

CREATING A MODEL CURRICULUM FOR A CERTIFICATION  
PROGRAM TO TRAIN PEOPLE TO WORK IN THE FIELD  
OF EXHIBITING LIVING ARTHROPODS

by

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## ABSTRACT

The purpose of this project was to create a model curriculum for a certification program for the live arthropod exhibit industry. An overview of live arthropod exhibits and the current educational and training programs for the field were examined as well as reasons why a program of this type would be of value to the industry.

The data for this project was collected using a web based survey instrument. The population consisted of 52 professionals from the live arthropod exhibitry field. These entomologists, USDA representatives, insect suppliers and educators were all members of a professional list serve which was a clearinghouse for the live arthropod display industry. The survey instrument consisted of four sections: demographic information about respondents; the respondents' level of agreement or disagreement regarding areas of training to be included in a proposed certification program; preferences on prerequisites for the program; written comments and input.

A demographic profile of the respondents was compiled showing that the majority were experienced in the live arthropod exhibitry field and possessed a variety of educational backgrounds.

Overall, respondents supported the proposed certification program and felt it would benefit the live arthropod exhibit industry. Only four respondents were pessimistic about the proposed program.

A model curriculum for a certification program for the live arthropod exhibit industry was created from the data gathered by the survey instrument.

## CHAPTER 1

## INTRODUCTION

History and General Overview

Insects and their relatives, or arthropods, were the most numerous group of animals on our planet yet they were also the most misunderstood. There were a proliferation of zoos and aquariums in the world which educated the public about mammals, fishes and birds (Zoos & Aquariums, 2004). Many of these facilities exposed the public to animals from all over the world which they might otherwise never have the opportunity to see. In recent years a more heightened interest in the environment made television channels like Animal Planet and the National Geographic Channel extremely popular. An increasing enthusiasm for learning about the natural world was triggered by exposure to excellent nature films and photography depicting the lives of insects (Saul-Gershenz, 2003). This opened up new opportunities to expand the horizons of the public and a new type of zoo; the insect zoo experienced a growth spurt all over the United States, as well as the world. Even though the first major public live insect exhibit was opened at the London Zoo in 1881, other display facilities of varying sizes and duration slowly gained popularity around the world. There were insect displays in Finland, Canada, England, Australia, China, Japan, Malaysia, Hungary, the Netherlands, France, Austria, Czechoslovakia, Africa, Singapore, Costa Rica, Belize, the United States and many more (Saul-Gershenz, 2003). However, in

1987 with the opening of the Cecil B. Day Butterfly Center at Callaway Gardens in Pine Mountain, Georgia, as well as two other butterfly enclosures in Florida at approximately the same time (Corley, 2002), this trend became very popular and continued to gain momentum. "Today there are over 100 insect zoo exhibits throughout the world" (Saul-Gershenz, 2003, p. 582).

There were two major types of live insect exhibits. The Day Butterfly Center, for example, was a 6500 square foot glass-house filled with tropical plants and free flying butterflies (Corley, 2002). This was known as an immersion exhibit because the guest was immersed into the animals' habitat and there was no barrier between them and the butterflies. Immersion exhibits were created in Asia for fire flies and grasshoppers as well as for butterflies (Saul-Gershenz, 2003). Butterfly houses spurred a greater interest in displaying insects in the United States. This interest grew into an explosion of new insect exhibits with more of them opening every year. These exhibits tended to display living insects and their relatives in a more traditional manner of individual habitats or vivariums. As opposed to an immersion style exhibit where there was no barrier between the visitor and the display animal, the traditional style exhibit generally had a transparent barrier of glass or Plexiglas, usually in the form of a collection of terraria. This afforded the public a "safe" way to observe venomous and non-venomous arthropods at close range. These exhibits were extremely popular and were used to generate increased visitation and revenue for many zoos, museums and other non-profit organizations (Saul-Gershenz, 2003).

All of these exhibits were monitored and permitted by the United States Department of Agriculture's Animal Plant Health Inspection Service, Plant Protection and Quarantine (APHIS PPQ). A strict permitting process was in place to protect the United States from any unwanted introduction of foreign specie which could be very damaging to the ecosystems. Certification of personnel in this field would assist the USDA in knowing the knowledge level of a person applying for a permit. It would also create a way for managers of live insect exhibits to gauge the knowledge of potential job candidates for their facilities.

#### Purpose of the Project

The purpose of this project was to create a curriculum that would prepare the student to enter the field of live arthropod exhibitry. This would build a larger and more qualified pool of applicants for these jobs, which in turn would raise the level of quality in the exhibits presented to the general public, thus improving the entire industry. It would also enable the qualified workers to earn higher salaries.

#### Need for the Project

In 2004 there were no programs of this sort in existence. There were numerous museum studies curricula which in some cases were combined with either zoo-keeping curricula or entomology curricula but none of these programs existed for the purpose of professional training for employment in a live arthropod

exhibit. The availability of a certification program would save time by decreasing the number of hours spent in on-the-job training, increase productivity by raising the skill levels of the people working in the field and increase the quality of the exhibits.

### Objectives

The objectives of this project were:

- 1) To determine the demographic characteristics of industry respondents.
- 2) To survey current and past industry professionals regarding what information was valuable to include in a certification program.
- 3) To create a model curriculum at the university level to support and improve the level of knowledge in the industry.

### Assumptions

The following assumptions existed for this study:

- 1) The field of displaying living arthropods was a valuable and growing industry.
- 2) A certification program would improve the live arthropod exhibit industry.
- 3) The survey instruments used in this study were a reliable method for collecting the data necessary for analyses with this specific population.

- 4) The population used for this survey had experience and knowledge in this field.
- 5) Improving the educational opportunities of the professionals in this industry would improve the quality of the exhibits for the public.

### Limitations

The following limitations existed for this study:

- 1) The survey population was limited to persons registered on the Sonoran Arthropod Studies Institute list serve, Inverticap@yahoogroups.com.
- 2) Surveys were administered on the World Wide Web and responses were collected using Microsoft Access.
- 3) The surveys were administered to the pilot group in the fall of 2003 and to the population in the month of October 2004.

### Definition of Terms

- 1) Live arthropod exhibit: A public exhibit at a zoo, museum, botanical garden, nature center or other similar facility that displayed living arthropods.
- 2) Certification program: A college level program designed to prepare a person for employment in a live arthropod exhibit facility.



- 3) Butterfly house: A live arthropod exhibit which only displayed Lepidoptera (butterflies and moths).
- 4) Insect zoo: A live arthropod exhibit which displayed insects and their relatives sometimes including Lepidoptera.
- 5) USDA APHIS PPQ: The United States Department of Agriculture, Animal Plant Health Inspection Service, Plant Protection and Quarantine. This government agency regulated and controlled all of the permitting for live arthropod exhibits in the United States.

## CHAPTER 2

### REVIEW OF LITERATURE

#### Introduction

This chapter provided an overview of the literature related to live arthropod exhibits and research conducted to improve or establish a professional certification program to train people for work in this industry using a multi-disciplinary formula.

Insects make up 53 percent of all animals on earth. “Children need opportunities to explore insects in depth, investigate insects’ habits, share observations and internalize what they have learned” (Danoff-Burg, 2002, p. 42). For this very reason, exhibits displaying living insects and their relatives collectively referred to as arthropods, were very popular at zoos, museums, universities, nature centers, botanical gardens and theme parks. For a number of children in the U.S. their first insect encounter was through a museum (Danoff-Burg, 2002). There were approximately 140 live arthropod exhibits in the U.S. These exhibits ranged from small seasonal displays of native species of butterflies to elaborate year round displays of tropical species of insects, arachnids, myriapods and crustaceans in large rainforest-like conservatories.

### Insectarium Definitions and Overview

The following was a brief description of some different types of live insect exhibits. First, there was the traditional glass butterfly house; this consisted of a large glass greenhouse-like conservatory planted inside to be similar to a tropical rainforest. When one entered this type of exhibit one was surrounded by living butterflies. This was called an immersion exhibit because the visitor was “immersed” into the butterfly’s habitat. There were no walls, glass or screens between the visitor and the animals. The second major type was a more traditional exhibit which usually consisted of a number of glass or Plexiglas containers or aquaria each containing microhabitats for individual or colonies of residents. “Many of the animals, such as predaceous diving beetles and leaf cutter ants, are kept in spacious custom-built tanks or are housed in large vivaria with beautifully designed naturalistic environments (Evans, 1996, p. 3). Unlike an immersion exhibit, in this second type there was glass between the visitor and the animal. Many visitors found this to be a more comfortable situation. A number of the more traditional exhibits also have discovery areas where visitors were given the opportunity for a more up close and personal experience (Corley, 2002). At the Crawlaseum at Callaway Gardens for example, visitors were afforded the opportunity to hold a live Madagascar Hissing Cockroach or a Giant African Millipede. This one-on-one interaction was very successful in opening people’s minds to the world of insects. People may not remember everything they saw or read in an exhibit, but they never forgot holding a giant cockroach.

One thing all of these exhibits had in common was the need for knowledgeable employees to design and create the exhibits, care for the animals, administer the facilities and interpret for and educate the public. Choosing a career was one of the most important decisions a person made in life. The next step was where and how to acquire the proper education and training in the chosen field (Schwarzer, 2001). Unfortunately, there were no existing college level programs to train people to work in this industry. This limited the potential field of candidates to either people who already had experience in the field or those who would need to be fully trained on the job. This not only decreased the number of candidates, it increased the time the staff had to spend training them.

### Current Educational Opportunities

An entomology degree seemed like the logical place to start. There were 51 college level entomology programs in the U.S. (Colorado State University, 2003), none of which had a program for the live exhibitry field. Kansas State University even had an Entomology Graduate Certificate program for students in other disciplines to demonstrate a proficiency in entomology as it related to their field of study (Kansas State University, 2002). An entomology degree however, did not prepare a student for “projects such as building an interpretive display or coordinating a visitor program” (Palombi, 2002, p. 111), just two of the many tasks that were part of working in an exhibit. There were also certification programs in the fields of Museum Studies and Museum Education, but these did

not tend to have the science or entomology background incorporated into them that was needed for this field (Palombi, 2002). Although very helpful in the field of live arthropod exhibits, these programs did not include the full realm of training that was needed to fully prepare a student for a career in this field. Museum studies programs taught very little about science oriented exhibits. Most of these programs were geared toward art and history exhibits, but the exhibit design and museum administration training would have been highly valuable in the live exhibit field. Entomology programs taught all of the needed background and scientific foundations, but they lacked training in administration, exhibit design and visitor programming. Both programs could be supplemented with courses in education. Neither program taught the care and husbandry of live animals for display or how to create a display habitat that was healthy for the animal, looked natural yet did not allow the animal to hide from the view of the visitor. "So far, there are no official professionally oriented graduate programs for entomology exhibits" (Palombi, 2002, p. 112). There was a zoo animal technology program available at Santa Fe Community College in Gainesville, Florida. It "is a five-semester technical program that offers a wide range of practical instruction and clinical experiences leading to the Associate of Science Degree in Zoo Animal Technology" (Santa Fe Community College, 2004). The campus had its own teaching zoo which was where many of the classes were held and hands on experience similar to an internship was acquired. This program was accredited by the AZA (American Zoo and Aquarium Association) but did not include any

training for work with insects and their relatives (Santa Fe Community College, 2004). Oregon Coast Community College had developed an interesting program for training Aquarium professionals. This was a two year program which culminated in an Associate of Applied Science in Aquarium Science degree. This program had courses in aquarium science, interpretation and communication, scientific diving, biology of captive species, reproduction and nutrition, principles of exhibit design and fish and invertebrate health management. Practicum courses and an internship were also part of the curriculum (Oregon Coast Community College, 2004). Although a well rounded program, unfortunately it was not focused on insects.

#### Determining the Content of a Certification Program

To determine the content of a certification program for the live arthropod exhibitry field, a survey of “experts” and current workers in the field was employed. This method of consulting experts in the field instead of academics had been shown to be a successful way of gathering data to create a quality curriculum. “In appraising the content, one can also look for the extent to which what is taught is made relevant to ideas in other content areas or to issues and situations outside of the school.” (Eisner, 1998, p. 178). Most certification programs consisted of a set number of credit hours, which could be met with a choice of classes from different departments. Michigan State University for example required a minimum of 15 credits and an internship to earn a graduate

certificate in museum studies. The program included Introduction to Museum Studies which was required and then a choice of at least three electives from a group of six, coupled with a three credit internship. The electives included Museum Education, Curatorial Practices, Special Topics, Theory and Development of Exhibitions, Interpretation and Visitor Information, but nothing involving finance, live exhibitry, human relationships or any type of management (Michigan State University, 2003). The Michigan State program was approximately one semester's worth of classes, a rather small number for such a diverse field. Harvard, on the other hand, required 32 hours or "units" with a required introduction course and administration course for a certification in museum studies. Other subjects listed under Harvard's Natural History section included vertebrates, fish, plants, oceans, fungi and geology, but nothing for insects or arthropods and nothing in terms of live exhibit training (Harvard University Extension School, 2003). Although there were similar certification programs in structure, training in the specific skill set needed for this field just was not available.

#### Need for a Certification Program

Why, one may ask, was there a need for a program like this, besides the fact that this was a popular and growing industry? Brown answered this question when he stated:

Certification of competence in the ability to perform the duties of an occupation indicates a person's achievement of predetermined standards. It offers a benchmark for assuring that the individual possesses the qualifications required for employment in a given occupation or occupational specialty. (1999, p. 1)

As a young and growing industry, there existed a void which substantiated the need to create standards. "Such standards and credentialing systems provide a common language for employers, workers, students and education and training providers to communicate skill requirements and quality expectations for all major industry and occupational areas" (Illinois Occupational Skill Standards and Credentialing Council, 1998, p. iv). Certification also benefited the certified worker by enabling them to pursue better paying positions and demand higher salaries. This was an important factor considering most of these facilities were not-for-profit organizations where pay scales were generally lower. According to Sanchez and Laanan (as cited in Brown, 1999) people completing certification programs realized the largest increase in earnings in their chosen field. Until 2004, on-the-job training had been the preliminary method for learning job skills in the live arthropod exhibitry field. As the field increased in size and scope, growth in training was definitely indicated. "Technical certification of skills is of increasing importance to employers, especially when they have been involved in setting the certification standards" (Brown, p. 2). The availability of a certification program would save time by decreasing the number of hours spent in on-the-job



training, increase productivity by raising the skill standards of the people working in the field which in turn would increase the quality of the exhibits for the public who visit them.

Very little had been written about the methods of training for careers in the live arthropod exhibit field. There were small numbers of articles on animal husbandry for display insects, exhibit design, and the exhibits themselves, new ones and old ones, yet almost nothing about the people who created them and worked in them. There were many programs in related fields, which could be used as models in the creation of such a program. A large number of live arthropod facilities already existed and more were being built every year. They were of great value to the public, especially to children, for increasing the understanding of the natural world. Although certification programs existed in related fields, the only previously existing training programs in this field were on-the-job training and internships. Previously, the Day Butterfly Center at Callaway offered one of two formal internships available in the United States. It was created by the researcher in response to a request from a student at Michigan State University. This internship program was founded in 2002 and ran from May through August. According to Dr. Leslie Saul-Gershenz, Director of Conservation and Science at the Center for Ecosystem Survival, the second internship opportunity was with the San Francisco Insect Zoo and was founded by her and others in the early 1980's. Some interns in this program have been supported by university work-study funds and others by stipends. These Interns came primarily

from the University of California Berkeley, U. C. Santa Cruz, San Francisco State University, New College and the University of San Francisco (personal e-mail, October 1, 2004).

Many benefits were derived from certification programs, such as higher earning potential and better job skills. There was clearly a need for some type of certification program in the field of live arthropod exhibits. Creating this program was of great benefit to the industry, its institutions, their staff and most of all to the public that visited these exhibits.

## CHAPTER 3

## MATERIALS AND METHODS

Introduction

This chapter detailed the materials and methods used to gather and analyze data from live arthropod exhibit professionals to determine the scope and curriculum of the proposed project. It examined instrument design and population description as well as data collection methods, data analysis and survey reliability.

Method of Investigation

The following methods were used to satisfy the purpose and meet the objectives of this study. They were described in four sections: 1) Population Description, 2) Instrument Design, 3) Data Collection Methods, and 4) Data Analysis Procedures.

Population Description

Entomologists and arthropod exhibit professionals were contacted to determine the scope of their entomology education programs and to identify potential individuals for the study population. Respondents who possessed the expertise to respond to this study included entomologists currently or formerly employed at live arthropod exhibits, educators, USDA representatives, students

desiring a career in live arthropod exhibits, and other arthropod specialists. A professional list serve hosted by the Sonoran Arthropod Studies Institute that consisted of the above described members from all over the world was identified as an appropriate study population. This list serve had a total of 246 possible participants and served as a clearinghouse for information exchange for the live arthropod exhibit industry. An e-mail request explaining the study was sent to each potential respondent via this professional list serve. Most responses were positive. The population included in the study was limited to individuals meeting any one or more of the following criteria:

- 1) Individuals who possessed a BS or higher degree in entomology or a related scientific discipline.
- 2) Those professionals who were currently working or have worked in a live arthropod facility.
- 3) USDA representatives.
- 4) Educators who used live arthropods in their curricula.
- 5) Suppliers who bred and sold live arthropods to live arthropod exhibits.

#### Instrument Design

The research was conducted using a single instrument developed by the researcher. The survey consisted of four sections: Section one requested demographic information about the respondents; section two requested the respondents' level of agreement or disagreement regarding areas of training to

be included in a professional certification program for the management of or employment in a live arthropod exhibit; section three requested the respondents' preferences on prerequisites needed to enter a certification program; section four requested the respondents' comments and input.

A pilot study of the survey was conducted. A group of 17 arthropod professionals completed the survey. While this audience did not have all of the same characteristics of the respondent population, many similarities existed. This audience was encouraged to evaluate the survey and identify problems with the web site and time taken to complete the surveys. The instrument was finalized based on the results of the pilot study and the suggestions of the pilot study participants.

The instrument was validated by a panel of experts from the fields of entomology and agricultural education at 1862 land grant institutions. Survey reliability for all Likert-type items was calculated by Cronbach's Alpha reliability coefficient and is found in the Data Analysis Procedures section of this chapter.

### Data Collection Methods

#### Pilot Group

The data for this study was collected using a traditional hard copy survey instrument. The following timetable was followed:

- 1) September, 2003 – the group was chosen and initial contact was made by telephone.

- 2) October 1, 2003 – survey instruments were mailed or faxed to members of the group.
- 3) October 14, 2003 – reminders were conducted by phone.
- 4) October 21, 2003 – cut-off date for data collection.

### The Population

The data for this study was collected using a web based survey instrument. The following timetable was followed:

- 1) August, 2004 – initial contact was made by announcement at the Invertebrates in Captivity Conference.
- 2) October 1, 2004 – request for use of the list serve as a dissemination tool was made and granted.
- 3) October 8, 2004 – request for participation and announcement that the website was up and survey instructions were sent by e-mail.
- 4) October 19, 2004 – final reminder and thank you were sent by e-mail.
- 5) October 26, 2004 - phone calls were made to encourage last minute participation in the survey.
- 6) October 27, 2004 – cut-off date for data collection.

As stated earlier, a total of 246 possible participants were identified. A cover letter and instructions (Appendix C) were provided by email to each of the respondents participating.

### Data Analysis Procedures

Because the survey was web-based, all data were collected from the web site using Microsoft Access®™. The data was transferred into Microsoft Excel. Data analysis was completed using procedures available through SPSS 12.0 for Windows. Expert guidance was sought during statistical analysis of the data. Early and late respondents were examined for statistical difference by a t-test and Mann-Whitney U tests. The hypothesis that there is no difference between the groups was tested at the .05 significance level. No significant differences were found. Descriptive statistics were generated for the instrument results based on demographic variables. A Cronbach's alpha coefficient was calculated for the survey. The statistic resulted in a 0.903 coefficient. Descriptive Analysis was employed to further analyze instrument data, utilizing the demographic variables as the pool of comparative variables. The .05 alpha level was established as the criterion for determining significant findings.

## CHAPTER 4

## RESULTS AND ANALYSIS

Introduction

The researcher looked at four different aspects of the survey data: the breakdown of the demographics section; the results of the Likert-type sections; the opinions of the respondents regarding the inclusion or exclusion of the suggested curriculum items presented in the survey; and the written comments and suggestions of the respondents.

Demographic Data

The demographics of the respondents were broken down in a number of different ways. Of the 52 respondents, 98% or 51 respondents have worked or were currently working in a facility that displayed living arthropods. Eighty-three percent of those had been working in the industry for over five years, 10% for two to four years and 7% for zero to two years. When asked what had been more beneficial to them while working in the live arthropod exhibitry field, 92% chose on-the-job experience and only 8% chose formal education.

In examining the educational backgrounds of the respondent population, 81% of the respondents had completed some type of college degree with 77% being a four year degree or higher. Of the respondents 17% had only a high school diploma or the equivalent. This was illustrated in Figure 1.



Figure 1

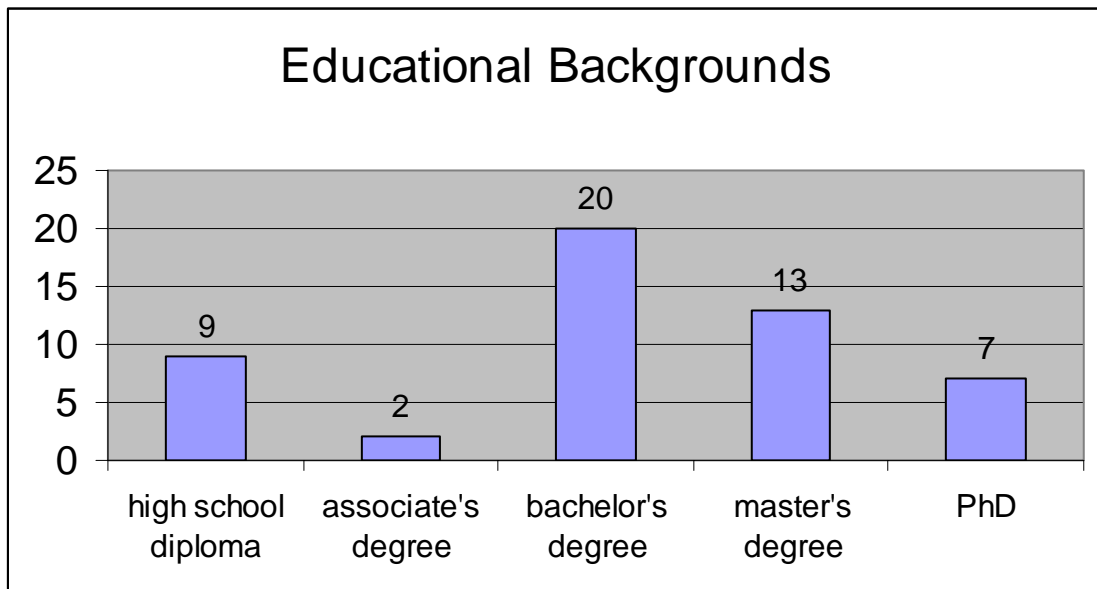


Table 1 summarized the respondents' degrees and fields of study.

Although there was a very broad range of specialty areas listed, the results were heavily weighted towards the sciences.

Among the 77% of respondents who had a four year degree or higher the field of studying among bachelor's degree holders were the most diverse although heavily weighted towards the sciences. The master's degree recipients were almost entirely science or environment based with 46% of those being in entomology. A slightly tighter focus in the PhD. category showed 100% of the degrees in the sciences and 43% in entomology.

Table 1. Degree Levels and Fields of Study

Degree Level	Field of Study
Bachelor's degree	art
Bachelor's degree	biology
Bachelor's degree	biology
Bachelor's degree	biology
Bachelor's degree	biology/art
Bachelor's degree	business
Bachelor's degree	chemistry
Bachelor's degree	education
Bachelor's degree	english/communications
Bachelor's degree	environmental geography
Bachelor's degree	environmental science
Bachelor's degree	horticulture
Bachelor's degree	minor in biology/scientific illustration
Bachelor's degree	psych, soc, anthro, minors in biology and communications
Bachelor's degree	theology
Bachelor's degree	wildlife ecology
Bachelor's degree	zoology
Bachelor's degree	zoology
Bachelor's degree	zoology
Master's degree	art
Master's degree	bio sci / entomology
Master's degree	biology
Master's degree	biology, education
Master's degree	education and environmental studies
Master's degree	entomology
Master's degree	entomology
Master's degree	entomology
Master's degree	entomology
Master's degree	entomology
Master's degree	environmental management/conservation biology
Master's degree	conservation biology and sustainable development
Master's degree	recreation and park administration
PhD	biochemistry
PhD	botany
PhD	entomology
PhD	entomology
PhD	entomology
PhD	microbiology
PhD	plant ecology

Although there was diversity of job titles within the population respondents as illustrated in Figure 2, 34 were either at the management or curatorial level with the other four remaining categories adding up to only 18.

Figure 2

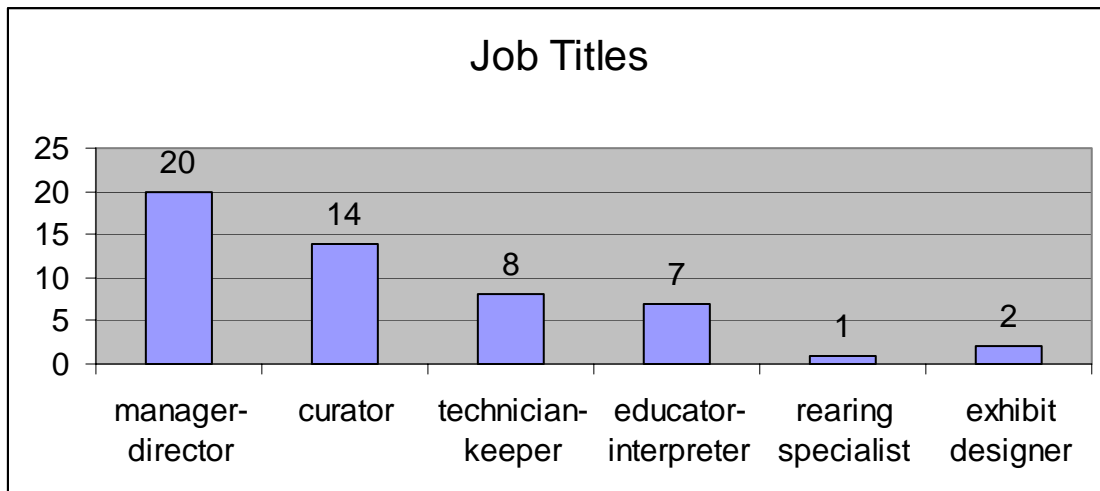
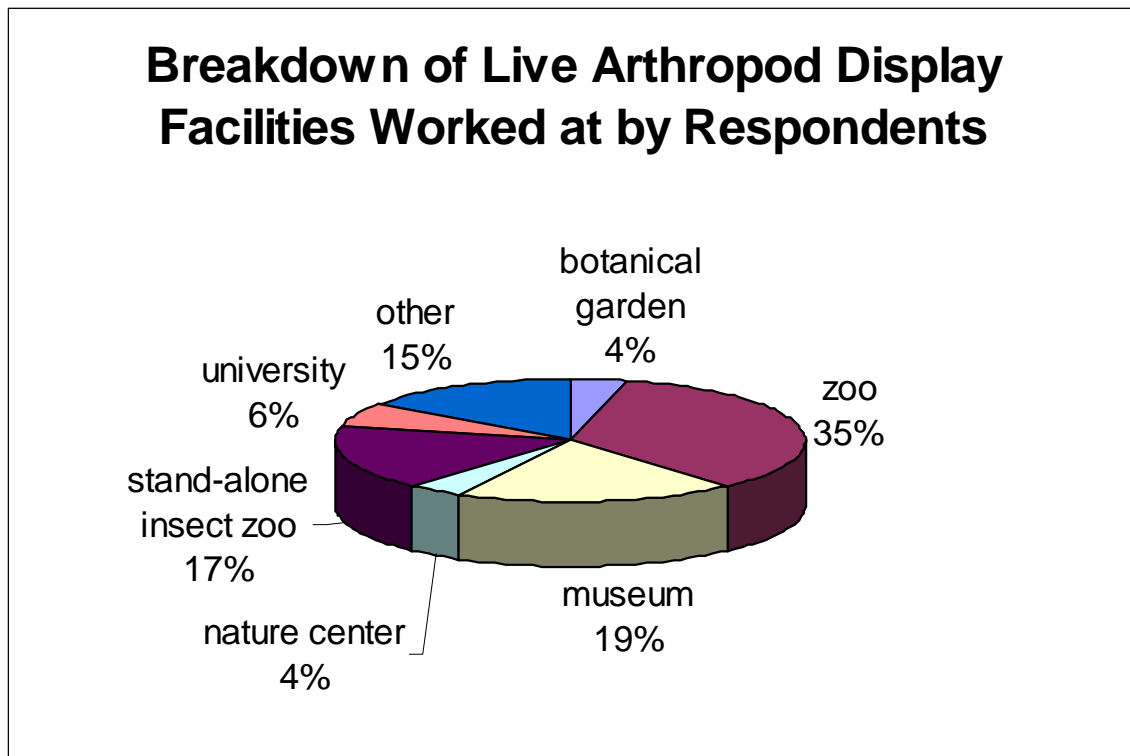


Figure 3 was a breakdown of institution types that employed the respondents. It illustrated the diversity of institutions using live arthropods for display. Some of the respondents chose the response "other". The institution types listed by these respondents in the space provided were as follows:

- Zoo, Aquarium, Botanic Garden
- Museum before, now Dept. of Agriculture
- Commercial breeder
- University Nature Center
- Zoo and aquarium professional organization

- Professional association
- Public aquarium

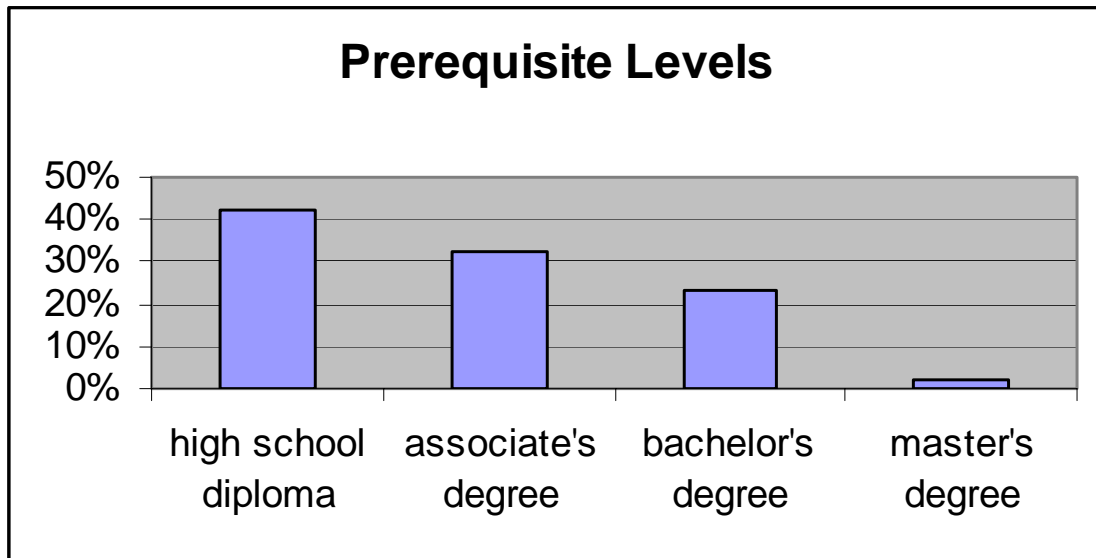
Figure 3



#### Prerequisite and General Data

There was a clear preference among respondents for the prerequisite level to be set lower, thus allowing greater access to the program. This coincided with the opinions expressed in the respondents' written comments, which will be discussed later in this chapter. Figure 4 illustrated the percentage breakdown of the respondents' choices for the prerequisite level to enter the proposed certification program.

Figure 4



Respondents were asked if the degrees should be completed before beginning the certification program. A response of "No" also indicated that the certification program could be taken concurrently with a degree program. The responses were almost evenly split with 49% answering "no" and 51% answering "yes".

Respondents were asked to rank some suggested major fields of study or degrees to best create a foundation for this type of certification program, with 1 being the most appropriate and 5 being the least. The suggested fields and each field's mean ranking ( $\pm$  SD) were Entomology 1.81 (1.299), General Biology 2.79 (1.391), Zoology 3.10 (1.241), Horticulture 3.17 (1.232), and Wildlife Biology 3.60 (1.317). As illustrated in Table 1, there were people with extremely varied educational backgrounds already involved in this industry.

Respondents were given four options regarding program length; one year, two years, one year plus an internship or two years plus an internship. In the population, 71% preferred to include an internship in the program. When asked, 57% of respondents felt the proposed program should last one year plus an internship, 12% preferred a two year program, 14% a two year program plus internship and 18% preferred a one year program.

### Core Curriculum Data

A Likert-type scale (4= strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree) was used to discern the respondent's ideas on the core courses necessary for a live arthropod exhibit certification program. The results were summarized in Table 2. Means for all but Integrated Pest Management were above 3.0 indicating agreement that these courses should be included in the proposed program. The mean for Integrated Pest Management was 2.88, indicating some support for inclusion of this course.

Table 2. Means and Standard Deviations of Core Curriculum for Live Arthropod Exhibit Certification Program.

Quest. No.	Core Curriculum - Course Title or Description	Mean <sup>a</sup>	S.D.
1.	Entomology (non entomology majors only)	3.48	.727
2.	An overview of live arthropod exhibits course	3.63	.627
3.	Integrated Pest Management	2.88	.758
4.	Insect Husbandry	3.69	.612
5.	A course in USDA and government regulations	3.42	.696
6.	An internship at an established arthropod exhibit	3.23	.807

<sup>a</sup> Mean calculated from a Likert-type response scale ranging from Strongly Agree (4), to Agree (3), to Disagree (2), to Strongly Disagree (1).

Elective Curriculum Data

Table 3 summarized a list of possible elective courses of which were combined to total twelve credit hours to complete the certification program. They were divided by possible job specialization. The respondents were asked if these courses should be included as electives in a live arthropod exhibitry

Table 3. Means and Standard Deviations of Electives for Live Arthropod Exhibitry Certification Program.

Quest. No.	Electives - Course Title or Description	Mean <sup>a</sup>	S.D.
<b>Insect Technician/Keeper/Curator</b>			
7.	Advanced Arthropod Husbandry (non-lepidopterous)	3.60	.634
8.	Tropical Insect Identification	2.90	.748
9.	Aquatic Entomology	3.06	.639
10.	Advanced Lepidoptera Husbandry	3.19	.742
<b>Exhibit Designer</b>			
11.	Basic Design Skills	3.35	.738
12.	A studio course in mixed media and construction	3.15	.724
<b>Manager/Director</b>			
13.	Business Management	3.25	.711
14.	Marketing	3.10	.781
15.	Public Relations	3.33	.734
16.	Human Relations	3.26	.696
17.	Personnel Management	3.44	.698
18.	Grant Writing	3.08	.710
19.	A course in budgeting and basic accounting	3.02	.671
20.	Public Speaking	3.25	.682
<b>Educator/Interpreter</b>			
21.	A Curriculum Development course	3.27	.744
22.	A course in basic classroom teaching skills	3.31	.729
23.	Medical Entomology	2.37	.627
24.	A course in information technology for educators	2.81	.687
25.	Environmental Education	3.29	.667
<b>Horticulturist</b>			
26.	Insect Identification	3.44	.639
27.	Butterfly Gardening	3.25	.653
28.	Biological Control	3.54	.641
29.	Insect Plant Interactions	3.40	.664

<sup>a</sup> Mean calculated from a Likert-type response scale ranging from Strongly Agree (4), to Agree (3), to Disagree (2), to Strongly Disagree (1).

certification program. This section of the survey instrument was set up in the same way as the core curriculum section with a four-point Likert-type scale. Only three course suggestions yielded means below the agreement level of 3.0. These courses were Tropical Insect Identification (mean 2.90); Medical Entomology (mean 2.37); and Information Technology for Educators (mean 2.81). The Advanced Arthropod husbandry course yielded the highest mean 3.60 followed by Biological Control (mean 3.54), Insect Identification (mean 3.44) and Insect plant interactions (mean 3.40).

#### Written Comments from the Population Survey Instrument

The written text from the “comments” section (Appendix D) of the population survey was copied in their entirety from the survey responses. They were copied verbatim and no attempt was made to correct any spelling or grammatical errors.

Of 52 total respondents, 22 or approximately 42.3% included written comments. The majority of these comments was positive and supported the creation of a certification program. Only four responses were completely negative, representing 9.5% of the respondents who included written comments or 7.7% of the total number of respondents. The negative respondents believed the creation of a certification program was unnecessary or would create problems for the live arthropod exhibit industry such as an overabundance of qualified professionals.



Respondents also stated a prevailing concern regarding the prerequisites to participate in the proposed certification program and the overall opinion expressed in the “comments” section of the survey was that anyone, regardless of their previous level of education, should be able to participate in the proposed certification program. Additionally, it was noted this would create an opportunity for anyone interested in the field, not just college graduates or students seeking a college degree to expand their knowledge of this growing field.

There appeared to be some confusion as to the purpose of the survey which was to gather data to aid in the creation of a certification program and gather opinions regarding its value. Some respondents tended to focus on their own institution instead of the entire array of live insect exhibit facilities in the United States. This may have skewed their responses toward inclusion or exclusion of certain classes in the purposed curriculum.

## CHAPTER 5

## CONCLUSIONS AND RECOMMENDATIONS

Introduction

Based on the responses of the majority of the population surveyed, the researcher concluded a certification program for the live arthropod exhibit industry would be a valuable addition to the industry as well as to academia. It would provide a standard qualification level for the USDA to use when deciding whether or not to grant a permit to someone. It would also create another multi-disciplinary program which helps to produce more well-rounded graduates who are better prepared for our ever-changing world.

Conclusions

Based on the results of the study and the suggestions and opinions of the industry professionals who participated in the survey, following are the conclusions of this study.

Demographic Characteristics of RespondentsDemographic Data

One of the objectives of this study was to determine the demographic characteristics of the population. In a study such as this one that involved

determining the certification requirements of a professional standards training program, the demographic profile of the population is worthy of study.

Almost all (98%) of respondents had work experience in a live arthropod display facility. Eighty-three percent of those had been working in the industry for over five years; however, they had a varied academic background with no specific training other than formal science education that prepared them for their position. The vast majority of the respondents chose on-the-job training and experience as more beneficial than their formal educations.

Most had college degrees of varying disciplines, but as the degrees became more advanced entomology and the sciences became much more prominent fields of study. At the PhD level, all respondents' degrees were science based with nearly half being in entomology.

The majority of the respondents held higher level job titles, which indicated greater experience in the field. A broad variety of institutional types were represented in the sample, from zoos to commercial breeders.

This data provided the researcher with information needed to make a better judgment about the findings in Chapter 4 that address the other two objectives of this study. It also demonstrated the validity of the population base that determined the requirements for a certification program such as the one examined in this study.

### Written Comments from the Population Survey

There were four responses that were completely negative. The respondents felt the creation of a certification program was unnecessary or would create problems for the live arthropod exhibit industry. They stated that a certification program would create an overabundance of qualified professionals. Although this was a possibility, with the growing number of live arthropod exhibits in the United States and abroad this seemed unlikely.

There also appeared to be some confusion as to the purpose of the survey. Some respondents focused entirely on the internal structure of their own institution instead of the entire array of live insect exhibit facilities in the United States as was the intention. This may have skewed their responses toward inclusion or exclusion of certain classes in the purposed curriculum. One respondent noted some institutions have separate departments to handle responsibilities such as marketing, public relations, development and human resources, therefore courses in marketing, public relations and grant writing would be a waste of time for a person working at those facilities. What these respondents failed to consider was that generally, the student would not know at what type of institution they would be working. It could be a large institution with separate departments for marketing, public relations, development, human resources and exhibit design such as the Cincinnati Zoo or the Houston Museum of Natural Science, however, it could just as easily be a stand-alone facility like the Sonoran Arthropod Studies Institute or Greathouse Butterfly Farm at which

the curator was also responsible for education, marketing, public relations, grant writing, exhibit design and fabrication, personnel, recruitment, finance as well as animal care. It was also likely a person would change jobs at some point during their career and would need different skills for that new position. There were many different types of jobs in the live arthropod exhibit field which had varied requirements. To properly prepare for these possibilities the curriculum needs to be as complete and well rounded as possible even though not all positions will require all skills. If a person is employed in an institution with separate departments, possessing a good basic understanding of what those departments do would create better interdepartmental working relationships which benefit the institution as a whole.

#### Recommendations: Curriculum Model for Live Arthropod Exhibit Certification

The following was the suggested curriculum plan for a live arthropod exhibitry certification program. The program was designed by using the findings of this research.

#### Program Requirements

To successfully complete the program and earn the Live Arthropod Exhibit Specialist certificate the student should complete the core curriculum to consist of 10 credit hours; 12 hours of electives in any combination chosen from the list below; and at least one internship with a USDA permitted arthropod exhibit

facility. When taken together on a full time basis the program was designed to last approximately one year plus the time spent in the internship.

### Prerequisites

The only prerequisite for entering the certification program would be a high school diploma or the equivalent and acceptance as a student to the particular institution at which the certification program was being offered. The student would not have to be formally accepted into the certification program to take any of the classes that are offered.

### Core Curriculum

Many of the courses listed in the core curriculum and in the elective curriculum already exist in some form at universities and colleges across the country.

The core curriculum of required classes should consist of the following;

- Basic Entomology (non entomology majors only)
- An overview of live arthropod exhibits course - a one hour seminar.
- Insect Husbandry - a four hour course with a lab element.
- A course in USDA and government regulations - a one hour seminar.
- An internship at an established arthropod exhibit - a description of the internship is listed below.

## Electives

The elective portion of the curriculum would provide an opportunity for the student to specialize in a particular job area of the live arthropod exhibit field.

The following course list was divided into specific job title headings under which were suggested classes relating to that particular job description. For certification the student must complete at least 12 hours of study in any combination of the following courses, in addition to the core courses

### Insect Technician/Keeper/Curator.

- Advanced Arthropod Husbandry (non-lepidopterous) - Four hours with a lab element
- Advanced Lepidoptera Husbandry - Three hours with a lab element
- Aquatic Entomology
- Tropical Insect Identification - Three hours with a lab element

Tropical Insect Identification was a borderline class for inclusion. The researcher chose to include it because basic entomology courses in the United States usually concentrate on North American fauna exclusively. In example, at the Insect Zoo at the Natural History Museum of Los Angeles County “About half of the collection consists of exotic species from around the world,” (Evans, 1996, p. 3). The same applied to most of the insectariums around the United States. Being able to identify and having knowledge of these tropical species is a necessity when working with them on a daily basis.

Exhibit Designer.

- Basic Design Skills
- A studio course in mixed media and construction.

Manager/Director.

- Human Relations
- Personnel Management
- Grant Writing
- A course in budgeting and basic accounting
- Business Management
- Marketing
- Public Relations
- Public Speaking

Educator/Interpreter.

- A Curriculum Development course
- A course in basic classroom teaching skills
- Environmental Education
- A course in information technology for educators

The information technology for educators course had a mean of below 3.0 in the survey data. The researcher chose to leave this course in as an option for those students who may not be computer literate.



Horticulturist.

- Insect Identification
- Insect Plant Interactions
- Biological Control
- Butterfly Gardening - a one hour seminar.

Internship Description

The internship component of the program should consist or at least a one semester internship with a USDA containment facility that displays arthropods all year long. The internship should include time spent working in all areas of the facility including but not limited to insect rearing and husbandry, management, permitting, horticulture, display maintenance, education, interpretation and visitor relations. Once all of these areas are covered, the intern should chose an area or two of focus for the remainder of the internship. This format enables the student to experience all aspects of working at a live arthropod display facility and chose the one they find most rewarding or interesting.

If the student is specializing in exhibit design two internships possibly of shorter duration should be considered. The first would be a general internship. The second should be with an exhibit design firm which specializes in exhibit design and fabrication for zoos and museums.

### Where Should the Curriculum Model be Housed?

The model program could be implemented at any college, university or community college with the appropriate classes and departments and an affiliation with a qualified live arthropod exhibit facility willing to take on interns.

### Recommendation for Further Study

More research is needed to actually implement this program. The following steps would need to be followed and would make an excellent project for the future.

- 1) An appropriate institution of higher learning that is willing to take on this program needs to be identified.
- 2) Supply and demand for the program needs to be studied in different areas of the country to help locate an appropriate institution. This would facilitate relationships with industry professionals as well as provide local internship opportunities for students of the program.
- 3) A live arthropod display facility that is willing to host interns on a regular basis needs to be identified and brought into the program.
- 4) Already existing courses that fulfill the requirements of the curriculum need to be identified and reviewed.
- 5) Courses specifically for the program need to be created and their objectives specified. Materials and curricula for those courses need to be written. A survey of industry professionals would be very valuable

for this as well as interviews with USDA officials and insect breeders and suppliers.

- 6) The processes for bringing the above steps to fruition need to be designed and implemented.
- 7) An exploration of alternatives for delivering the program should be conducted. This could include distance learning, web-based delivery and extension service programming.

### Implications

The data and written comments provided by this study allowed the researcher to believe and make the following statements:

- 1) There is a need for a certification program for the live arthropod exhibit industry.
- 2) Data obtained by this study may also be pertinent to other areas of natural science exhibitry where similar facilities are maintained.
- 3) A need for training and technical support for this certification may exist. USDA and American Association of Zoos and Aquariums (AZA) could offer training on topics identified in this certification program.

## REFERENCES CITED

- Brown, B. L. (1999). Vocational certificates and college degrees. (ERIC Digest No. 212, No. ED434248). Retrieved September 4, 2003, from <http://askeric.org/plweb-cgi/obtain.pl>
- Colorado State University. (2003). Entomology departments around the world. Retrieved September 5, 2003 from <http://www.colostate.edu/Depts/Entomology/colleges.html>
- Corley, T. (2002). *Let's go buggy*. Encino, CA: Corley Publications
- Danoff-Burg, J. A. (2002). Be a bee and other approaches to introducing young children to entomology. *Young Children, September 2002*, 42-46.
- Eisner, Elliot W. (1998). *The enlightened eye: qualitative inquiry and the enhancement of educational practice*. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Evans, A.V. (1996). A photographic survey of selected arthropod exhibits in Britain, Canada, South Africa, and the United States. *Conference Proceedings, 1996 Invertebrates in Captivity Conference*, 38-43.
- Harvard University Extension School. (2003). Museum studies. Retrieved October 8, 2003 from <http://www.extension.harvard.edu/2003-04/courses/muse.jsp>
- Illinois Occupational Skill Standards and Credentialing Council. (1998). *Illinois Occupational Skill Standards: Landscape Technician Cluster*. Macomb, IL: Curriculum Publications Clearinghouse. (ERIC Document Reproduction No. ED443024)
- Kansas State University. (2002). Entomology graduate certificate program. Retrieved September 25, 2003 from <http://www.oznet.ksu.edu/entomology/programs/entocert.htm>
- Michigan State University. (2003). Museum studies program requirements. Retrieved October 8, 2003 from <http://www.msu.edu/~msumsp/requirements.html>
- Oregon Coast Community College. (2004). Aquarium science program. Retrieved October 4, 2004 from <http://www.occc.cc.or.us/aquarium/>

Palombi, L. (2002). Insect exhibits and graduate school: Creating a program that works. *Conference Proceedings, 2002 Invertebrates in Captivity Conference*, 110-113.

Santa Fe Community College. (2004). Zoo animal technology. Retrieved September 30, 2004 from <http://inst.sfcc.edu/%7Ezoo/zat.htm>

Saul-Gershenz, L. (2003). Insect zoos. In V. H. Resh & R. T. Carde (Eds.), *Encyclopedia of insects* (pp. 582-589). San Diego, CA: Academic Press.

Schwarzer, M. (2001). *Graduate training in museum studies: What students need to know*. Washington DC: American Association of Museums.

Zoos & Aquariums. (2004). Zoos, aquariums and conservation organizations in the united states. Retrieved November 18, 2004, from <http://www.americanzoos.info/Files/Webpages/USA/USlist.html>

APPENDICES

APPENDIX A

PILOT SURVEY INSTRUMENT

CREATING A CERTIFICATION CURRICULUM FOR  
THE LIVE ARTHROPOD EXHIBIT INDUSTRY

**Section I :** Please answer the following questions by putting a check on the appropriate line or filling in the blank.

**Section I, Demographics:**

1. Are you currently employed at or have you ever worked at an institution that displays living arthropods?  
Yes \_\_\_\_\_ No \_\_\_\_\_
  
2. How many years have you been employed in the Live Arthropod Exhibit Industry?  
0-2 \_\_\_\_\_  
2-4 \_\_\_\_\_  
5 + \_\_\_\_\_
  
3. How would you describe your institution?  
Zoo \_\_\_\_\_  
Museum \_\_\_\_\_  
Botanical Garden \_\_\_\_\_  
University \_\_\_\_\_  
Nature Center \_\_\_\_\_  
Other \_\_\_\_\_ Explain; \_\_\_\_\_
  
4. What methods or types of media do you use to educate your audiences?  
Interactives \_\_\_\_\_  
Interpretive text \_\_\_\_\_  
Lectures \_\_\_\_\_  
Live interpretation \_\_\_\_\_  
Web based \_\_\_\_\_  
Video or Film \_\_\_\_\_  
Audio \_\_\_\_\_  
Other \_\_\_\_\_
  
5. What is your educational background?
  - a. Ph.D. \_\_\_\_\_ What field? \_\_\_\_\_
  - b. Master's degree \_\_\_\_\_ What field? \_\_\_\_\_
  - c. Bachelor's Degree \_\_\_\_\_ What field? \_\_\_\_\_
  - d. High school diploma or equivalent \_\_\_\_\_



6. What position (present or past) do you hold in your organization?  
 Manager/Director \_\_\_\_\_  
 Curator \_\_\_\_\_  
 Technician/Keeper \_\_\_\_\_  
 Rearing Specialist \_\_\_\_\_  
 Horticulturist \_\_\_\_\_  
 Educator/Interpreter \_\_\_\_\_  
 Exhibit Designer \_\_\_\_\_  
 Supplier \_\_\_\_\_  
 USDA \_\_\_\_\_
7. In working in the Live Arthropod Exhibit Industry what has been more beneficial to you?  
 Formal education \_\_\_\_\_ on-the-job experience \_\_\_\_\_

**Section II: Please respond to the following items using the four point scale below to indicate your level of agreement or disagreement about whether these items should be included in a Live Arthropod Exhibitory Certification program. Please type an "X" on the line following your choice.**

**Rating scale:**  
**4= strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree**

**Section II, Certification Program:  
 Core Curriculum (required for all students).**

**If a core curriculum were developed, how strongly do you feel about the inclusion of these courses in it?**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_    1. Basic Entomology (non entomology majors only)
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    2. An overview of live arthropod exhibits course.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    3. Integrated Pest Management.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    4. Insect Husbandry.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    5. A course in USDA and government regulations.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    6. A course in teaching and presentation methods.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    7. An internship at an established arthropod exhibit.

**Elective Curriculum (any combination can be chosen by students to complete required credit amounts).**

**Beyond the core curriculum students would be required to complete a number of credit hours from the following courses. How strongly do you feel about the inclusion of these courses in the curriculum? They are sorted by areas of specialization.**

**Insect Technician/Keeper/Curator**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_    7. Advanced Arthropod Husbandry (non-lepidopterous).
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    8. Advanced Lepidoptera Husbandry.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    9. Aquatic Entomology.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    10. Tropical Insect Identification.

**Exhibit Designer**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_    11. Basic Design Skills.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    12. A studio course in mixed media and construction.

**Manager/Director**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_    13. Human Relations.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    14. Personnel Management.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    15. Grant Writing.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    16. A course in budgeting and basic accounting.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    17. Business Management.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    18. Marketing.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    19. Public Relations.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_    20. Public Speaking.

**Educator/Interpreter**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 21. A Curriculum Development course.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 22. A course in basic classroom teaching skills.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 23. Environmental Education.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 24. A course in information technology for educators.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 25. Medical Entomology.

**Horticulturist**

- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 26. Insect Identification.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 27. Insect Plant Interactions.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 28. Biological Control.
- 4\_\_ 3\_\_ 2\_\_ 1\_\_ 29. Butterfly Gardening.

**Section III : Please answer the following questions by putting a check on the appropriate line or filling in the blank.**

**Section III, Prerequisites:**

1. What should be the terminal degree required to enter the Live Arthropod Exhibitory Certification program?
  - a. Ph.D.\_\_\_\_\_
  - b. Master’s degree\_\_\_\_\_
  - c. Bachelor’s degree\_\_\_\_\_
  - d. Associate’s degree \_\_\_\_\_
  - e. High school diploma or equivalent\_\_\_\_\_
  
2. Should the above listed degrees be *completed* before beginning the certification program? Check “No” if you think they should be allowed to be taken concurrently.
 

Yes\_\_\_\_\_ No\_\_\_\_\_

3. Please rank the following degrees as to which would be best as a foundation for this type of certification, with 1 being the most appropriate and 6 being the least.

- Entomology \_\_\_\_\_
- Wildlife Biology \_\_\_\_\_
- General Biology \_\_\_\_\_
- Zoology \_\_\_\_\_
- Horticulture \_\_\_\_\_
- Science Education \_\_\_\_\_
- Other \_\_\_\_\_ Please specify \_\_\_\_\_

**Section IV : Please answer the following questions by putting a check on the appropriate line or filling in the blank.**

**General Information:**

1. How long should the program take to complete? (One semester of course work equaling approximately 16 hours and an internship of three to six months.)
  - a. 1 year \_\_\_\_\_
  - b. 2 years \_\_\_\_\_
  - c. 1 year plus internship \_\_\_\_\_
  - d. 2 years plus internship \_\_\_\_\_

2. The following space is provided for your comments and input. Please feel free to write as much as you would like.

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You have now completed this survey. Thank you for your participation and input!

APPENDIX B  
POPULATION SURVEY INSTRUMENT,  
WEB-BASED FORMAT

## Creating a Certification Curriculum for the Live Arthropod Exhibit Industry

### Section I: Demographics

Please answer the following questions by selecting the appropriate response or filling in the blank.

1. Are you currently employed at or have you ever worked at an institution that displays living arthropods?

Yes  No

2. How many years have you been employed in the live exhibit field?

0-2  2-4  5+

3. How would you describe your institution?

--Choose One--

If other, please explain:

4. What is your educational background? Please choose highest level achieved.

--Choose One--

If you have a degree, in what field?

5. What position do you hold in your organization? Please choose only one.

--Choose One--

6. In working in the Live Arthropod Exhibitory field what has been more beneficial to you?

Formal education  On-the-job experience

## Section II: Certification Program

Please respond to the following items using the four point scale below to indicate your level of agreement or disagreement about whether these items should be included in a live arthropod certification program.

### Rating Scale:

4 = Strongly Agree 3 = Agree 2 = Disagree 1 = Strongly Disagree  
 Certification Program:

#### Core Curriculum (required for all students)

- | 4                        | 3                        | 2                        | 1                        |   |
|--------------------------|--------------------------|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 1. Entomology (non entomology majors only).           |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 2. An overview of live arthropod exhibits course.     |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 3. Integrated Pest Management.                        |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 4. Insect Husbandry.                                  |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 5. A course in USDA and government regulations.       |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 6. An internship at an established arthropod exhibit. |

**Elective Curriculum (any combination can be chosen by students to complete required credit amounts).  
 They are divided by possible job titles.**

#### Insect Technician/Keeper/Curator

- | 4                        | 3                        | 2                        | 1                        |  |
|--------------------------|--------------------------|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 7. Advanced Arthropod Husbandry (non-lepidopterous). |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 8. Tropical Insect Identification.                   |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 9. Aquatic Entomology.                               |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 10. Advanced Lepidoptera Husbandry.                  |

**Exhibit Designer**

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. Basic Design Skills

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. A studio course in mixed media and construction.

**Manager/Director**

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. Business Management.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Marketing.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. Public Relations

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

16. Human Relations.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17. Personnel Management.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

18. Grant Writing.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

19. A course in budgeting and basic accounting.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

20. Public Speaking

**Educator/Interpreter**

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21. A Curriculum Development course.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

22. A course in basic classroom teaching skills.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Medical Entomology.

4	3	2	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24. A course in information technology for educators.



4 3 2 1  
    25. Environmental Education.

**Horticulturist**

4 3 2 1  
    26. Insect Identification.

4 3 2 1  
    27. Butterfly Gardening.

4 3 2 1  
    28. Biological Control.

4 3 2 1  
    29. Insect Plant Interactions.

**Section III: Prerequisites**

Please answer the following questions by selecting the appropriate response or filling in the blank.

1. What should be the minimum degree required to enter the Live Arthropod Exhibitory Certification program?

2. Should the above listed degrees be completed before beginning the certification program? Check "No" if you think they should be allowed to be taken concurrently.

Yes  No

3. Please rank the following degrees as to which would be best as a foundation for this type of certification, with 1 being the most appropriate and 5 being the least.

Entomology

General Biology

Horticulture

Wildlife Biology

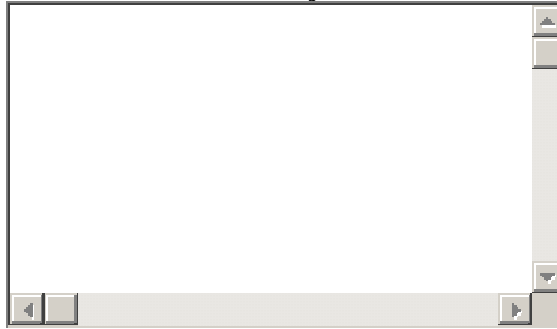
Zoology

### Section IV: General Information

Please answer the following questions by selecting the appropriate response or filling in the blank.

1. How long should the certification program last?

2. The following space is provided for your comments and input. Please feel free to write as much as you would like.



APPENDIX C  
POPULATION SURVEY PARTICIPATION  
AND INSTRUCTION LETTER

## POPULATION SURVEY PARTICIPATION AND INSTRUCTION LETTER

Dear Live Arthropod Specialists,

I would like to request that you participate in a research project that could benefit our industry. The survey is designed to obtain information on the live arthropod exhibit field and the skill set needed for a career in that industry. The information gathered from this survey will be used to complete my master's thesis in Agricultural Education/Entomology at Montana State University. The project title is Creating a Certification Program for the Live Arthropod Exhibit Industry. The survey takes approximately 6 minutes to complete and additional comments are encouraged. Space is provided on the final page for your comments and input. It is set up on a webpage and is very user friendly. You just click the link below, click the appropriate responses to the questions and then click the "submit" button at the end of the survey. The survey is broken down as follows;

Section I requests demographic information about respondents.

Section II requests your level of agreement or disagreement regarding areas of training to be included in a certification program curriculum.

Section III requests your preferences on prerequisites needed to enter a certification program.

Section IV requests your comments and input.

All responses to the survey will be kept confidential and should be recorded in this survey. After completing all four sections simply click on the submit button at the bottom of the page and your responses will be recorded. Please complete the survey by Friday October 15<sup>th</sup> at 5:00 pm est. and be sure to take the survey only once. Also, if you were a member of my pilot group that has already taken the survey, please do not take it again.

Thank you for your assistance in this research project.

Please feel free to contact me if you have any questions.

Sincerely,

Celia Stuart Whitman  
cwhitman@auduboninstitute.org

Please click on this link to go to the survey.

<http://www.sturgesconsulting.com/survey/>

Celia Whitman  
Director of Animal and Visitor Programs  
Audubon Insectarium  
504-378-2641

APPENDIX D  
WRITTEN COMMENTS FROM  
POPULATION SURVEY

The following comments were copied directly from the Microsoft Access survey data sheet. None of the spelling or grammatical errors have been corrected.

- I have found those having graduate degrees in entomology often to be pedantic and wanting to show off their superior knowledge to effectively educate the public in any real way in a regular display. You must know the information but have a little Barnum and Bailey in you. You must be able to educate by being able to engage and entertain. If you cannot do this stay in the academic environment and out of public displays.
- Much of this is not really very compatible with the way institutions actually operate. Many keepers do not have degrees, most do not have advanced degrees, only some have degrees in related fields. There seems to be little incentive for institutions to have employees "certified" given the considerable time and probably financial commitment required.
- Interest and experience count for as much, if not more than academic qualifications in this industry at entry level. This course might, if instituted, benefit extant employees who are seeking advancement.
- Had trouble with ranking degrees as the best foundation for certification. I believe that the certification should be open to individuals with the

appropriate interest and need. All the degrees (disciplines) listed would benefit greatly from a program of this nature, and individuals with multi-disciplinary degrees, in many cases, provide a very broad skill set vital to non-profit organizations which encompass the majority of arthropod exhibits.

- Experience is priceless. The industry has a huge use for generalists as well as specialists. Cross educating would be extremely valuable.
- I am no longer in the insect zoo business, but definitely support the idea of a certificate program. Simply having that option probably would have given me more of a reason to finish college (4 years at Oregon State, in entomology, but no degree). For students not wishing to go into economic entomology, this would offer a GREAT alternative. This enterprise is going to get more difficult as commerce in live insects becomes increasingly regulated and more costly, but I think the educational benefits outweigh the financial costs. One thing that has to change is the mindset of the institutions hosting the invertebrate exhibits, at least here in the states. It has been a money-driven industry, so butterfly houses have been embraced while insect zoos have not been (certainly not to the same degree). Any manager of an insect zoo must CONSTANTLY justify their exhibit to administrators, and push marketing departments to publicize it.



Lastly, I cannot emphasize enough the need to provide diversity in the job description for technicians and keepers. Personally, I was not at all happy doing "grunt work" without having the chance to do interpretation (which I excel at). I was coaching volunteers and docents on how to do interpretation. Reliance on docents to do the "fun" stuff can create animosity with the keepers. I would be more than happy to help anyone craft a good, solid certificate program. Feel free to contact me at any time. Eric R. Eaton 5201 E. Second St., C-4 Tucson, AZ 85711-1303 (520) 318-1883 [bugeric@webtv.net](mailto:bugeric@webtv.net)

- It would be great if a major portion of this program could be taken "on line".
- Thank you for giving us the opportunity to complete you survey. I hope you will present the findings at Invert In Captivity next year.
- I do not think a program such as this would benefit students. Currently Michigan State has an undergraduate concentration in Zoo and Aquarium Science that graduates many more students than there are jobs available. I feel a curriculum in live arthropod exhibitry would do the same disservice to the students. Even a small number of students going through this process would graduate many more students yearly than positions opened

through attrition or field expansion. Compounding this problem would be people that did not participate in this program but were still qualified in arthropod exhibitry. The end result would be where zookeeping is today, many more applicants than jobs, keeping wages and benefits for the field low, and creating unreasonable expectations for students. I also do not see how having a formal curriculum would benefit the field over the current situation of professionals with a general combination of education and experience.

- Prerequisites and course should depend on the type of certification. For example, managers probably should have some college but this may be necessary for technicians.
- I believe that a degree in Informal Science Education would be more worthwhile than all but Entomology and General Biology.
- I was a little unclear on sec. III #3 about prerequisites...I think that all but the horticulture degree would be fine for entering the certificate program - the ranking difference is marginal for the other degrees.
- One year? How many hours would that be, daily classes, weekly, not enough information. Also under degrees, you should have included "some

college, and how many years". There is a big difference between no college and just a highschool diploma, and 3 or more years of college, but no degree for some unforeseeable reason. Also some consideration should be taken for how long a person has studied entomology on their own. Possibly a proficiency exam could be given and then certification could fill in the gaps. Only courses in areas they were lacking would be taked.

- I feel that most people working in captive arthropod exhibits have gained their experience "on the job". However, a certificate program would make great strides towards raising the professional standards of this field.
- Neat idea.
- The one thing missing here is any reference to avocation. I believe that people who enter this field do so out of a pure love of doing it. For some it is an add-on to other duties, but to the majority it is an avocation - the thing they most want to do. A certification course may foster that or it may dampen it. If it gives those with the desire the lattitude to learn while exploring the field they so love them it will be a success and will benefit this field. If it bogs down the participants so they have to drag themselves through a process just to ge the certificate then it will dampen their desire

to continue and may exclude some whose enthusiasm we need in this industry.

- This would be a great 2-year program to be offered by a community college. I bet someone will do it!
- Having been an educator in insect education with no formal degree, I feel very strongly that anyone can be trained to be a strong educator. My education in the arthropod arena was hands on as well as training that was given at my facility. I continue to learn about the world around me and the insects that occupy it. However if there had been a program that would have enhanced my learning early on, I definitely would have taken advantage of it. Education, no matter what the level of degrees is always important. One does not necessarily need a degree to work in the industry, just continuing education whether formal or informal.
- Certainly anyone who wishes to be in the live arthropod exhibit business should take a plant family identification course, especially if they are planning on working with butterflies. A course in IPM is advisable.
- I'm a bit torn on a few sections - I approached this survey and the whole certification idea from a vocational training perspective, so I didn't

emphasize the need for higher education of any sort. This allows folks with a strong interest and hands-on experience in arthropods to qualify for certification, rather than limiting the program to those with college or more advanced degrees. I'm thinking of invert keepers here, and while a college degree helps in many ways, I also know several fantastic keepers who just didn't feel they were or are "college material". I really like the idea of there being a certification program that would allow them to hone their skills and acquire a credential that would help them get hired down the road. I could also argue for this type of program being open to college graduates who want a specialized credential without having to go through additional academic training a la Master's degree program work. In the end, the more open-door approach appealed more to me, so my answers reflect that attitude. I would think that for a manager/director or educator specialization, a college degree would be necessary (and suspect that folks coming in with those specializations in mind would probably already have appropriate/relevant degrees).

- The survey does not ask whether respondents feel that this sort of certification program is needed. I'm frankly lukewarm on the idea. I do all of the hiring for my exhibit (my title is curator because the butterfly exhibit is but one part of a larger museum. I function as the manager/director of the exhibit, but not for the museum as a whole). I have never felt at a loss

for good candidates for open staff positions even without this sort of certification. I am especially skeptical of aspects of such a program that would deal with aspects not specific to an arthropod exhibit.

Management, design, and education courses should be other parts of someone's resume, not part of a certification. Additionally some of my best employees do not have the kinds of direct backgrounds that a certificate program would produce (nor do I, for that matter). I think that the industry is richer from this diversity of backgrounds and experiences. Finally, on the question concerning the relative importance of formal education and on the job experience, a third option- independent experience is left off. This is very important- if available I would have ranked it lower than on the job experience, but higher than formal education.

- I was not comfortable in many of my selections, due to the format of the survey. In many cases, the answer I would have given was not an option. For one, there should be a neutral choice rather than only an "agree" vs. "disagree." It is almost impossible to disagree that any course is at least somewhat useful, but some of the ones listed were certainly not absolutely necessary. Also, for the Manager/Director position, the answers/appropriateness of the requirements would depend on the institution. Many larger institutions have marketing and development

departments that handle such things as marketing, public relations, and grant writing, etc., not to speak of a human resources department and an education department. In such situations it would not be necessary for the manager/director to have formal training in these areas. Similar problems hold for several of the questions. For example, you ask how long should the certification program last. For which position? You also ask what is the minimum education level required to enter the certification program. Again, it depends on which position the person is aiming/training for. In Section III, whether or not one should be able to do a degree program concurrently with the certification program certainly depends on the degree in question. I would say one should have at least an associate's degree before entering the certification program. But I would certainly not say that one should have an advanced degree before entering the program. Any of the college level and above degrees could be pursued concurrently with the certification program. I don't mean to be unhelpful, but I really think you would get better results if you redesigned the survey to allow better specificity/detail. Or, perhaps you should limit the questions to just one position, that of animal husbandry and display. I'm not sure exactly what you will really learn from this survey due to the forced vagueness of the answers.

- I think this would be a good idea not only for those interested in a career in the field but also for volunteers who want to further their education.