and 13 asked students to name their local creek watershed, define the term “watershed”, and identify why a healthy watershed is important.

Results Summary: Results show a significant increase in knowledge about watersheds.

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
1	1	$t_{(98)} = 14.68$, $p < 0.0001$	0.71
2	1	$t_{(98)} = 4.79$, $p < 0.0001$	0.30
13	1	$t_{(98)} = 3.42$, $p < 0.001$	0.14

Questions 3, 5 and 6 checked students' knowledge about estuarine environments and how water flows into the San Francisco Bay to create an estuary.

Results Summary: Results show a significant increase in knowledge about estuaries and the San Francisco Bay estuary. Item #5 did not show a statistically significant change in knowledge between the pre- and post-test. Pre-tests results show an already high level of knowledge about the location of fresh and salt water within San Francisco Bay geography; therefore, although the change in knowledge was not significant, the knowledge was already present within the student population.

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
3	1	$t_{(98)} = 7.00, p < 0.0001$	0.33
5	2	$t_{(98)} = 0.52, p = 0.603$	0.05
6	2	$t_{(98)} = 3.16, p = 0.002$	0.36

Questions 4 and 10 checked students' knowledge about the storm drain system. Question 4 tested if students knew that storm drains connect to a local body of water. Question 10 asked students to identify, from a list of illustrated actions, which actions could cause storm drain pollution.

Results Summary: Results show a significant increase in knowledge about the storm drain system and potential pollutants.

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
4	1	$t_{(98)} = 6.16, p < 0.0001$	0.39
10	1	$t_{(98)} = 4.92, p < 0.0001$	0.28

Questions 7, 8, and 9 checked to see if students knew about food chains, how toxins accumulate in top predators such as humans, and how humans can ingest toxins by consuming polluted Bay fish.

Results Summary: Results show a significant increase in knowledge about how Bay pollution can harm humans through the food chain.

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
7	1	$t_{(98)} = 8.52, p < 0.0001$	0.50
8	1	$t_{(98)} = 4.92, p < 0.0001$	0.23
9	1	$t_{(98)} = 5.11, p < 0.0001$	0.27

Individual Question Results: Marine Sanctuaries Watershed Action Program Survey

Question 1 asked students to choose the correct names of the three local National Marine Sanctuaries, and also asked them to locate each marine sanctuary on a map.

Results Summary: Results show a significant increase in knowledge about the names and locations of the three National Marine Sanctuaries near to the San Francisco Bay.

Question 2 asked students to identify the reasons why the National Marine Sanctuaries are important.

Results Summary: Results show a significant increase in knowledge about the importance of the National Marine Sanctuaries.

Question 3 checked students' knowledge about actions they could take to protect the National Marine Sanctuaries.

Results Summary: Results show a significant increase in knowledge about actions they can take to protect the National Marine Sanctuaries.

Question	Total Possible Score	Paired t-test Results	Mean Score Increase
1	6	$t_{(174)} = 14.22, p < 0.0001$	1.97
2	1	$t_{(174)} = 5.35, p < 0.0001$	0.20
3	1	$t_{(174)} = 4.21, p < 0.0001$	0.25

Individual Question Results: Toxins Reduction Watershed Action Program Survey

Question 1: Which of the following actions can cause mercury to enter the San Francisco Bay?

Answer	Answer Value
a) Flushing broken mercury thermometers down the toilet.	0.5
b) Mercury washing down the Sacramento River from the gold mines in the mountains.	0.5
c) Both a and b	1.0
d) I don't know	0

Total Possible Score	Paired t-test Results	Mean Score Increase
1	$t_{(134)} = 5.84, p < 0.0001$	0.23

Results Summary: Results show a significant increase in knowledge about ways that mercury can enter the San Francisco Bay.

Question 2: How can you and your family stop mercury from getting into your bodies?

Answer	Answer Value
a) Eat less fish from the San Francisco Bay.	0.5
b) Eat less canned tuna.	0.5
c) Both a and b	1.0
d) I don't know	0

Total Possible Score	Paired t-test Results	Mean Score Increase
1	$t_{(134)} = 4.51, p < 0.0001$	0.19

Results Summary: Results show a significant increase in knowledge about strategies to reduce exposure to mercury through eating fish.

Teacher Pre- and Post-Program Survey Results

Table 1. Pre- and Post- Marine Sanctuaries WAP Survey Results N = 12

Statement	Change (increase or decrease) in Response from Pre- to Post-Program Survey		
	Decreased	No Change	Increased
1. I feel confident <u>using the local environment as a learning resource.</u>	1 8%	3 25%	8 67%
2. I feel confident <u>teaching environmental science concepts.</u>	0 0%	3 25%	9 75%
3. I feel confident <u>leading an outdoor field trip with my class.</u>	1 8%	5 42%	6 50%
4. I feel confident <u>facilitating an environmental action project with my class.</u>	0 0%	4 33%	8 67%
5. I think <u>environmental stewardship</u> is important for my students.	0 0%	12 100%	0 0%

Table 1. Pre-Post Program Survey Results Summary

The majority of teachers increased their confidence levels in using the local environment as a learning resource, teaching environmental science concepts, and facilitating an environmental action project with their students. Half of the teachers showed an increase in confidence in leading an outdoor field trip, and five teachers showed no change in their confidence levels relating to leading an outdoor field trip. All twelve teachers had no change in their belief that environmental stewardship is important for their students. Every teacher marked the highest level of response, “strongly agree”, on both the pre- and post-surveys for item #5, thus no change was seen.

Table 2. Post- Marine Sanctuaries WAP Survey Results N = 12

Statement	Post-Program Survey Response				
	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
6. Participation in the Watershed Action Program has <u>increased my students' concern about their watershed.</u>				2 17%	10 83%
7. Participation in the Watershed Action Program has <u>increased my students' interest in learning.</u>				6 50%	6 50%
8. The Watershed Action Program <u>helped me to teach required CA State Content Standards to my students.</u>			1 8%	4 33%	7 58%
9. The <u>curriculum guide</u> provided to me is helpful in teaching the Watershed Action Program next year.				3 25%	9 75%
10. The <u>in-class modeling</u> of the lessons and activities increases my confidence in teaching the program myself.			1 8%	3 25%	8 67%
11. The <u>equipment kit</u> , which will be provided to me next fall, will be helpful in teaching the program next year.			1 8%	2 17%	9 75%
12. The <u>support</u> from my KftB Program Director will be helpful in teaching the Watershed Action Program next year.				3 25%	9 75%
13. I feel <u>prepared to teach the Watershed Action Program to my class next year.</u>				8 67%	4 33%
14. I would <u>recommend the Watershed Action Program</u> to other classroom teachers.				1 8%	11 92%

Table 3. Mean Response Ratings for Each Post-Program Survey Statement

Statement Number	Mean Response Rating
6	4.83
7	4.50
8	4.50
9	4.75
10	4.58
11	4.67
12	4.75
13	4.33
14	4.92

Strongly Disagree = 1 Disagree = 2 Neutral = 3 Agree = 4 Strongly Agree = 5

Table 2. and Table 3. Post- Marine Sanctuaries WAP Survey Results Summary

Results from the post-program survey were extremely positive in all areas. All teachers felt that the program increased their students' concern about their watershed and increased their interest in learning. All but one teacher felt that the WAP helped to teach CA Content Standards. All but one teacher felt that the curriculum guide and the support from KftB staff are helpful in continuing to teach the program themselves, and all but one teacher felt that the in-class modeling and equipment kit prepare them to teach the program themselves. Every teacher felt prepared to teach the program themselves in the next school year and all teachers would recommend the program to other classroom teachers, with 92% strongly agreeing with this statement.

Teacher Written Evaluation Form Results
Marine Sanctuaries Watershed Action Program

Question 1: How has the Watershed Action Program helped you as a classroom teacher?

Results Summary: Seven out of the twelve respondents cited that the WAP has given them direct professional development in environmental and science education. Many teachers also noted that their participation in the WAP has increased their confidence in teaching science and environmental education. Three teachers appreciated learning how to integrate science into their classroom curriculum. The remaining responses were varied, and included noting the high quality of the program, the value of having teaching support in the classroom, and noticing the positive impact of the program on their students.

Table 4. Teacher Written Evaluation Form Results, Question 1 N = 12

Evaluation Form Question: How has the Watershed Action Program helped you as a classroom teacher?		
Category Code Word	Frequency of Response	Sample Response(s)
Professional Development	7	“(The program) has provided added complimentary curricula and given me professional development in teaching strategies for science.”
Confidence Increase	4	“The program has given me the confidence to guide the students through the science curriculum using all the resources available right in our backyard.” “The program has given me confidence to teach about our watershed.”
Science Integration	3	“Definitely helped me see how science could be incorporated into curriculum.”
Increased Awareness/ Knowledge	2	“To be more aware of really keeping the bay clean because everything does really go to it.” “It has helped me become more aware of the importance of teaching children about the environment...”
Support in Classroom	1	“Having at KftB instructor to lean on was extremely helpful the first time.”
Program Quality	1	“The WAP brought great lessons into the classroom...”
Student Impact: Science Engagement	1	“It has made my kids more engaged in science.”
Student Impact: Environmental Awareness	1	“(My kids) think environmentally almost all the time now.”
Student Impact: Learning & Retention	1	“The WAP brought great lessons into the classroom that have a lasting impact on students’ learning and retention of concepts.”

Question 2: Please share the impact that the Watershed Action Program has had on your students. Have you noticed a change in attitude or behavior in your students as a result of the program?

Results Summary: The highest frequency response, eleven out of the twelve teacher participants, focused around the teachers’ feeling that their students are more environmentally aware due to participation in the WAP. Many of the teachers mentioned a positive change in attitude about the environment in their students. Four teachers noted positive changes in environmental behavior in their students. Remaining, less frequent responses included citing how their students shared their environmental knowledge with others, increased their own knowledge, and increased their concern about the environment.

Table 5. Teacher Written Evaluation Form Results, Question 2 N = 12

Evaluation Form Question: Please share the impact that the Watershed Action Program has had on your students. Have you noticed a change in attitude or behavior in your students as a result of the program?		
Category Code Word	Frequency of Response	Sample Response(s)
Awareness Increase	11	“Students are much more mindful about being good environmental stewards.” “More aware of the environment around them, a greater understanding of the big picture.”
Positive Attitude Change	5	“Less ‘eww’ comments and more ‘interesting’ comments.” “My students are more concerned about protecting our world.”
Behavior Change	4	“Littering has decreased...” “It has promoted better waste reduction behavior.”
Sharing Knowledge	2	“Storm drain message hit home.” “I have noticed my students are...more eager to spread the word of taking care of the watersheds in California.”
Knowledge Increase	1	“(My students) learned about oil spills and other chemicals that pollute/destroy the bay and the impact it has on animals.”
Increased Concern	1	“My students are more concerned about protecting our world.”
Opportunity	1	“The lessons, activities and field trips all offered unique opportunities for the kids.”

Discussion and Conclusions

Overall, results from the 2008-09 school year evaluation process indicate that the goals of the Watershed Action Program were achieved. The WAP provided meaningful watershed experiences for elementary school students, and also provided professional development to classroom teachers in environmental education.

Program Impact on Students

One hundred percent of teachers agreed that participation in the WAP increased their students’ concern for their watershed and increased their students’ interest in learning (Table 2, p.15). These survey results show that teachers perceive the program to have had an extremely positive impact on their students’ learning experiences.

Teachers gave some feedback and insight into the impact of the program on student participants in their written evaluation forms as well. All of the comments in Question 2 (Table 5, p.18) from

teachers' written evaluation forms were positive. The most common comment from teachers was that their students became more aware of the environment around them. Many teachers also cited positive environmental attitude and behavior changes in their students due to their participation in the WAP.

Students showed a statistically significant overall increase in knowledge of the program content through results from the pre- and post-program surveys. The individual survey item results reveal that students did learn about their local watershed and its connection to the larger bay and ocean watersheds. Students also learned about their neighborhood's connection to their local creek, the San Francisco Bay, and the ocean through the storm drain system. Students increased their awareness about the storm drain system and potential pollutants that can enter the system and affect the local creek, the bay, and the ocean. Many teachers commented that their students are more aware of how their actions can impact the environment. Teachers went on to report that their students have demonstrated a noticeable increase in environmentally-friendly attitudes and behaviors. These reports of positive changes in students' awareness, attitudes, and behaviors are coming from teachers who are in close and constant contact with their students and are able to give accurate accounts of what they observe.

Marine Sanctuaries WAP Impact on Students

In addition, students who participated in the Marine Sanctuaries WAP showed an increase in knowledge about the names and locations of the three local National Marine Sanctuaries, the reasons why the marine sanctuaries are important, and ways that they can help protect the marine sanctuaries.

Toxins Reduction WAP Impact on Students

In addition, students who participated in the WAP that had an additional focus on toxin reduction education showed an increase in knowledge about how mercury enters the San Francisco Bay and how they and their families can reduce their exposure to and intake of mercury through eating fish. Students also increased their knowledge about food chains and the biomagnification of pollution in food chain systems. They showed knowledge about how toxins, such as pesticides, move up the food chain and can negatively impact the health of top predators such as humans.

Program Impact on Teachers

Survey results from teachers participating in the WAP show that the program had an extremely positive impact on teachers in many different areas. Overall, teachers enjoyed the WAP; received adequate training, resources, and support to feel confident teaching the program themselves; and felt that their participation in the WAP was worthwhile and worth recommending to others. Most teachers increased their confidence in teaching environmental science, facilitating an environmental action project with their class, and using the local environment as a learning resource. Half of the teachers expressed an increase in confidence for leading an outdoor field trip with their students. This finding is consistent with evaluation data from previous school years, and further acknowledges the need for support from KftB staff for the field trip portion of the WAP during the second follow-up year of the program.

Teachers did not show any change in their belief that environmental stewardship is important for their students. This lack of increase in their belief is not because teachers do not believe in the importance of environmental stewardship; rather, all twelve teachers already had a very strong belief in environmental stewardship before their participation in the program, marking the highest response – “strongly agree” – possible on both the pre- and post-tests. This may be one reason why teachers were attracted to participating in the WAP in the first place.

Results from Question 1 of the teachers' written evaluation form (Table 4, p. 17) show that teachers were grateful for the professional development opportunities gained from participation in the program. Teachers thought that having the WAP in their classroom benefited them (e.g. it increased their confidence to integrate science in their classroom) and their students (e.g. students became more engaged in science). A few teachers mentioned excitement in teaching the program lessons and activities themselves. This is fully supported by the survey results that show that at the end of the program 100% of teachers felt prepared to teach the program to their students the next school year.

Teachers have shown through their survey responses and written feedback that the WAP has been beneficial to them in many different aspects. One hundred percent of teachers would recommend the WAP to other classroom teachers, with 92% of teachers marking "strongly agree" for this statement. These response results indicate a high level of enjoyment of the program and a feeling that the program was worthwhile.

Recommendations

Overall, we received encouraging results as to the impact of the Watershed Action Program on teachers and students from the 2008-09 evaluation process. Through this evaluation process, we do have recommendations to improve the program content and delivery so the WAP can more effectively meet its goals and objectives. We also have some recommendations to improve the program evaluation process itself in order to strengthen the process and better assess whether we are achieving our objectives.

- Continue to provide classroom teachers with high-quality professional development opportunities: in-class training; resources such as a comprehensive curriculum guide and program equipment; and support so teachers feel confident teaching environmental science concepts and program activities and lessons.
- Continue to provide hands-on, engaging environmental science lessons to elementary school students, both in the classroom and in the field. Continue to provide meaningful and relevant learning experiences, and opportunities for students to be engaged in learning about and caring for their local watershed environment and the local National Marine Sanctuaries.
- Continue to provide opportunities for students to increase their awareness around pollution in the San Francisco Bay and ways to reduce exposure to toxins through eating Bay seafood. Continue to provide opportunities for students to educate others about this important information through interviews at local fishing piers and informational presentations to family members and school peers.
- Continue to work on ways to increase teachers' level of confidence in leading an environmental field trip with their students. The survey results indicate that teachers' are not as confident leading a field trip, after participating in one with a KftB Instructor and receiving curricula and equipment, as we would hope. These results are consistent with evaluation results from previous school years. We recommend ensuring that teachers receive adequate support for the field trip during the second follow-up year of the program. This can include checking in with the teachers before the field trip to find out what support they need, being present and actively helping during the field trip, and

following up with teachers after the field trip to evaluate the experience and re-check for their level of confidence in leading the field trip themselves.

And, finally

- Evaluate and continue to improve the evaluation tools used to assess the impact of the program on teacher and student participants. The evaluation process is cyclical in nature, in that we are constantly moving along a cycle of assessment, program improvement, and evaluation improvement. Current recommendations to improve the evaluation tools include:
 - The post-survey-only results from teachers were extremely positive, and are not necessarily consistent with the pre-post survey results. This may indicate that there is an inconsistency with the way that either survey is formulated. A suggestion is to take a deeper look at the items on both surveys, and the way that the surveys are formulated, to see if either or both can be improved.
 - The sample size for the teachers' written evaluation form, at twelve respondents, is fairly small. A suggestion is to look into the possibility of combining the twelve Marine Sanctuaries WAPs with the other WAPs to create a bigger sample size and to hopefully gain a more complete picture of the teachers' feedback and responses to the open-ended questions.
 - Include data from surveys and written evaluation forms from teachers who have participated in their second follow-up year of the WAP to have a more comprehensive view of the long-term impact of the program on classroom teachers.