Special Publication No. 16-11

Assessment of Anchorage School District Students Participating in the *Salmon in the Classroom* Program, 2007–2010

by

Jay A. Baumer

and

Patricia A. Hansen

July 2016

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

SPECIAL PUBLICATION NO. 16-11

ASSESSMENT OF ANCHORAGE SCHOOL DISTRICT STUDENTS PARTICIPATING IN THE *SALMON IN THE CLASSROOM* PROGRAM, 2007–2010

by
Jay A. Baumer
and
Patricia A. Hansen

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

July 2016

This investigation was partially financed by the Federal Aid in Sport Fish Restoration Act (16 U.S.C. 777-777K) under Project F-10-23,24,25 Job No.AE-2-1.

The Special Publication series was established by the Division of Sport Fish in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library, Alaska Resources Library and Information Services (ARLIS) and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review.

Jay A. Baumer,
Alaska Department of Fish and Game, Division of Sport Fish,
333 Raspberry Road, Anchorage, AK, USA

and

Patricia A. Hansen,
Alaska Department of Fish and Game, Division of Sport Fish,
333 Raspberry Road, Anchorage, AK, USA

This document should be cited as follows:
Baumer, A., and P. A. Hansen. 2016. Assessment of Anchorage School District students participating in the Salmon in the Classroom *program, 2007–2010. Alaska Department of Fish and Game, Special Publication No. 16-11, Anchorage.*

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) and the Anchorage School District (ASD) conducted an assessment of the *Salmon in the Classroom* program over 3 school years (August 2007–May 2010). ASD students in fourth through sixth grades who participated in the program were given identical pre- and post-program tests that consisted of 21 multiple-choice questions assessing basic knowledge about salmon and 4 opinion statements. Overall, students' knowledge increased from September (pretest) to May (post-test). The program objective was for 25% of students in the program to score at least 70% on the post-test; this objective was exceeded in all 3 school years. Throughout all years of the study, more than 60% of the students scored 70% or higher and average change in score exceeded 7%. Although the percentage of students correctly answering the multiple choice questions increased for all questions between pre- and post-tests, at the end of the program students still retained misperceptions for many important concepts. Student enthusiasm was measured by the percentage of students responding "yes" or "maybe" to 4 opinion statements: "I would like to learn more about salmon," "I think studying fish is an interesting job," "It's good to have a real fish in class to study," and "I would like to go fishing." The percentage of students responding "yes" or "maybe" decreased after participating in the program. To increase its effectiveness and identify potential improvements to the *Salmon in the Classroom* program, SF aquatic educators should review the topics that remained misunderstood, consider possible reasons why student enthusiasm decreased, identify ways to engage students more effectively, and develop a mechanism for encouraging feedback on the program from teachers and students.

Key words: *Salmon in the Classroom*, aquatic education, education assessment, education evaluation, pretest, post-test, multiple choice test, student, strategic plan, Anchorage School District

INTRODUCTION

The Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) began dedicating staff and funding to information and education activities in Southcentral Alaska (Region II; Figure 1) in 1996. Dubbed the STREAM (Salmon Trout Restoration Education and Aquatic Management) program, the goal was "to increase the public's awareness of Alaska's healthy wild salmon stocks through education and the offering of hands-on opportunities" (Kraus 1999; Kraus and Olson 2003a, 2003b). Region II's primary aquatic education focus was the *Salmon in the Classroom* program, also called *Salmonids in the Classroom* or *In Class Salmon Incubation Program*, primarily for elementary students. This program, which was designed for elementary teachers who are not required to have an in-depth biological science background, has provided teachers the support and teaching aids to better incorporate science content into their classroom. Since inception, the number of schools and communities participating in the program has grown. The program has been well received by teachers and growth has only been limited by available resources. The Alaska *Salmon in the Classroom* program was modeled after similar ones in Washington, Canada, and Oregon (Kraus 1999). These programs support aquariums placed in public schools in which students raise salmon from eggs to fry. Similar incubation programs are currently being used throughout the United States and United Kingdom. *Salmon in the Classroom* or *Trout in Classroom* has become a common method for providing science education to young students[1].

[1] For example, Trout Unlimited. 2006. Trout in the Classroom. http://www.troutintheclassroom.org/teachers/state-specific-resources (Accessed December 2015).

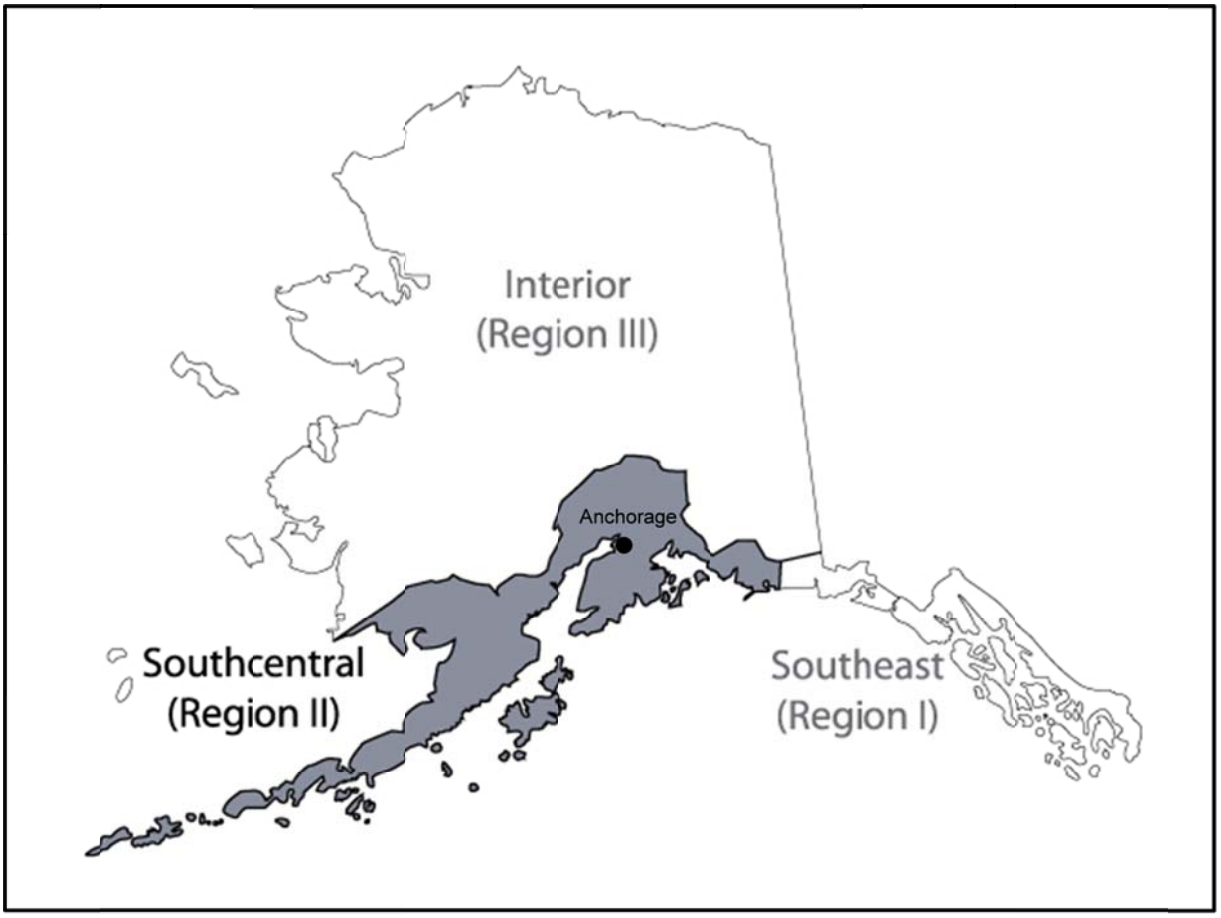

Figure 1.–Locations of Division of Sport Fish Region II and Anchorage, Alaska.

In Region II, the program includes the following 5 components: 1) support for classroom aquariums for raising salmon from egg to fry, 2) field trips to watch an egg take and receive eggs for the aquarium, 3) salmon dissections in the classroom, 4) ice fishing field trips to a local stocked lake, and 5) *Salmon Celebration* field trips to release fry raised in the classroom or to watch a hatchery stock fish.

All of the components of the *Salmon in the Classroom* program are organized and run by ADF&G staff. These components are offered free of charge, but not every classroom or student has the opportunity to participate in all of the components. Because staff and resources are limited, the number of classes that can participate in each component of the program is limited. However, ADF&G staff provide equal opportunity for all classes to participate in all components of the program and give no preference to classes participating in program assessments. Many of the components are located at schools, thereby reducing travel cost, but other components require costly transportation to the site. The classes that are unable to attend field trips are often limited by the availability of chaperones and funds for transportation of students.

The *Salmon in the Classroom* program is optional and voluntary for schools and teachers. Even though this is an optional program, many teachers and schools continue to participate annually. Teachers are provided with an aquarium to raise salmon eggs, a chiller and other equipment to maintain the correct water temperature, food for the salmon fry, and technical support from aquatic education employees. Educational support materials are also available including a guide

to setup and maintenance of the aquariums, a curriculum for elementary grades (*Salmonids in the Classroom*, aimed specifically at second grade), a salmon life cycle poster, and the *Alaska's Wild Salmon* publication. Due to popular demand, participating teachers and classes are often limited to 1 aquarium per school. To include as many students as possible, aquariums are frequently placed in common areas so that multiple classes within the school can participate in the program. In addition, multiple classes per school may participate in the other components. All grades are allowed to participate, but historically most participation is by elementary schools, particularly kindergarten through third grade, although the program has been expanded to include many classes in fourth through sixth grades as well.

In 2006, Region II developed a strategic plan (Timmons 2006) to guide the aquatic education program in supporting the overall mission and goals of Region II, the SF strategic plan (ADF&G 2002), and ADF&G as a whole. A vision statement, mission statement, and 7 goals were outlined for the aquatic education program, and measurable objectives and strategies for accomplishing the objectives were developed (Timmons 2006). The *Salmon in the Classroom* program has remained one of the primary tools for meeting the goals and objectives of the plan. The vision in the executive summary of the Region II aquatic education plan is as follows (Timmons 2006):

> Alaskans and visitors to Southcentral Alaska understand and appreciate the unique value of the region's aquatic resources and sport fisheries, the factors affecting them and principles for conserving them, and the role of ADF&G, Division of Sport Fish in sustaining those valuable resources.
>
> Alaskans and visitors demonstrate this understanding and appreciation through responsible sport fishing practices, sustainable uses of aquatic resources, involvement in fishery management, and support for the missions of the Department and Division.

The mission of the sport fishing and aquatic education program of Region II, SF is as follows (Timmons 2006):

> …to foster an informed and educated public that appreciates, respects, and sustainably uses the State's fisheries and aquatic resources in Southcentral Alaska, and supports the Division's mission to protect, improve, and manage the use and development of those fisheries and aquatic resources.

Three of the executive summary goals pertinent to the *Salmon in the Classroom* program are as follows (Timmons 2006):

> Among children in Southcentral Alaska, cultivate an understanding of the basic fundamentals of fish biology and aquatic resource principles, and fisheries and aquatic resources management; and kindle a life-long appreciation and stewardship of aquatic resources.
>
> Among Alaskans in Southcentral Alaska and visitors to the area, foster knowledge about and support for the core activities of the Division of Sport Fish used to accomplish its mission: stock assessment, management, hatchery production, access development and maintenance, habitat assessment, information and education, enforcement, and planning and surveys.

> Encourage and facilitate new anglers in adopting sport fishing as a pastime, and promote responsible sport fishing by children and adult anglers in Southcentral Alaska.

Establishing an evaluation procedure is important to determine the success of a program, how a program can be improved, and to ensure the desired outcomes are being produced. While outputs (such as numbers of students, presentations, and classes) have been well documented, there has been limited evaluation of the various components of Region II's education program, particularly the *Salmon in the Classroom* program. Therefore, a study to assess the *Salmon in the Classroom* component of the Region II's education program was initiated for the 2006–2007 school year (Timmons et al. 2009). The 2006–2007 assessment provided the ground work for the following years of assessment, and prompted significant changes to the survey method and primary educational staff. Although the Region II strategic plan includes goals and objectives for all aquatic education programs across the entire region, this evaluation project is focused only on selected knowledge-related objectives from the plan that pertain to students participating in the *Salmon in the Classroom* program in the Anchorage School District (ASD).

STUDY LOCATION AND PARTICIPANTS

Anchorage is Alaska's largest city and center of commerce with a population of 291,826[2]. Bordered by Cook Inlet, the city limits span an area of 1,697 square miles that ranges from a densely populated city center to semi-rural mountainous regions north and east.

As the largest city, it has reflected the state, which has one of the highest rates of population turnover, historically due to the "boom and bust" of economic events (Huntsinger et al. 2012). Between 2000 and 2010, the population in the city of Anchorage has grown by 114% and the Anchorage–Matanuska–Susitna region experienced the highest rate of turnover in the state (Huntsinger et al. 2012). Within the state, 20% of the migration occurs into the Municipality from rural Alaska by American Indians or Alaska Natives[2]. The movement from traditional native areas to Anchorage has steadily increased since 2004 (Williams 2010). Currently, minorities in the Anchorage Municipality compose 34% of the population and the primary minority groups are Asian, Native Hawaiian, or Pacific Islander (10%); American Indian and Alaska Native (8%); African American (6%); and other non-white races or 2 or more races (9%)[3]. Anchorage is also the home of Alaska's largest military installation, Joint Base Elmendorf-Richardson, with its 42,000 transient service members. The overall transiency of the state and city populations are reflected by the movement of individuals within the public ASD; the transient rate is high (26.7% during the 2010–2011 school year; UAA Center for Alaska Education Policy Research 2011), although the dropout rate for the ASD is lower than the national average (about 4% [UAA Center for Alaska Education Policy Research 2011] versus about 7% [Snyder and Dillow 2013]).

ASD, designated as a U.S. Department of Education "central city" district, is the 94th largest school district in the nation, enrolling almost 50,000 students (about 39% of the state's school-age population) and employing about 3,000 teachers (UAA Center for Alaska Education Policy Research 2011). It is very ethnically diverse, with greater than 50% of students defining

---

[2] U.S. Department of Commerce, Washington D.C., U.S. Census Bureau, 2010 Census Interactive Population Search. Population Finder: Alaska, Areas Within: Alaska, Counties/Municipios: Anchorage Municipality. http://www.census.gov/2010census/ (accessed 11/15/2013).

[3] Anchorage Economic Development Corporation. 2013. Anchorage 2012 indicators report. Prepared for the Municipality of Anchorage. http://aedcweb.com/anchorage-2012-indicators-report/ (accessed 11/15/2013).

themselves as non-whites; the absolute numbers of all non-white racial, ethnic, and students with English as their second language have grown over the past 5 years, as well as the number of students from economically disadvantaged, low-income homes (UAA Center for Alaska Education Policy Research 2011).

ASD was chosen for this project because it has been a participant of the *Salmon in the Classroom* program for 21 years; there is strong support for the program among teachers, school officials, and parents; and ASD was willing to provide critical infrastructure support for implementing an evaluation. In addition, the *Salmon in the Classroom* program is an approved component of the ASD science curriculum for second grade.

The purpose of this assessment project was to evaluate selected outcomes from the Region II aquatic education strategic plan (see Timmons 2006: Appendix A1) as they relate to fourth through sixth grade ASD students participating in the *Salmon in the Classroom* program, and to determine if goals 1, 3, and 4 of the strategic plan are being met. Because teaching methods and assessment tools are age- and grade-specific, it was determined that only students in fourth through sixth grades would be included in the study.

OBJECTIVES

The objectives for this study were to estimate the following for Anchorage School District students in the fourth through sixth grades who participated in the *Salmon in the Classroom* program during 3 school years (August 2007–May 2010):

1) the percent who scored at least 70% on the post-program test at the end of the school year
2) the average score on the preprogram test and the post-program test
3) the average change in score between the preprogram test and post-program test

An additional objective was to test the null hypothesis that there was no correlation between the following variables:

1) teacher experience (years participating in the *Salmon in the Classroom* program) and the average post-program test score for the class
2) the number of *Salmon in the Classroom* activities and the average post-program test score for the class
3) teacher experience (years participating in the *Salmon in the Classroom* program) and the average change in score between preprogram and post-program tests for the class
4) the number of *Salmon in the Classroom* activities and the average change in score between preprogram and post-program tests for the class

In all cases a positive correlation was the alternative hypothesis and the null hypothesis was rejected if the sample correlation coefficient was greater than or equal to 0.25 with probabilities of Type I and Type II errors 0.20 and 0.05, respectively.

METHODS

STUDY DESIGN AND DATA COLLECTION

Students in ASD fourth through sixth grades in classes participating in the *Salmon in the Classroom* program during the 2007–2010 school years were given preprogram and post-program tests ("pretest" and "post-test"; identical within each school year) to test their knowledge of topics covered by the program (Appendices A1–A2). All fourth through sixth grade teachers in the program were provided the tests, although not all students took the tests. The tests were reviewed by the ASD Science and Assessment departments to ensure validity, such as nonbiased wording and age appropriateness. The tests were administrated through the online survey tool Survey Monkey[4]. The ASD Assessment Department distributed to participating teachers the electronic link to access the tests. Each teacher then administered the tests to their students. The pre- and post-tests included a field allowing students to enter their unique student identification number so that pretest data could be paired with post-test data at the student level. To respect the privacy of the students, this number was modified before the data were provided by ASD to ADF&G.

The pretests were administered each year in early September prior to the first field trip. The student post-test and the teacher questionnaire (Appendices B1–B3) were administrated in late May, after the final field trip. Exact test dates were left to the discretion of the administrating teacher. At the conclusion of the 2007–2008 school year, many teachers reported frustration that new students entering their class were not allowed to participate in the post-test because they had not participated in the pretest. To alleviate this inconvenience for other teachers during that year and all teachers the following years, we allowed students to participate in the post-test even though these data could not be paired for analysis.

DATA ANALYSIS

The percentage of students scoring at least 70% on the post-test was calculated as a binomial proportion (Cochran 1977):

$$\hat{p}_{>70\%} = \left(\frac{n_{>70\%}}{n} \right) * 100 \tag{1}$$

with variance estimated as

$$\hat{Var}(\hat{p}_{>70}) = \frac{\hat{p}_{>70}(1-\hat{p}_{>70})}{n-1} * 100^2 \tag{2}$$

where

$n_{>70\%}$ = the number of students who scored greater than 70% on the post-test, and

n = the total number of students who took the post-test.

[4] Vendor names and products used in this publication are included for completeness but do not constitute product endorsement.

The average scores on the pre- and post-tests were calculated as follows:

$$\bar{x}_t = \frac{\sum_{s=1}^{n_s} x_{ts}}{n_s} \tag{3}$$

with variance

$$s_t^2 = \frac{\sum_{s=1}^{n_s} \left(x_{ts} - \bar{x}_t\right)^2}{n_s - 1} \tag{4}$$

where

x_{ts} = the score of student *s* on test *t* (pre- or post-test),

n_s = the number of students who took test *t*.

For each student for which there were paired pre- and post-test data, the change in score between the tests taken before and after the program was calculated as follows:

$$d_s = x_{post,s} - x_{pre,s} \tag{5}$$

where

$x_{post,s}$ = the score of student *s* on the post-test,

$x_{pre,s}$ = the score of student *s* on the pretest.

The average change in score was calculated as follows:

$$\bar{d} = \frac{\sum_{s=1}^{n_s} d_s}{n_s} \tag{6}$$

with variance

$$s_{\bar{d}}^2 = \frac{\sum_{s=1}^{n_s} \left(d_s - \bar{d}\right)^2}{n_s - 1} \tag{7}$$

where

n_s = the number of students with paired pre- and post-test data.

A *t*-test was used to test all 4 correlation hypotheses:

$$t = \frac{r\sqrt{n - 2}}{\sqrt{1 - r^2}} \tag{8}$$

where *r* (sample correlation coefficient) was calculated as follows:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\sqrt{n(\Sigma y^2) - (\Sigma y)^2}} \quad (9)$$

and where *n* equals the number of teachers participating in the program and *x* and *y* are defined as follows and depend on which of the 4 correlation hypotheses was tested:

Hypothesis	*x*	*y*
a	teacher experience	average post-test score for the class
b	number of activities	average post-test score for the class
c	teacher experience	average change in score between pre- and post-tests for the class
d	number of activities	average change in score between pre- and post-tests for the class

RESULTS

In the results given below, only data from students with both pre- and post-test scores were used in the analyses.

SUMMARY STATISTICS

Overall, the number of students and schools that participated in the *Salmon in the Classroom* program increased over the study years (2007–2010 school years), and in each year, students' scores were higher on the post-test compared to the pretest (Table 1). In all years combined, 64% (SE 3%) of all students scored 70% or higher. Overall, students' knowledge of salmon increased between the pre- and post-tests (Figure 2).

For paired-test students, more than 60% of the students scored 70% or higher on the post-test and had an average change in score that exceeded 7% throughout all years (Table 1). Scores from all years ranged from 17% up to 100% on the pretest and 24% up to 100% on the post-test with an average score of 69.6% or greater on the pretest and 71.3% or greater on the post-test (Table 1).

Table 1.–Assessment statistics for the *Salmon in the Classroom* program, 2007–2010.

	School year					
	2007–2008		2008–2009		2009–2010	
Parameter	Pretest	Post-test	Pretest	Post-test	Pretest	Post-test
Schools participating	10	10	16	15	18	15
Students	190	195	535	401	649	454
Paired-test students[a]	189		295		351	
Average score	69.6%	76.5%	59.8%	71.4%	62.2%	71.3%
SE of average score	1.2%	1.2%	0.8%	0.9%	0.7%	0.8%
Average change in score		7.0%		12.0%		10.0%
SE of average change		1.0%		0.9%		0.7%

[a] Average score and change in score and standard errors were calculated only for students that took both pre-and post-tests.

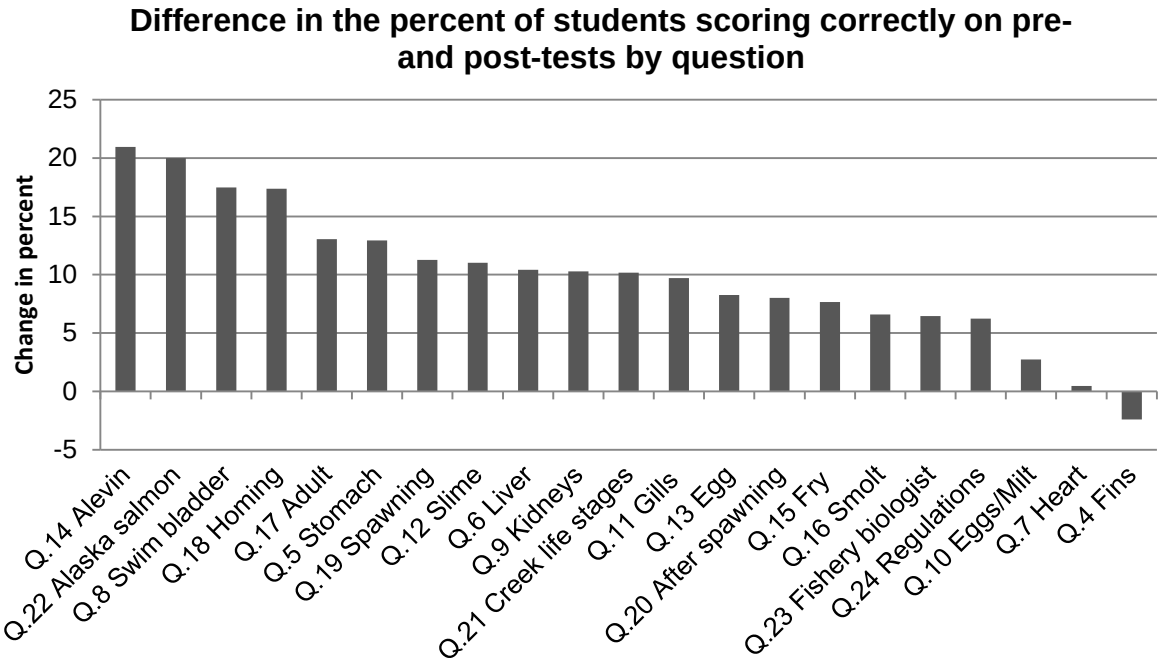

Figure 2.–Ordered from high to low is the weighted average over all school years (2007–2010) of the difference in the percent of students scoring correctly on pre- and post-tests by question.

Note: Question numbers match those in Appendix A1. Averages are weighted by the number of students per year.

YEARLY STATISTICS

During the 2007–2008 school year, 72.8% of students scored 70% or higher on the post-test, and the average change in score was 7% (SE 0.010). Scores ranged from 20% to 100% on the pretest and 26% to 100% on the post-test with an average pretest score of 69.6% (SE 0.012) and an average post-test score of 76.5% (SE 0.012) (Table 1).

During the 2008–2009 school year, 62.8% of students scored 70% or higher on the post-test, and the average change in score was 12% (SE 0.009). Scores ranged from 24% to 100% on both the pre- and post-test, with an average pretest score of 59.8% (SE 0.011) and an average post-test score of 71.4% (SE 0.011) (Table 1).

During the 2009–2010 school year, 61.2% of the students scored 70% or higher on the post-test, and the average change in score was 10% (SE 0.007). Scores ranged from 17% to 100% on the pretest and 24% to 100% on the post-test, with an average score of 62.2% (SE 0.009) on the pretest and 71.3% (SE 0.009) on the post-test (Table 1).

RESULTS BY QUESTION

Pretest

For questions 4–24 (Appendix A1) asked on the pretests, the weighted average percent of students with the correct answer over all 3 school years was 70% or higher on 7 questions (Figure 3, Appendix C1). Students showed the most prior knowledge about the function of the fins, the purpose of milt and eggs, and the function of the heart (88.0%, 86.0%, and 85.1%, respectively). Students had the most difficulty when asked about the function of the swim

bladder, what is not true about salmon that are getting ready to spawn, and the life stages of salmon that are found in creeks (26.7%, 37.7%, and 47.4%, respectively).

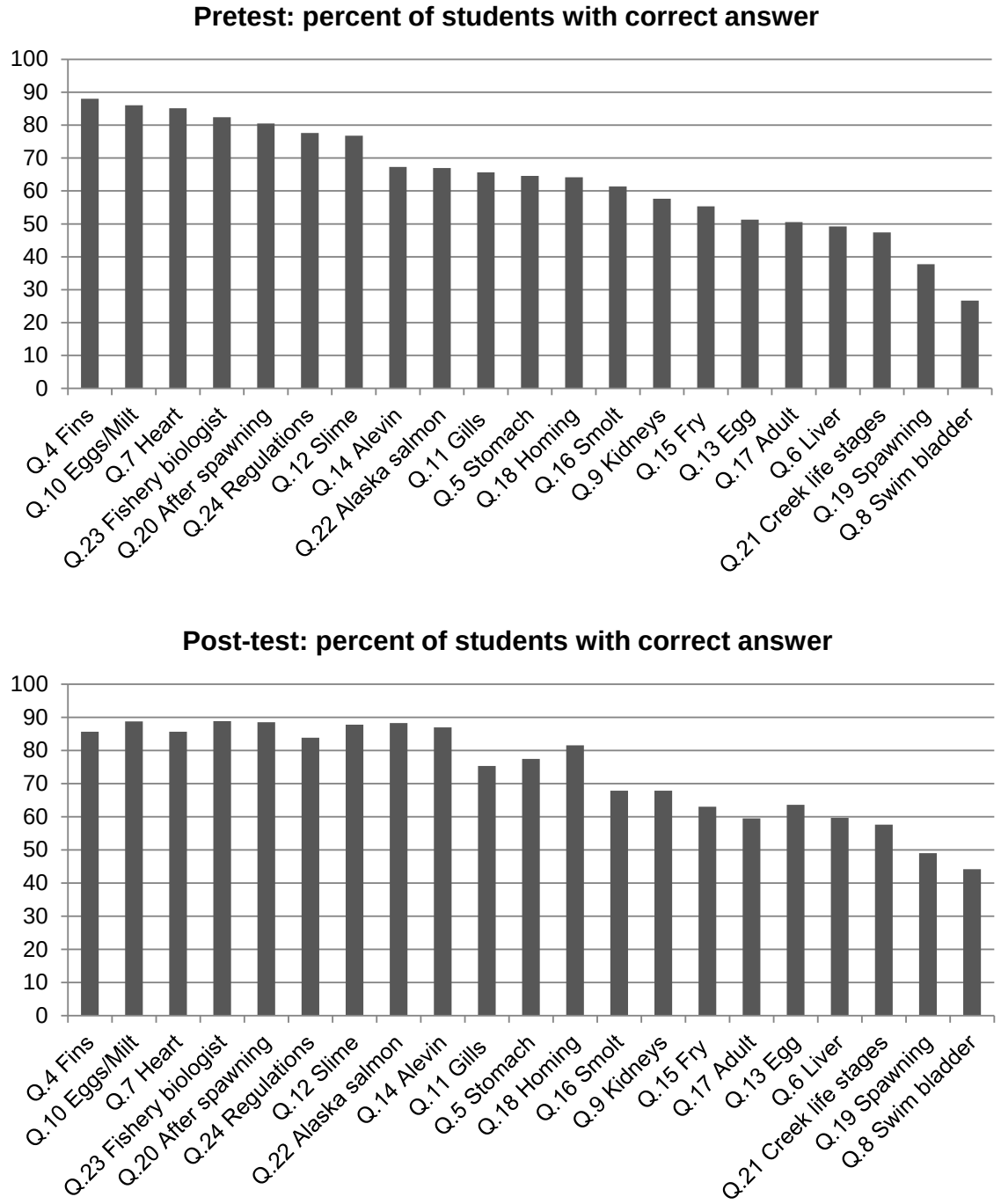

Figure 3.–Ordered from high to low based on pretest results is the weighted average over all school years (2007–2010) of the percentage of students that answered a question correctly for the pretest (top) and the post-test (bottom).

Note: Question numbers match those in Appendix A1. Averages are weighted by the number of students per year.

Post-test

For questions 4–24 (Appendix A1) asked on the post-tests, the weighted average score over the 3 school years was 70% or higher on 12 questions (compared to 7 on the pretest; Figure 3, Appendix C1). Students showed the most knowledge about what a fishery biologist does, the purpose of eggs and milt, and what happens to a salmon after spawning (88.9%, 88.7%, and 88.5%, respectively; Figure 3). Students had the most difficulty on the same 3 questions as the pretest (swim bladder 44.2%, getting ready to spawn 49.0%, and life stages of salmon in creeks 57.6%), although the average scores were higher (Appendix C1).

The weighted average difference over all 3 school years of the percent of students scoring correctly on the pre- and post-test demonstrated an increase in knowledge for most of the questions (Figure 2, Appendix C2); the only question that indicated a decrease in knowledge concerned the function of fins. The weighted average percent of students with the correct answer to the function of fins question was greater on the pretest (88.0%) than on the post-test (85.6%) (Appendix C1). The percent of students scoring correctly increased by 7% or more on 15 of 21 questions, but increased by less than 4% on only 3 questions, and decreased on 1 question (Figure 3, Appendix C2). The greatest increases in knowledge from the pretest to the post-test were on the questions referring to the alevin stage of the salmon life cycle, recognizing which fish was a type of salmon, and the function of the swim bladder (21.0%, 20.0% and 17.5%, respectively; Figure 2, Appendix C2). Students showed the lowest level of improvement when asked about the function of the fins, heart, and eggs or milt (−2.4%, 0.5%, and 2.8%, respectively; Figure 2, Appendix C2); these are also the same 3 topics for which students had the most knowledge in the pretest. Overall, on each question, except the question about fins, students gained knowledge between the time they took the pretest and the time they took the post-test.

STUDENT OPINION QUESTIONS

The majority of students responded positively to the opinion questions, selecting "Yes" or "Maybe a little," which were the 2 positive options out of the 5 possible choices (Figure 4). Over all years, more than 70% of all students responded positively to the pretest on all of the opinions: "I would like to go fishing," It's good to have a real fish in class to study," "I would like to learn more about salmon," and "I think studying fish is an interesting job" (88.1%, 86.5%, 79.8%, and 71.3%, respectively; Appendix C3). On the post-test, more than 57% of all students over all years responded positively to all of the opinions; the most positive responses were to the statements "I would like to go fishing" (84.6%) and "It's good to have a real fish in class to study" (80.7%). On the post-test, only 57.2% of all students over all years responded positively when asked if they thought studying fish is an interesting job. When comparing the percentage of positive responses on the pretest to the post-test over all students, positive opinion decreased on the post-test. The greatest decrease in positive opinion was expressed when students were asked if they would like to learn more about salmon (−15.3%). The least decrease in positive opinion was expressed when students were asked if they would like to go fishing (−3.5%).

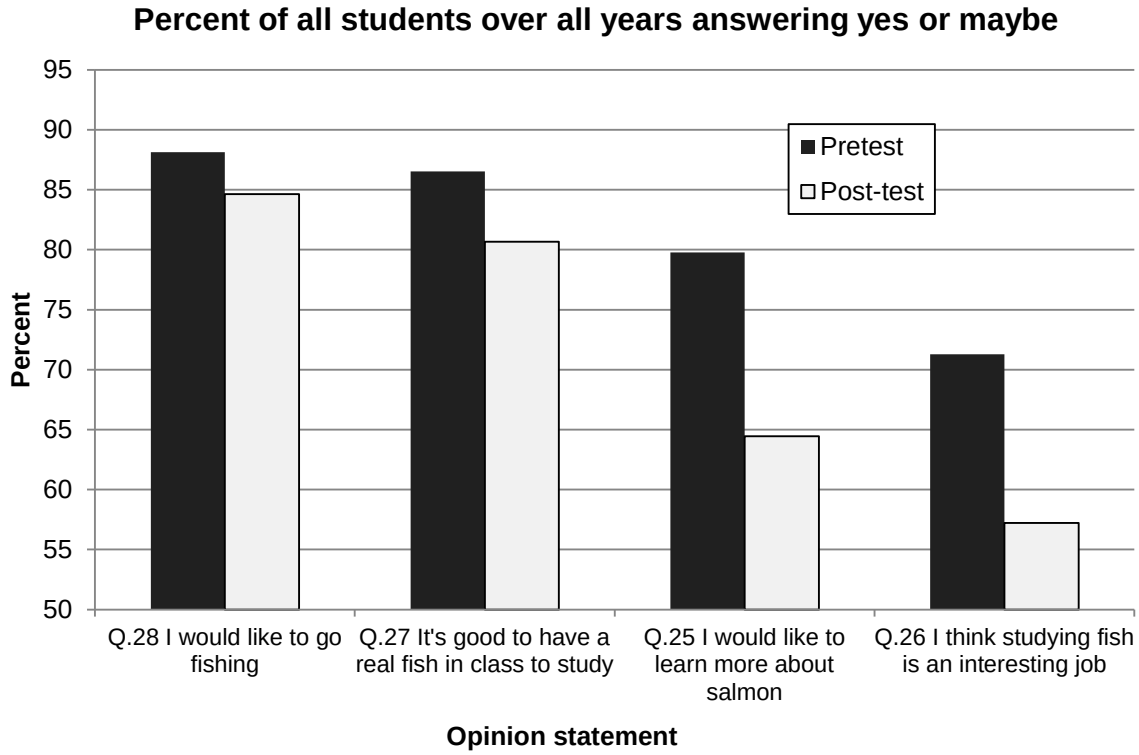

Figure 4.–Weighted average over all school years (2007–2010) of the percentage of students responding "yes" or "maybe a little" to 4 opinion statements on the pre- and post-tests.

Note: The y-axis starts at 50%.

TEACHER QUESTIONNAIRE

Teacher questionnaires were distributed to all teachers that oversaw classes participating in the assessment. In the 2007–2008 school year, 19 out of 26 questionnaires (73.1%) were returned; in the following 2 years, 20 out of 24 (83.3%) and 19 out of 22 (86.4%) questionnaires were returned, respectively. Over all years, 33.9% of teacher respondents taught sixth grade, 32.1% taught fifth grade, 26.8% taught fourth grade, and the remaining 7.2% taught a combination of grade classes (Table 2). Over all school years, most teacher respondents (98.2%) had access to an aquarium to raise salmon and when asked in the 2009–2010 school year, 42.1% of the teachers reported their students visiting the tank on a daily basis. Teachers used most of resources available to them and over all school years, 58.9% of teacher respondents had greater than 5 years of experience with the program.

Only 13 questionnaires were from unique teachers and were used to test 4 correlation hypotheses. Of those 13, three were from the 2007–2008 school year, 7 from the 2008–2009 school year, and 3 from the 2009–2010 school year. There were no significant correlations between the number of years that a teacher participated in the program (teacher experience) or the number of activities partaken and the average student test score (Table 3). There were also no significant correlations between teacher experience or the number of activities partaken and the average change in student test score (Table 3).

Table 2.–Percent of teacher respondents making a selection on the teacher questionnaire.

Topic	Selection[a]	2007–2008	2008–2009	2009–2010	All years
Grade					
	4	27.8%	26.3%	26.3%	26.8%
	4–5 Combined			15.8%	5.4%
	5	38.9%	36.8%	21.1%	32.1%
	5–6 Combined		5.3%		1.8%
	6	33.3%	31.6%	36.8%	33.9%
Experience[b]					
	1 year	11.1%	0.0%	0.0%	3.6%
	2 years	0.0%	10.5%	0.0%	3.6%
	3 years	0.0%	0.0%	10.5%	3.6%
	4 years	0.0%	5.3%	5.3%	3.6%
	5 years	38.9%	21.1%	21.1%	26.8%
	>5 years	50.0%	63.2%	63.2%	58.9%
Support materials					
	Curriculum	61.1%	68.4%	73.7%	67.9%
	Life cycle poster	94.4%	100.0%	100.0%	98.2%
	Alaska wild salmon	83.3%	84.2%	73.7%	80.4%
	Aquarium Setup for Dummies	38.9%	42.1%	52.6%	44.6%
	Other	77.8%	68.4%	89.5%	78.6%
Class participation					
	Egg take	94.4%	94.7%	89.5%	92.9%
	Aquarium	100.0%	94.7%	100.0%	98.2%
	Salmon dissection	83.3%	84.2%	84.2%	83.9%
	Ice fishing	50.0%	52.6%	52.6%	51.8%
	Salmon celebration	88.9%	84.2%	89.5%	87.5%
	Casting in the classroom[c]			0.0%	
	Other	38.9%	36.8%	57.9%	44.6%
Average number of tank visits					
	Multiple times per day			15.8%	
	Daily			42.1%	
	Bi-weekly			31.6%	
	Weekly			10.5%	
	Monthly			21.1%	
	Other			5.3%	
Activity to replace dissection					
	Fly tying		73.7%	73.7%	
	Spin and fly casting		36.8%	36.8%	
	Knot tying and fishing skills		52.6%	52.6%	
	Angler ethics		31.6%	26.3%	
	Aquatic insects		73.7%	73.7%	
	Other		10.5%	10.5%	

Note: 19 teachers responded to questionnaires in 2007–2008, 20 in 2008–2009, and 20 in 2009–2010.

[a] If applicable, a teacher may select more than one selection.

[b] Experience with the *Salmon in the Classroom* program.

[c] Activity proposed but never offered.

Table 3.–Results of correlation hypotheses tests.

Hypothesis	*x*	*y*	*r*	*t*	*P*
a	teacher experience	average post-test score for the class	0.19	0.63	0.54
b	number of activities	average post-test score for the class	0.19	−0.66	0.52
c	teacher experience	average change in score between pre- and post-tests for class	−0.06	−0.20	0.85
d	number of activities	average change in score between pre- and post-tests for class	−0.03	−0.10	0.93

DISCUSSION

This project assessed the ADF&G Region II *Salmon in the Classroom* program by quantifying the program's impact on student preprogram and post-program test scores and opinions. Because this is a year-long program and we only influence student academics for short periods of time (during field trips and salmon dissections), academic success for any particular student depends largely on longer-term effects such as their teacher or family, and variable or uncontrollable events such as school attendance, changing schools, or moving out of the school district. It is also important to recognize students are developmentally changing throughout the school year and between grades.

Although teacher influence could not be controlled in this assessment, we did determine that teacher experience (number of years that a teacher had participated in the program) and the number of *Salmon in the Classroom* activities partaken by their class did not significantly influence how well the students performed on the assessment.

STUDENT LEARNING

The single most important factor influencing new learning is what the learner already knows (Ausubel 1968). Whether teaching a new subject or a familiar subject, it is important to establish a solid foundation on which to base all further learning. Once the knowledge level is determined, a teacher can address the class with the appropriate level of information and build upon earlier learning or prior knowledge. It is very important to make sure students have the necessary building blocks to be successful in an activity or understand more complex concepts. Informal assessments are routine in classrooms in order to establish existing knowledge levels and assure students have the basic knowledge to build on future explorations.

The assessment of the pretest helped determine how much prior knowledge students brought to the *Salmon in the Classroom* program. Based on these baseline results, more than 70% of students already had a basic understanding of the function of a fish's fins (Question 4), heart (Question 7), eggs and milt (Question 10), and slime (Question 12); they understood that salmon die after spawning (Question 20); they knew what fishery biologists do (Question 23); and they knew where to find fishing regulations (Question 24) (See Appendix A1 for all questions). This high degree of knowledge regarding specific salmon life-history terms is probably the result of previous involvement in salmon education at multiple grade levels prior to our pretest. Even though salmon education is not emphasized in lower grades, younger children get exposed to the program through access to the aquarium in a common area, attending program components with their older classmates, and teachers taking the lead to incorporate salmon into their lesson plans. In addition, many children in Alaska are involved in sport fishing or other salmon-related

activities outside of the classroom, and salmon are a crucial part of Alaska culture. Another possible explanation for the high level of salmon knowledge is that some classes began the salmon unit prior to administration of the pretest. Pretests were distributed to teachers right before the egg take in mid-September because it was the first activity with student involvement and we assumed teachers would use the egg take as the introductory activity for the program. However, some teachers informed us that they began teaching about salmon from the first day of school in mid-August, providing those students with salmon life-history information prior to the pretest.

Overall, students' knowledge of salmon increased over the school year (Figure 3). The Region II strategic plan objective for aquatic education was for 25% of students in the program to score at least 70% on the post-test; this objective was exceeded by a large margin: 64% (SE 3%) of students scored 70% or higher for all years combined. Lack of understanding or misconceptions were indicated for the liver, swim bladder, and kidneys (Questions 6, 8, and 9 in Appendix A1); and concerning egg, fry, smolt, ocean and creek life stages, and spawning (Questions 13, 15, 16, 17, 21, and 19 in Appendix A1). Because staff and resources are limited, not all participating classes were able to do salmon dissections. This could have affected the overall results, as one would expect these students to fare poorly on sections of the assessment dealing with salmon anatomy. However, this possibility could not be assessed based on the available data.

Seng and White (2007: p.142) conclude that "continuous, integral evaluation is the only real measure of program effectiveness." Sport Fish aquatic educators should carefully evaluate presentations as they are currently structured to ensure that the program covers poor-scoring topics and in ways that are meaningful to students. The *Salmon in the Classroom* curriculum will be revised during 2013–2014 school year and special attention will be given to these concepts.

STUDENT OPINIONS AND PROGRAM FEEDBACK

Student opinion questionnaires are not used by the Anchorage School District at the beginning and end of academic units to evaluate the change in students' attitudes about subjects. The effectiveness of this assessment methodology in elementary school has not been established. However, as this methodology is developed and refined, the results should be considered. Although it is clear from the pre- and post-test results that students learned about salmon, pre- and post-program comparisons of the students' opinion questions failed to show 1) that students liked the program itself and 2) that the program enticed them to want to learn more about or participate in sport fishing. For all questions, students' positive opinions about the program declined after participating. On average students were 9.7% less positive about learning more about salmon, studying fish as a job, having a real fish in class to study, and going fishing at the end of the program than at the beginning. It is possible these results simply reflect students' "learning fatigue" because the post-test was administered at the end of the school year. However, the possibility that these results are a reflection of the program itself or a negative experience while participating in the program should be considered. For example, the presentation of the material may not fully engage students, perhaps making them less interested in learning about salmon at the end of the program. Another possibility is that students had unrealistic expectations. For example, students may have had the expectation of catching a lot of fish at the ice fishing event, but when they attended, catch rates were low and the temperature was colder than anticipated, decreasing their opinion of the fishing experience. Students may have also had unrealistic expectations about raising salmon. Because young salmon develop over

several months, students may have lost interest and become bored with the process. It is also possible that students found dissecting fish distasteful or even disturbing. Finally, it is possible that modification of the opinion questions themselves might clarify these results. For example, a decline in positive opinion about "I would like to learn more about salmon" may indicate a realization that salmon are uninteresting to a student or may indicate satisfaction with the educational content of the program that the student just received. More precise wording of opinion questions may also allow a determination of whether students liked particular aspects of the program (e.g., "I would like to learn more about salmon" could be changed to "I think that students who are going to be in this class next year should learn about salmon too").

Recommendations (Timmons et al. 2009) to increase feedback from teachers remain valid, although these were not followed because of the growing program and limited staff time available.

CONCLUSIONS

Overall, results of this project indicate that ASD fourth through sixth graders that participated in the *Salmon in the Classroom* program increased their overall knowledge of salmon during the 2007–2010 school years. The *Salmon in the Classroom* program far exceeded the strategic plan objective for 25% of students in the program to score at least a 70% on the post-test. This result assumes that the *Salmon in the Classroom* program directly contributed to this knowledge. To verify this assumption, it would be useful to compare these results to similar students that did not have exposure to the *Salmon in the Classroom* program.

Many students in this assessment had exposure to salmon and knowledge about salmon prior to participating in the *Salmon in the Classroom* program. Multiple exposures and repetition are important to learning and improve retention of information as long as students stay engaged and challenged. It would be useful to identify other sources of pre-existing knowledge to make sure that *Salmon in the Classroom* presentations build upon any earlier exposure. To address the issue of prior knowledge and determine the scope or impact of the program, it would be advisable to perform additional assessments and activity surveys at all elementary grade levels to see when students gain information and to determine levels of retention. If additional sources of knowledge are identified, ADF&G educators should develop educational activities to complement this knowledge to assure that students stay engaged and challenged. If ADF&G staff are unavailable to perform these educational activities, ADF&G-run workshops would allow teachers another means to integrate salmon into their lessons.

In order to foster future anglers, stewards of the resource, and biological scientists from Alaska school children, the Region II aquatic education program deemed it critical that children have exposure and a solid educational foundation rich in natural resources on which to build future experiences. This assessment determined that after participating in the *Salmon in the Classroom* program, students have a good foundation for further salmon education. Additional investigation is still required to better understand the long-term impacts of this program in terms of the aquatic education goals, to determine if students' positive attitudes about salmon education actually did decrease after participating in the program, and whether those attitudes change with additional experiences or time.

To continue to improve the quality of the Region II *Salmon in the Classroom* program, ADF&G staff should develop a system of ongoing assessment that solicits feedback from teachers participating in the program. Certified teachers and education professionals can give valuable

insight on how to improve teaching methods and materials to better meet our goals. Until a more effective means for achieving sport fishery education can be created, the *Salmon in the Classroom* program remains the primary tool by which Region II pursues its aquatic education goals.

ACKNOWLEDGMENTS

Many thanks to Saree Timmon and Texas Raymond for provided the ground work and initial expertise in the planning and development phase of the assessment; Michael Fenster, Anchorage School District Science Technology and Engineering and Math Department Coordinator, as well as Kristine Stout, Anchorage School District Coordinator of the Program Evaluation Department, for establishing, monitoring, and administrating the online assessment tool; and all of the fourth through sixth grade teachers in the Anchorage School District who took the time to complete the teacher questionnaire and allowed their students to participate in the assessment. Most importantly, we want to thank the anonymous fourth through sixth grade students for participating in the *Salmon in the Classroom* program and this assessment.

REFERENCES CITED

ADF&G (Alaska Department of Fish and Game). 2002. Division of Sport Fish Strategic Plan 2002-2009. Alaska Department of Fish and Game, Division of Sport Fish. http://www.adfg.alaska.gov/FedAidpdfs/StrategicPlan2002-2009

Ausubel, D. 1968. Educational psychology: a cognitive view. Houghton Mifflin Harcourt Publishing, New York and Toronto.

Cochran, W. G. 1977. Sampling techniques. 3rd edition. John Wiley and Sons, New York.

Huntsinger, E., D. Howell, and E. Sandberg. 2012. Alaska's highly migratory population. Alaska Economic Trends 32(4):4-13. http://labor.state.ak.us/trends/apr12.pdf

Kraus, F. R. 1999. Summary of public education and outreach activities conducted by the Salmon Trout Restoration Education and Aquatic Management (STREAM) program, July 1990-June 1998. Alaska Department of Fish and Game, Special Publication No. 99-3, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/sp99-03.pdf

Kraus, F. R., and L. Olson. 2003a. Summary of public education, outreach and information activities conducted by Southcentral Region's information and education program, July 1, 1998-June 30, 1999. Alaska Department of Fish and Game, Fishery Management Report No. 03-08, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fmr03-08.pdf

Kraus, F. R., and L. Olson. 2003b. Summary of public education, outreach and information activities conducted by southcentral region's information and education program, July 1, 2000-June 30, 2001. Alaska Department of Fish and Game, Fishery Management Report No. 03-09, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fmr03-09.pdf

Seng, P. T., and G. M. White. 2007. Measures of aquatic stewardship from a fisheries perspective, Aquatic Stewardship Education: American Fisheries Society Symposium 55:137-144.

Snyder, T. D., and S. A. Dillow. 2013. Digest of Education Statistics 2012 (NCES 2014-015). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Timmons, L. S. 2006. Strategic plan for the Division of Sport Fish, Southcentral Region, Sport Fishing and Aquatic Education Program. Alaska Department of Fish and Game, Special Publication No. 06-30, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/Sp06-30.pdf

Timmons, L. S., P. A. Hansen, and T. G. Raymond. 2009. Assessment of Anchorage School District students participating in the *Salmon in the Classroom* program, 2006-2007. Alaska Department of Fish and Game, Fishery Data Series No. 09-20, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds09-20.pdf

UAA Center for Alaska Education Policy Research. 2011. Anchorage School District overview November 2011. University of Alaska Anchorage, Anchorage. http://www.muni.org/departments/mayor/documents/district overview final.pdf

Williams, G. 2010. Anchorage migration. Alaska Economic Trends 30(2):4-12. http://labor.state.ak.us/trends/feb10.pdf

APPENDIX A: SALMON ASSESSMENT TESTS FOR STUDENTS

Appendix A1.–Salmon assessment test used pre- and post-program in the 2007–2008 and 2008–2009 school years.

1. Please enter your name:

First Name
Last Name

2. What is your Anchorage School District student ID? (If you are unsure please ask your teacher for help)

3. Who is your teacher? [List of choices given]

4. How does a fish steer its body through the water?

- ○ swim bladder
- ○ gills
- ○ fins
- ○ pyloric caeca

5. What does the fish's stomach do?

- ○ makes eggs
- ○ digests food
- ○ watches out for predators
- ○ helps it hear

6. What does the fish's liver do?

- ○ helps with digestion, stores fat, and removes poisons from the blood
- ○ helps the fish breath oxygen out of the water
- ○ pumps blood through the fish's body
- ○ grows the fish's eggs

7. What does the fish's heart do?

- ○ filters blood
- ○ pumps blood
- ○ makes blood
- ○ stores blood

8. What does the fish's swim bladder do?

- ○ digests food
- ○ helps the fish swim faster
- ○ holds urine
- ○ helps the fish float in one place

9. What do the fish's kidneys do?

- ○ takes waste out of blood
- ○ helps the fish hear
- ○ pumps blood
- ○ helps the fish stay warm

10. Why are eggs and milt important?

- ○ they help pump blood
- ○ they help digest food
- ○ they make baby salmon
- ○ they protect the fish

11. What part of the human body is similar to a fish's gills?

- ○ liver
- ○ lungs
- ○ heart
- ○ kidneys

-continued-

12. What does the slime on a fish do?
- ○ digests food
- ○ gets oxygen from the water
- ○ filters blood
- ○ protects from the germs

13. When the salmon starts out its life as an egg in a stream, where would it be found?
- ○ buried carefully in the mud
- ○ in a nest made of sticks
- ○ under the gravel
- ○ floating on a pond

14. After hatching, how does an alevin get its food?
- ○ it eats small bits of plants
- ○ its mother brings it food
- ○ it strains insects
- ○ from its yolk-sac

15. Which sentence is NOT true about salmon fry?
- ○ Some salmon fry may travel to the ocean right after they come out of the gravel
- ○ Birds and other animals eat salmon fry
- ○ All salmon fry are found far out in the middle of the sea
- ○ Some salmon fry live in streams or lakes for a while

16. What happens to salmon when they change into smolt?
- ○ Their bodies change to a shiny, silvery color
- ○ Their stomachs must be able to digest plants in addition to insects
- ○ Their eyesight get better by 200%
- ○ They make eggs or milt

17. Which sentence is TRUE about adult salmon living in the ocean?
- ○ They always stay close to their home stream
- ○ They may swim thousands of miles
- ○ They only live in the ocean a few weeks
- ○ Their travels in the ocean are very random

18. How do salmon find their way back to their home stream to spawn?
- ○ by sight
- ○ by touch
- ○ by sound
- ○ by smell

19. Which is NOT true about salmon that are getting ready to spawn?
- ○ they eat a lot
- ○ they change color
- ○ they stop eating
- ○ they grow a hump

20. What happens to salmon after they spawn?
- ○ go to lakes for the winter
- ○ go back to the ocean
- ○ stay with the baby salmon
- ○ die

21. What life stages of salmon are found in the creeks in Anchorage?
- ○ eggs and smolt
- ○ feeding adults and fry
- ○ eggs, alevin, fry, smolt, spawner
- ○ eggs alevin, fry

-continued-

22. Which one is an Alaskan salmon?

- ○ catfish
- ○ minnow
- ○ coho
- ○ perch

23. What do fishery biologists do for their job?

- ○ They take people on fishing trips
- ○ They study fish and what fish need to be healthy
- ○ They catch fish and sell them to grocery stores
- ○ They make artwork out of fish for fishing stores

24. What's the best way to know the rules for fishing?

- ○ look in the regulation book
- ○ look in a dictionary
- ○ just catch as many fish as you want
- ○ ask your friends

The next five questions are about your opinions. There is no right or wrong answer.

25. I would like to learn more about salmon.

- ○ Yes
- ○ Maybe a little
- ○ I don't know
- ○ Not really
- ○ No way

26. I think studying fish is an interesting job.

- ○ Yes
- ○ Maybe a little
- ○ I don't know
- ○ Not really
- ○ No way

27. It's good to have a real fish in class to study.

- ○ Yes
- ○ Maybe a little
- ○ I don't know
- ○ Not really
- ○ No way

28. I would like to go fishing.

- ○ Yes
- ○ Maybe a little
- ○ I don't know
- ○ Not really
- ○ No way

This last question doesn't have a right or wrong answer. Write what you think.

29. What is something you can do to help take care of Alaska's fish and water?

Fish and Game along with the Anchorage School District thank you for participating in this assessment

Appendix A2.–Modifications used in pre- and post-program salmon assessments for the school year 2009–2010.

Additions inserted following question 24 (Appendix A1):

25. When handling a fish you want to release you should wet your hands to protect what part of the fish?

- ○ gills
- ○ slime
- ○ heart
- ○ head

26. To properly release a fish, what part of the fish should you never touch?

- ○ head
- ○ tail
- ○ gills
- ○ scales

27. Which two species are not supposed to be found here in Anchorage?

- ○ Chinook and Pink salmon
- ○ Northern pike and Atlantic salmon
- ○ Rainbow trout and Dolly varden
- ○ Chum and Sockeye salmon

28. What problems can be caused by walking or playing in a stream where fish are spawning?

- ○ makes the water cloudy so fish cannot see
- ○ makes the fish go back out to the ocean
- ○ may step on salmon eggs
- ○ may be attacked by fish

29. Salmon need which of the following to survive?

- ○ predators
- ○ clean waters
- ○ pollutants
- ○ none of the above

30. What happens if not enough salmon are able to spawn?

- ○ number of salmon in the future will increase
- ○ people won't be able to catch and keep as many fish
- ○ bears and predators will eat more salmon
- ○ none of the above

31. What happens to pollutants that are washed down your driveway?

- ○ they are cleaned at a water treatment plant
- ○ they flow into streams and creeks
- ○ they stay on the driveway
- ○ they disappear

32. How many eggs from each pair of spawning salmon need to complete their lifecycle to maintain salmon populations?

- ○ 1
- ○ 2
- ○ 10
- ○ 100

Subtraction removed following question 28 (Appendix A1):

This last question doesn't have a right or wrong answer. Write what you think.

29. What is something you can do to help take care of Alaska's fish and water?

APPENDIX B: TEACHER QUESTIONNAIRES

Appendix B1.–Teacher questionnaire for the 2007–2008 school year.

Teacher Name: _____
School Year: 2007-2008
Grade: _____
School: _____

1. How many years have you participated in the Salmon in the Classroom program, including this year?

- ☐ 1 year (2007– 2008 was my first school year participating in the program)
- ☐ 2 years (started in 2006–2007 school year)
- ☐ 3 years (started in 2005–2006 school year)
- ☐ 4 years (started in 2004–2005 school year)
- ☐ 5 years (started in 2003–2004 school year)
- ☐ other, please specify: _____

2. Which of the following supporting materials do you use for teaching about salmon in 2007–2008 school year? (Selecting the box next to the resource means "yes" I do use this resource in my classroom)

- ☐ Salmonids in the Classroom curriculum
- ☐ Salmon life cycle poster
- ☐ Alaska's Wild Salmon
- ☐ Aquarium setup for Dummies
- ☐ Other educational materials that I have created and/or collected

3. Which of the following activities did your class participate in during the 2007-2008 school year? (Selecting the box next to the resource means "yes" we did attend or participate in this activity).

- ☐ Egg takes at Campbell Creek
- ☐ Aquarium in my classroom or school
- ☐ Salmon dissection
- ☐ Ice fishing
- ☐ Salmon Celebration (fry or smolt release)
- ☐ Other salmon-related presentations by guest experts and/or field trips that I arranged myself

Appendix B2.–Teacher questionnaire for the 2008–2009 school year.

Teacher Name/school:

School Year: 2008 – 09

Grade:

1. How many years have you participated in the Salmon in the Classroom program, including the 2008-09 school year?

- ☐ 1 year (this is my first year)
- ☐ 2 years
- ☐ 3 years
- ☐ 4 years
- ☐ 5 years
- ☐ other, please specify:

2. Which of the following supporting materials did you use for teaching about salmon (2008-09)?

- ☐ Salmonids in the Classroom curriculum
- ☐ Salmon life cycle poster
- ☐ Alaska's Wild Salmon
- ☐ Aquarium setup for Dummies
- ☐ Other educational materials that I have created and/or collected.

3. Which of the following activities did your class participate in during the 2008-2009 school year?

- ☐ Egg takes at Campbell Creek
- ☐ Aquarium in my classroom or school
- ☐ Salmon dissection
- ☐ Ice fishing
- ☐ Salmon Celebration (fry or smolt release)
- ☐ Other salmon-related presentations by guest experts and/or field trips I arranged myself.

4. Which of the following activities if offered would your class participate instead of the salmon dissection?

- ☐ Fly Tying
- ☐ Spinning and Fly Casting
- ☐ Knot tying and fishing skills
- ☐ Angler Ethics
- ☐ Aquatic Insect
- ☐ Other

Appendix B3.–Teacher questionnaire for the 2009–2010 school year.

Teacher Name:_____
School Year: 2009 – 10
Grade:_____

1. How many years have you participated in the Salmon in the Classroom program, including this year?

- ☐ 1 year (this is my first year)
- ☐ 2 years
- ☐ 3 years
- ☐ 4 years
- ☐ 5 years
- ☐ other, please specify: _____

2. Which of the following supporting materials do you use for teaching about salmon?

- ☐ Salmonids in the Classroom curriculum
- ☐ Salmon life cycle poster
- ☐ Alaska's Wild Salmon
- ☐ Aquarium setup for Dummies
- ☐ Other educational materials that I have created and/or collected.

3. Which of the following activities did your class participate in during the 2009-2010 school year?

- ☐ Egg takes at Campbell Creek
- ☐ Aquarium in my classroom or school
- ☐ Salmon dissection
- ☐ Ice fishing
- ☐ Salmon Celebration (fry or smolt release)
- ☐ Casting in the Classroom
- ☐ Other salmon-related presentations by guest experts and/or field trips I arranged myself.

4. If your class or school had an aquarium how often, on average did your students view the aquarium?

- ☐ Multiple times a day
- ☐ Daily
- ☐ bi-Weekly
- ☐ Weekly
- ☐ Monthly

5. Which of the following activities if offered would your class participate instead of the salmon dissection?

- ☐ Fly Tying
- ☐ Spinning and Fly Casting
- ☐ Knot tying and fishing skills
- ☐ Angler Ethics
- ☐ Aquatic Insect
- ☐ Other

APPENDIX C: PROGRAM ASSESSMENT DATA

Appendix C1.–The percentage of students that answered a question correctly for the pretest and the post-test during each school year and the weighted average over all school years.

		School year							
		2007–2008 [c]		2008–2009 [d]		2009–2010 [e]		Weighted average [b]	
Question [a]	Topic	Pretest	Post-test	Pretest	Posttest	Pretest	Posttest	Pretest	Post-test
4	Fins	85.7	87.3	87.5	84.7	89.7	85.5	88.0	85.6
5	Stomach	66.1	80.4	60.7	74.9	67.0	78.1	64.6	77.5
6	Liver	52.4	66.7	42.0	55.6	53.6	59.3	49.2	59.6
7	Heart	86.8	83.1	85.4	87.1	84.0	85.8	85.1	85.6
8	Swim bladder	31.2	49.2	27.5	41.7	23.6	43.6	26.7	44.2
9	Kidneys	57.7	72.0	55.3	64.7	59.5	68.4	57.6	67.9
10	Eggs/Milt	89.9	88.9	83.4	88.1	86.0	89.2	86.0	88.7
11	Gills	68.8	76.7	66.4	72.5	63.2	76.9	65.6	75.3
12	Slime	85.7	90.5	75.3	87.5	73.2	86.6	76.8	87.8
13	Egg	67.2	62.4	46.8	59.0	46.4	58.4	51.3	59.5
14	Alevin	80.4	89.9	61.0	87.1	65.5	88.3	67.3	88.3
15	Fry	60.3	67.7	51.2	61.4	56.1	61.8	55.3	63.0
16	Smolt	57.7	67.2	57.3	69.5	66.7	67.0	61.3	67.9
17	Adult	54.5	61.4	46.8	62.0	51.6	66.1	50.5	63.6
18	Homing	77.2	87.3	60.3	81.7	60.4	78.3	64.2	81.6
19	Spawning	53.4	56.6	36.3	50.8	30.5	43.3	37.7	49.0
20	After spawning	84.7	87.3	78.6	88.5	79.8	89.2	80.5	88.5
21	Creek life stages	53.4	65.1	43.4	58.6	47.6	52.7	47.4	57.6
22	Alaska salmon	72.0	86.8	66.1	85.4	65.0	88.3	66.9	86.9
23	Fishery biologist	88.4	89.9	79.3	88.1	81.8	88.9	82.4	88.9
24	Regulations	86.8	91.0	69.2	80.0	79.8	83.2	77.6	83.8

Note: Only data from students that had both pre- and post-test scores were used in this table.

[a] Questions correspond to numbers in Appendix A1.

[b] Averages were weighted by the number of students per year; there was a total of 835 students that took both the pre- and post-test during 2007–2010.

[c] There were 189 students that took both the pre- and post-test during 2007–2008 school year.

[d] There were 295 students that took both the pre-and post-test during the 2008–2009 school year.

[e] There were 351 students that took both the pre- and post-test during the 2009–2010 school year.

Appendix C2.–Increase between the pre- and post-tests in the percentage of students that answered a question correctly during each school year and the weighted average over all years.

Question [a]	Topic	School year 2007–2008 [c]	2008–2009 [d]	2009–2010 [e]	Weighted average [b]
4	Fins	1.6	-2.7	-4.3	-2.4
5	Stomach	14.3	14.2	11.1	12.9
6	Liver	14.3	13.6	5.7	10.4
7	Heart	-3.7	1.7	1.7	0.5
8	Swim bladder	18.0	14.2	19.9	17.5
9	Kidneys	14.3	9.5	8.8	10.3
10	Eggs/Milt	-1.1	4.7	3.1	2.8
11	Gills	7.9	6.1	13.7	9.7
12	Slime	4.8	12.2	13.4	11.0
13	Egg	-4.8	12.2	12.0	8.3
14	Alevin	9.5	26.1	22.8	21.0
15	Fry	7.4	10.2	5.7	7.7
16	Smolt	9.5	12.2	0.3	6.6
17	Adult	6.9	15.3	14.5	13.1
18	Homing	10.1	21.4	17.9	17.4
19	Spawning	3.2	14.6	12.8	11.3
20	After spawning	2.6	9.8	9.4	8.0
21	Creek life stages	11.6	15.3	5.1	10.2
22	Alaska salmon	14.8	19.3	23.4	20.0
23	Fishery biologist	1.6	8.8	7.1	6.5
24	Regulations	4.2	10.8	3.4	6.2

Note: Only data from students that had both pre- and post-test scores were used in this table.

[a] Questions correspond to numbers in Appendix A1.

[b] Averages were weighted by the number of students per year; there was a total of 835 students that took both the pre- and post-test during 2007–2010.

[c] There were 189 students that took both the pre- and post-test during 2007–2008 school year.

[d] There were 295 students that took both the pre-and post-test during the 2008–2009 school year.

[e] There were 351 students that took both the pre- and post-test during the 2009–2010 school year.

31

Appendix C3.–Percent of students responses to 4 opinion statements on the pre- and post-tests during each school year and the weighted average over all years.

	School year							
	2007–2008 [b]		2008–2009 [c]		2009–2010 [d]		Weighted average [a]	
Statement and response	Pretest	Post-test	Pretest	Post-test	Pretest	Post-test	Pretest	Post-test
I would like to learn more about salmon.								
Yes	48.4	26.1	60.0	36.3	54.7	37.3	55.1	34.4
Maybe a little	32.1	38.0	23.1	30.2	21.9	25.6	24.6	30.0
I don't know	9.2	15.8	6.1	12.5	12.5	13.7	9.5	13.7
Not really	7.1	17.4	7.8	13.6	6.6	14.8	7.1	15.0
No way	3.3	2.7	3.1	7.5	4.3	8.5	3.6	6.8
I think studying fish is an interesting job.								
Yes	38.2	28.5	50.2	35.6	45.9	31.3	45.6	32.2
Maybe a little	32.8	29.0	24.4	24.7	22.8	23.1	25.6	25.0
I don't know	13.4	18.3	11.2	13.6	13.1	17.9	12.5	16.5
Not really	12.4	17.2	9.5	18.0	11.1	15.4	10.8	16.7
No way	3.2	7.0	4.7	8.1	7.1	12.3	5.4	9.6
It's good to have a real fish in class to study.								
Yes	70.4	62.9	75.9	64.4	73.5	61.5	73.7	62.9
Maybe a little	15.6	18.8	12.9	17.3	11.4	17.7	12.9	17.8
I don't know	7.5	12.4	7.1	8.1	8.8	9.4	7.9	9.6
Not really	4.8	3.2	2.0	6.4	4.0	8.8	3.5	6.7
No way	1.6	2.7	2.0	3.7	2.3	2.6	2.0	3.0
I would like to go fishing.								
Yes	74.9	74.9	78.3	74.2	75.2	73.5	76.2	74.1
Maybe a little	15.0	8.0	12.5	11.2	9.7	11.4	11.9	10.6
I don't know	3.2	8.6	4.7	6.4	4.3	3.4	4.2	5.6
Not really	4.3	4.8	2.0	4.1	6.6	5.4	4.4	4.8
No way	2.7	3.7	2.4	4.1	4.3	6.3	3.2	4.9

Note: Only data from students that had both pre- and post-test scores were used in this table.

[a] Averages were weighted by the number of students per year; there was a total of 835 students that took both the pre- and post-test during 2007–2010.

[b] There were 189 students that took both the pre- and post-test during 2007–2008 school year.

[c] There were 295 students that took both the pre-and post-test during the 2008–2009 school year.

[d] There were 351 students that took both the pre- and post-test during the 2009–2010 school year.