

Exploring the Perspectives and Behaviors of Teachers on Invasive Species

by

Skye Root

MPP Essay

Submitted to

Oregon State University

In partial fulfillment of
the requirements for the
degree of

Master of Public Policy

Presented March 19, 2010
Commencement June 12, 2010

ABSTRACT

Exploring the perspectives and behaviors of teachers on invasive species

This study explores the role of classroom use of live organisms as a pathway for the spread of invasive species. The overall guiding research question is “Are behavioral changes necessary to reduce the spread from the classroom pathway?” Using focus groups comprised of key educators, this study seeks to identify attitudes, norms, and barriers to inform the development of solutions to mitigate the spread of aquatic invasive species from the classroom. A modified version of the Theory of Planned Behavior is used to tabulate values, knowledge, concerns, and solutions that could lead to behavioral change. A total of 65 educators participated in six different focus groups, with nearly half of the participants elementary teachers. Findings indicate strong educational, use-related, and ethical values deeply rooted in having, and continuing to have, live organisms in the classroom. Information about invasive species, however, is not perceived as readily available, and credible sources are often difficult to discern by participants who are mainly searching online for needed information. Logistical concerns, euthanization practices, ecological damages, and children’s outdoor experiences are described as potential barriers to behavior change, and educational liaisons, outreach activities, and policy changes are suggested solutions intended to change behavior. Using the Theory of Planned Behavior as a foundational theory and Multiple Streams framework as a policy guide, this study recommends five specific actions be taken by policy entrepreneurs: (1) Fund, develop, and maintain an invasive species informational website where educators can go for up-to-date references on sourcing, care and handling, disposal, and species identification. (2) Create example fact sheets for organism suppliers and encourage their adoption by the suppliers. (3) Add invasive species educational standards on a national scale through the NSTA and NISC, and provide teachers with curriculum suggestions involving the integration of invasive species education into core subject matter. (4) Develop and test an invasive species professional development training seminar for K-12 educators to be applied to large scale science association

meetings or local in-service days. (5) Seek funding for the development of invasive species education curriculum that could be implemented through credentialing programs.

Keywords: invasive species, theory of planned behavior, teachers, values, knowledge, concerns, solutions, focus groups, multiple streams policy framework.

ACKNOWLEDGEMENTS

The past two years at Oregon State University have been an exceptional opportunity. I knew water was my “thing” long before coming here, but quickly discovered upon arrival that this was the place to study water policy. I owe many thanks to Denise Lach for her suggestions, mentoring, and high expectations. She taught a quantitative, budding water economist how to do real-life qualitative research, and for that I am very grateful. Brent Steel must have grown weary of my endless questions and constant pushing of the envelope, but I appreciate his flexibility within the program and will forever be glad that I chose this program. If I know one person consistently busy person, it is Sam Chan. He is involved with everything, and does so well. For an entire year we traveled, worked, and learned together. Thank you Denise, Brent, and Sam; your examples, lessons, and time commitments will not be forgotten.

This thesis document would never have come to fruition had it not been for 65 participants scattered across North America who took part in the focus groups. In addition, I dedicate this document to Tania Siemens, Dr. Wei Ying Wong, Kevin Moua, Jennifer Lam, and Lisa Limongan. Because of their great assistance, everything came together. I also acknowledge Gail Achterman, Geoff Huntington, Jeffrey McDonnell, Todd Jarvis, Mary Santelmann, Marshall English, Greg Perry, Aaron Wolf, Brenda Bateman, Phil Ward, Rich Adams, and myriad friends, classmates, and associates for teaching me so much about water and its many facets relating to law, economics, politics, policy, business, and science.

I want to sincerely thank the people who *really* got me through this two-year double master’s ordeal. Becca, my wife, deserves this and my other Masters degree for all she has put up with the past two years; I love you and couldn’t have done it without your support, advice, love! Grandma Maureen, thank you so much for your tireless efforts on behalf of me, Becca and the boys. Bryce and Brandon, boys, I promise you will soon see me more often and we can have some fun for a change. I am so thankful to my own parents for instilling in me a motivation to succeed and constantly providing the encouragement to keep going. Lastly, I want to thank my Father in Heaven for giving me the faith and energy to get up everyday and endure to the end. It has been a busy, exciting, and fun ride, thank you all!

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
Politics and Pathways Defined.....	1
Overview of “AIS in Classroom” Project.....	3
Phase Two Objectives.....	4
LITERATURE REVIEW	5
Foundations on Changing Human Behavior.....	5
Theory of Planned Behavior and Reasoned Action.....	5
METHODS	11
Focus Group Methodology	11
Focus Groups and the Theory of Planned Behavior	11
Defining the Sample Population	12
Recruiting Participants.....	12
Focus Group Format	13
<i>Main Questions</i>	14
Recording Methods.....	17
Transcription Methods.....	17
Analyzing the Transcript.....	18
Coding Methods.....	18
Analysis Methods.....	20
RESULTS	22
Participant Demographics.....	22
Data Distribution.....	25
VALUES	26
Educational Values	26
Use-Related Values.....	29
Ethical Values	30
KNOWLEDGE	32
Definition of Invasive Species	32
Species Knowledge.....	33
Information Sources.....	36
CONCERNS	37
Logistical Barriers.....	38
Ethical Concerns	42
Potential Damage Concerns.....	43
Children’s Outdoor Experience Concerns	44

SOLUTIONS	45
Educational Liaisons	46
Outreach	48
Policy Change	50
DISCUSSION	54
Values	54
Knowledge	55
Concerns	57
Solutions	58
<i>Addressing Value Barriers</i>	58
<i>Addressing Knowledge Barriers</i>	58
<i>Addressing Concern Barriers</i>	59
POLICY IMPLICATIONS	62
Multiple Streams Analysis	62
Problem Stream	65
Policy Stream	66
Politics Stream	68
Multiple Streams-Syntheses	69
CONCLUSION	73
Limitations and Recommended Future Research	74
BIBLIOGRAPHY	76
APPENDICIES	80

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
Figure 1: Theory of Planned Behavior.....	6
Figure 2: Theoretical Framework Used to Explore Potential Solutions for Changing Behavior, Adapted from the Theory of Planned Behavior	10
Figure 3: Grade Level Distribution.....	23
Figure 4: Participants by Location.....	23
Figure 5: Percent by State	26
Figure 7: Euthanasia Summary	30
Figure 8: Sources of Organisms.....	35
Figure 9: Focus Group Policy Concerns	38
Figure 10: Multiple Streams Framework.....	63
Figure 11: Multiple Streams Applied to Invasives Species Considerations	72

LIST OF TABLES

<u>Table</u>	<u>Page</u>
Table 1: Project Objectives	3
Table 2: First Level Coding Examples	20
Table 3: Focus Group Participant Legend	22
Table 4: Summary of Values	32
Table 5: Summary of Knowledge	37
Table 6: Summary of Concerns	45
Table 7: Summary of Solutions	52

LIST OF APPENDICIES

<u>Appendix</u>	<u>Page</u>
Appendix A: Schools and Science Curricula as Potential Pathways for AIS.....	80
Appendix B: Recruitment Scripts	81
Appendix C: Informed Consent Form for Participants.....	83
Appendix D: Overview of Project for Participants.....	86
Appendix E: The Codebook.....	88
Appendix F: Map of Focus Group Locations	101
Appendix G: Overview of Methods for AIS in Classroom Project.....	102
Appendix H: Level One Comment Distribution by Location.....	103

INTRODUCTION

The National Invasive Species Council (NISC) defines an invasive species as a non-native species whose introduction does or is likely to cause economic or environmental harm or harm to human, animal, or plant health. (NISC, 2006) Aquatic invasive species are a critical environmental and economic threat that impact myriad industries, governments, and livelihoods on a global scale. Furthermore, their spread is marked by many pathways, some of which can be traced while others cannot. Schools have recently been identified as a potential vector for the spread of invasive organisms, but their impact is not well-understood (Chan et. al., 2005). Using focus groups comprised of key educators, this study seeks to identify attitudes, norms, and barriers of educators to inform the development of solutions to mitigate the spread of aquatic invasive species from the classroom.

Politics and Pathways Defined

On February 3rd, 1999, Executive Order (EO) 13112 was signed establishing the National Invasive Species Council (NISC). The EO required that a council of cabinet departments dealing with invasive species be created, and in 2009 there are 13 departments and agencies on the council (NISIC, 2009). EO 13112 specifically called for the creation of a Federal Advisory Committee (ISAC) to provide information and advice for consideration by the council. The ISAC has been influential in writing the original National Invasive Species Council Management Plan (NISMP) in 2001 and the updated version in 2008 (NISC, 2009).

The original management plan outlined an action map for the nation that included an integral section on leadership and coordination. Therein, the NISC and its staff agreed to manage invasive species by drawing on the expertise of existing organizations, to include state agencies, state invasive species committees and councils, regional organizations such as regional weed boards, the Aquatic Nuisance Species Task Force (ANSTF), the Federal Interagency Committee on the Management of Noxious and Exotic Weeds (FICMNEW), the Committee on Environment

and Natural Resources (CENR), and various non-government organizations (NISMP, 2001). The ANSTF is the specific organization to be further explored in relation to this project.

As part of their strategic plan, the ANSTF established six regional panels whose membership include representatives of states, Indian Tribes, non-governmental organizations, commercial interests, and neighboring countries (ANSTF, 2007). To date, four regional panels have been formed—the Western Regional Panel (WRP), the Great Lakes Panel, the Gulf of Mexico Panel, and the Northeast Regional Panel (Sea Grant, 2009), and they are continually facilitating research and outreach in their respective stewardships. The WRP encompasses all states and provinces west of the 100th Meridian as well as Guam, Hawaii and Alaska (WRP, 2009).

The NISMP (2001) identified the funding interaction between NOAA Fisheries, the Sea Grant Program, and invasive species outreach and education. NOAA's Sea Grant Program provides matching grants for outreach and education efforts dealing with aquatic nuisance species under the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA). The guiding principle of this policy was to, "Be cautious and comprehensive." The updated 2008-2012 proposal went further by establishing a *strategic goal* to maximize organizational effectiveness through the *objective* of enhancing outreach on invasive species by *implementing* a working relationship with existing educational organizations to enhance invasive species information delivery to primary and secondary educators [emphasis added] (NISMP, 2008). This study is emphasizing the latter policy as a starting point to explore potential behavioral gaps of educators.

ISAC formed an invasive species task force in 2003, which identified three major categories of pathways for the spread of invasives: transportation, living industries, and miscellaneous (Campbell and Kriesch, 2003). Meanwhile, the EPA expanded upon those categories to include intentional and aquaria releases, science/laboratory escapes, disposals or introductions, and disposal of wastewater (EPA, 2009). Schools, supply houses, and curricula have not been officially identified in the policies as potential outlets for the spread of aquatic invasive species (AIS), and that lack of attention led to research regarding the role of AIS in the classroom.

Overview of “AIS in Classroom” Project

Because invasive species impact ecological, economical, and epidemiological outcomes, desires have surfaced to better understand this three-fold relationship (Appendix A). The acquisition, use, and disposal of live plants and animals by biological supply houses (BSH), science coordinators, and school teachers have been an overlooked relationship and pathway when exploring the spread of AIS. Led by the Oregon Sea Grant College Program, an international team of researchers from Oregon Sea Grant, Washington Sea Grant, Illinois-Indiana Sea Grant, Michigan Sea Grant, New York Sea Grant, University of Florida, USC Sea Grant Program, University of Washington and Fisheries and Oceans Canada came together to explore the role of classroom use of live organisms as a pathway for AIS (Chan et. al., 2008).

The West Coast (Oregon, Washington, California, and British Columbia), the Great Lakes (Indiana, Illinois, and Ontario), and Florida were identified as study sites for a three-phased project funded by NOAA Fisheries and the Sea Grant. The objectives of the overall project are to formally define the AIS in the classroom pathway, gain input from stakeholders on effective solutions, and develop three to four pilot outreach and education tools for AIS prevention. Below is a summary of the objectives for each phase of the AIS in Classroom Project.

Table 1: Project Objectives

Objectives of AIS in Classroom Project	
• Phase I-AIS in Classrooms Problem Analysis	a. Elucidate key components of the AIS in classroom pathways.
	b. Identify the species available, used, and transferred through the pathway.
	c. Identify constituents and their networks.
	d. Identify regional and national stakeholders for focus group problem analysis.
• Phase II-Planning for Solutions with Stakeholders	a. Evaluate the problem from stakeholder perspective through focus groups comprised of pathway constituents.
	b. Solutions based on stakeholder input to reduce risks from the AIS in classroom pathway.
• Phase III-Outreach Tool Development, Testing and Evaluations	a. Identify, integrate and prioritize prevention tools and outreach/education products.
	b. Develop top two-four prevention tools that have national implications.
	c. Adapt tools for pilot testing.
	d. Collaborate with constituents to develop outreach materials.

Source: Chan, S. et.al. (2008).

The Classroom Problem Analysis (Phase I) was accomplished through literature and website reviews, school surveys, and BSH surveys. The results were then used to inform the focus group methodology used during Phase II, and the final Phase III will be based on solutions gleaned from the focus groups and the survey data. This paper describes the focus groups used during Phase II.

Phase Two Objectives

The focus groups were designed to interview elementary school and junior/high school science teachers in the Great Lakes region and the West Coast of the United States. The focus groups delve into AIS related questions, characterize concerns, and elicit potential solutions to concerns raised by teachers. The overall guiding research question is “What are efficacious approaches to reducing the AIS in the classrooms pathway?” To accomplish this task, four core questions aimed at identifying behavioral motivations were derived to assess values, concerns, and knowledge in preparation for suggested solutions. The four questions include:

1. What values do living organisms have in science education and in the classroom?
2. What are some of your concerns with living organisms in the classroom?
3. What do you know about invasive species, and AIS?
4. What are some potential solutions for dealing with the concerns identified about invasive species in the classroom?

In addition to the focus groups conducted in the US and Canada for educators, individual interviews with biological supply houses and curriculum coordinators were completed to better understand the pathways networks, constituent roles, and potential impacts. These interviews will not be addressed in this paper. Although beyond the scope of this analysis, coordination of all stakeholder input will eventually facilitate recommendations for effective behavioral change. In the following sections, the theoretical framework used in data collection and analysis is described, methods are introduced in detail, results related to the focus group analysis are discussed, and policy implications are considered.

LITERATURE REVIEW

Changing human behavior through a variety of mechanisms is a frequently researched phenomenon. The scope of this literature review was narrowed to surface level analysis of the human behavior foundations and detailed summaries of the theories of planned behavior and reasoned action. Focus group literature and its applications are reviewed at the beginning of the methods section, and the multiple streams approach to policy analysis is included in the policy section near the end of the thesis. These theories and frameworks have helped to form research questions, analyze data, and make final recommendations and conclusions.

Foundations on Changing Human Behavior

The literature associated with changing human behavior is broad in scope and application, but the core principles have remained quite consistent. Initially, behavioral models formed as an attempt to explain the reasons behind the fluctuations in humans' behavioral patterns. Bandura (1977) found that the main determinants of change were environment and individual personality characteristics. A variety of different theories grew from the desire to understand behavioral patterns. A preliminary literature review examined some of the more prevalent theories, including the Social Cognitive Theory (Bandura, 1989), Learning Theories (Skinner, 1953), Theory of Reasoned Action (Hale, Householder and Greene, 2003: p. 259), and Theory of Planned Behavior (Ajzen, 1991). In recent years, there has been increased frequency in the application of these theories, specifically in the arenas of health, education, environmentalism, and criminology. These theoretical foundations provide context for the framework to be adopted throughout this study.

Theory of Planned Behavior and Reasoned Action

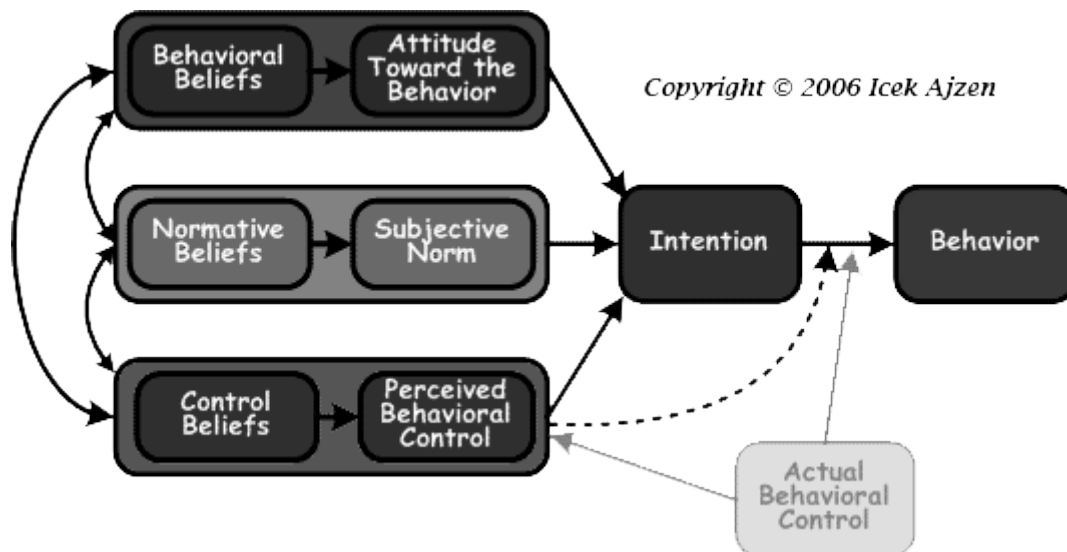
Based on prior research conducted by the Oregon Sea Grant (Kubeck, 2008), the AIS in the Classroom project was grounded in the Theories of Reasoned Action and Planned Behavior, with some minor applications and additions specific to its scope of research. The Theory of Reasoned Action specifically provides a framework for linking behaviors, intentions, attitudes, and norms and applies to the exploratory nature of the research questions within this study. The model defines the variables as follows:

- **Behavior:** A specific behavior defined by combinations of action, target, context, and time.
- **Intention:** An illustration of a person's willingness to perform a specific behavior.
- **Attitude:** A person's positive or negative feelings toward performing the defined behavior.
- **Norms:** A person's perception of other people's opinions regarding the defined behavior.

In essence, the behavioral and normative beliefs sway individual attitudes and subjective norms, respectively. The model also suggests a feedback loop in that attitudes and norms also shape a person's intention to perform a behavior (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975; and Ajzen, 1985). The Theory of Reasoned Action has evolved into The Theory of Planned Behavior by one of its original developers, Icek Ajzen (See Figure 1). A scholarly explanation for the change and addition is described by Miller (2005, p. 127), "This extension involves the addition of one major predictor, perceived behavioral control, to the model. This addition was made to account for times when people have the intention of carrying out a behavior, but the actual behavior is thwarted because they lack confidence or control over behavior."

Furthermore, Ajzen built upon the simple definitions of the earlier models to better clarify the definitions associated with each level of the model.

Figure 1: Theory of Planned Behavior



Source: <http://people.umass.edu/ajzen/images/tpb.png>

Behavioral beliefs are beliefs about the consequences of a specific behavior. They are further defined as the subjective probability that the behavior will produce a given outcome. By combining the believed consequences with the subjective probabilities, attitudes toward a behavior can be assessed. East (1993), for example, shows that predicting personal investment decisions is highly correlated with an individual's past behavioral beliefs in any particular investment arena. By assessing values and the strength of those values toward the spread of AIS, one can predict future attitudes towards the spread from various vectors.

Attitude towards behavior is the evaluation (positive or negative) of one's performance of a specific behavior. Ajzen and Fishbein (2005) find that general attitudes toward policies, people, and institutions are found to correlate well with behavioral patterns, but not with specific behaviors themselves. This suggests that in order to predict specific actions or outcomes dealing with the spread of AIS from the classroom, a measurement of the attitude of applicable parties towards the behavior itself are required.

Normative beliefs are perceptions about a specific behavior, which are swayed by the perspective of significant others. An individual's spouse, family, friends, and—depending on the population and behavior studied—teachers, doctors, supervisors, and coworkers can be important reference points for many normative beliefs. The model assumes normative beliefs, in combination with motivation to comply, determine the eventual subjective norms. Lam (2006), for example, ties people's intentions to save water in Taiwan based largely on normative beliefs attained throughout life and its experiences. Through focus group processes this research seeks to assess normative beliefs about AIS associated with educators.

Subjective norm is the perception of social pressures that an individual should (or should not) perform a specific normative behavior. A compelling study of adolescent females in Ethiopia (Fedaku and Kraft, 2002) shed additional light on the topic of subjective norms. Results revealed that subjective norm was the most important predictor of contraceptive intentions. In addition, descriptive norms and group norms exerted significant main effects upon intention. Essentially, these girls were influenced more by social than personal considerations. One goal of

this project is to analyze any existing social pressures and leverage them to the benefit of all parties involved.

Control beliefs are about the influence of exogenous factors that may positively or negatively affect behavioral performance. This study will call them concerns or barriers, because it is assumed that each concern, in combination with the perceived power of that concern, ultimately determines the perceived behavioral control. Blue (1995), for example, reported that the Theory of Planned Behavior was useful to predict human exercise patterns because the model included a metric for barriers or control beliefs. The assumption of this project is similar because curbing the spread of AIS via the classroom will require understanding the essential concerns and barriers faced by educators.

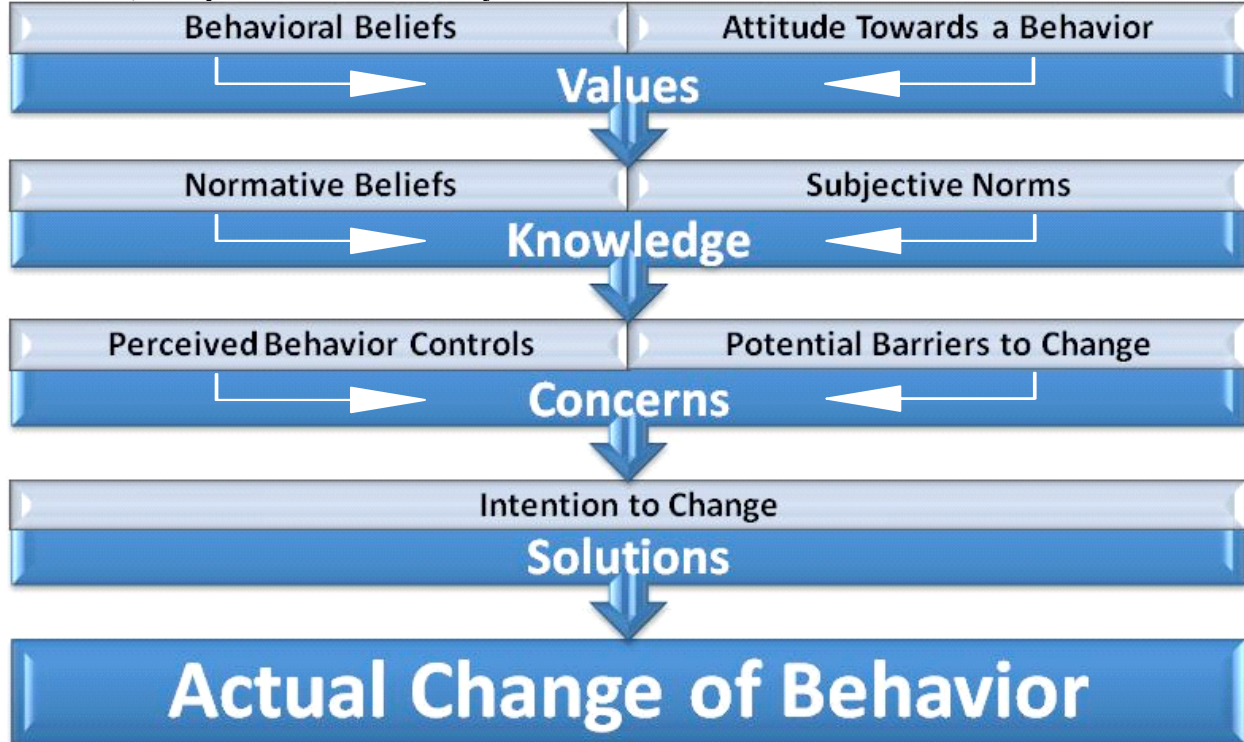
Perceived behavioral controls are the perceived barriers blocking the performance a specific behavior by an individual. Actual barriers exist in decision making processes and in real life, but the perceived barriers are often the more limiting factor. Ajzen added this construct to the overall model to account for this phenomenon. Myriad research has been done in recent years to analyze and present the effects of perceived behavioral controls. Flannery and May (2000), for example, while studying environmental ethical decision intentions associated with the U.S. metal finishing industry, show that three of five antecedent contextual influences are perceived behavioral controls. The relationships of biological supply houses with both curriculum coordinators and teachers are believed to be laced with many perceived barriers or concerns.

Behavioral intention is an indication of a person's willingness to perform a specific behavior. Furthermore, its inputs are attitude toward a behavior, subjective norms, and perceived behavioral controls; each with appropriate weights that influence overall intention. Arvola et. al. (2008) report using the Theory of Planned Behavior to predict the intention to purchase organic food. They find attitudes, norms, and perceived behavioral controls explain considerable variance in intention. Meanwhile, they add moral attitude to the model and conclude that it further improves the predictive ability of the model.

Behavior is a discernable reaction to a specific situation concerning an independent target. Conceptually, the model defines perceived behavioral control as the moderator of intention on actual behavior, but in practice, intentions and perceptions of behavioral control are mostly found to affect behavior rather than significantly interact with it. In a fascinating study about the household recycling of newspapers, Boldero (1995), looks at affects of recycling in the past, evaluations of the recycling service, number of newspapers purchased per week, individual's beliefs about recycling, and perceptions of insufficient storage space as predictor variables. He found that attitudes and intentions were significant predictors of behavior, but he also discovered the perceptions of storage space and norms associated with the inconvenience of recycling as important, significant forecasters. Burak (1994), in a study comparable to the AIS in the classroom project, examined elementary school teachers' intentions to teach HIV/AIDS education in the classroom and found attitude, subjective norm, and perceived behavior control explained 64% of the variance in intention to teach HIV/AIDS education. Furthermore, in-service training, teaching higher grades, and past teaching experience were all highly correlated with behavioral outcomes. In looking for potential solutions, the AIS in the Classroom project utilizes this framework to understand what will affect teachers' behavior regarding AIS.

Teachers, biological supply houses, curriculum coordinators, school administrators, and policy makers are all part of this dynamic model that could predict an eventual change of behavior associated with spreading AIS via the classroom. Attitudes, subjective norms, and perceived behavioral controls have been shown as legitimate predictors of intention and eventual behavioral outcome. This study expands the Theory of Planned Behavior to include awareness of an additional variable comparable to behavioral intention (solutions); otherwise the model fundamentally remains unchanged (See Figure 2 for the theoretical framework used in this study).

Figure 2: Theoretical Framework Used to Explore Potential Solutions for Changing Behavior, Adapted from the Theory of Planned Behavior



Values, knowledge, concerns, and solutions are the study variables that informed the survey, the focus groups, and used to consider policy implications associated with the spread of AIS. Values are an amalgamation of both behavioral beliefs and attitudes towards that behavior, and influence a person's knowledge base about invasive species. The subjective norms teachers are exposed to, coupled with their individual normative beliefs merge to produce knowledge surrounding AIS. Both values and knowledge influence how concerned an individual is about certain aspects of the spread of AIS and specifically the spread of AIS from the classroom. It is assumed that proposed solutions are a manifestation of teacher's willingness or intention to change, and like the original Theory of Planned Behavior model, an intention to change can translate to an actual change.

METHODS

Focus Group Methodology

Kreuger (1988) suggests that focus group interviews were born in the late 1930s by social scientists doubting the accuracy of traditional information gathering methods. The goal was to shift to a non-directive approach where the emphasis was placed on the interviewee rather than the interviewer. Meanwhile, Stewart and Shamdasani (1990) locate focus group origins in 1941 when Robert Merton evaluated audience responses to radio programs. Later Merton applied this training to the analysis of army training and morale films during World War II and it sparked a new form of research methods (Merton, 1946). Regardless of origin, the focus group methodology of qualitative research has become very popular for data collection in many fields of applied social research (Robson, 2002).

As the title suggests, a focus group is a group interview about a specific topic, in this case, AIS in the classrooms. By keeping a narrow focus, participants are essentially empowered to comment in their own words while being stimulated by various probes and questions. Participant numbers around eight to twelve are usually ideal for most focus groups (Stewart and Shamdasani, 1990). Robson (2002) highlights some key advantages and disadvantages of focus groups, including:

- Highly efficient technique for qualitative data collection; group dynamics help focus important topics; relatively inexpensive; facilitation can help the introduction of exogenous topics; and participants tend to enjoy the experience.
- The number of questions covered is limited; facilitating objectively requires considerable expertise; personality conflicts and disagreements may arise; confidentiality can be a problem; results are difficult to generalize to a larger population; and the nature of the interactions may bias the nature of the findings.

Focus Groups and the Theory of Planned Behavior

Because focus groups are so effective for eliciting exploratory information about feelings and attitudes (Stewart and Shamdasani, 1990), using them in connection with the Theory of Planned Behavior seems fitting. The evolutionary behavioral processes associated with the Theory of

Planned Behavior matches well with focus group methodology because facilitators can guide participants based on the framework. Ajzen and Fishbein (1980) refer to the importance of qualitative research as a method for discerning beliefs and behaviors, and much of the research that has applied the Theory of Planned Behavior has been done through focus group methods. Overall, focus groups have been an important tool for understanding attitudes, beliefs, and perceptions associated with the Theory of Planned Behavior (e.g. East, 1993; Fekadu and Kraft, 2002; Flannery and May, 2000).

Defining the Sample Population

Participants for focus groups were selected using a non-probability purposive sample. The principle of selection in purposive sampling is the researcher's judgment as to typicality or interest, and a sample is built up to satisfy the needs of the project (Robson, 2002). Phase one of the overall project included a survey that collected information about AIS from teachers in multiple US states and Canadian provinces. One of the questions on that survey asked teachers if they were interested in attending a summertime focus group on AIS. Each of these interested persons received an invitation to participate in a near-by focus group within their state or province. Six focus groups were convened for this project, located in Portland, Oregon; Seattle, Washington; Los Angeles, California; Chicago, Illinois; Toronto, Ontario, Canada; and Vancouver, British Columbia, Canada (Appendix F). A total of 65 educators participated in a focus group, 11 males and 54 females. Nearly half of the teachers taught at the elementary level, and a dozen participants were not classroom teachers although all 65 were educators.

Recruiting Participants

The recruitment protocol included the following tasks:

1. Individuals who voiced interest in participating via the survey were contacted concerning the scheduled focus group in their respective State or Province (see focus group recruitment attachment in Appendix B). For those school districts that had not yet participated in the survey, we used key contacts among school administrators to notify and recruit potential participants (see administrator recruitment in Appendix B).

2. Participants were contacted four to five times during the recruitment and focus group process. The first contact was an email confirming their voiced interest. If they did not reply within one week they were contacted with a phone call using the same script as the email. Once the person agreed to attend the focus group, they received an email with logistical information regarding their respective focus group, and a few days before their focus group another reminder was sent. Final contact was usually the actual focus group where they were presented with the appropriate informed consent documentation prior to starting the focus group (Appendix C). In certain cases, additional contact was necessary to further facilitate paperwork or participant concern.
3. Participants were recruited on the basis that they were willing to take part in a focus group discussion on the use of live plants and animals in the classroom. They were informed they would receive a free lunch and travel reimbursement. Once at the focus group, facilitators also provided a variety of informational booklets and resources for professional development and classroom application (Appendix D).

Focus Group Format

In this study, each of the six focus groups convened between 9-10 AM and continued until 2-3 PM, including a one hour lunch and a couple of 15 minute breaks. I facilitated focus groups in Oregon, Los Angeles, and British Columbia; and Dr. Wei Ying Wong, from Connecticut College, facilitated groups in Washington, Chicago, and Ontario. Each focus group had a strict protocol for both beginning and ending, but conversation during the session was directed by the knowledge, experience, and interests of participants. The flow in each focus group was slightly different, although all main questions were covered in each.

Objective: The objective of each focus group was to 1) provide depth and specific examples to help interpret the results of an international survey regarding the use of invasive species in the classroom, and 2) as problems or needs were identified, develop a list of solutions or tools.

Approach: After introductions, the informed consent document was reviewed and signatures secured after all participant questions were addressed. A brief over-view of how the focus group would proceed was followed by another opportunity for participants to ask questions. The proceedings were audio taped, and videotaped for further analysis (see discussion below). A lunch break and two 15 minute breaks were provided during the focus group.

SAMPLE AGENDA

- 9:00 AM-Research team meets to prep everything for the event
- 9:30 AM-Sign-in and Paperwork (informed consent, reimbursements, etc.)
- 10:15 AM-Introduction to Project (welcome, agenda, location logistics, introductions, and overview power point)
- 10:45 AM-Focus Group Dialogue:
Tentative Schedule-10:45-11:15 AM-Question 1; 11:15-11:45 AM-Question 2
- 11:45 AM-Lunch
- 12:30 PM-Focus Group Dialogue:
Tentative Schedule-12:30-1:00 PM-Questions 3; 1:00-2:00 PM-Question 4
- 2:00 PM-Debrief and Wrap-up (refer to concerns and solutions; question 5 debrief, conclusion power point, recruitment for phase three)
- 2:30 PM Adjourn Focus Group

During the focus group dialogue a series of four questions was used to elicit information about values, concerns, knowledge, and solutions from participants. Each of the four questions built upon the foundation of previous answers to eventually culminate with viable suggestions for solutions. Those four main questions and associated probes are summarized below.

Main Questions

In an attempt to discover core values espoused by participants, the first main question was, “What values do living organisms have in science education and in your classroom?” For this first question, a few minutes were provided to ponder responses, and all were encouraged to privately write down any feelings or responses. Furthermore, for the initial question, a round

robin format was used to elicit a response from every participant. Following the first lap around the table, the discussion was then opened to general comments and opinions. Probes were used to glean further information as appropriate:

- What kind of living organisms do you use in the classroom?
- Why did you specifically pick these?
- How do you use them?
- What is your source or vendor for living organisms?
- Do you know if they are native or non-native species to your area?

The second main question asked about some of the concerns with living organisms in the classroom. The facilitator took notes on a flipchart summarizing each concern offered by participants. The flipchart was used to prevent repetitive comments, and as a reference for the solutions section in question four. Following the protocol of the theoretical model, concerns helped researchers learn about the real and perceived barriers faced by educators. The additional questions used to bring out concerns included:

- What happens to the classroom living organisms when you are done with them?
- What would have been a satisfactory way of dealing with them?
- What do you think should happen?
- What about euthanizing, how do you feel about that?

The third main question assessed knowledge about invasive species; the group would have been interacting and communicating for over an hour before the topic of invasive species was ever introduced. The initial question posed to participants in this section of the process was, “define invasive species.” In most groups, this question reverted to the round-robin method, and the facilitator provided a few minutes to think about the response. This series of questions was asked to draw factual information as well as personal and institutional norms existing for educators. Probes used to glean information on this topic included:

- How concerned are you about invasive species? (problem)
- What about aquatic invasive species (AIS)?
- Do you know if any of the living organisms you use in your classroom are AIS?
- Where might you seek out information to find out whether an organism is AIS?

- Do you handle the AIS any differently than other living organisms?
- What about disposal, different treatment?
- Who should be responsible for disposing of living organisms?

The fourth main question was, “What are some potential solutions for dealing with the concerns we’ve identified about invasive species in the classroom?” Usually the question would be asked followed by a brief break for thinking and processing. Again the round-robin format was utilized for one round, and then once everyone had spoken, the opportunity was granted for everyone to continue the conversation. The question was prefaced with the assumption that money and time were not limiting factors, and therefore, some of the solutions tended towards grandiose. The specific probes associated with practical solutions included:

- Where do you go to learn more about the living organisms you use in the classroom?
- What would help you learn more about aquatic invasive species?
- What kinds of information would you want about AIS?
- Where are credible sources for that information?
- What kinds of material for classroom would be effective?
- What might make you want to use those materials?

After the completion of the four questions, participants were asked to participate in a reflection activity the researchers dubbed, “Next Steps.” They were given a few minutes to ponder and respond to two questions reflecting the larger three-phase project:

1. Based on what you have learned and heard today, what will you now do differently?
2. What are your expectations for us in the coming months?

Following this debriefing session, a short recruitment speech was offered to shore up further contact and commitment to the next phase of the project, and the focus group was ended. The focus group was intended to step participants through a discussion of values, concerns, knowledge, and solutions related to AIS in the classroom. The values proved helpful in assessing attitudes and behaviors, which in turn informed the underlying premise of any solution. Concerns surfaced as potential barriers, on a personal or institutional level, to any solutions developed, enforced, or proposed. The knowledge section added a referencing benchmark that

researchers in phase III, and others concerned about this pathway, can build on. Finally, discussion about solutions provided ideas about ways to address this issue in real-life settings.

Recording Methods

Two primary methods were used to record the data at each focus group, audio and visual. The main method was video recording because it allowed both researchers and transcribers the ability to decipher who was talking at any given time. This was important because it allowed coding at the individual level and then associating each response with demographic variables for later analysis. The demographic information collected was gender, grade level, school district, state, and country. The main video camcorder used was a Sony DCR-47. With an internal hard drive of 60 GB, researchers were able to record each focus group with ease without switching tapes or causing any interruptions with the focus groups. Generally the camcorder was placed in an area where it was able to record the whole group, usually in the front of the group or to the side of the moderator. The audio recording was used as a backup in case the video camcorder couldn't pick up the audio from the teachers. It was generally placed in the middle of the table to pick up all the voices of the teachers. In the focus groups, we used an Olympus DS 40 audio recorder. Flipcharts, personal notes, and participant written notes were also additional methods of recording information.

Transcription Methods

Immediately following each focus group, researchers uploaded the video files onto a computer to provide a back-up in case something should happen to the actual recording. From there the video files were uploaded onto the www.oregonstate.edu/media site in order to share the video with the entire research team. The audio files were also uploaded onto the computer immediately following the groups, but they were distributed through Yousendit.com emailing service. Since there were two different recordings, the transcription process was smooth as a system of checks and balances was built right into the recording. Transcribers watched the video and typed word for word what was being said for a minute or more. Then they would listen to the audio recording to confirm that what they had typed matched what was actually said. This was done for nearly 25 hours of live footage, producing thousands of lines of transcripts. To systematically check transcribers' work another person would go through a small part of each

transcription to check reliability and consistency. This inter-coder reliability test was performed because checking every word was not feasible. The protocol was to verify five minutes for every hour of data. The two transcribers were not allowed to check themselves. The checkpoints produced consistency 98% of the time; in fact, there was only one instance where the verification did not align with the transcription.

In addition to taping the actual focus group, researchers also strategically taped the introductory minutes to capture footage on demographic variables as each participant went around the table introducing themselves. Each participant was identified with a number, and transcribers used that identification number throughout the remainder of the transcript. Having video recording made it easy to decipher who was talking and it helped transcribers interpret when there was more than one person talking at the same time.

Analyzing the Transcript

With nearly 600 pages of single-spaced transcripts, researchers defined a protocol for beginning the analysis process. Bernard (2006) suggests that the first stage is to establish data units, and in this study the transcripts were numbered by line to assist in the coding process. The data units applied are participant name, state or province affiliation, gender, grade-level currently teaching, school district, and comment. The majority of the data units were gleaned from introductory dialogue each participant provided, but the comment data unit is the actual conversation that went on throughout the focus group. Any names used in the dialogue were preserved to provide context for analysis and reference for potential solutions. The questions asked by the facilitators are also included to provide the whole picture for readers. Because there were two facilitators and many different focus groups, including the questions allows future studies of the transcripts to be undertaken based on the context of the actual questions asked in each focus group.

Coding Methods

The daunting task of coding 25 hours of data was overwhelming at the start. Research assistants estimated that for every hour of footage, it took five hours to transcribe, five hours to code, and five hours to analyze. Roughly speaking, that puts just under 400 hours of labor to crunch through the data. Bogdan and Bilken (1998) parallel the process of qualitative data analysis to a

funnel where things are open at the beginning and more directed at the bottom. The qualitative researcher plans to use part of the study to learn what the important questions are. He or she does not assume that enough is known to recognize important concerns before undertaking the research.” Utilizing this description, a five-step protocol was used to code the transcripts.

Step One: Study the purpose and objectives of phase two of the AIS Project. Marshall and Rossman (1999) suggest that anytime someone codes transcripts, they need to constantly have the objectives of the study in the back of their minds and frequently ask themselves—what are you trying to learn? Because the questions were founded upon the framework of the theory of planned behavior, the primary level of coding was based on identifying values, knowledge, and concerns or barriers that would lead to viable solutions.

Step Two: Code the first level of analysis—values, knowledge, concerns and solutions—in the transcripts. The Los Angeles, CA group was selected as the pilot transcript to develop the codebook to be used for the remaining five groups. Based on the flow of the questions, the majority of the coding followed the order of the questions, but many variations surfaced within each question type. Table 2 describes the types of comments in each of the first level codes.

Step Three: Following the initial pass of coding the data into the four general categories, the resulting 1,800 comments were individually entered into Excel with corresponding demographic variables. First-level codes were then analyzed two more times, resulting in secondary and tertiary codes. When the third level of analysis was complete, there was 35 total codes for the data—values (9), concerns (11), knowledge (6), and solutions (9). Refer to Appendix E for definitions and examples from the codebook. Refer to Appendix G for an overview of AIS project methods.

Table 2: First Level Coding Examples

VALUES	It's valuable, it's really incredible, it's important, it's fortunate, I feel that, I actually witnessed a change, it's great that, it's wonderful that, connectedness, purpose, I want, I have used them as, it's huge to learning, it makes a difference.
KNOWLEDGE	I know that, I don't know, it looks like this, we have, taxonomy, I have learned that, I think from experience that, I have seen, I never understood until.
CONCERNS	It's difficult to, I find it hard to, I cannot, I will not, how can I possibly do that, when will I find the time to, it's an issue, it's rigorous for the teachers to, limited space, unfortunately, how are we supposed to know what is going on, misidentification, I don't want, the problem is.
SOLUTIONS	It is our job to, I have seen this work, I wish we were doing this, I think this would help the problem, we tried this out, a good solution would be, we need to have, I really want, I like the idea of, you can do this or try that.

Step Four: Many of the third level codes still contained hundreds of responses, so several categories were coded to a fourth level. The protocol here was to divide comments based on keywords highlighted in the third tier of coding. With a fourth level of coding, the codebook became much bigger and more complex. At the end of this fifth step, all the comments were divided into individual excel worksheets to simplify the analysis process.

Step Five: The final stage of coding was another round of inter-coder reliability, this time for the coding process. Two individuals who had not been involved in either transcribing or coding were given a sample of 10 pages of transcript, without any markings, with the entire codebook and its explanations, and they coded based on the codebook developed. Results showed a 90% reliability test at the third level and above 80% at the fourth level.

Analysis Methods

Data analysis began by reviewing each tab within the excel database for error. Rubin and Rubin (2005) summarize some of the methods corresponding to qualitative data analysis as sorting, comparing, and listing. The data were sorted at each level, where frequency tabs were formed, and graphs made to illustrate relationships and influences. At each level, comments were

selected as representative of their respective categories, and each connected back to the theoretical framework.

RESULTS

This section will include demographic information gathered on each participant and the results from the dialogue of each focus group. The unit of analysis is each individual comment, but group level analysis also a portion of the results commentary. Results will be discussed by first level codes: values, knowledge, concerns, and solutions, all placed within the context of the modified Theory of Planned Behavior.

Participant Demographics

In total, 65 participants attended the various focus groups to provide information for the project. Table 3 shows the legend used for the remainder of the demographic variables. All figures use these corresponding denotations and definitions. Participants were predominately female (83%), and 40% were elementary, 20% middle school, and 25% high school teachers (see Figure 3). The remaining 15% were a combination of seven different denotations. Figure 4 displays the participants by location, followed by a description of each focus group and its associated demographic characteristics.

Table 3: Focus Group Participant Legend

PARTICIPANT LEGEND		
Symbol	Denotation	Definition
H	High school	Individuals that teach grades 9-12
M	Middle school	Individuals that teach grades 6-8
E	Elementary school	Individuals that teach grades K-5
OS	Outdoor School	Individuals that teach special outdoor programs
Z	Zoo	Individuals that teach or coordinate at zoos
OC	Outreach Coordinator	Individuals that reach out to teachers at multiple schools
P	Principal	Individuals that are principals of a school
C	College	Individuals teaching at community colleges or universities
L	Librarian	Individuals who work as school librarians
AE	Adult Education	Individuals teaching adult learning courses

Figure 3: Grade Level Distribution

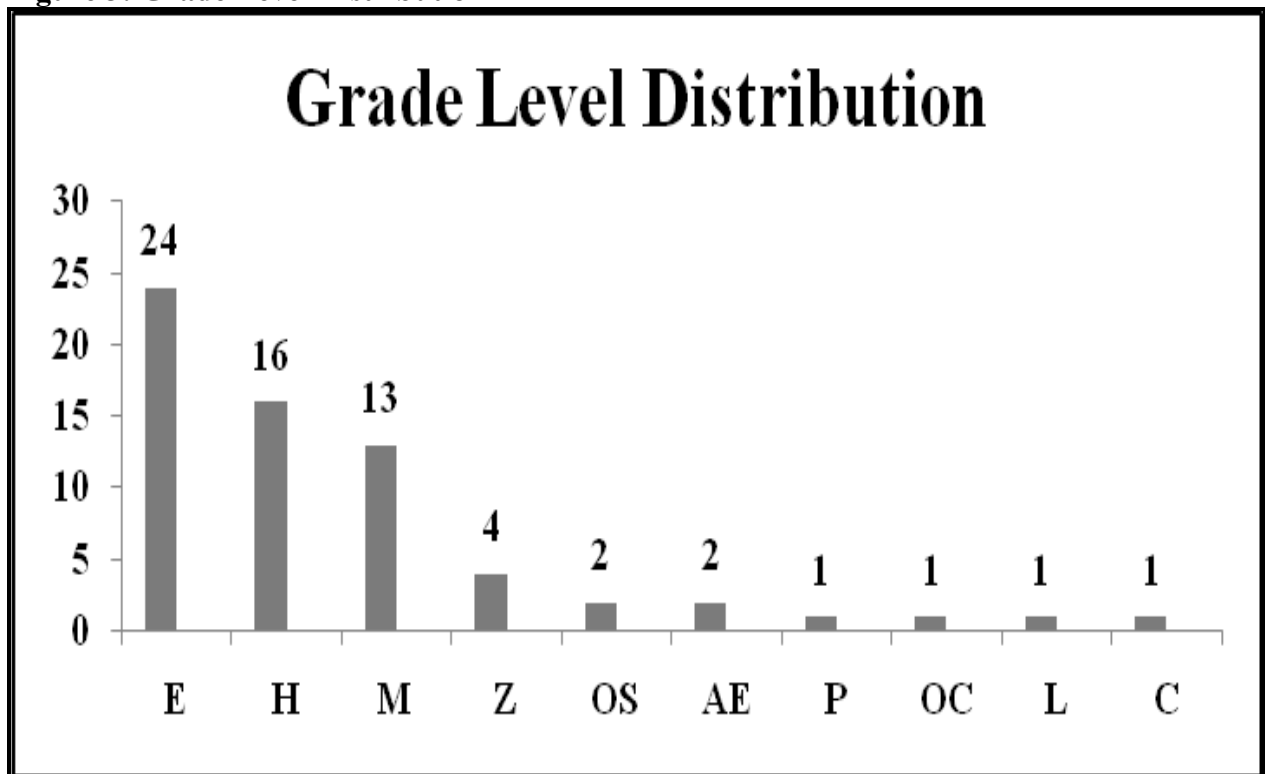
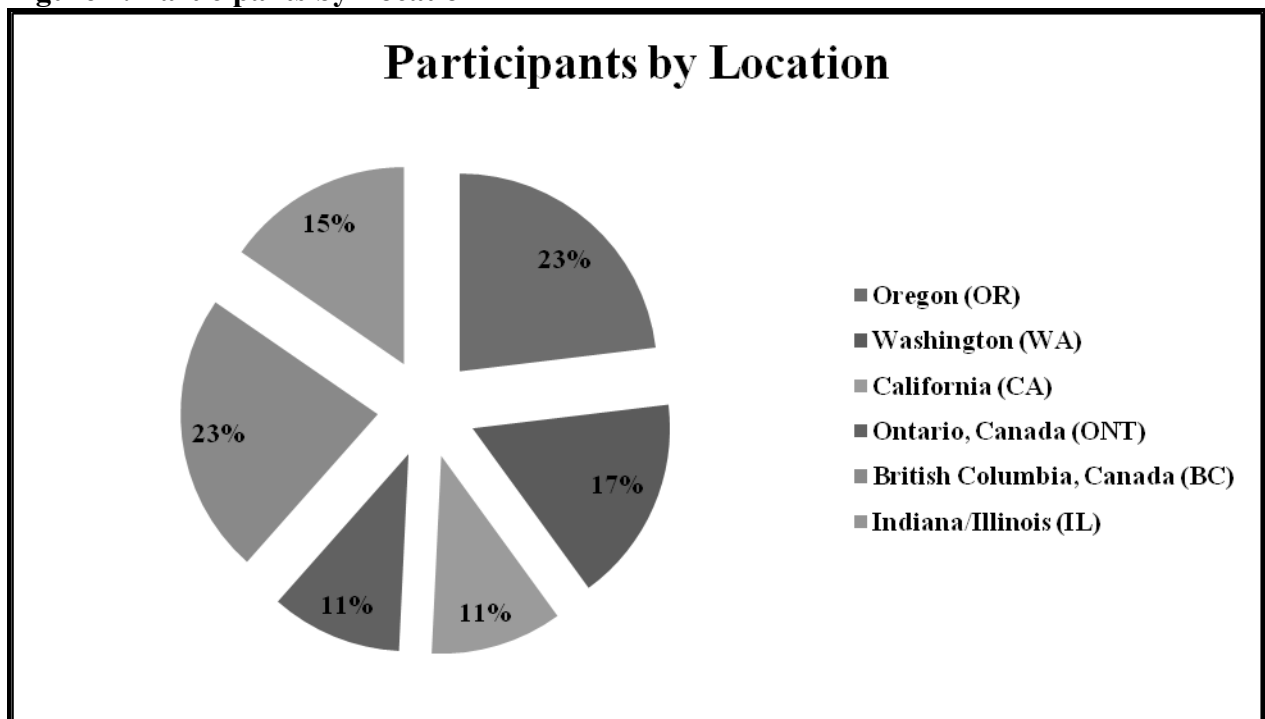


Figure 4: Participants by Location



- **Oregon Focus Group:** On July 16, 2009, at the Portland Zoo, in Portland, Oregon the first focus group was held from 11 AM-4 PM. The fifteen participants included: five elementary teachers from Corvallis School District (2), Salem-Keizer School District (2), and Redmond School District (1); five middle school teachers from Portland School District (2), Beaverton School District (2), and Mapleton School District (1); three high school teachers from Astoria School District (1) and the Beaverton School District (2); one zoo educator from the Portland Zoo; and one principal from the Mapleton School District. Two males and thirteen females participated in the Oregon Focus Group.
- **Washington Focus Group:** On July 20, 2009, at the Woodland Park Zoo in Seattle, Washington the second focus group was held from 10 AM-3 PM. The eleven participants included: five elementary teachers from Lake Washington School District (2), North Shore School District (2), and Seattle School District (1); four middle school teachers from Central Kitsap School District (2), Seattle School District (1), and a private school district (1); one high school teacher from the Orchard Prairie School District; and one zoo educator from the Woodland Park Zoo. Two males and nine females participated in the Washington Group.
- **Los Angeles, CA Focus Group:** On August 7, 2009, at the University of Southern California (USC), in Los Angeles, California, the third focus group was held from 9 AM-2 PM. The seven participants included: one retired elementary teacher; two middle school teachers from the Los Angeles School District; three high school teachers from Santa Monica-Malibu School District (1) and Peninsula School District (2); and one adult educator from the CA Sea Grant. All participants in the L.A. Focus Group were female.
- **Toronto, ONT Focus Group:** On August 10, 2009, at the Ontario Government Complex in Aurora, Canada, the fourth focus group was convened from 11 AM-4 PM. The seven participants included: three elementary teachers from the Sudbury School District (1), the Peel School District (1), and an unnamed school district (1); two high school teachers from Thunder Bay School District (1) and an unavailable school district (1); a new community college teacher; and a zoo educator from the Toronto Zoo. Three males and four females participated in the Toronto Group.

- **Chicago, IL Focus Group:** On August 12, 2009, at the Chicago Brookfield Zoo, in Chicago, Illinois, the fifth focus group was held from 11 AM-4 PM. The ten participants included: three elementary teachers from the Kilmer School District (1), the Crown Point School District (1), and the Chicago Public School District (1); two middle school teachers from the Westchester School District (1) and the Columbia School District (1); three high school teachers from the Riverton School District (1), the Thornridge School District (1), and the Township School District (1); one librarian from the Parkridge School District; and one zoo educator from the Chicago Brookfield Zoo. Two males and eight females took part in the Chicago Group.
- **Vancouver, BC Focus Group:** On August 28, 2009, at the Vancouver Aquarium, in Vancouver, British Columbia, the sixth focus group was held from 10 AM-3 PM. The fifteen participants included: seven elementary teachers from Surrey School District (3), the Vancouver School District (1), the Richmond School District (1), the Burnaby School District (1), and the Delta School District (1); four high school teachers from the Port Alberni School District (1), the Surrey School District (1), the Richmond School District (1), and the Duncan School District (1); one outreach coordinator from Okanagan; two outdoor school educators from the North Vancouver School District, and one adult educator from Williams Lake. There were 13 females and two males in the Vancouver Focus Group.

Data Distribution

The data for this project are the coded transcripts. Each coded comment became the unit of analysis. In general, the comments were evenly distributed across the six focus groups (See Figure 5). The average number of comments from a focus group was 283, but due to differing length constraints, participant personalities, and overall facilitation variance, the range was from 238 (WA) to 359 (CA) (see Figure 6). Refer to Appendix H for individual breakdowns for each state/providence.

Figure 5: Percent by State

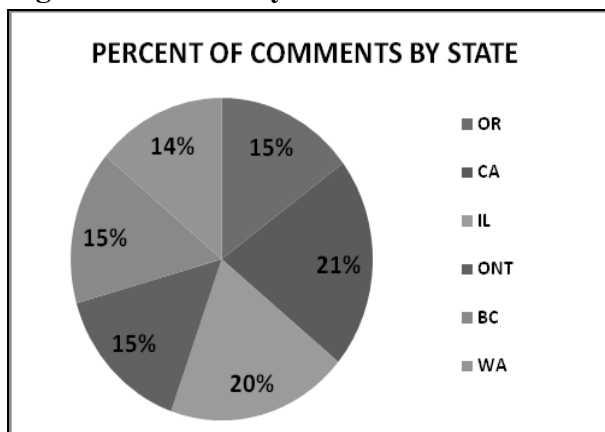
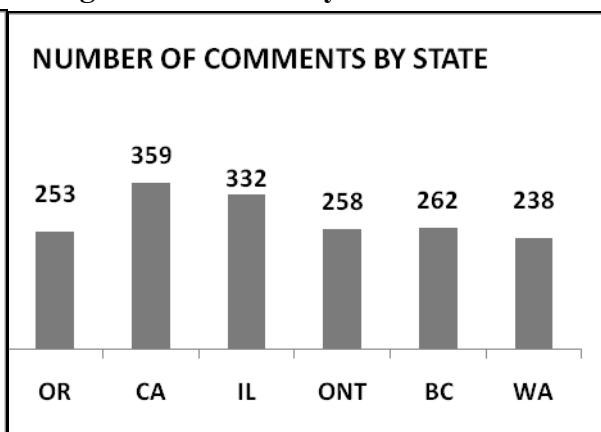


Figure 6: Number by State



VALUES

Questions related to values were asked at the beginning of every focus group to allow participants the opportunity to explore the personal values they associated with various aspects of live plants and animals in the classroom. After posing the initial question and giving participants the chance to write down thoughts and feelings, their responses were individually elicited. More than half (60%) of these comments were about the educational values related to the importance of live plants and animals in the classroom. Other values mentioned by participants included ethical issues (22%) and specific uses (18%). The predominance of educational values was consistent across states, gender, and even at the individual level. One teacher's opening comment is exemplary of the values expressed by participants: "To me, if you don't have living things in the classroom then you're taking away that opportunity to really focus on what it means to be a living thing yourself."

Educational Values

Three major themes surfaced from analysis of the educational values associated with live plants and animals in the classroom: stewardship, motivation, and calming effects. Stewardship can be defined as learning or teaching environmental values within the classroom. Motivation means the influence live organisms have on the attitudes and behaviors of students in the educational environment. Calming effects are associated with organisms building confidence and destroying fears within the individual student.

Stewardship

There is value for students in learning about live organisms and how to be good stewards of both the organism and its surrounding environment. Many participants (65%) discussed this learning-stewardship interaction, and those comments about learning and stewardship or learning and connectedness speak to the value of passing on a legacy of outdoorsmanship and stewardship.

One teacher illustrated this point, “It’s also wonderful to see, and I think a lot of people touched on this, is a group of students working together in trouble shooting, problem solving, caretaking, really learning.” Awareness, teaching, connectedness, learning, and stewardship were common descriptions offered by participants. An elementary teacher said, “You know the connection with them having, we have eggs in the center of the classroom, the connection those kids have to the eggs when they start to hatch and they don’t understand it, these fish don’t know how to swim, they have to develop that.” Many participants talked about how live organisms truly connect students with their outside environment for the first time. Additionally, several comments highlighted the sheer value of students just learning from live organisms, echoed here by a high school biology teacher, “They [students] get to learn about the anatomy and behavior, biology, ecosystem relationships and other kinds of stuff. It’s a combination of ethical life experience and educational opportunity.”

The participants’ high regard for learning and stewardship opportunities through the use of live organisms was balanced by a few less than positive comment such as, “Typically, a lot of them [teachers] see value but they’re not sure if it’s worth all the work and they get really frustrated, that’s what I get from other teachers with, um, who maybe aren’t that much in science and stuff.” Participants at every location discussed, often in great detail, the importance of stewardship and education with live organisms.

Motivation

The second theme that emerged from analysis of the value comments is the motivational effects associated with direct organism interaction. As one high school teacher described, “We have a lot of withdrawn kids come in. My room is open at lunch hour, we have rabbits and stuff so any kids that are withdrawn and maybe don’t socialize that well they’ll often come in at lunch and sit

and pet the animals and that sort of thing, the interaction motivates them.” More than three-quarters of these motivation comments spoke about the stimulating and interactive nature of live organisms. A passionate elementary teacher said,

A lot of the kids now days learn in so many different ways and having something in there [classroom], hands on, will teach some of the kids that will be lost in there otherwise. The big thing that you guys have mentioned is the hook, having them engage and excited about the learning, whether it be in their classroom or just their daily life.

An adult educator also discussed the motivational aspects of stimulating community involvement, “It’s really incredible that there are more and more realizations happening in communities of how important it is to have community gardens and to have school gardens.” School teachers, adult educators, outreach coordinators, and zoo staff all agree that live organisms have an implicit motivational factor for humans, at any age, who interact with them.

Calming Effects

The third educational value that emerged was about how live plants and animals have a calming or emotional affect on students. A comment from one middle school teacher sums up these values, “The furrier the animal gets, the more attachment people seem to develop to it.” Every group on the west coast (OR, WA, CA, BC) made reference to the calming influence live animals have in the classroom. Speaking of having a sea aquarium in the classroom one Canadian outreach coordinator reported,

It focuses observation, and for the at risk kids in particular or special needs kids in the school that’s the timeout period now. They’re freaking out throwing chairs, you sit them in this quiet little space by the seaquarium and they just immediately calm and that aspect of it I think is really important.

One elementary teacher reported, “It can be very loud during math time and everybody is busy and all of a sudden the frog will start croaking, and it’s a little bitty frog with a gigantic croak,

and there is instant quiet.” Teachers consistently discussed various ways in which live organisms had a calming or emotionally positive effect on students.

Use-Related Values

Teachers regularly highlighted additional values to live organisms not directly related to educational values. These included possession of live organisms, using organisms as a food source for other organisms, and creating a less sterile classroom environment. Some teachers use the possession of live organisms, for example, to teach responsibility through in-class chores: “During the school year I don’t clean the tank. I don’t clean anything when it comes to the animals. I don’t feed the animals. The students are responsible for 100 percent for the care of the animals, feeding and everything.” Furthermore, many teachers alluded to possessing classroom pets, but only a few teachers actually highlighted them as having value within the context of uses in the classroom. All these comments were from elementary teachers and one of them said, “I think in the elementary schools there are more organisms in the classroom where they just kind of have pets and they have to take care of them and the kids live for the animal for ten months.”

Participants in all but one group mentioned using organisms as a food source for other organisms, and some even collected non-native organisms to get rid of by feeding, but this was not mentioned as often as other values. An exemplary comment from a high school teacher describes these use values, “So I got a Venus fly trap because I figured that would be cool, to at some point feed them. Because the kids were really excited at that, you know like ‘can we feed it? can we feed it? can we feed it?’, and it was fun to feed.” Only a few comments highlighted the use of organisms to create a less sterile environment, but one middle school teacher described: “Because our classrooms are sterile, horrible fluorescent lit environment, I always have huge terrariums everywhere just because it smells better and I think it feels better and I think we have more oxygen in my room.” Although there are not as many use related comments as educational values, they appear to contribute to how teachers construct their value of classroom organisms.

Ethical Values

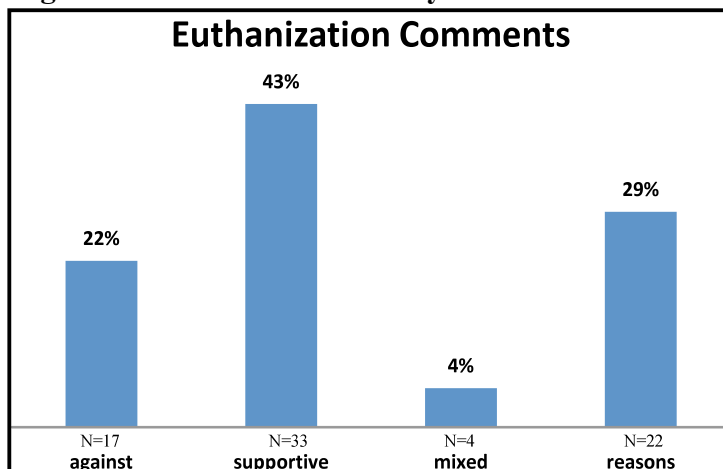
The final category of values is ethical values. About 20% of values comments related to ethical values, with over 75% of those linked to issues regarding euthanasia. Other ethical values included communicating ethical issues about capturing, harming, or releasing animals, and what it means to have invasive plants and animals in the classroom.

Euthanizing organisms is a touchy subject in any environment, but the teachers were more than willing to share their feelings and offer suggestions. Their perspectives varied from those absolutely against the thought of it to those that would do it but did not want to and then to those who were fine with euthanization. When asked about euthanasia, one teacher replied, “Easy to say but hard to do.” Another added,

I tell the kids the worst thing I have ever dissected were human beings and they were like, “Oh my gosh, why did you have to do that?” and [with] invasive species, I don’t know, I wouldn’t have a problem euthanizing those things but I think getting them and knowing that I will just have to euthanize them when I am finished with them. I mean I don’t want to do it unnecessarily I guess.

An outreach coordinator described her attitude at how euthanizing classroom organisms can serve multiple purposes, “I think as long as it is a teaching mechanism that it’s okay. And I think that our society is far too protective about death and the sense that you’re actually genuinely teaching life cycles and ecosystems and that kinds of activities I mean there is a whole life cycle

Figure 7: Euthanasia Summary



associated with every single living thing and some of them are very short and some of them are very long and that is just reality.”

Results from the focus groups suggest no conclusive evidence of the educators being for or against euthanasia, but the individual comments aggregated together point to a clear message that euthanasia is seriously considered by all participants, even those who are willing to do it. As shown in Figure 7 about 43% of the 76 comments related to support of properly euthanizing, 22% were against, 5% were mixed, and 29 % of the comments were about reasons why they felt one way or another. Based on a few comments, teachers show a slight difference in their willingness to euthanize an invasive species versus a native or non-invasive species, but there is not enough information to draw conclusive evidence from this data.

The second ethical value revealed through the analysis relates to the issue of animal captivity, harm and release. The results show a wide variety of responses. One elementary teacher responded, “I’m on the fence with captive animals to be honest with you. Most of what I have done has been capture and release, so this is a new thing for me.” A high school teacher speaking for teachers in general said, “And a lot of teachers do [release organisms], they would prefer to release as oppose to killing them.” There is not enough evidence from this study to understand any of the variables that might contribute to educators’ values about releasing organisms.

The final ethical value regarded the use and possession of invasives in the classroom, and participants’ comments can be summarized by the response of one adult educator, “Don’t have them in your classroom.” Participants claim they would treat invasive species differently than other live organisms. One teacher said, “As far as invasive plants are concerned, I remove them...will burn knapweed because I am really worried about dispersals and inadvertently one seed falls and you are done.” Another reported, “I guess I don’t value the lives of invasives as much as other organisms.”

Table 4 is a summary of the educational, uses, and ethical values associated with live plants and animals in the classroom. Within the Theory of Planned Behavior, these values now set the stage for understanding and analyzing the knowledge teachers draw from in addition to their values.

Table 4: Summary of Values

VALUES
1. Educational values, including stewardship, motivational, and calming affects are associated with live organisms in the classroom; this doesn't vary by state, gender, country, or grade level.
2. Participants value the use of live organisms because possessing them connects students to the outside environment and greatly enhances the classroom environment.
3. Euthanasia is the most commonly mentioned ethical concern although there is no consensus about the willingness or ability to euthanize live organisms.

KNOWLEDGE

We engaged participants in a round-table discussion about the definition of invasive species. Participants were asked one by one to define invasives species or to build on the things that had already been said. As a result, every focus group hit each aspect of the 2006 definition outlined by the National Invasive Species Council (NISC), which defines an invasive species as, “a species that is non-native to the ecosystem under consideration and whose introduction causes or is like to cause economic or environmental harm or harm to human health” (Invasives White Paper, 2006: p.7). The NISC also says invasive species can be plants, animals, and other organisms (e.g., microbes) and human actions are the primary means of invasive species introductions. Of the comments related to participants’ knowledge, 40% were definitions of invasive species, 38% were referring to knowledge about individual species and what kinds of organisms’ teachers had in their classrooms, and 22% discussed the credibility of information teachers accessed. Each of these categories is discussed below.

Definition of Invasive Species

Participants consistently described three components of invasive species: (1) species introduced or transported to a new area; (2) species takes over (invades) area due to lack of predators; and (3) introduced species competes with native species for resources (space, food, etc). In one focus group, a teacher told us, “I think most invasive species that I know of are inadvertently introduced by humans.” Another responded, “One that can out-compete natural species in their

region.” An outreach coordinator added, “Anything that is directly harming plants and animals that are native to the area.” These definitions provided by educators are perfectly aligned with the NISC definition of invasive species.

Participants also provided evidence of more sophisticated knowledge about invasive species. One commented, “I was just going to say that if it is non-native I would think that it can be considered non-invasive because maybe it is not out-competing the native species there; so if it is not out-competing other species than I wouldn’t consider it necessarily invasive even though it is non-native.” Another added, “Well, if you introduce a species that doesn’t necessarily become invasive, then invasive is a whole different definition. A species can be introduced but not be invasive so you kind of have to separate the definition.”

We did hear from participants that they believed people—both in education and outside of it—do not know much about invasive species. For example, a high school teacher suggested,

The average U.S. citizen knows very little about the invasive species or their definition because Roper [a survey group] did a study for one of the environmental groups and it was dealing with environmental science and invasive species in the United States. When they gave that survey to adults, only one out of 25 who took the survey would score 70% or above. Pretty scary results.

Participants’ knowledge about invasive species is fairly extensive as they collectively understand what an invasive species is and what it means for the environment.

Species Knowledge

When asked what they know about invasive species, participants talked about three species-related topics including: (1) lists of organisms, (2) sources of organisms, and (3) disposal of organisms. Sources and disposal considerations will become important when the practicalities of solutions are critically examined. Each of these topics is reviewed below.

List of Organisms

For the sake of time, participants were not given a long opportunity to share every creature they ever had in the classroom, although we did ask them to write a list prior to the start of this discussion. But, some of the teachers could not resist the opportunity to describe the variety of organisms in the classroom. One elementary teacher told us,

I have had crayfish, I wrote down crayfish, chicken, lizards, salamanders, beetles, slugs, butterflies, when you buy organisms commercially they are very expensive so rather than buying Bess beetles we'll just go out and collect beetles from around the garden. I have a Plath row of slugs.

Other teachers had goldfish, gerbils, rats, fish, and many other organisms. Very few of the classroom organisms are considered invasive species, but it is safe to say that teachers participating in the focus group have a wide variety of organisms in their classroom at any given time.

Sources of Organisms

Participants provided information about the sources they are using for their classroom organisms. The initial results show that 35% of participants report sourcing organisms from supply houses, with an additional 25% borrowing organisms. Pet stores and nature rounded out the major sources by combining for nearly 30% of the responses. There do appear to be differences by grade level as to sources of classroom organisms, (Figure 8), with elementary teachers predominately reporting biological supply houses as a main source (47%) while high school teachers are tending to get their organisms from pet stores (31%). All levels also used borrowing and collecting from nature as a common method for obtaining organisms in the classroom.

Figure 8: Sources of Organisms

Sources of Organisms by Grade Level				
Source\Grade Level	Elementary	Middle School	High School	Other
Pet Store	0%	24%	31%	0%
Supply Houses	47%	41%	15%	29%
Nature	18%	12%	15%	0%
Online	6%	6%	0%	0%
Science Centers	0%	0%	15%	0%
Organizations	6%	6%	0%	14%
Borrowing	24%	12%	23%	57%
	n=17	n=16	n=14	n=7

One high school biology teacher reported, “Well, like the snails in my classroom, I had to get a USDA permit, so I would say that’s invasive; but the other ones, if they’re allowed, like you can buy them from the biological supply house.” This was a rare comment, because high school teachers tended not to report biological supply houses as sources. Others described the variety of sources: “I think even just Petco. I get crickets there to feed the tortoise and I use it for observational studies,” and, “They come from Carolina biological supply and I’m confident they got something local in the beginning and been breeding it ever since, so I know it comes from someplace else, probably.” One comment showcases the role of the internet: “Craigslist, that’s where I got my lizard and have gotten other animals.”

It is increasingly evident that many live organisms used in the classroom are not sourced from a professional biological supply house. The policy implications associated with additional sources could be an important finding later on in the AIS in the Classroom Project.

Disposal of Organisms

Asking participants to discuss possible disposal methods resulted in a wide variety of responses. Primary methods of disposal include freezing, giving away and composting. The comments associated with disposal do not necessarily refer only to invasive organisms, but to all classroom organisms.

While a small portion of respondents described releasing an organism into the wild when they were done using it in the classroom, we did hear participants describe practices that may be

delayed release: “I know some teachers that will allow, with a note from home, the kids can take the animal’s home or the plants home at the end of the unit.” Others described other methods of disposal. Another confidently concluded, “Probably freezing that goldfish is going to be much less stressful than letting that goldfish swim sideways in that tank.” One participant described a professional practice at a NOAA workshop: “When I was at NOAA last week, they had a grinder and when we were done with the slit dissection we put everything in the grinder into a bucket and then they disposed of it.” And another told us, “When they die I bury them on their own of course. I’ve never euthanized anything that was sick.” Participants seem to have a familiar set of disposal methods that they use depending on the organism, regardless of protocol or policy.

Information Sources

Most of the participants referenced two places they go for credible information: online and to organizations/agencies. For all practical purposes, those two could be combined in many circumstances to involve surfing agency or organization websites for helpful information. A middle school teacher said, “I would go to the internet probably in environmental education, there’s lots of science and good sources.” A zoo educator said, “To Google.” A seasoned high school teacher added,

Online. I find COSEE, I find NOAA, I find a million websites, I have a teacher list serve that I get ideas from and I just research it and I assign the kids to research invasive species projects, so I look up names of invasive species all over the world and they [students] researched them.

Other participants asked colleagues, pet stores, colleges, or government agencies by phone or in person. A small percentage of respondents (18%) consider biological supply houses and FOSS curriculum representatives as credible sources. FOSS is a research-based science curriculum for grades K–8 developed at the Lawrence Hall of Science, University of California at Berkeley, and implementing their curriculum requires the purchasing of organisms. One elementary teacher said,

The FOSS website for our science program [is a good source] because our science program is really organized and it sounds like you guys kind of have to flounder where as ours is all laid out. You use the beetles for so long, destroy them. You use the plants for so long, destroy them. They give us everything including the website.

Participants consider a variety of sources credible, but seem to favor information they can access online. Table 5 summarizes the core results from the knowledge portion of the focus group questions.

Table 5: Summary of Knowledge

KNOWLEDGE	
1. Participants can define an invasive species as a collective group, but in general need more information about specific invasive species. They also perceive a lack of knowledge about invasive species in the general public.	
2. Participants have a variety of species in the classroom from many sources, and biological supply houses are not a major source for most of the participants. Freezing, giving away, and composting are common disposal methods.	
3. Participants consider government agencies and universities as credible sources of information, and prefer to access information online.	

CONCERNS

Concerns are those comments that describe participants' perceived behavioral controls and barriers to change. Most identified concerns were related to logistical issues (e.g. time, resources), although participants also described barriers related to the practice of euthanizing, damages caused by spread of invasive species, and the lack of childhood outdoor experiences. For one of the first times in the analysis, there are differences across countries. US participants overwhelmingly described logistical barriers while Canadian participants tended to describe multiple barriers.

Logistical Barriers

Multiple logistical concerns were identified, with many participants consistently reporting specific policies and issues related to species handling as critical barriers. In addition, time, cost, health concerns, and communication with biological supply houses were mentioned in every group at least once, suggesting that concerns are similar across differing locations and situations. Each logistical concern is reviewed below.

Specific Policies

This section highlights concerns about administration and support, curriculum coordination, and describes how many local, as well as state and national policies affect what participants do in the classroom. The most among these for US participants was lack of support and staff/faculty/administration. Canadian participants tended to talk more about curriculum and rules/regulations. Refer to Figure 9 for an illustration of the policy concerns that surfaced across the focus groups (n=97).

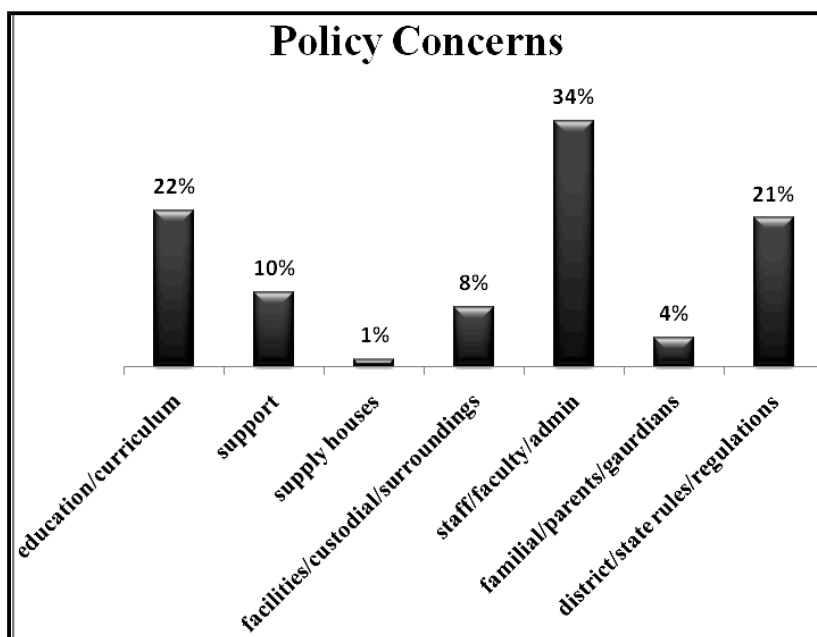


Figure 9: Focus Group Policy Concerns

One retired elementary teacher illustrated a perceived barrier when she described the policy concerns at her old school, “It seemed like often the administrators are being given different directives than the teachers are and that is a huge problem.” Other teachers echoed by suggesting, “One school that I worked at the

administration wouldn’t let me have snakes because the principle was deathly afraid of snakes. It wasn’t a good role model,” and, “Where I have to do work with inner city populations and the [policies aimed at] funding just aren’t there it always gets funded in biology, can’t get parents to

collaborate, can't do this, can't do that, the scheduling in high school, and that entire sort of thing."

Moving beyond administrative concerns, one Canadian teacher added, "Yeah, but there has to be more [policy] regulation I think too." Talking about other policy considerations, one middle school teacher added, "There doesn't seem to be any watch dog." Another lamented, "I would take that question one step further, and do the states have individual guidelines? Does Oregon? Does Illinois? Does Indiana? Do they have guidelines on what you should and should not be bringing into the classrooms? I've not read them if there are." One admission by a seasoned educator concerning the many policy implications described a strategy for dealing with policy barriers, "I think forgiveness over permission is much easier..." In many cases, the barriers teachers face, assuming certain value and knowledge levels, are coming from policy arenas including administrative interpretation of educational rules and regulations.

Handling Species

Details related to handling species—their care and disposal—were identified by many participants as concerns in having live organisms in the classroom. Regardless of state or country, participants in every group independently mentioned without being prompted by researchers, the need to better understand care and disposal of organisms. The source of information, whether a pet store, biological supply house, or another teacher, was not as important as credible facts. A middle school teacher said, "I don't know how to care for them." One experienced high school teacher discussed a difficulty: "How you keep the darn things alive? I mean if we lost nine fish in three hours, all I would have to do is break the water flow. So we have no problem killing them [salmon], but keeping them alive." While another added,

Another question is say an animal dies or something dies in your classroom, how do you go about disposing that? I mean, how is it going to affect [the ecosystem], do you just put it in the trash, do you? There are so many questions that come up, it's not just the living ones, yes the living ones do more damage but you've got to think of all avenues.

Combining the disposal issues with release and care concerns, a high school teacher noted, “Release issues or how to deal with them in June, whether they’re too big or what.” A high school teacher added, “I just don’t want to take care of this thing over the summer and during March break. I don’t want to bring it home; so I don’t have animals. I have never had animals and I probably never will have animals unless I can see some fitting into that schedule.” A knowledge related to understanding how to care for organisms appears to exist for many participants.

Time

Some participants identified time—securing, caring for, disposal, etc—as a major concern when thinking about the use of organisms in the classroom. And, some of these comments suggest time as the main logistical barrier for individuals. One teacher said, “Time is a big issue and that is why I have given up on animals. The way animals are set up I don’t have time.” Another elementary teacher added, “Sometimes I question just having them in the room; for me, because it’s so much of my time.” Extending beyond school use, one zoo outreach coordinator reported, “We get requests all the time to do stuff but you can only spread your volunteer base so thin.”

Cost

According to participants in every group, live organisms are not only expensive, but they are often funded by teachers’ personal monies. However, the enhancement to the classroom is of such value to them that they are mostly willing to bear the extra expense. We were told: “funding is really critical,” “cost is always a big thing,” “I’m going to say it right up front, funding. I have no money for food supply and it is always coming out of my pocket.” A fairly new elementary teacher responded, “The initial setup cost like getting the tanks and supplies and body works, is an issue.” Time and cost were not discussed in great detail, probably because both are obviously well-understood and documented concerns within the profession.

Health and Safety

Nearly two-thirds of the comments about health and safety are related to allergies and sicknesses. Keeping students and organisms safe and protected from each other is a major concern within school policy and teacher liability. Participants were equally concerned about humans and

animals. On the subject of disease, one teacher reported, “Disease, not just the disease of the animal but diseases you can get and the cure we can have. One year we had this huge series of meetings about using reptiles and we finally do not allow the children who come here to touch the turtles in the classroom.” Another zoo educator added, “What about the animal? Do I have to clean my hands before hand? We have all this hand sanitizer but then I worry for the little mouse all this hand sanitizer isn’t healthy for them.” On the other side, an elementary teacher talked about her students by suggesting, “So I am responsible for keeping my kids healthy and safe and they are not going to keep their hands off the chicks. So I don’t have them in my classroom.” Health and safety issues appear to be a logistical concern that can lead to a barrier to using live organisms in some classrooms, schools, and districts.

Supply Houses

Teachers uniformly describe wanting more information and resources from organism suppliers, not just biological supply houses but suppliers in general. More than half the comments describing a lack of information requested suppliers (e.g. biological supply houses, pet stores, and zoos) to better explain the species origin, what the organism thrives on, and what is to be done with the organism when it dies. This could be done through labels as one teacher suggests, “sometimes they are not labeled...they don’t normally say where they came from, that would be nice to know.” One adult educator, however, warned about dangers of relying on suppliers for information:

It [supplier] can also provide you with the wrong things even if they are education suppliers that have a long history, somehow building that confidence and building that responsibility and picture. You folks are all here because you care, but this room ideally would be so packed that we need a giant auditorium because everyone would be aware of the issue.

While participants are uniformly committed to the value of live organisms in the classroom, logistical barriers including policies, care and handling species, and lack of resources appear to weigh heavily on their decisions and classroom practices.

Ethical Concerns

The primary ethical barrier is related to the previously discussed values of euthanizing organisms when they are no longer needed. There continues to be no consensus on the ethical premise of euthanizing, but the data speak to a few informative trends. A middle school teacher summarized some of the differences across teachers as follows:

It's very different between the urban and rural community. I mean the schools I go to it would not be very hard to find the teachers that will do that [euthanize] for you. I mean there are so many farmers that are teachers there so it's a natural thing for them to do anyway. If you were going to go into the Toronto area or any of the big cities where they are not used to euthanizing animals or even knowing why you do it and things like that there would be a barrier about it.

We found a cross-section of how participants' values about euthanasia present concerns about the use of organisms in the classroom.

- Participants do not feel comfortable killing native species to be used in experiments, as is summarized by this response, "When you collect native species that are likely threatened or endangered there is a legal issue there as well as a moral issue."
- Some teachers feel that euthanizing invasives species is essential. An elementary school teacher speaking about euthanization in general said, "There are a lot of teachers who aren't and there is one person who is 'all right I'll do this, I have done it before.' It's fine, I am trained and I'll do it. It's not an issue."
- Other teachers are blatantly against the thought of euthanizing anything at all. A high school teacher with this perspective said,

I just don't feel comfortable with that. About two weeks ago I had to euthanize some quagga mussels and I felt guilty. I had to put them in the freezer and I felt like what a waste. I used it for an experiment. I was done with my experiment and I had to euthanize them by putting them in the freezer and I felt like gosh

these can be used for so much more. It could be used for many more experiments. Why my little experiment and now they die. What a waste. So I just feel like it's wasteful to do that.

The range of values participants expressed about euthanasia is reflected in the range of practices that they accept and use. In some, the prospect of euthanizing organisms definitely influences their use of live organisms.

Potential Damage Concerns

In relation to the spread of invasive species, participants in each focus group talked about ecological concerns, and two-thirds had this as their most discussed concern about potential damages. Oregon and California participants appear to be more concerned about economic and health implications than the participants in other states, and only women made comments about economic and health concerns. The ecological, economic, and health concerns associated with the spread of invasive species will each be discussed below.

Ecological Damages

Participants' concerns about potential ecological damages were discussed in terms of the ecological impacts and distribution channels of invasives. An outreach coordinator explained, "I don't bring invasive plants into the classroom at all because I worry about dispersal. So we have a plastic one we teach." Another concerned teacher added,

I would say I'm very concerned about invasive species because I live by the beach and every time they're replanting they're putting back ice plants and I just go ugh. Or I'm driving up I-5 and I see this tamarisk and I know it's pulling ground water and the fields are not being planted because they don't have enough ground water. And I try to be more aware of what I'm doing that would impact or encourage the invasives and try to discourage them.

Less often mentioned were ecological concerns about organisms escaping or being accidentally transported to foreign situations. An elementary teacher, discussing the ecological issues of invasives suggested, "it's concerning to me because it's all connected. All of our food chains

and everything and it eventually leads back to us.” Only two teachers expressly mentioned concern about invasives coming from the classroom. Educators are aware and concerned about the ecological impacts of invasive species, but do not necessarily view their practices as a big factor in the spread of invasives. A few teachers are deeply concerned with inadvertent release by teachers, while others are just not convinced that teachers contribute to the problem.

Economic and Health Damages

A few US participants expressed concerns related to the economy and health issues, while no Canadian described health concerns related to invasives. One US teacher reported: “We keep reading the newspaper about the catfish and the carp and the mussels and it’s just like it’s getting out of control and it’s going to impact financially the world supplies and food.” Another provided an excellent summary of participants’ concerns, “I feel like also it’s just like our health care system we’re dealing with the emergencies, we’re not dealing with the prevention.”

Children’s Outdoor Experience Concerns

A major issue introduced by participants was children’s outdoor experiences. Participants expressed frustration at all levels and locations that they really wished that children had a better outdoor experience. They report their beliefs that if students had experiences with organisms out of the classroom they would not be so crucial to curriculum. More than one half of the comments about childhood experiences expressed the wish that children were connecting better to the outside environment and exploring the outdoors free from concrete and buildings. One elementary teacher said, “So there is still that lack of connection for the natural environment throughout the grades and so I want to do even more with that.” A zoo educator added, “A lot of them have never gone into the backyard. They have never gone out near the rivers and seen the wildlife and all of it...they don’t access it.”

In general, participants largely expressed concerns about similar issues regardless of gender, location, or grade level. Table 6 summarizes the main concerns identified by participants.

Table 6: Summary of Concerns

CONCERNS	
1. Logistical concerns dominated the discussion with three major themes:	Specific policies-local and state regulatory, administrative, and curriculum barriers. Care and disposal of species are barriers to many participants. Lack of resources-(time, cost, and safety) keeps many participants from having organisms.
2. The need to euthanize classroom organisms is a barrier for a substantial number of participants, although many have developed practices with which they are comfortable.	
3. Participants are uniformly concerned about the spread of invasives, and most mention potential ecological damages. A few indentified potential economic and health damages as concerns. Additionally, most did not believe classroom use was a huge factor in the spread of invasive species.	
4. The fact that children are not getting enough outside time was a big concern for participants, and many are trying to make-up for that by bringing organisms into the classroom.	

SOLUTIONS

Finally, when we asked participants for suggestions about solutions, three general categories emerged: outreach, policy change, and educational liaisons. The theoretical framework suggests that once values, knowledge, and concerns are known and understood, solutions should manifest a participant's intentions to change behavior or values, willingness to address any knowledge gaps, and commitment to tackle overarching concerns. As part of preparing participants to address questions about potential solutions, the facilitator reviewed the concerns before proceeding to the discussion on solutions. Suggestions related to educational liaisons were most

frequent in every group, with outreach suggestions also frequently mentioned. Needed policy changes were mentioned briefly in all groups. Each category is reviewed below.

Educational Liaisons

Participants provided many comments about potential educational liaisons including partnerships, biological supply houses, and curriculum or handouts. Although mentioned in every focus group, supply houses were not identified as a primary educational liaison. Participants talked more about partnerships with outside organizations and curriculum sources.

Agency Partnerships

Many participants sought to resolve their concerns about organism use in the classroom through information, resources, or expertise from an outside entity. Over 50% of the comments expressed a desired connection with organizations such as non-profits, NGOs, or government organizations. Participants specifically wanted information on care, disposal, and invasives, and they trusted these three sources as generally reliable. In addition, participants also described various organizations represented by adult educators, outreach coordinators, or select teachers who have expressed interest in finding ways to help teachers with classroom organisms. One middle school teacher suggested, “Working with universities, because they can write the grants and get them.” Another added, “Maybe we can link it up with a book distributor, like Pearson or one of the other book distributors so that every time a company or schools purchase these books it is being distributed with that knowledge [about invasive species].” An innovative partnership solution that might work for others was described by one participant:

We started this teacher program in the Chicago area called, Teacher Training Helps, where places like the zoos and the nature centers get together and support each other in doing teacher trainings, and we were so successful that we have expanded to the state and so there are hubs in different areas of the state.

Participants expressed willingness to partner with organizations, but they struggle with the amount of time it takes to make connections as revealed in the earlier discussions about barriers.

Biological Suppliers

Participants suggested standardized labels on fact sheets coming from biological supply houses. They identified biological supply houses as a realistic place to get information, and often suggested potential website modifications to portray the information. One elementary teacher said, “[A] detailed fact sheet should be available before actually you buy it.” Another agreed with this, “Standardized labels, that would fix so much.” A high school teacher expanded on this line of potential educational liaison: “Maybe contacting FOSS and having them have some sort of insert into all their kits that deal with living creatures. You know, having that be a part of the kit is teaching about the concerns of the invasives, you know, a better way to find an alternative.”

Several participants considered biological supply house solutions to be more regulatory rather than partnership oriented, but not all agreed. One participant comment went, “We thought supply houses, when you’re talking about legislation, were all required to talk about disposing. That would be easy to enforce.” Another envelope-pushing suggestion was made by an elementary teacher,

One idea I would love to have is a regional biological supply organization. There can be a private company like Carolina biological supply, why can’t we develop those? If we had a centralized state agency, they have all the most recent information, all I have to do is give them a call and send them fifty bucks and they send me the animals I need, problem solved.

Simply put, teachers desire consistent and clear information from pet stores, supply houses, and FOSS kits to help them make better decisions about issues surrounding plants and animals in the classroom.

Curriculum and Handouts

Many teachers report that invasives could be easily included in current curriculum without a lot of effort; one high school teacher suggested an easy integration of invasives species into the

curriculum by developing a, “Creature feature every week, by taking an invasive animal or plant and giving the breakdown on it: native, non native, invasive, what it eats, what its life cycle is, all that kind of thing.” Another suggested, “A multi-disciplinary curriculum.” Speaking of a combination of curriculum and handouts, one teacher enthusiastically responded,

It would be awesome to have an invasive species binder [with] facts and you’ve got it all, you’ve got stuff to teach yourself with and stuff to teach the kids with, but interesting stuff, it’s not just you know stand up and talk, they’re playing games, it’s almost like a monopoly kind of thing, you could have it with species, like what species would you want or not want, so turning it into games for the kids to learn.

These educational liaisons illustrate several innovative opportunities that teachers see to effectively form lasting partnerships, deal with supply houses, and change existing curriculum.

Outreach

Teachers universally felt that knowledge barriers could be filled and concern mitigated through effectively developed and placed outreach efforts. Online, written, and professional development outreach were the three types participants discussed, brainstormed, and suggested. Canadian participants placed heavy emphasis on outreach via written communication and professional development; while the four US groups recognized these as viable alternatives, they discussed online outreach as the primary way to go. One teacher hit all three in this comment, “Either manual or website or local outreach people, those are the best ways.”

Online

Websites were the predominant type of outreach activity identified by participants. Although many of the ideas might be difficult to execute, these educators expressed a desire for a one-stop-shop website where they can find resources on live plants and animals in the classroom, invasives species information, curriculum suggestions, and other information. A frustrated teacher said, “Right now it is just a hodge-podge of a bunch of websites that I really don’t understand or know what they are or know what they have.” Another suggested, “I think

somehow we have to find a way that everybody is on this list serve...because everybody in the science department could know about this.” A good summary for the online outreach was from a middle school teacher who desired, “Something authoritative but not overwhelming. Not too difficult but easy to get at. Easily accessible in information or one way or the other.”

Written

For those who suggested written communication, fact sheets and booklets were identified in over half (60%) of the comments. Participants provided examples of the type of written outreach materials they would find valuable:

We have a booklet that tells you what you are suppose to do with your leftover chemicals at the end of the year, what you are suppose to do with your leftover cleaners at the end of the year, so there probably should be a what do you do with your leftover animals at the end of the year.

I think it would be valuable to have fact sheets for organisms that are used that includes things like natural history and their role in the eco-system, how the organism is collected or bred or harvested, the disposal, potential impact of education uses, and having kits history. Teachers being able to have a kits history of what has happened with organisms could be so helpful.

Every couple of years somebody starts a book of resources with the names of all these places in it, so it'll be like “places that give classes for teachers, places that offer resources for field trips, places that will come to you,” and everybody puts it on their shelf and doesn't use it.

The variety of these comments showcases how information is accessed, as discussed earlier when barriers were identified, from such different viewpoints. Some teachers would never use the internet for these types of materials, and others have evolved to the point of never looking at the printed page.

Professional Development

Several comments were made about professional development being a potential avenue to educate teachers about disposal, handling, and other issues related to invasive species. In-service days were not perceived as particularly effective, but workshops or conference presentations were described as possible targets for outreach. A high school teacher responded, “I was thinking the Oregon Science Teachers Association and then somehow, I know in October they do a conference or workshop, you know, just to put it out there to make more people aware.” Another participant suggested,

In our district at the beginning of the year we have a secondary science day that we have to go to and some of the presenters are so awful. If you wanted to reach as many teachers, what you can do is call our district and say “we have a 2 hour presentation on invasive species for your teachers.” They will say great come on down, that’d be perfect. You’d have a captive audience that would be interested and you would do that for free.

Our respondents suggest that effectively spreading the message about invasive species through professional development efforts can be reaching the masses through big functions with hundreds of teachers in attendance or at local in-service days.

Policy Change

As described earlier, many participants identified specific policies as presenting barriers to effective and safe use of classroom organisms. When asked to suggest solutions, they responded with ideas for specific policy changes. Participants in Oregon, California, and Illinois groups were evenly split between local/district and state/national policies while British Columbia participants favored local/district, and Ontario and Washington participants favored state and national considerations.

Local and District Policy Change

Participants identified needed policy changes at the district level, and the major categories included standardized procedures and modified regulations. One elementary teacher, not allowed to have organisms in the classroom for a variety of reasons, responded, “I think the first

step should be actually getting live plants and animals in the classroom whether they be invasive or noninvasive.” In addition, another high school teacher suggested, “There should be standardized procedures for me to dispose an animal or organism in my classroom.” Two other elementary teachers added information about district-wide policy change:

A lot of people use crayfish so why not provide to districts accurate information about living organisms so that they can make informed decisions about how they are instructing teachers to you know either use these kits or use these organism and dispose of them at the end of their time.

I think it needs to sift down through the school systems and I think it needs to sift up through the city systems because each region is distinctly different and has different issues, but I think at a classroom level, when we bring it in we take responsibility and do our best. There is a bigger policy picture.

State and National Policy Change

Nearly three-fourths of participant comments were about state and national rules and regulations that need to be changed to enhance the circumstances around live organisms in the classroom and also regulate teachers from releasing invasives into the wild. Included below are several comments illustrating potential state or national policy solutions:

- Having some sort of national guidelines on how to kill animals in the classroom.
- If you have an actual guide or something official from the Ministry or whatever that said these are the correct ways to get rid, I never thought of freezing things to get rid of them, I think it’s brilliant and it’s simple, that kind of idea sharing like you were saying about having experienced teachers mentor newer teachers.
- Honestly I think it [policy regulation] needs to start at the US legislative level.
- Work on getting environmental education benchmarks, either be through the state or hopefully as a country, since we currently have none.

Integrating invasive species education into credentialing programs was mentioned in every group because they see this as a way of solving the knowledge gaps that teachers will face in the future. One fairly new middle school teacher, who was considering policies surrounding credential programs, offered a solution to spreading the message of invasives: “I personally think it should be part of the educational curriculum. If we are going to come up with anything here at the table, it should be going to the education schools and saying it should be part of that in their process.”

Participants suggest that teachers are open to national and state policy changes. A mixture of local, district, state, and national policy changes could be a mechanism in providing a framework for the teachers to have, use, dispose of, and fund live organisms in the classroom. The policy implications section will further explore policy applications. Educational liaisons, policy changes, and outreach efforts, showed a range of solutions to perceived barriers as seen by participants. Table 7 summarizes key solutions.

Table 7: Summary of Solutions

SOLUTIONS	
1. Educational liaisons are suggested as providing solutions in three major ways:	Agency partnerships with universities and NGOs to provide reliable information. Biological suppliers to provide standardized labels or fact sheets on organisms they sell. Curriculum innovations to provide information about invasives to students.
2. Outreach activities also were proposed as primary solutions:	Participants would like to see online information that is readily accessible. Written materials including textbooks and other materials can be used for information. Both large conferences and in-service days provide opportunities to share information.
3. Policy change was recommended in the form of local and state/national:	Local policy- modified rules and regulations and standardized procedures. State/National policy-credential program improvements and legislative awareness.

Participants value live plants and animals in the classroom for educational, use, and ethical purposes. They collectively have a working knowledge of invasive species, but desire more credible information on sourcing and disposal of live organisms in general. Logistical concerns such as specific policies, handling species, resources, and ecological damage are at the forefront of participants’ minds. Educational liaisons, outreach activities, and policy changes are potential solutions suggested by participants. The next section will connect values, knowledge, and

concerns with participant solutions to identify synergies and impending gaps to behavioral change.

DISCUSSION

The purpose of the AIS in the Classroom study is to better understand the potential pathways contributing to the spread of invasive species and identify ways to manage those pathways. By conducting teacher focus groups, researchers have come to better understand this potential vector. Each focus group was based on a modified version of the Theory of Planned Behavior, and the theoretical framework explored values, knowledge, concerns, and solutions in the context of live plants and animals and invasive species in the classroom. The project is an ongoing search for addressing invasive species in the classroom, and this study finds several noteworthy factors for discussion.

Values

Focus group participants value live plants and animals in the classroom for a variety of reasons. In fact, with a few exceptions, there was consensus that live organisms greatly enhance the classroom environment. Participants attending the focus groups utilized live organisms to showcase stewardship and generate motivation resulting from interaction with organisms because they felt it helped students better connect with the outside environment and taught them how to interact responsibly with other species. Furthermore, ethical values and treatment issues were often mentioned as supplementary values resulting from organisms in the classroom, and teachers valued the real-life applications that students could witness. The amalgamation of these factors provide substantial evidence that teachers have deeply rooted values for live organisms in the classroom, and do not need to be convinced of their usefulness or worth. In fact, it might be difficult to convince these participants that live organisms should be eliminated from classroom use.

When appealing to the value of using organisms in the classroom, focus group results suggest that references to opportunities for students to learn about stewardship of the natural world and the potential for creating stimulating and exciting classroom environments will resonate with teachers in both elementary and secondary settings. Participants also hold a range of values regarding euthanizing organisms suggesting they may react differently to messages and information about organism disposal. Generally, there is indicative evidence that participants do

distinguish between invasive and other species (e.g. native, non-native) and do not necessarily accord invasives the same value as other organisms, so there is unlikely to be attitudinal barriers to wise use of invasive species as long as teachers are clear that the species is actually an invasive in the specific context.

Knowledge

There was widespread knowledge among participants about the general definition of invasive species, although they recognize that they probably do not represent the average classroom teacher or the general public. An inherent bias associated with the roundtable facilitation format could have enabled learning to be occurring during the questioning. It is possible that definition variability would have surfaced had each teacher been interviewed individually.

A myriad of live organisms make it into the classroom based on grade level, source, and curriculum requirements. High school and middle school teachers use edible plants to teach students how to grow a garden, elodea (waterweed) to teach reproduction, and exotic spiders, turtles, or albino rats, as pets. At these upper levels, use of organisms in the classroom is likely limited to life science teachers. School regulations mandate student safety within the science teacher's classroom, but teachers are largely free to do what, how, or when they want beyond that as long as they meet program outcomes. Additionally, secondary teacher participants appeared to be more familiar than other educators with both definitions of invasives and ways to handle and dispose of organisms. This could be both a benefit and a weakness.

The benefits are connected to the level of experience and exposure that an upper level science teacher is bringing into the classroom. The expectation of increased science knowledge is higher than that of more generalist elementary teachers, and as a result, upper level teachers are likely to understand issues related to invasive species. Potential weaknesses associated with over-confidence about knowledge may be a real barrier to any behavioral changes in upper level educators. The knowledge gaps of upper level teachers seem to be in discerning credible sources for both species and information, information dissemination constraints associated with a partitioned workforce, and upper level curriculum guidelines that are largely non-existent concerning invasive species. In addition, secondary level participants report multiple sources of

organisms (pet stores, nature, and borrowing) that are unlikely to provide any detailed information about source, care, or handling.

Elementary participants, on the other hand, are generalists and tend not to have the level of scientific training or knowledge possessed by secondary teachers in sourcing, caring, or handling of live organisms. Elementary curriculum is mostly driven by mandate, and school districts expect teachers to cover a certain range of topics at each specific grade level. Since science education is only a small portion of overall elementary curriculum, it is no surprise that invasive species education gets little attention from teachers, books, or lesson plans. Participants report reliance on curriculum aids such as FOSS kits with kits pointing to organisms they can secure from biological supply houses, thereby reducing the work of individual teachers. This suggests that elementary teachers, on average, are likely to have less exposure to invasive species education and access to credible resources for learning about invasive species education than do secondary teachers. From this study we identified two potential sources for increasing knowledge of invasive species: (1) exposure to invasive species education in the credentialing curriculum of elementary teachers, and (2) mandated curriculum that introduces invasives into the class as part of a science kit.

For the purpose of discussing knowledge implications, zoo educators, outreach coordinators, community college teachers, and adult educators will be considered together. Despite being fundamentally different disciplines, participants in each of these areas displayed high levels of knowledge associated with invasive species, especially the definitions and concepts of invasive. This group seems well connected with credible sources, and willing to circulate information aimed at addressing any knowledge gaps. In fact, they could be used to address the gaps within elementary and upper level educators.

Analysis of focus groups found that in spite of an excellent foundation of knowledge, participants did report some gaps, particularly related to identification of species as invasives, how to handle, care and dispose of organisms, and curriculum requirements. These knowledge gaps differed by grade level, with secondary science teachers and non-school educators reporting more knowledge about these topics than elementary teachers. This suggests messages about the

use of live organisms and targeted invasive species will need to be designed for different audiences, with more detailed information provided to secondary teachers and non-school educators than to elementary teachers.

Concerns

A variety of concerns may be barriers for teachers in the classroom. Since focus group participants' logistical concerns dominated the discussion at every location regardless of grade level or gender, great strides could be covered by addressing the logistical barriers faced by teachers. Policy concerns are of real importance to breaking down any barriers in the future, because participants are concerned about curriculum requirements, the role of the administrator, and regulations that mandate what they can and cannot do. Although participants frequently spoke of policy concerns, few actually had solutions that went beyond informing the legislature of regulatory concerns or requiring university credentialing to include information on the invasives issues.

Care and disposal of species and resource constraints further add to the logistical barriers of educators, which likely causes many teachers to avoid opportunities to learn more about using organisms in the classroom or invasive species. A real barrier seems to be a communication breakdown between the regulators, administrators, teachers, and institutional researchers. Each has its own specific mission and goal and there is potential overlap not being properly leveraged such as institutional invasives species research being introduced to both regulators and school administrators to inform them of specific problems surrounding invasives and the classroom.

Knowing how to properly euthanize seems to be a critical topic among educators. A few participants were unwilling to have live organisms because they did not understand proper disposal methods for classroom animals and were not confident on where to find credible sources to learn how. This barrier could potentially be addressed with information or services provided by the source of the animal (biological supply house, pet store, or borrowing).

Participants are also concerned about the spread of invasives, and many mention potential ecological damages as the primary consideration; but most believe classroom-related practices

are minor factors in the spread of invasive species. This belief could lead to a barrier in accepting solutions that ask them to change behavior, especially in the face of perceived and real barriers participants identified. If teachers are identified as a significant potential pathway for invasives, some of the participants' expressed concern that administrators would simply cut all live organisms from the classroom to address the risk associated with the release or escape of invasives. If that happened, students deprived of outdoor experiences could lose the opportunity to interact with organisms in classroom, and many children could reach adulthood with minimal organism interaction. Participants express concern about limited child outdoor experiences and see administration, policy-makers, regulators, suppliers, and other teachers as vital players in making sure that live organisms can be continued to be used in the classroom.

Solutions

Participants were given a lot of freedom in the focus groups to brainstorm solutions that might help mitigate their various concerns while also promoting live plants and animals in the classroom and discouraging the spread of invasive species through the classroom vector. An overarching trend emerged when comparing the US to Canada, in that Canada seems more favorable to a top down approach to solving problems whereas the US often suggested bottom-up strategies. Certain solutions were common in every group and are correlated with a lack of value barriers, knowledge gaps, and concern barriers. These solutions, which the model connects to behavioral change, are discussed in terms of feasibility and theoretical application.

Addressing Value Barriers

Teachers that attended the focus groups did not identify any solutions in response to value barriers, and therefore, these barriers do not appear to keep them from implementing potential solutions. Further research is needed to determine if educators in general share these values.

Addressing Knowledge Barriers

In response to a knowledge gap connected with the need for more specific information about invasive species, participants proposed the idea of a clearinghouse website to include information about sourcing, care, and disposal options. Although the website was a consensus item at every focus group, ideas about actual implementation of the website were either non-

existent or quite confusing. Furthermore, participant comments only suggested the website and its design rather than potential funding to create the website or challenges associated with keeping it going. A website could address key gaps, but currently the task seems difficult to execute. According to the Theory of Planned Behavior, knowledge gaps must be addressed to achieve behavioral change; therefore addressing the future feasibility of a website is high-priority, with more research needed to find critical gaps for different groups.

In addition to a website clearinghouse, focus group participants' also recommended large association conferences, in-service days, and written outreach as primary outreach activities, but followed with the caveat that written outreach is difficult to inject into the minds of educators. In-service days appear to be an intimate opportunity to address knowledge gaps, but the expense associated with scaling to a regional or national basis could prove unfeasible. Large association conferences, therefore, are an important platform to address knowledge gaps because they address large targeted audiences, could be done at a reasonably low expense on a regional basis, and easily impart credible information sources in a short amount of time.

A final knowledge gap showcased by teachers is information credibility. Teachers need to know *from a credible source*, what a credible source is. Governmental agencies, universities, and outreach coordinators are all trusted entities by focus group participants because the information is less biased and aimed at informing rather than persuading.

Addressing Concern Barriers

Many concerns and barriers were identified by participants with three general categories of solutions including educational liaisons such as expanding partnerships, curriculum innovations, and standardized supplier labeling. Each is discussed below.

Expanding partnerships is consistent with earlier findings because participant values and knowledge gaps can be addressed through collaboration with agencies, universities, and other organizations. Zoo educators and outreach coordinators were suggested as a valuable resource to inexpensively disseminate information from the collegiate level to the elementary science classroom through classroom presentations, but it is unlikely that any standardized partnership

across all educational levels will yield efficient behavioral change because partnerships are largely based on individual relationships made on a personal level.

Curriculum barriers associated with invasive species education could be addressed through curriculum innovation. Participants' were vague about these solutions but spoke to administrative control blocking classroom science innovation. It is possible that policy solutions such as modified rules and regulations and standardized procedures would address curriculum barriers, but the sustainable solution seems to be extending the values about organisms in the classroom to administrators by addressing their knowledge and logistical concerns. This would require specific research with administrators to identify their concerns.

Supplier labeling practices confuse participants with inconsistencies that make understanding essential information about organisms difficult. Participants recommended standardizing the labels, but they did not include why or how that should be accomplished. Understanding what would make an effective standardized label appears to be a feasible next step towards addressing this concern. Regulatory solutions are one option proposed as a policy change that could address labeling practices. Biological supply houses could be encouraged through tax incentives or sanctions to include certain things in all their outgoing shipments. Aside from the political battle that would create between regulators and suppliers, this study finds that this policy approach would address only a fraction of the suppliers. Collaborating with supply houses and even a few pet store chains through a partnership arrangement seems a much more likely approach, although participants did not suggest how this might take place.

A substantial number of participants identified euthanasia as a barrier, and then proposed solutions such as partnering with universities or agencies to learn proper procedures; receiving outreach via pamphlet, online, or through development that demonstrates euthanasia; and recommending standardized procedures in education policy circles. Just as the values and concerns surrounding euthanasia were inconclusive, neither are the proposed solutions. The topic of euthanasia could be feasibly integrated into outreach activities involving care and disposal or information credibility presentations, but participants did not directly suggest any specific methods for doing that.

Continuing to bring organisms into the classroom is vital to children's outdoor experience because many children are deprived of this opportunity in today's society. Solutions surrounding credential program requirements and legislative awareness were identified as possible avenues to address children's general lack of outdoor experiences. Participants did not suggest potential ways to reach these objectives, but agreed they would be important for the long-term goals of organisms in the classroom.

POLICY IMPLICATIONS

Multiple Streams Analysis

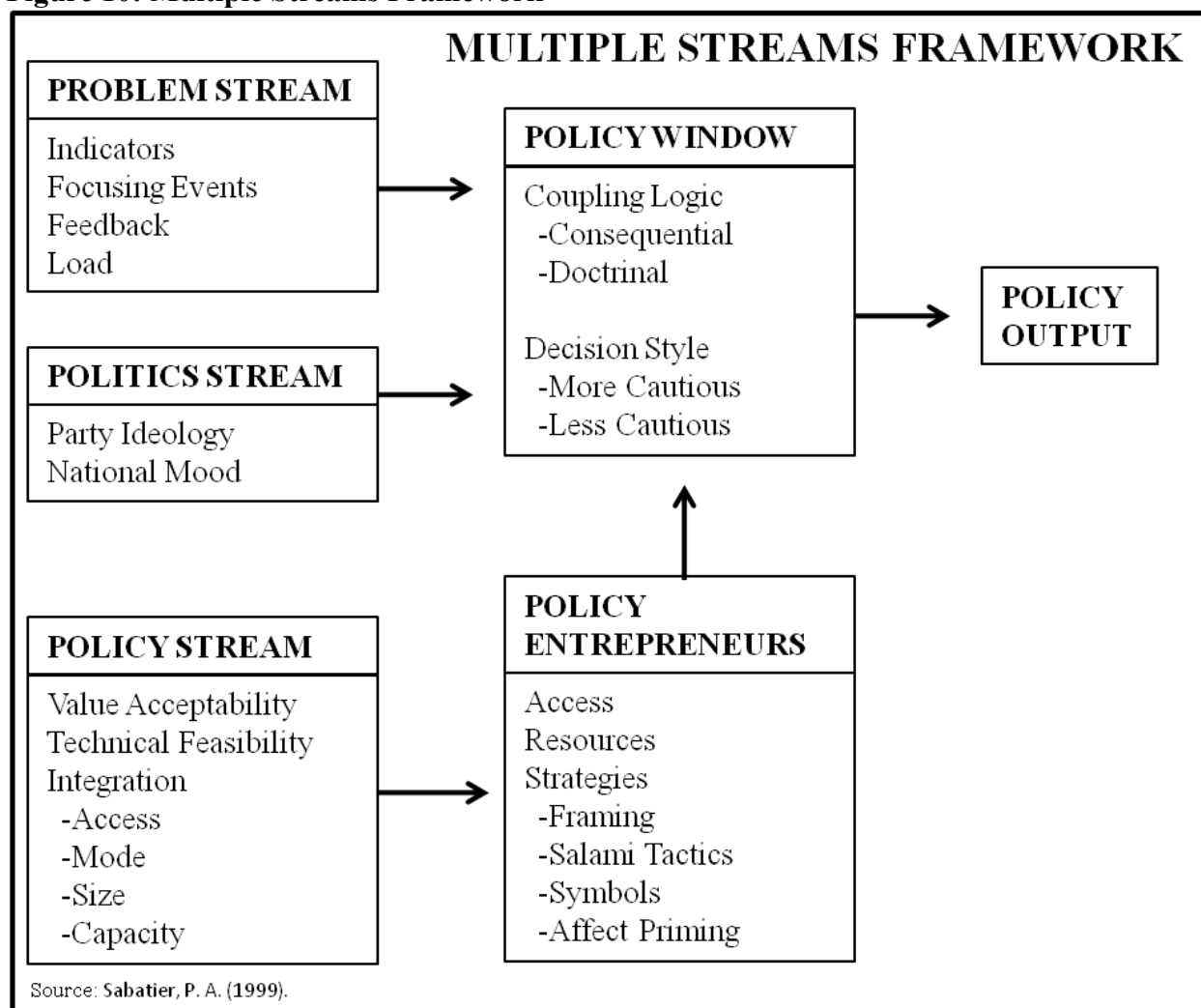
Rather than depict the decision-making process involved in policymaking as a matter of rationality, Kingdon (1984) and other theorists such as Cohen, March, and Olsen (1972) have described it as a progression distinguished by organizational disorder or anarchy. The central point of their message is that organizations are not mechanical computers solving complicated, but predictable optimization problems. Their argument is that organizations function like garbage cans into which a mix of problems and possible solutions are poured, with the precise mix determining decision outcomes (Padgett, 1980). This foundational picture is important to understand the specific histories, goals, assumptions, and examples of the multiple streams approach to policy theory and analysis.

Multiple streams analysis has its origins with the development of the Garbage Can model of organizational theory (Cohen et al., 1972). It was a theory that rooted itself in the study and relationship of ambiguous behaviors, and the operation of university bureaucracies with their potential for chaotic inter-departmental interactions proved an excellent observation grounds (Cohen et al., 1972). Irrational behavioral responses in the face of aggregate uncertainty influenced the formulation of the Garbage Can Model, which in turn informed the original multiple streams frameworks.

The current multiple streams approach is a model highlighting the existence of three separate, but complementary, processes in public planning processes (Kingdon, 1984). It is the coupling of these streams that allows, at a given time and in a given context, for a particular issue to be turned into a policy (Pariszi, 2010). The three streams are defined as problem, policy, and politics. The problem stream revolves around agenda-setting processes and entails studying indicators and focusing events to characterize the problem (e.g., Bender, 2001). The policy stream involves defining policy solutions, often described as looking to which problems lead to which solutions through different policy proposals. The politics stream centers on contention over various options, and ultimately echoes public opinion, interest groups, experts, elections, partisan forces, and judicial, executive, and legislative bodies (Cohen et al., 1972).

In this approach, the policy streams are advocated by policy entrepreneurs, the people or institutions that actually connect the streams, at vital points in time (policy windows) to influence agenda setting and generate policy alternatives (Sabatier, 1999, p. 74). A policy window then opens in either the political stream or the problem stream and in so doing provides the occasion for action in the form of policy proposals and alternatives. Therefore, structurally speaking, the multiple streams framework includes five different components: problems, policies, politics, policy entrepreneurs, and policy windows. When all five interact in just the perfect manner, policy output is the observed result. Figure 10 shows a recent explanation of the multiple streams approach (Travis, 2002). Pay particular heed to the flow, or timing, of the diagram, as that will be important when actually applying this framework to the AIS in the Classroom project.

Figure 10: Multiple Streams Framework



Every theory has essential assumptions that accompany its overall analysis, and the multiple streams approach is guided by three specific assumptions. First, individual attention or processing is serial, systemic attention or processing is parallel. According to Zahariadis, this means while individuals are limited to attending to one issue at a time, because of the division of labor in both organizations and government individuals can attend to many issues simultaneously (Sabatier, 1999). Second, policy makers operate under significant time constraints, meaning that a sense of urgency tends to be employed by any individual striving to champion a certain policy. Third, the streams flowing through the system are independent; this assumption is often challenged by critics of the model because it is probable that the streams are dependent upon one another for potential success.

Multiple streams analysis has been used in a variety of situations and under many unrelated circumstances. Travis and Zahariadis (2002) developed an explanation based on the multiple streams model to argue that foreign aid decisions are perhaps a result of trade ties, socialist orientation, human needs, and the political ideologies of the administration and the senate. They conclude among other things that the multiple streams framework, in fact, “can be tested empirically and that the results are largely consistent with the theoretical expectations” (Travis and Zahariadis, 2002: p 495). In addition, they suggest that Kingdon's work is a good way to organize diverse types of information and to illustrate the interactive natures of the policy process. Finally, they show that an extension of the multiple streams model that was initially used to explain agenda setting in domestic politics can be taken to foreign settings.

The AIS in the Classroom project is laced with problem, policy, and politics streams, and identifying potential entrepreneurs and windows is central to moving forward any viable solutions suggested in the results section. A multiple streams analysis of the AIS in the Classroom project is discussed below.

Problem Stream

The underlying principle of the problems stream is that a given situation has to be acknowledged and openly recognized as a problem or public policy issue for it to bear the slightest chance of evolving into a policy. In addition to the concern showcased by teachers in the focus groups about the outdoor experience of children, other potential problem streams have been identified through this research and could be affecting the likelihood of policy change or formulation. Rising childhood obesity, nature deficit disorder, narrowing curriculums, and invasive species spreading rapidly are just a few problems identified by educators. Meanwhile, teacher credential programs, funding issues, and communication channels are further contributing to the problem of the potential spread of AIS from the classroom.

Kingdon (1984) cites indicators, focusing events, and feedback as important factors influencing attention to a specific problem. For instance, systemic indicators that are quantifiable (e.g. climate change, test scores, and obesity rates) may be used to illustrate that a problem exists; conversely, they may also be used in an effort to argue that, in fact, a problem does not exist (e.g. No Child Left Inside Act). Two focusing events will be reviewed to illustrate how society is dealing with the fundamental problems regarding invasive species identified throughout this study: a spring release party in Oregon and a Western Regional Panel meeting in 2007.

Scientists were invited to a classroom in Oregon several years ago to participate in a spring release party of organisms that had been used in the classroom throughout the school year. Upon arrival the scientists quickly discovered that the children were about to release invasive species into the wild, and took this occasion as an opportunity to stop the release and teach about invasive species. That single experience spawned this current project because it added a previously unconsidered vector to the spread of invasive species. The Western Regional Panel listened to this story and responded with seven solutions aimed at addressing the problems (see p 57). As a result of this awareness, researchers were able to secure NOAA funding to launch the AIS in the Classroom project. The release party experience in Oregon was repeated dozens of times in many states and provinces, as reported by focus group participants, further confirming the notion that teachers, supply houses, and curriculum coordinators could be a potential vector.

The key indicators gleaned from the focus groups are that most teachers lack the training and resources to police invasive species issues within their classroom environment. Furthermore, organisms are sourced from multiple areas, thereby creating a convoluted supply system that is not easy to trace while invasive species continue to spread across North America. In funding this project, NOAA Fisheries offers a key indicator that classroom spread may be a problem stream for invasives control.

Feedback, according to Sabatier (1999), is highlighting what works and what does not work. This study suggests there may be broken communication channels between teachers, curriculum specialists, biological supply houses, pet stores, scientists, students, policy-makers and many other participants involved in the use of live organisms in the classroom. Currently there appears to be very partial feedback between and among participants, potentially limiting the wide emergence of this issue.

In the AIS in the Classroom project, the problem stream began as a blank sheet of paper and is emerging as a policy priority in invasive species agenda setting. Through the focus groups and NOAA Fisheries internal meetings, specific considerations were introduced as focusing events and their implications were collectively evaluated. Getting a consensus on problem definition is an ongoing, difficult process that will likely take many years and resources. As the problem definition matures, additional key indicators will become more apparent because feedback loops among communication channels will be strengthened. Focusing events such as large science teacher conferences and training events will identify this issue as a widespread problem worthy of potential policy attention.

Policy Stream

The forming of policy alternatives and proposals is the nexus of the policy stream (Pariszi, 2010). New policies need ideas and policy proposals on which innovative discussion can take policy ideas to the next level. The stream includes a “soup” of ideas that compete to win acceptance in the policy networks (Sabatier, 1999, p 72). Some ideas can come out this policy stream relatively unchanged, while others are often reworked to the point of non-recognition. When an appropriate climate arrives, policy entrepreneurs can attempt to “soften up” policy

communities and legislators to advance their problem into a policy (Travis, 2002, p. 496).

Technical feasibility and value acceptability are two criteria essential for the survival of a policy alternative. Advocates for a proposal must anticipate details and technicalities by eliminating inconsistencies gradually, dealing with implementation feasibility, and specifying practicality of mainstreaming an idea (Kingdon, 1984).

The 2001 adoption of the National Invasives Species Management Plan (NISMP) by the National Invasive Species Council (NISC) marked a policy beginning for invasives species prevention and control. At that time, however, schools were not characterized as a vector and educational components were secondary to higher commitments to fix identified problems. A true sign of value acceptability came in 2008 when an updated version of the NISMP was published. The updated NISMP (2008-2012, p. 31) version reads:

Implementation Task OC.6.2: Work with existing educational organizations to enhance invasive species information delivery to primary and secondary educators.

Performance Element OC.6.2.1: Information about at least eight invasive species or federal invasive species programs provided to educational organizations/invasive species outreach programs and reported to the NISC staff.

The feasibility of implementation remains unproven, but acceptability of the classroom vector continues to grow. Meanwhile, in the face of management plans, biological teachers' associations and various universities have begun to incorporate invasive species curriculum and education into both credential programs and outreach information (as described by participants in this study). Finally, a federal bill, No Child Left Inside Act (NCLI) of 2009, has emerged to propose appropriations be provided to train teachers for environmental instruction, provide innovative technology, and develop studies assessing the worth of these programs in elementary and secondary school curriculums (NCLI, 2009). While predominately encouraging environmental stewardship, this legislation also encourages child outdoor recreation. Several states including Connecticut, Washington, Michigan, Massachusetts, Wisconsin, and Oregon have adopted policies aimed at promoting environmental education and healthy living based on outdoor activities. As environmental education is emphasized, plant and animal considerations may lead to discussions on invasive species, and invasives species education policy could sprout as a mainstream issue.

The third component of the policy stream is integration, which refers to connections among participants. Integration is fundamentally evaluated across four dimensions: size, mode, capacity, and access (Kingdon, 1984). Sabatier taught,

“Networks can be classified as more or less integrated. Less integrated networks are larger in size and have a competitive mode, lower administrative capacity, and less restricted access. Conversely, more integrated networks are smaller in size have a consensual mode, higher capacity, and more restricted access (Sabatier, 1999, p. 73).”

Based on a non-empirical observation, the invasive species policy network is not overly integrated as it is relatively large in size and still seeking basic levels of consensus. However, there are elements of higher integration through administrative capacity at the scientist level and potential access restriction associated with credentialing, curriculum mandates, and funding. The policy stream may be stronger than it looks at first glance. Even though invasive species policy and its connections to education are not in the mainstream media, there are professional and scientific efforts pushing policy platforms towards Washington D.C through the NISC, NISMP, and other organizations.

Politics Stream

Although independent of the other two streams, political events, such as an election or a dramatic change in government, can lead any given topic and policy to be included or excluded from the agenda (Pariszi, 2010). Of the three elements in the political system, the combination of the national mood and turnover in government exerts the most powerful influence on agendas (Kingdon, 1984). With the nation experiencing a drastically declining economy since 2007, policy efforts such as the No child Left Inside Act lose the attention and momentum as economic issues and job security are trumping any environmental education campaigns.

According to Sabatier (1999, p.73), the politics stream consists of three elements: the national mood, pressure group campaigns, and administrative or legislative turn-over. This research suggests participants in the different focus group locations have similar preferences when it comes to organisms in the classroom. Furthermore, these concerns and preferences are supported by an army of political entities and government agencies including the National

Invasive Species Council, Invasive Species Advisory Council, Regional Aquatic Nuisance Panels, Teachers Unions and Organizations, and Lobbyists. All are involved in the politics of controlling the spread of invasive species.

Politicians often view the support or opposition of interest groups as indicators of consensus or dissent in the broader political arena, and in this case those siding with No Child Left Inside groups are often viewed as pushing an environmental agenda on society-at-large. With the 2008 election of President Obama, the national mood of economic gloom could be at least partially ameliorated by a strong educational agenda.

Multiple Streams Syntheses

As mentioned above, these three streams are assumed to be discrete and independent; problem recognition, the formulation of policy proposals, and political events are each assumed to have their own dynamic and respective tempo. As such, no stream is decisive of the general policy process, and all streams contribute to its formation. In fact, it is through the meeting of these streams that issues are transformed from mere problems into concrete policy. An important side note is that it is not always necessary for all three streams to meet simultaneously for a policy to develop (Pariszi, 2010). Often, there occurs a partial coupling or the convergence of two of the streams until a window of opportunity is opened for streams to coincide and potentially become a policy.

Windows are specifically derived from either a compelling problem or a substantial political event. Usually policy windows are of a short duration; therefore, it behooves the many policy actors to pay close attention to their potential formation (Sabatier, 1999). Policy windows are opened through the coupling of a justification logic and a decision style that is either careful and methodical or urgent and rushed. Coupling logics can be after the fact (consequential) or preventive (doctrinal), depending on the current status of the policy streams. Justifying policies regarding invasive species are currently using consequential logic, describing the impacts and potential damages from the spread of invasive species. While some scientists and other community members feel the pressure of increasing damages from the spread of invasives,

operating in the educational arena forces a careful and methodical decision style: evidence collected, allies aligned, and policy recommendations vetted by many vested interests.

Kingdon (1984) argues that policy entrepreneurs play a key role in connecting the streams within these policy windows. Zahariadis also adds that, “When the policy windows open, entrepreneurs must immediately seize the opportunity to take action” (Travis, 2002, p 495). He also suggests that successful entrepreneurs are those that have three essential elements: intimate access to policy makers, sufficient resources to withstand the duration, and manipulative coupling strategies within their capacity. Even these entrepreneurs are not always successful in their attempts; although persistence is key to eventual accomplishment.

In considering the AIS in the Classroom case, certain parties come to mind including the researchers and groups affiliated with the AIS in the Classroom study, Western Regional Panel, NOAA Fisheries, and NISC. Collectively, they are the entrepreneurs aimed at coupling the streams and pushing policies like No Child Left Inside specifically and invasive species education generally, into legislation in the near future. However, as described earlier, these entrepreneurs are loosely coupled with weak feedback loops with not much current evidence of the power or resources necessary to see this policy through under existing political and economic circumstances. In addition, the policy window has not yet been created and recommendations will seek to facilitate that transition.

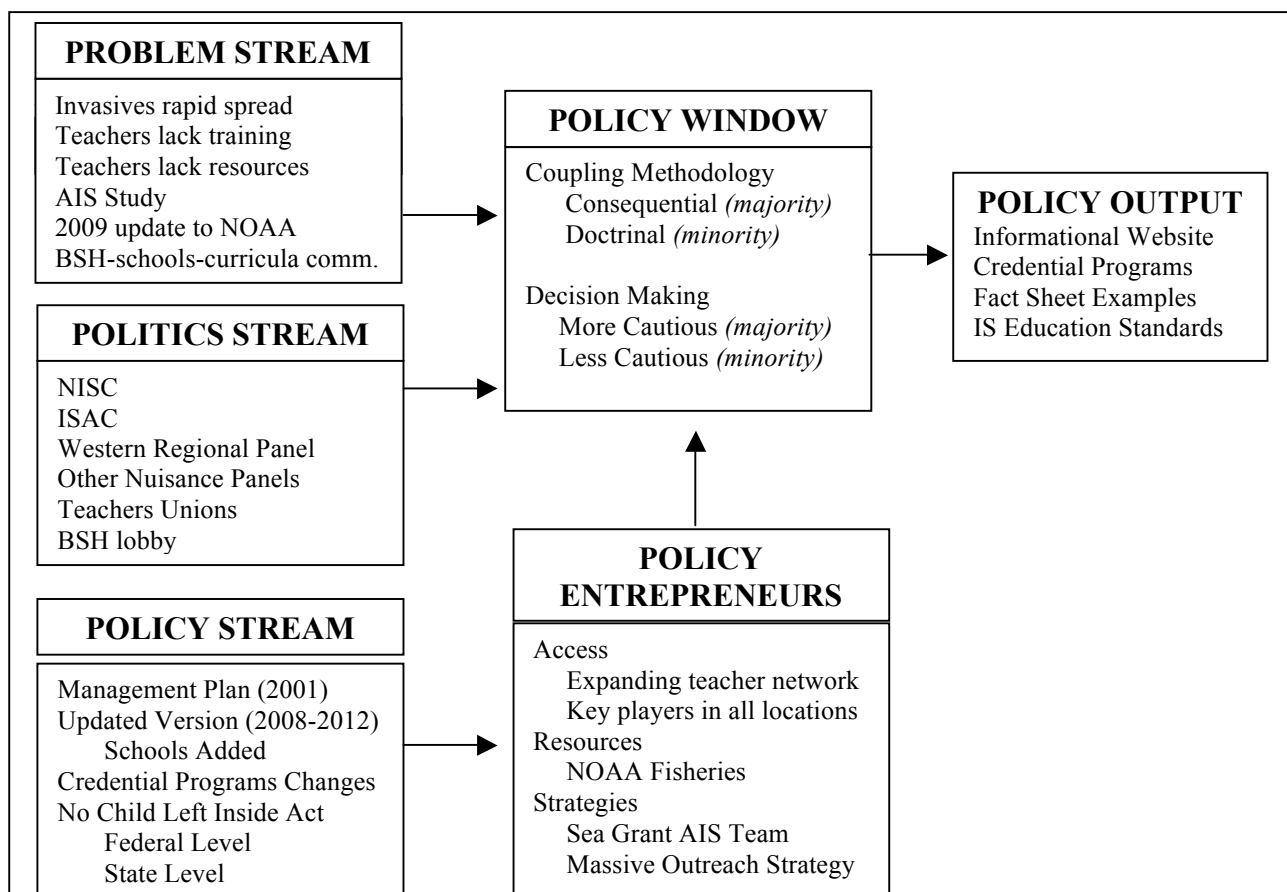
Over two years ago, the Western Regional Panel on Aquatic Nuisance Species held a meeting where they identified seven potential solutions to the AIS in the Classroom project including a list of organisms considered invasive in region, better information on the biology/ecology of organisms, a list of biological supply houses that specialize in local species, learning materials, workshops on invasive species education and care of plants and animals in classroom, and better information on how to properly dispose of organisms. The solutions from focus group participants relate to these recommended solutions, but there are some fundamental differences that distinguish the specific results from this study. Using the Theory of Planned Behavior as a foundational framework and Multiple Streams Analysis as a policy guide, this study expands upon the WRP (2007) list to recommend five specific actions to potential policy entrepreneurs such as the WRP, NISC or Sea Grant:

1. The NISC and/or WRP should fund the development and maintenance of an invasive species informational website where educators can go for up-to-date references on sourcing, care and handling, disposal, and species identification. This will be a response to participants' concerns about a lack of easily accessible and credible information about invasive species. It may also contribute to the integration of an emerging policy stream currently populated primarily by professionals and scientists. Leveraging the high value educators' place on live organisms in the classroom and their search for credible information can bring a wide variety of entrepreneurs to the policy arena.
2. Suppliers of classroom organisms should also be integrated into the policy stream and engaged as policy entrepreneurs. One way to do this is through a request from one or more school districts and engaged teachers for fact sheets about organisms they sell. This may be facilitated with example fact sheets prepared by the WRP or other organizations that should include the kind of information teachers need to fill knowledge barriers. Because suppliers could provide opposition to any emerging policy that increases their work and/or reduces their profit, their participation must be carefully cultivated through partnerships within a non-threatening setting.
3. Based on the communication network that exists between the NISC, WRP, NOAA Fisheries, Sea Grant, Federal and State Agencies, Universities, and Teachers Associations, a consortium needs to be formed to advocate adding invasive species educational standards on a national scale. This would provide teachers with curriculum innovations involving the integration of invasive species education into core subject matter, and these entrepreneurs would be merging the problem and politics streams thereby aiming to create a policy window.
4. The Sea Grant AIS Team should use beta test funding to develop and pilot test an invasive species professional development training seminar for K-12 educators to be given in either a large scale science association meetings or through local in-service days. This proposed outreach solution addresses logistical barriers while spreading awareness to produce a synergistic outcome.

5. The Sea Grant AIS Team should seek to leverage their expanding network of contacts that includes key players in locations throughout the US and Canada in order to secure future NOAA Fisheries funding to create an invasive species curriculum for university K-12 credentialing programs. This entrepreneurial output would incorporate facets of all three streams (problem, policy, and politics) in a forward-looking fashion that will provide new teachers with the resources to integrate invasive species materials into the classroom environment thereby creating a potential policy window and output.

A visual representation of the multiple streams approach, specific to the AIS in the Classroom Project is included as Figure 11.

Figure 11: Multiple Streams Applied to Invasives Species Considerations



CONCLUSION

In conclusion, this study sought to clarify the values, knowledge, concerns, and solutions that lead to behavioral change within the context of AIS in the Classroom. Educational values including stewardship, motivation, and calming effects, use-related values such as possession, and ethical values including euthanasia combine to illustrate a value system deeply rooted in having, and continuing to have, live organisms in the classroom. Knowledge gaps present a problem because information is not perceived as readily available, and credible sources are often difficult to discern by participants who are mainly searching online for needed information. In addition, biological supply houses do not seem to be a major source for most of the participants. Logistical barriers are dominated by three major concerns including policies, care and disposal, and lack of resources. Many participants have developed euthanization practices they are comfortable with, but a substantial number of educators see euthanasia as a barrier to the use of live organisms. Ecological damages associated with the spread of invasive species are important to educators, but most believe the classroom vector to be a minor player in the overall spread of invasives. Children's outdoor experiences are a concern to participants, and continuing to have live organisms in the classroom is important to augment this gap. Educational liaisons including agency partnerships, supplier labeling, and invasive species curriculum innovation are initial answers to these concerns, and outreach activities such as online, written, and professional development workshops enhance that information. Participants recommend policy changes in the form of standardized procedures and modified regulations on the local level, and legislative awareness and credential program improvements on the national scene.

By using the Theory of Planned Behavior to evaluate behavioral intentions regarding organisms and invasive species in the classroom, and augmenting the findings with the Multiple Streams policy framework, this study characterizes achievable options for addressing the AIS in the Classroom dilemma. Policy entrepreneurs such as the NISC, Sea Grant, and the AIS team will gain the most traction by addressing the unfilled gaps identified by participants in the focus groups, and utilizing proper policy windows to forge ahead with innovation.

Limitations and Recommended Future Research

Methods

A qualitative methodology was appropriate to gather information because little information is currently known about the values, knowledge, concerns, and solutions associated with teacher's perspective of live organisms and invasive species from the classroom. The focus group format was useful to elicit interaction and explore the variables within the theoretical framework.

Because of a purposive sample, there was a high degree of homogeneity and self selection among participants making results impossible to generalize to any larger population of educators. Definite conclusions are difficult to draw from focus group analyses; therefore, a random sample survey testing the findings of the focus groups could be a future starting point for researchers interested in this topic. This quantitative survey could use critical variables to further identify similarities and differences between educators at different levels and influence the creation of materials.

Models

Theory of Planned Behavior: Values, knowledge, and concerns were effectively addressed within the construct of this study, but the kind of solutions identified by participants were limited in their ability to make wide ranging changes in this policy arena. For example, the problems and solutions identified in the study play out at different educational and political levels, which could be an artifact of Theory of Planned Behavior, which does not pay much attention to political behavior or motivations. Future research could utilize information about the values, knowledge, and concerns identified in this study within a theoretical framework that explicitly addressed social learning or policy change.

Multiple Streams: This policy framework is best applied to situations that have already occurred, as it is much easier to identify streams, windows, entrepreneurs, policy outputs after the fact of policy change. Since the AIS project is such a new policy agenda item, windows and entrepreneurs can only be suggested rather than analyzed. Because of the nature and complexity of the classroom as an invasive species vector future research could compare these results with analogous educational and environmental policy shifts.

Current Research

For this study, only a portion of the database of collected information was utilized. Future research could assess each of the core variables (values, knowledge, concerns, and solutions) in more detail to ask additional questions. In addition, this study does not connect phase one survey results with focus group results, and doing that could both confirm current findings and inform future gaps in the AIS in the classroom research. With this understanding, future surveys and feasible pilot testing projects could be developed.

BIBLIOGRAPHY

- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior Human Decision Process*. 50, 179-211.
- Ajzen, I. and Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Ajzen, I. and Fishbein, M. (2005). The Influence of Attitudes on Behavior. In Albarracín, D. Johnson, B., and Zanna, M. *The Handbook of Attitudes* (pp. 173-221). Mahwah, NJ: Erlbaum.
- Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In Kuhl, J. and Beckman, J. *Action-Control: From Cognition to Behavior* (pp. 11-39). Heidelberg: Springer.
- Aquatic Nuisance Species Task Force (ANSTF). (2007). URL: http://www.anstaskforce.gov/Documents/ANSTF_Strategic_Plan_2007_Final.pdf. Last accessed 1/10/2010.
- Arvola, A., Vassallo, M., Dean, M., Lampila, P., Saba, A., Lähteenmäki, L., et al. (2008). Predicting Intentions to Purchase Organic Food: The Role of Affective and Moral Attitudes in the Theory of Planned Behavior. *Appetite*. 50: 443-454.
- Bandura, A. (1977). Self-Efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*. 84, 191-215.
- Bandura, A. (1989). Social Cognitive Theory. In Vasta, R. *Annals of Child Development. Six Theories of Child Development* (pp. 1-60). Greenwich, CT: JAI Press.
- Bendor, J., Moe, T., and Shotts, K. (2001). Recycling the Garbage Can: An Assessment of the Research Program. *American Political Science Review*. 95(1), 169-190.
- Bernard, R. (2006). *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. AltaMira Press: Lanham, MD.
- Blue, C. (1995). The Predictive Capacity of the Theory of Reasoned Action and the Theory of Planned Behavior in Exercise Research: An Integrated Literature Review. *Research in Nursing and Health*. 18, 105-121.
- Bogdan, R. and Bilken, S. (1998). *Qualitative Research for Education: An Introduction to Theory and Methods*. Boston: Allyn and Bacon
- Boldero, J. (1995). The Prediction of Household Recycling of Newspapers: The Role of Attitudes, Intentions, and Situational Factors. *Journal of Applied Social Psychology*. 25: 440-462.

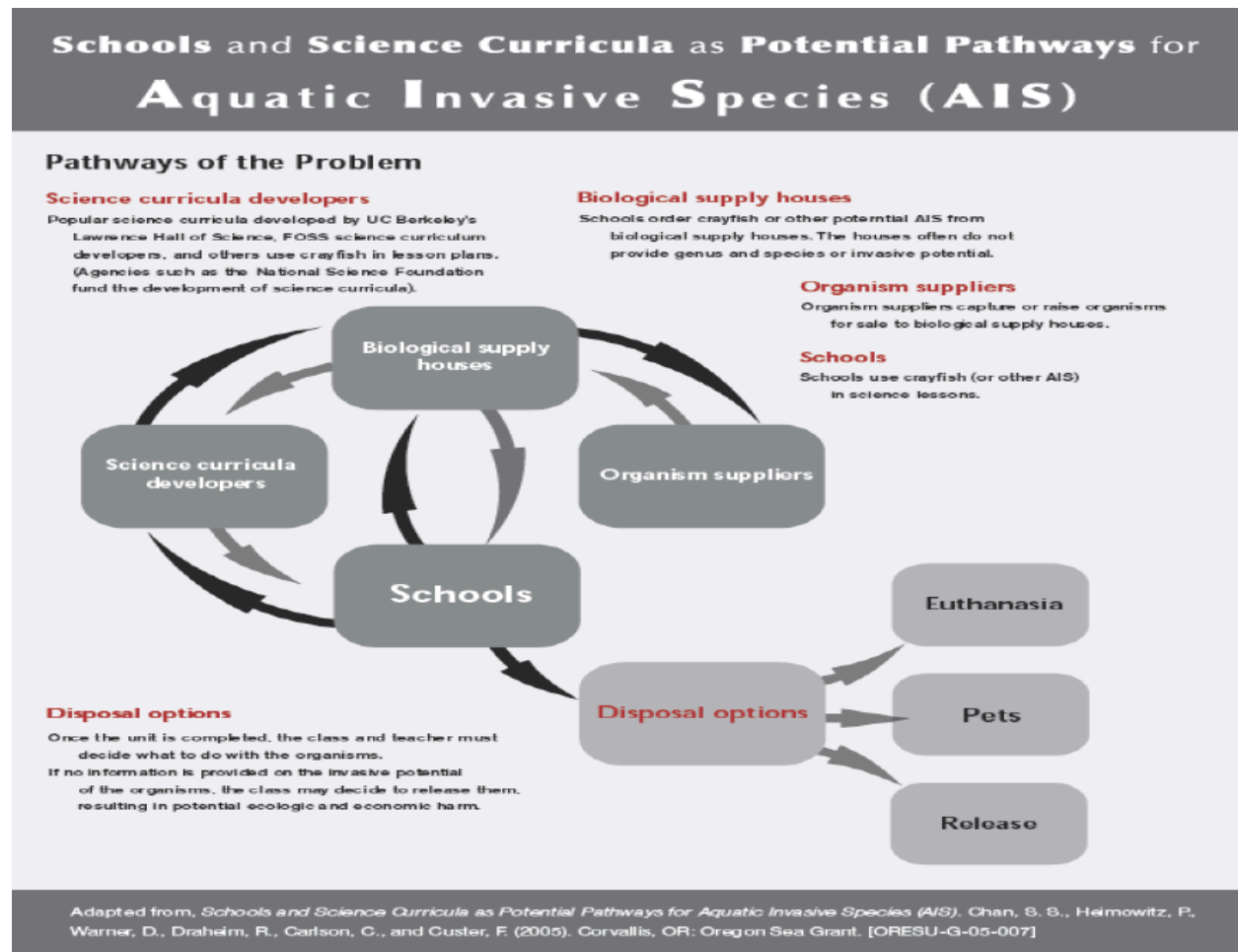
- Burak, L. (1994). Examination and Prediction of Elementary School Teachers' Intentions To Teach HIV/AIDS Education. *AIDS Education and Prevention*. 6, 310-321.
- Campbell F. and Kriesch P. (2003). Final Report by the National Invasive Species Council's Invasive Species Pathways Team of the Prevention Working Group. URL: www.invasivespeciesinfo.gov/council/wrkgrps.shtml. Last accessed 12/22/2009.
- Chan, S. et.al. (2005). Schools and Science Curricula as Potential Pathways for Aquatic Invasive Species (AIS). Corvallis, OR: Oregon Sea Grant. [ORESUG-05-007]
- Chan, S. et.al. (2008). Reducing the Risk of Schools, Science Curricula and Biological Supply Houses as Pathways for Spreading Aquatic Invasive Species. Corvallis, OR: Oregon Sea Grant.
- Cohen, M., March, J., and Olsen, J. (1972). A Garbage Can Model of Organizational Choice. *Administrative Science Quarterly*. 17(1), 1-25.
- East, J. (1993). Investment Decisions and the Theory of Planned Behavior. *Journal of Economic Psychology*. 14, 337-375.
- Environmental Protection Agency (EPA). (2009). Pathways for Invasive Species Introduction. URL: http://www.epa.gov/owow/invasive_species/pathways.html. Last accessed 12/19/2009.
- Fekadu, Z. and Kraft, P. (2002). Expanding the Theory Of Planned Behavior: The Role of Social Norms and Group Identification. *Journal of Health Psychology*. 7, 33-43
- Fishbein, M. and Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.
- Flannery, B. and May, D. (2000). Environmental Ethical Decision Making in the U.S. Metal-Finishing Industry. *Academy of Management Journal*. 43, 642- 662.
- Hale, J., Householder, B., and Greene, K. (2003). The Theory of Reasoned Action. In Dillard, J. and Pfau, M. *The Persuasion Handbook: Developments in Theory and Practice* (p. 259 – 286). Thousand Oaks, CA: Sage.
- Invasive Species Definition Clarification and Guidance White Paper*. (2006). The National Invasive Species Council, submitted by the Definitions Subcommittee of the Invasive Species Advisory Committee. URL: http://www.invasivespecies.gov/global/ISAC/ISAC_documents/ISAC%20Definitions%20White%20Paper%20-%20FINAL%20VERSION.pdf. Last accessed 12/19/2009.
- Kingdon, J. (1984). *Bridging Research and Policy: Agendas, Alternatives, and Public Policies*. Second Edition. NY: Harper Collins.

- Kreuger, R. (1988). *Focus Groups: A Practical Guide for Applied Research*. London: Sage.
- Kubeck, G. (2008). Exploring Stakeholders' Attitudes and Beliefs Regarding Behaviors that Prevent the Spread of Invasive Species: A Focus Group Study. URL: <http://ir.library.oregonstate.edu/jspui/bitstream/1957/8912/1/MRM.Thesis.Kubeck.FINAL.6.10.08.pdf>. Last accessed 5/15/2008.
- Lam, S. (2006). Predicting Intention to Save Water: Theory of Planned Behavior, Response Efficacy, Vulnerability, and Perceived Efficiency of Alternative Solutions. *Journal of Applied Social Psychology*. 36, 2803-2282.
- Marshall, C. and Rossman, G. (1999). *Designing Qualitative Research (3E)*. Thousand Oaks: Sage Publications.
- Merton, R., and Kendall, P. (1946). The Focused Interview. *The American Journal of Sociology*. 51, 541-557.
- Miller, K. (2005). *Communications Theories: Perspectives, Processes, and Contexts*. New York: McGraw-Hill.
- National Invasive Species Council (NISC). (2009) URL: http://www.invasivespecies.gov/main_nav/mn_NISC_ManagementPlan.html. Last accessed 12/17/2009.
- National Invasive Species Information Center (NISIC). (2009) URL: <http://www.invasivespeciesinfo.gov/laws/execorder.shtml>. Last accessed 12/17/2009.
- National Invasive Species Management Plan (NISMP). (2001). URL: http://www.invasivespecies.gov/home_documents/2001%20Invasive%20Species%20National%20Management%20Plan.pdf. p 26. Last accessed 1/15/2010.
- National Invasive Species Management Plan (NISMP). (2008). URL: <http://www.invasivespeciesinfo.gov/council/mpdraft07.pdf>. p 31. Last accessed 12/15/2009.
- National Sea Grant Aquatic Invasive Research and Outreach (Sea Grant). (2009). URL: <http://www.seagrant.noaa.gov/funding/aquaticinvasiveresearchou.html>. Last accessed 12/15/2009.
- No Child Left Inside Act of 2009 (NCLI). (2009). H.R. 2054. URL: <http://www.opencongress.org/bill/111-h2054/show>. Last accessed 2/12/2010.
- Padgett, J. (1980). Managing Garbage Can Hierarchies. *Administrative Science Quarterly*. 25(4), 583-604.

- Pariszi. (2010). Streams Model. *Metagora Training*. URL: <http://www.metagora.org/training/encyclopedia/streams.html#90th>. Last accessed 6/30/2010.
- Robson, C. (2002). *Real World Research*. Oxford: Blackwell Publishers.
- Rubin, H. and Rubin, I. (2005). *Qualitative Interviewing: The Art of Hearing Data*. Thousand Oaks, California: Sage.
- Sabatier, P. (1999). *Theories of the Policy Process*. Boulder, Colo.: Westview Press.
- Skinner, B. (1953). *Science and Human Behavior*. New York: Free Press.
- Stewart, D. and Shamdasani, P. (1990). *Focus Groups: Theory and Practice*. Newbury Park: Sage.
- Travis, R. and Zahariadis, N. (2002). A Multiple Streams Model of U.S. Foreign Aid Policy. *Policy Studies Journal*. 30(4), 495.
- Western Regional Panel on Aquatic Invasive Species (WRP). (2009). Science Education Pathway Workgroup Final Report and Recommendations. URL: <http://www.fws.gov/answest/aboutus.htm>. Last accessed 2/1/2010.

APPENDICES

Appendix A: Schools and Science Curricula as Potential Pathways for AIS



Appendix B: Recruitment Scripts

Administrator Recruitment Script:

Dear Administrator:

Hello, this is Skye Root at Oregon Sea Grant Extension. I am contacting you to see if you would be willing to share an exciting opportunity for teachers to participate in a focus group discussion on the use of live plants and animals in the classroom and awareness of invasive species. Teachers will receive a free lunch and travel reimbursement, plus gain access to information and resources for professional development and their classroom. Please refer to the attachment below that will be sent to teachers that voice interest.

Focus Group Recruitment Script:

Dear Teacher:

This is Skye Root [sub name of person doing the interviews] and I am a research assistant at Oregon State University in the Master of Public Policy Program. I received your contact information from the survey you recently completed on Aquatic Invasive Species (AIS). I am contacting you today in regard to the next phase of a University led multistate and bi national* project funded by NOAA and [or sub in Fisheries and Oceans Canada/Province of (fill in)] on use of live plants and animals for educational use in schools.

Our research involves surveying teachers and curriculum developers to understand how live organisms are selected and used in the classroom and in the science curricula; as well as how live organisms are acquired, cultivated, distributed for educational use in classrooms. Many of the plants and animals used in the classroom are not native to Oregon (or fill in your area), and may become invasive if released. Our goal is to address this issue by developing tools and products that can help prevent new invasions while maintaining the use of live organisms as learning tools. Results from an ongoing teacher survey at your district indicate that teachers care very much about this issue and want more resources regarding the use of live plants and animals and education about invasive species.

Input from teachers is critical to insuring that educational products we develop will be useful and effective for your school district. Therefore, I am contacting you today to see if you would like to contribute to this research by sharing your knowledge and perspective on the overall topic of AIS in the classroom by taking part in a focus group held at **(location) on (date) from (time)**.

Your partnership and input is critical as we work to explore solutions, develop and test tools, and new educational products on learning with living plants, animals and the environment. We hope you will participate in this focus group with us. I think you will find the interview interesting, informative and helpful.

Also, please feel free to give me a call if you have any questions or would like to go ahead and confirm your attendance at the focus group.

Appendix B: Recruitment Scripts (continued)

Focus Group Reminder Email:

Dear Teacher,

Are you looking for professional development opportunities? Would you like to participate in an exciting project at Oregon State University? Oregon Sea Grant at OSU is recruiting teachers to take part in a focus group discussion of issues surrounding the use on live plants and animals in the classroom and awareness of invasive species. Join the focus groups and:

- Learn and address benefits and issues on **the use, care and disposition of live plants and animals in the classroom.**
- **Have input** on what would be **effective classroom resources** that will prevent the use of or release of potentially invasive classroom plants or animals.
- **Explore and discuss** ways that learning about invasive species can contribute to **science learning and community stewardship.**
- Have the opportunity to **pilot educational materials** developed from this project.

When: July 16th, 11:30am – 4:00pm. Travel stipend, lodging, and lunch included!

Where: TBD, likely The Oregon Zoo

How: For more information or to sign up, call or email Tania Siemens at tania.siemens@oregonstate.edu or 541-914-0701

Appendix C: Informed Consent Form for Participants

Project Title: Analyzing perspectives and behaviors of teachers on aquatic invasive species using a focus group methodology

Principal Investigator: Sam Chan, Oregon Sea Grant

Student Investigator: Skye Root, Master of Public Policy

WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to gather information about the various pathways for the introduction and spread of aquatic invasive species (AIS) that threaten our ecosystems, human health, and economy. You will be asked questions relating to your role as a K-12 educator regarding practices related to AIS. The information collected will be analyzed to inform potential solutions to aid in controlling the spread of AIS. In addition, these results will also be published in an Oregon State University Master of Public Policy graduate student project and presented at meetings and conferences.

WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide if you want to participate in this study. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because on the AIS survey you identified yourself as an educator interested in exploring alternative solutions for preventing the introduction and spread of invasive species. The goal of this project is to gain a better understanding of what you and other educators know about invasive species, how your actions may or may not impact the spread of invasive species, how you feel about invasive species education, and your overall perceptions of invasive species. Your participation in this study will help us gain insights that will lead to the creation of outreach and education material to prevent the spread of invasive species.

WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

You are being asked to participate by attending a one-time focus group meeting that will last no longer than four hours. During this time, you will be in a room with other K-12 science educators from your state. As a group you will be asked to respond to a series of questions through discussion. You will not be forced to answer any questions that you prefer not to answer. We will be video recording the focus groups for analysis. We may ask to take pictures of the focus group in action to use in future presentations. You will have an opportunity to sign a photo release form. Your decision to sign or not sign the photo release form will not influence your participation in this study in any way. No photos will be taken of any participants who have not signed the photo release form. All of the pictures and the video recordings will be confidential.

WHAT ARE THE RISKS OF THIS STUDY?

Your participation in this study is voluntary and the risks associated with your involvement are considered minimal. There is a possibility that you may experience disagreeable feelings due to conflicting opinions within the focus group.

WHAT ARE THE BENEFITS OF THIS STUDY?

You will not benefit from being in this study directly, aside from receiving lunch and refreshments during the focus group. You will also be provided a stipend to cover your travel expenses. As a participant in this study, you will have the opportunity to interact with educators in your state and potentially gain increased awareness about invasive species and invasive species education. Your participation in this study will contribute to the creation of outreach and education materials designed to engage people in preventing or controlling the spread of invasive species.

WILL I BE PAID FOR PARTICIPATING?

A travel stipend will be provided to cover travel expenses.

WHO IS PAYING FOR THE RESEARCH?

Led by OSU Sea Grant Extension, *“Reducing the risks of Schools, Science Curricula and Biological Supply Houses as Potential Pathways for Spreading Aquatic Invasive Species”* is a large multi-partner NOAA-funded study on the educational use of live plants and animals in the school classroom. You are being asked to participate in the second phase of the overall three phase project. The second phase is called, *“Analyzing the perspectives and behaviors of teachers on aquatic invasive species using a focus group methodology.”* All stages of this project are funded by NOAA Fisheries.

WHO WILL SEE THE INFORMATION I PROVIDE?

One aspect of this focus group study involves video-taping questions and discussion. If you choose to be in this study, your participation in the focus group will be video-taped and/or recorded by a court reporter. The court reporter will be used to transcribe the focus group discussion and each participant will be assigned an anonymous number in the transcription process in order to maintain confidentiality. The video-tape will be used for back-up purposes only in case the stenographic transcription is unclear. Only the researchers will have access to this video-tape and the video-tape will be destroyed after transcription is complete. Your name will not be associated with any specific comments in any written or oral presentation. The transcribed data will be analyzed into major themes and presented as the overall group response. You will be asked to provide your name, contact information and affiliation upon agreeing to participate in this study. Federal government regulatory agencies and the Oregon State University Institutional Review Board (a committee that reviews and approves research studies) may inspect and copy records pertaining to this research. However, your name and information will not be connected to any particular comments and will not be made public.

DO I HAVE A CHOICE TO BE IN THE STUDY?

Participating in this focus group study is voluntary. You may choose to participate in all of this study or not at all. You may choose not to respond to any specific questions asked of you. You may stop participating at any time in which case you will be asked to leave the room where the focus group is taking place. You will not be treated differently if you decide to stop taking part in the study. If you choose to withdraw from this project before it ends, the researchers may keep information collected about you and this information may be included in study reports.

WHAT IF I HAVE QUESTIONS?

You may ask questions about this study any time proceeding, during or after the focus group study. Please direct your questions about the study to Sam Chan (samuelchan@oregonstate.edu) or Denise Lach (denise.lach@oregonstate.edu).

If you have questions about your rights as a participant, please contact the Oregon State University Institutional Review Board (IRB) Office, at (541) 737-8008 or by email at IRB@oregonstate.edu.

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Participant's Name (printed)

Signature of Participant

Date

Appendix D: Overview of Project for Participants

Brief Description

Led by OSU Sea Grant Extension, “*Reducing the risks of Schools, Science Curricula and Biological Supply Houses as Potential Pathways for Spreading Aquatic Invasive Species*” is a large multi-partner NOAA-funded study on the educational use of live plants and animals in the school classroom. This is a three- phase project: 1) web based teacher surveys and interviews with curriculum coordinators; 2) focus groups with stakeholders to evaluate appropriate solutions and; 3) developing pilot outreach and education tools geared toward preventing the introduction of invasive species. The second phase of the project, “*Analyzing the perspectives and behaviors of teachers on aquatic invasive species using a focus group methodology,*” is the specific subject of this application.

Professor Sam Chan at OSU Sea Grant Extension is the PI and lead in this multi-partner project. The research team includes Skye Root at Oregon State University, Wei Ying Wong at Connecticut College, Denise Lach and Tania Siemens at Oregon State University, and Robin Goettel at University of Illinois.

As mentioned, this IRB application pertains only to Phase Two of our research: focus groups with teachers to evaluate the use of living organisms in the classroom and to identify concerns as well as relevant solutions that will assist in preventing the spread of aquatic invasive species. Eight focus groups will be held throughout July and August 2009; either Skye Root or Wei Ying Wong will be facilitating each one with the assistance of our various host research sites. They will be supervised by Sam Chan and/or Denise Lach. All the data from the survey will be housed at OSU and analyzed by Sam Chan, Skye Root, Denise Lach, Wei Ying Wong, and Tania Siemens.

Expected project outcomes include a peer-reviewed publication on the results of our research and pilot outreach/education tools (brochures, DVDs, power points, curricula, or databases) aimed at minimizing aquatic invasive species (AIS) spread. We will also present our results at scientific workshops and to other interested parties.

Background and Significance

The distribution and use of live organisms by biological supply houses, science curricula, and schools is not a well-studied pathway for the introduction and spread of aquatic invasive species (AIS) that threaten our ecosystems, human health, and economy. The focus groups, as the middle piece of the three part study, are designed to interview elementary school and junior/high school science teachers in the Great Lakes region and the West Coast of the United States. The focus groups will delve into AIS related questions and characterize concerns and identify potential solutions to concerns raised by teachers. Led by the Oregon Sea Grant College Program, our international team includes researchers from Oregon Sea Grant, Washington Sea Grant, Illinois-Indiana Sea Grant, NOAA-Great Lakes Environmental Research Laboratory, Michigan Sea Grant, New York Sea Grant, University of Florida, USC Sea Grant Program, University of Washington and Fisheries and Oceans Canada. (Not all of these schools are involved in Phase Two of the project described here.)

Appendix D: Overview of Project for Participants (continued)

Focus Group Logistics

To develop and implement the focus groups we will carry out the following tasks:

4. Individuals who voiced interest in participating via the survey will be contacted concerning the scheduled focus group (see focus group recruitment attachment) in their respective State or Province. For those school districts that have not yet participated in the survey, we will use key contacts among school administrators to notify and recruit potential participants (see administrator recruitment).
5. Participants will be contacted four to five times during the recruitment and focus group process. The first contact will be an email confirming their voiced interest. If they do not reply within one week we will follow up with a phone call using the same script as the email. Once the person agrees to attend the focus group, we will send them an email with logistical information regarding their respective focus group, and a few days before their focus group we will send another reminder. Our final contact will be the actual focus group where we will present them with the appropriate informed consent documentation prior to starting the focus group.
6. We will video- and audio-tape each focus group for transcription by a project participant and further analysis. In addition, we will use a court reporter during the first group to check for inter-transcriber reliability (i.e., comparing transcriptions made through an in-person court reporter and after-the-fact video/audio-tapes). Depending on the reliability study, we may continue to use a court reporter at all sites in addition to the recording. All transcriptions will be housed in 307 Ballard until the completion of the study when they will be archived at OSU for up to seven years. All tapes will be destroyed upon completion of the project.

Appendix E: The Codebook

FIRST	SECOND	THIRD	TPB	CODE
Concerns	Logistical	Time	B	C1A
		Cost	B	C1B
		Policies (school-district)	B	C1C
		Handling Species	B	C1D
		Health/Safety	B	C1E
		Supply Houses/Suppliers	B	C1F
	Ethical Spread		A	C2
		Ecological	A	C3A
		Health/Economic	A	C3B
	Child Outdoor Experience	General Thoughts	A	C3C
			A	C4
Knowledge	Species	List	N	K1A
		Sources	N	K1B
		Disposal	N	K1C
	Invasives	Definition	N	K2A
		General Knowledge	N	K2B
	Information	Credible/Not Credible	N	K3
Solutions	Proposals	Outreach (o)		S1A
		Outreach (w)		S1B
		Outreach (PD)		S1C
	Policy Change	Local/District/etc		S2A
		State/National/etc		S2B
	Source	Partnership		S3A
		Kits/Supply Houses		S3B
		Info/Curriculum/Handout		S3C
	General			S4
Values	Educational	Learning/Stewards	A	V1A
		Motivational/Interation	A	V1B
		Emotional/Calming	A	V1C
	Uses	Having/Possession	A	V2A
		Food Source	A	V2B
		Classroom Pet	A	V2C
	Ethical	Euthanasia	A	V3A
		Capture/Harm/Release	A	V3B
		Possession of IS/AIS	A	V3C

Appendix E: The Codebook (continued)

CODE EXPLANATION

C1A	Concerns over the need for more time, or something taking too long to do.
C1B	Concerns about the cost of animals, materials, kits, etc.
C1C	Concerns about school board policy, curriculum, national or specific school policy.
C1D	Concerns about keeping alive, keeping safe, students handling, maintenance, and overall care.
C1E	The students and the animals, are they kept healthy and safe?
C1F	Any comments that dealt with concerns for the biological supply houses or other suppliers.
C2	Ethical concerns about capture, treatment, death, euthanizing, and care of organisms.
C3A	Concerns about the ecological affects associated with the potential spread of invasives.
C3B	Concerns about either the health or economic affects stemming from spread.
C3C	A place for general comments about the spread of invasives into our world.
C4	Concerns about outdoor exposure and the lack of it in our youth.
K1A	Names of plants and animals teachers have or have had in the classroom.
K1B	Where the teachers are getting organisms, supply house, back yard, pet store, kids, etc?
K1C	Different disclosed ways that plants and animals are being disposed.
K2A	What each focus group defined invasives species to mean.
K2B	Place for additional comments to be placed that highlighted additional knowledge of invasives.
K3	Knowledge gained from either credible or not credible sources
S1A	Any ideas about online outreach (such as a website).
S1B	Any ideas about written outreach (books, pamphlets, kits, packages)
S1C	Any ideas about professional development outreach (conferences, inservice days)
S2A	Recommendations to change school specific or district wide policies concerning animals
S2B	Recommendations to change either state or national policy in science ed
S3A	The potential source of a solution being through a partnership (colleges, NGOs, etc.)
S3B	The potential source of a solution coming from supply houses via kits of info sheets.
S3C	The potential source of a solution being curriculum changing, further information, or handouts.
S4	A place reserved for other general comments about solutions to the problems of invasives.
V1A	Educational process, learning, or teaching. Stewardship, connectedness, and awareness.
V1B	Changing attitudes, motivating, inspiring, and interactive.
V1C	Calming, exciting, stability, resolving fears, building confidence, and enthusiastic
V2A	Comments explaining the need to have animals and why they have them/possess them.
V2B	Using organisms as a source of food for another organism in the classroom or out.
V2C	Using organisms as a pet rather than as a project or part of the curriculum.
V3A	Explains their personal feelings about euthanasia, their values about it, not concerns with it.
V3B	Explains their stance on capturing, releasing, or harming both invasives and others organisms
V3C	Do they have invasives? Why? How do they feel about having them?

Appendix E: The Codebook (continued)

VALUES	Its valuable, its really incredible, its important, its fortunate, I feel that, I actually witnessed a change, its great that, its wonderful that, connectedness, purpose, I want, I have used them as, it is huge to their learning, it makes a difference
KNOWLEDGE	I know that, I don't know if..., It looks like this, we have, taxonomy, I have learned that, I think from experience that, I have seen, I never understood until, there was a disconnect in their knowledge
CONCERNS	Its difficult to, I find it hard to, I cannot, I will not, how can I possibly do that, when will I find the time to, its an issue, its rigorous for the teachers to, limited space, unfortunately, how are we supposed to know what is going on, misidentification, I don't want, the problem is,
SOLUTIONS	It is our job to, I have seen this work, I wish we were doing this, I think this would help the problem, we tried this out, a good solution would be, we need to have, I really want..., I like the idea of, you can do this or try that,

Appendix E: The Codebook (continued)

First Level Meta Analysis

Primary	Description
Concerns	comments that deals with issues with living organisms, children experiences, policy, treatment, and financial problems
Knowledge	comments that shows what teachers knows about dealing with living organisms, who/where they get their information from, and what they know about invasive species
Solutions	comments that deals with how to help solve issues with living organisms, outreach, awareness, improvement on curriculum, etc
Values	comments on their beliefs, morals, and feelings pertaining to living organisms

Secondary Level Analysis

Primary	Secondary	Description
Concerns	Logistical	comments about problems dealing with care and rules for living organisms
Concerns	Ethical	ethical concerns about capture, treatment, death, euthanizing, and care of organisms.
Concerns	Spread	comments concerning the spread of invasive species
Concerns	Child Outdoor Experience	concerns about outdoor exposure and the lack of it in our youth.
Knowledge	Species	comments that are about the types of species in the classroom, ways to dispose organisms or lack thereof, and source of where to get organisms
Knowledge	Invasives	comments about invasive species that is a definition of factual
Knowledge	Information	comments on sources of information
Solutions	Proposals	comments that deals with outreach solutions
Solutions	Policy Change	any kind of policy solution comments
Solutions	Source	comments of potential sources for teachers to use as a liaison or sources for teachers to use for educational purposes
Solutions	General	a place reserved for other general comments about solutions to the problems of invasives.
Values	Educational	comments on how living organisms are used for educational purposes
Values	Uses	comments on what living organisms are used for that does not pertain to educational uses
Values	Ethical	comments on harm, euthanasia, and possession of living organisms

Appendix E: The Codebook (continued)

Tertiary Analysis

Primary	Secondary	Tertiary	EXPLANATION
Concerns	Logistical	Time	Concerns over the need for more time
Concerns	Logistical	Cost	Concerns about the cost of animals, materials, kits, etc.
Concerns	Logistical	Policies (school-district)	Concerns about school board policy, curriculum, national or specific school policy, anything policy.
Concerns	Logistical	Handling Species	Concerns about keeping alive, keeping safe, students handling, maintenance, and overall care.
Concerns	Logistical	Health/Safety	The students and the animals, are they kept healthy and safe?
Concerns	Logistical	Supply Houses/Suppliers	Any comments that dealt with concerns for the biological supply houses or other suppliers.
Concerns	Ethical		Ethical concerns about capture, treatment, death, euthanizing
Concerns	Spread	Ecological	Concerns about the ecological affects associated with the potential spread of invasives.
Concerns	Spread	Health/Economic	Concerns about either the health or economic affects stemming from spread.
Concerns	Spread	General Thoughts	A place for general comments about the spread of invasives into our world.
Concerns	COE		Concerns about outdoor exposure and the lack of it in our youth
Knowledge	Species	List	Names of plants and animals teachers have or have had in the classroom.
Knowledge	Species	Sources	Where the teachers are getting organisms, supply house, back yard, pet store, kids, etc?
Knowledge	Species	Disposal	Different disclosed ways that organisms are being disposed.
Knowledge	Invasives	Definition	What each focus group defined invasives species to mean.
Knowledge	Invasives	General Knowledge	Place for additional comments to be placed that highlighted additional knowledge of invasives.
Knowledge	Information	Credible/Not	source of where information is coming from
Solutions	Proposals	Outreach (o)	Any ideas about online outreach (such as a website).
Solutions	Proposals	Outreach (w)	Any ideas about written outreach (books, pamphlets, kits)
Solutions	Proposals	Outreach (PD)	Any ideas about professional development outreach
Solutions	Policy Change	Local/District/etc	Recommendations to change school or district wide policies
Solutions	Policy Change	State/National	Recommendations to change either state or national policy
Solutions	Source	Partnership	The potential source of a solution being through a partnership
Solutions	Source	Kits/BSH	Solution coming from supply houses via kits or info sheets.
Solutions	Source	Info/Curriculum	Solution being curriculum changing or handouts.
Solutions	General		A place reserved for other general comments about solutions to the problems of invasives.
Values	Educational	Learning/Steward	Educational process, learning, or teaching
Values	Educational	Motivation/Interate	Changing attitudes, motivating, inspiring, and interactive.
Values	Educational	Emotional/Calmin	Calming, exciting, stability, resolving fears, building confidence
Values	Uses	Having/Possessio	Comments explaining the need to have animals and why
Values	Uses	Food Source	Using organisms as food for another organism in the classroom
Values	Uses	Classroom Pet	Using organisms as a pet rather than part of the curriculum.
Values	Ethical	Euthanasia	Explains their personal feelings about euthanasia
Values	Ethical	Capture/Harm/Release	Explains their stance on capturing, releasing, or harming both invasives and others organisms
Values	Ethical	Possession of IS/AIS	Do they have invasives? Why? How do they feel about having them?

Appendix E: The Codebook (continued)

Fourth Level Analysis

Process: after reading all the data for each second and third level analysis, these fourth level analysis categories are the topics that most often come up from the third level or second level that does not have a third level analysis. This level breaks the data down to the actual topic being discussed. This is the most concrete level of analysis.

FIRST	SECOND	THIRD	FOURTH	Description
Concerns	Logistical	Time		no fourth level
Concerns	Logistical	Cost		no fourth level
Concerns	Logistical	Policies (school-district)	Education/curriculum	comments that are about educating children and themselves about living organisms and dealing with curriculum issues
Concerns	Logistical	Policies (school-district)	Support	comments about any kind of support or lack thereof
Concerns	Logistical	Policies (school-district)	Supply houses	comments about policy for supply houses
Concerns	Logistical	Policies (school-district)	Facilities/custodial/surroundings	comments on lack of facilities or place in order to have living organisms and about care for those facilities and how it affects the living
Concerns	Logistical	Policies (school-district)	Staff/faculty/admin	comments concerning other colleagues and administrators
Concerns	Logistical	Policies (school-district)	Familial/parent/guardians	comments pertaining to familial concerns with live organisms
Concerns	Logistical	Policies (school-district)	District/state rules/regulation	comments about policy for having live organisms
Concerns	Logistical	Handling Species	Disposal/release	comments about concerns over disposal, release, death
Concerns	Logistical	Handling Species	Care/maintenance	comments pertaining to care and maintenance of living organisms
Concerns	Logistical	Handling Species	Feeding	comments about living organisms being a food source or receiving food
Concerns	Logistical	Handling Species	General	comments that don't fit the other categories that are from the handling species third level
Concerns	Logistical	Handling Species	Life cycle	comments about how survival of living organisms and the longest lifeline
Concerns	Logistical	Handling Species	Sympathy	comments pertaining to childrens feelings toward an living organism
Concerns	Logistical	Handling Species	Information	concerns about not having enough information on living organisms
Concerns	Logistical	Handling Species	Safety	concerns on the safety of the students and living organisms
Concerns	Logistical	Handling Species	Facility/space/room	comments that are about space and classrooms that affects living organisms or teachers from being able to use living
Concerns	Logistical	Health/Safety	Allergies	comments about concerns over allergies from the living organisms to the kids
Concerns	Logistical	Health/Safety	Hands	comments dealing with washing hands and hand sanitizers

Appendix E: The Codebook (continued)

Concerns	Logistical	Health/Safety	Health/ sickness/ disease	comments on concerns with the living organism and children getting sick or spreading diseases
Concerns	Logistical	Health/Safety	Safety	concerns on safety of the kids and animals
Concerns	Logistical	Health/Safety	Other	comments that don't fit the other categories
Concerns	Logistical	BSH/Suppliers	Pet store	comments on pet stores
Concerns	Logistical	BSH/Suppliers	Alternative/ local option- supplier	comments on wanting to have a local supplier or local supply house or not wanting to get products from non-local supply houses
Concerns	Logistical	BSH/Suppliers	Information	comments on wanting more facts and information on the living organisms
Concerns	Logistical	BSH/Suppliers	Animal origin	comments relating to knowing where the species and from and how they got to where they are
Concerns	Logistical	BSH/Suppliers	Resource	comments on where to get products and who to get products from
Concerns	Ethical		capture/collect	comments on ethical issues with capturing living organisms
			Treatment/care /use	comments on treatment, care, living organisms in school related activities like dissections, and the usage of animals
			Death/ euthanizing	comments on humane ways to kill organisms whether they are for or against
			Other	comments that don't fit the other categories
Concerns	Spread	Ecological	Transport	concerns on how invasives are being transported from one place to another
Concerns	Spread	Ecological	Dump/release	concerns over releasing of animals and dumping of organisms
Concerns	Spread	Ecological	Escape	concerns over escape of organisms
Concerns	Spread	Ecological	Distribution	comments over seed distribution of organism that can have an ecological impact
Concerns	Spread	Ecological	Impact	comments on types of impacts from invasives
Concerns	Spread	Ecological	Classroom	concerns of spread through classroom activities
Concerns	Spread	Health/ Economic	Economics	concerns over economical impact
Concerns	Spread	Health/ Economic	Health	concerns over health impact from not knowing enough about invasives
Concerns	Spread	General Thoughts		no fourth level
Concerns	Child Outdoor Experience		Attachment	concerns over attachment to living organisms
Concerns	Child Outdoor Experience		Knowledge	comments about childrens lack or awareness, knowledge, etc. pertaining to the environment
Concerns	Child Outdoor Experience		Connectivity	comments on the connection with the real world or the lack thereof
Concerns	Child Outdoor Experience		Education	comments on making children comprehend some aspect of the environment
Concerns	Child Outdoor Experience		Exploration/ interaction	comments on the lack of motivation to go outside and explore nature or learn about nature
Concerns	Child Outdoor Experience		Other	comments that don't fit the other categories

Appendix E: The Codebook (continued)

Knowledge	Species	List		no fourth level
Knowledge	Species	Sources	Store	comments on what stores they are getting their organisms from
Knowledge	Species	Sources	Supply houses	comments about supply houses and which ones they are getting their supplies from.
Knowledge	Species	Sources	Nature	comments about getting their organisms from the wild
Knowledge	Species	Sources	Online	comments on getting their sources from the internet
Knowledge	Species	Sources	Science centers	comments on getting their supplies from science centers
Knowledge	Species	Sources	Societies/ organizations	comments on which societies they get their supplies from
Knowledge	Species	Sources	Borrowing	comments on who they borrow from
Knowledge	Species	Disposal	Students	using the students as a way of mean to get rid of the organisms in the classroom
Knowledge	Species	Disposal	Curriculum	using the curriculum as a way to implement how or why they are disposing the organism
Knowledge	Species	Disposal	Science centers	comments about returning or giving organisms to science centers
Knowledge	Species	Disposal	Sink/toilet	comments on how some teachers are disposing of their organisms
Knowledge	Species	Disposal	Release	comments of release of organisms
Knowledge	Species	Disposal	Freeze	comments about freezing organisms to dispose of them
Knowledge	Species	Disposal	Feeding	using organisms as a food source
Knowledge	Species	Disposal	Garbage	comments on disposing organisms through the garbage
Knowledge	Species	Disposal	Compost	comments on using the compost to dispose of organisms
Knowledge	Species	Disposal	Bury	comments on burial of organism
Knowledge	Species	Disposal	Return	comments on returning an organism to where it came from or where they got it from
Knowledge	Species	Disposal	University	comments on using the university as a source
Knowledge	Species	Disposal	Lack of knowledge	comments on not knowing what to do with disposal
Knowledge	Species	Disposal	Other	comments that don't fit the other categories
Knowledge	Invasives	Definition	Introduced/ transported	defining invasives as introduce
Knowledge	Invasives	Definition	Competition	defining invasives as a competitor to others
Knowledge	Invasives	Definition	Harms/damage	defining invasives as a harm or damaging
Knowledge	Invasives	Definition	Invade/ take over	defining invasives as taking over
Knowledge	Invasives	Definition	Impact	defining invasives as a impact
Knowledge	Invasives	Definition	Displacement	defining invasives displacing natives and local
Knowledge	Invasives	Definition	Unsustainable	defining invasives as unsustainable
Knowledge	Invasives	Definition	Economic	defining invasives as an economical impact
Knowledge	Invasives	Definition	No predators	defining invasives as not being preyed on
Knowledge	Invasives	Definition	Balance	defining invasives as throwing off the balance of the ecosystem

Appendix E: The Codebook (continued)

Knowledge	Invasives	Definition	Ecological	defining invasives as an ecological harm
Knowledge	Invasives	Definition	Negative	defining invasives as evil, or looks at invasives as bad, in a negative view
Knowledge	Invasives	Definition	Native/non-native	defining invasives as non-native or even native
Knowledge	Invasives	Definition	Other	comments that don't fit the other categories
Knowledge	Invasives	General Knowledge		no fourth level
Knowledge	Information	Credible/Not Credible	Colleagues	referring to colleagues as a info source
Knowledge	Information	Credible/Not	Online	referring to the internet as a info source
Knowledge	Information	Credible/Not	Pet store	referring to pet stores as a info source
Knowledge	Information	Credible/Not	Distributors	referring to distributors as a info source
Knowledge	Information	Credible/Not	Ministry	referring to the ministry as a info source
Knowledge	Information	Credible/Not	Biologists/scientists/prof	referring to biologists or scientists as a info source, good or bad
Knowledge	Information	Credible/Not	Organizations/agencies	referring to organizations as a info source
Knowledge	Information	Credible/Not	Colleges	referring to college and universities as a info source
Knowledge	Information	Credible/Not	Other	comments that don't fit the other categories

Appendix E: The Codebook (continued)

Solutions	Proposals	Outreach (o)	Activity/ material	comments about having activities/materials as a potential outreach solution
Solutions	Proposals	Outreach (o)	List serve	comments about using a email listserve as a potential outreach solution
Solutions	Proposals	Outreach (o)	Newsletter	comments about having a online newsletter as a potential outreach solution
Solutions	Proposals	Outreach (o)	Link	comments about having links to other sites and having the site linked from another site as a potential outreach solution
Solutions	Proposals	Outreach (o)	Lists	comments about having a list online about things related to invasives in different areas as a potential outreach solution
Solutions	Proposals	Outreach (o)	Forum	comments about using a Forum as a potential outreach solution
Solutions	Proposals	Outreach (o)	Other	comments that don't fit the other categories
Solutions	Proposals	Outreach (o)	Updates	comments about having updated information as a potential outreach solution
Solutions	Proposals	Outreach (o)	Website	comments about using a website as a potential outreach solution
Solutions	Proposals	Outreach (w)	Book/booklets	comment on wanting books and booklets as guides or as a source of information
Solutions	Proposals	Outreach (w)	Pamphlets/ brochure	comment on wanting pamphlets and brochures for education and motivational reasons
Solutions	Proposals	Outreach (w)	Articles	comment on wanting newspaper, magazine, or journal articles
Solutions	Proposals	Outreach (w)	Fact sheet	comment on wanting facts sheets
Solutions	Proposals	Outreach (w)	Poster	comment on wanting posters
Solutions	Proposals	Outreach (w)	List	comment on wanting a list with information about books, invasive animals, etc
Solutions	Proposals	Outreach (PD)	Workshop/PD	comment on wanting workshops and professional development for teachers to help them
Solutions	Proposals	Outreach (PD)	Training/ learning	comment on wanting teacher training to help train teachers on how to use kits, dispose organisms, etc.
Solutions	Proposals	Outreach (PD)	Inservice days	comments about using the inservice day as a means to educate teachers
Solutions	Proposals	Outreach (PD)	Other	comments that don't fit the other categories
Solutions	Policy Change	Local/District/ etc	Education/ curriculum	comments on having invasives as part of the curriculum at the local/district level
Solutions	Policy Change	Local/District/ etc	Support	comments on having a support system for teachers at the local level.
Solutions	Policy Change	Local/District/ etc	Supply houses	comments on having regulations for supply houses at the local level
Solutions	Policy Change	Local/District/ etc	Facilities/ custodial	comments on having regulation for facilities and custodial at the local level
Solutions	Policy Change	Local/District/ etc	Staff/faculty/ admin	comments on having regulation for faculty and admins at the local level
Solutions	Policy Change	Local/District/ etc	Familial	comments pertaining to family or community regulations at the local level
Solutions	Policy Change	Local/District/ etc	Rules/ regulations	comments on having and following rules and regulations at the local level

Appendix E: The Codebook (continued)

Solutions	Policy Change	State/National/ etc	Education/ curriculum	comments on having invasives as part of the curriculum at the state/national level
Solutions	Policy Change	State/National/ etc	Support	comments on having a support system for teachers at the state/national level.
Solutions	Policy Change	State/National/ etc	Supply houses	comments on having regulations for supply houses at the state/national level
Solutions	Policy Change	State/National/ etc	Facilities/ custodial	comments on having regulation for facilities and custodial at the state/national level
Solutions	Policy Change	State/National/ etc	Staff/faculty/ admin	comments on having regulation for faculty and admins at the state/national level
Solutions	Policy Change	State/National/ etc	Familial	comments pertaining to family or community regulations at the state/national level
Solutions	Policy Change	State/National/ etc	Rules/ regulations	comments on having and following rules and regulations at the state/national level
Solutions	Source	Partnership	Schools	comments on connecting with other schools and having them as a resource
Solutions	Source	Partnership	stewards/ ministries	comments on having master stewards and ministries as a resource
Solutions	Source	Partnership	Media	comments on using the media
Solutions	Source	Partnership	Teachers	comments on having teachers supporting/helping one another.
Solutions	Source	Partnership	Scientists/ engineers	comments about having scientists involved
Solutions	Source	Partnership	Organizations	comments on having organizations as a means of support
Solutions	Source	Partnership	Students	comments on using students as support
Solutions	Source	Partnership	Coordinators	comments on coordinating and using the science coordinators
Solutions	Source	Partnership	Other	comments that don't fit the other categories
Solutions	Source	Kits/Supply Houses	Fact sheets/labels	comments on wanting fact sheets and label with product from supply houses
Solutions	Source	Kits/Supply Houses	Returns	comments on wanting supply houses to take back organisms once the classes are done or places to return/bring organisms to
Solutions	Source	Kits/Supply Houses	Instructions-use/release/etc	comments on wanting supply houses/kit to have instructions on disposal
Solutions	Source	Kits/Supply Houses	Alternatives species	comments on kits to have an alternative species list to show alternative or local species to use
Solutions	Source	Kits/Supply Houses	Places for teachers	comments on where teachers can go for resources
Solutions	Source	Kits/Supply Houses	Other	comments that doesn't fit the other categories
Solutions	Source	Info/Curriculum/ Handout	Curriculum	comments on type of curriculum or ideas about projects that teachers can use for their class
Solutions	Source	Info/Curriculum/ Handout	Activities/ handouts	comments pertaining to creating a binder with activities and information for teachers to use
Solutions	Source	Info/Curriculum/ Handout	Information	comments pertaining to information related to disposal, treatment, care, etc.

Appendix E: The Codebook (continued)

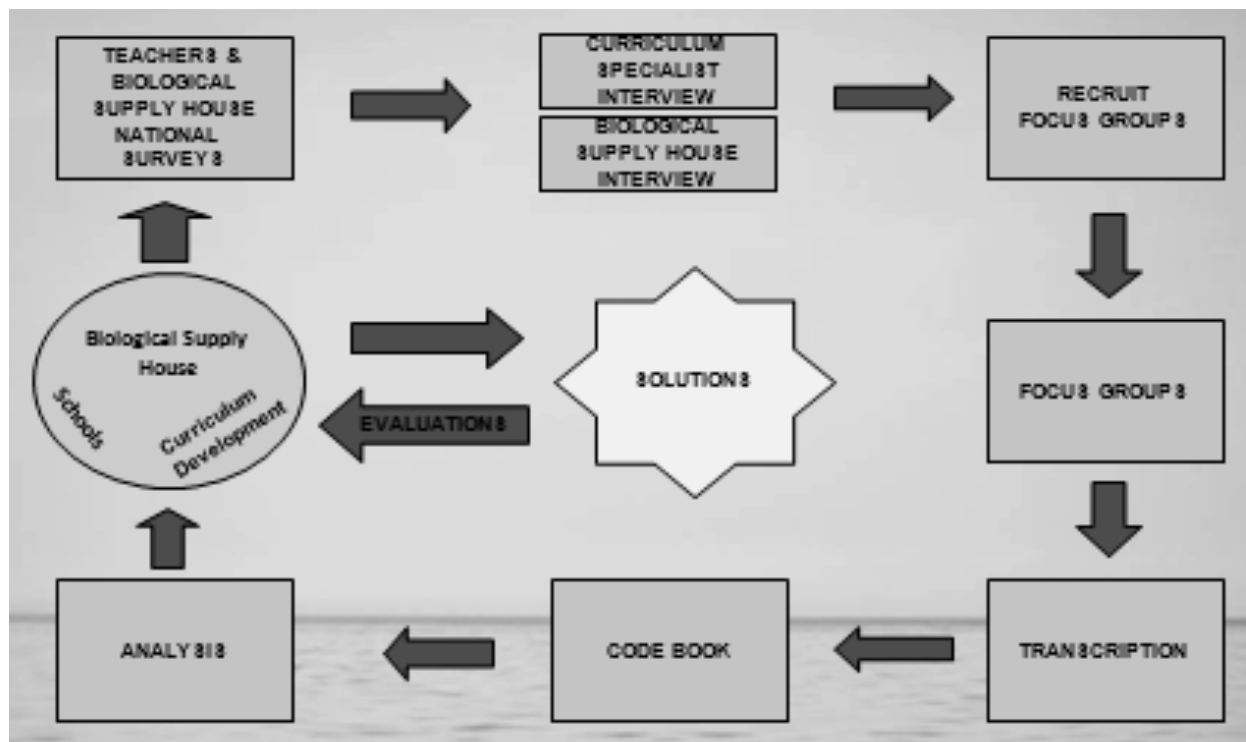
Solutions	Source	Info/Curriculum/ Handout	Updates/ current events	comments suggesting newspapers and current events
Solutions	Source	Info/Curriculum/ Handout	Audio/visual	comments on having audio/visual things to give to teachers.
Solutions	Source	Info/Curriculum/ Handout	Specimens	comments on teachers wanting to have examples
Solutions	General		Educate	comments about educating
Solutions	General		Funding	comments about funding
Solutions	General		Outreach	comments about outreach materials that are all not focused on one single material.
Solutions	General		Recycle	comments on recycling and reusing things
Solutions	General		Outdoor	comments on bringing the kids to the outdoors or the outdoors to them
Solutions	General		Students as resource	comments on teachers using their students as a place for resource
Solutions	General		Community	comments on using the community and the resources that it have
Solutions	General		Supporting info/materials	comments on supporting information or materials
Solutions	General		Contact info	comments on having a place to contact for information
Solutions	General		Teachers	comments on teachers being a point of information
Solutions	General		Other	comments that don't fit the other categories

Appendix E: The Codebook (continued)

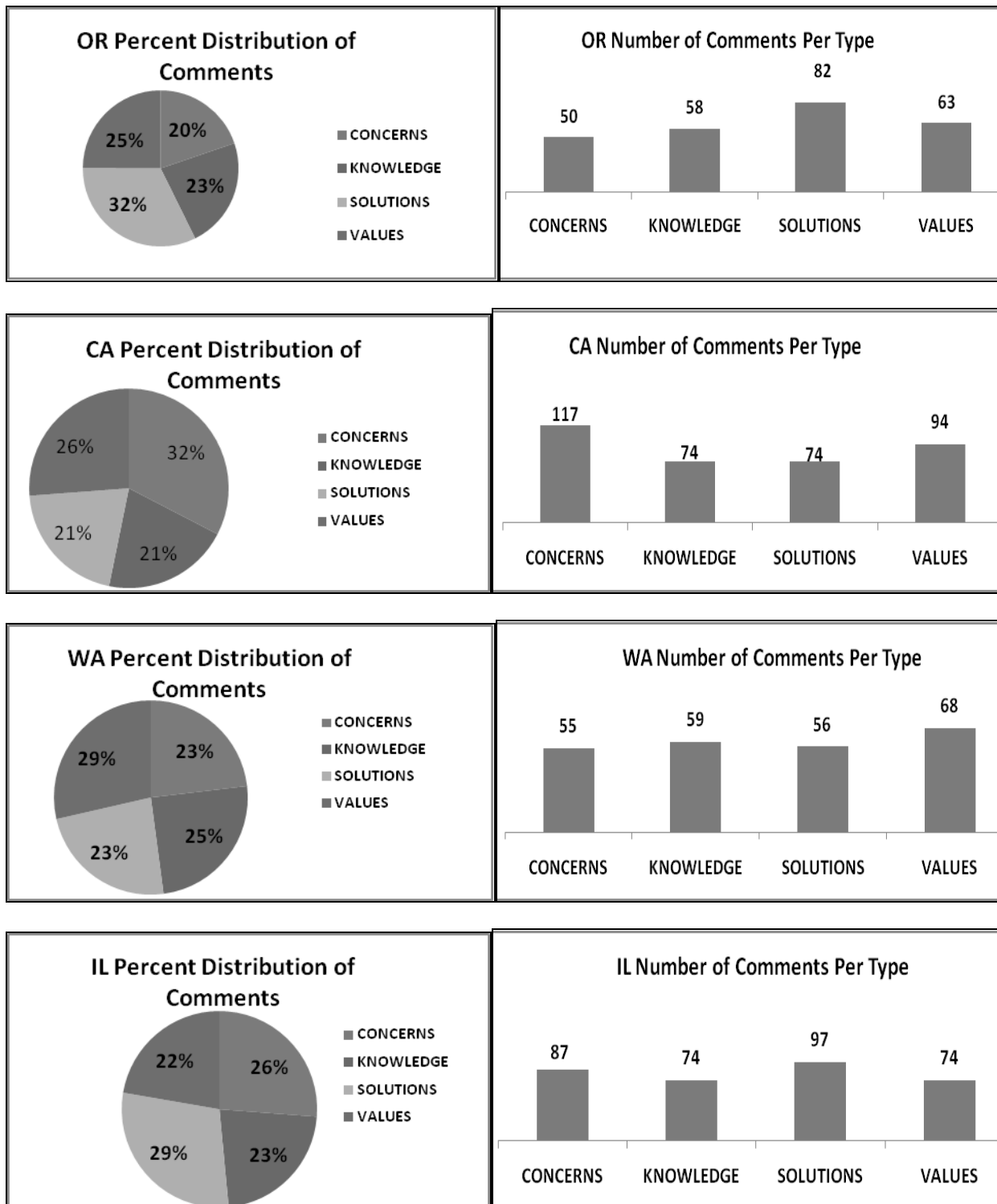
Values	Educational	Learning/ Stewards	Learning	comments on how teachers uses living organisms as a learning tool
Values	Educational	Learning/ Stewards	Teaching	comments on how teachers uses living organisms as a learning tool
Values	Educational	Learning/ Stewards	Stewardship	comments on how teachers uses animals to teach stewardship
Values	Educational	Learning/ Stewards	Connected ness	comments on connectedness of students
Values	Educational	Learning/ Stewards	Awareness	comments pertaining awareness of children
Values	Educational	Motivational/ Interaction	Engaging	when teachers talk about how they use animals for engagement
Values	Educational	Motivational/ Interaction	Motivating/ stimulating	when teachers talk about how they use animals as a motivational tool
Values	Educational	Motivational/ Interaction	Interactive	when teachers talk about how they use animals for interactions with students
Values	Educational	Motivational/ Interaction	Hook	when teachers talk about how they use animals as a hook
Values	Educational	Motivational/ Interaction	Awareness	when teachers talk about how they use animals for awareness
Values	Educational	Emotional/ Calming		no fourth level
Values	Uses	Having/ Possession		no fourth level
Values	Uses	Food Source		no fourth level
Values	Uses	Classroom Pet		no fourth level
Values	Ethical	Euthanasia	Against	comments on teachers against euthanasia
Values	Ethical	Euthanasia	Supportive	comments that supports euthanasia
Values	Ethical	Euthanasia	Mixed	comments that are mixed for euthanasia
Values	Ethical	Euthanasia	Reasons	reasons for why teachers are against and for euthanasia
Values	Ethical	Capture/Harm/ Release		no fourth level
Values	Ethical	Possession of IS/AIS		no fourth level



Appendix G: Overview of Methods for AIS in Classroom Project



Appendix H: Level One Comment Distribution by Location



Appendix H: Level One Comment Distribution by Location (continued)

