# THE EFFECTS OF THE SEA WORLD TALENTED AND GIFTED ENDANGERED SPECIES PROGRAM ON THE KNOWLEDGE OF SEVENTH GRADERS

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A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF SCIENCE

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

BY

SHARRON BRAUN, B.S.

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DENTON, TEXAS

DECEMBER, 1997

TEXAS WOMAN'S UNIVERSITY
DENTON, TEXAS

November 12, 1997

To the Associate Vice President for Research and Dean of the Graduate School:

I am submitting herewith a thesis written by Sharron Braun entitled "The Effects of the Sea World Talented and Gifted Endangered Species Program on the Knowledge of Seventh Graders." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Science.

Richard Jones, Major Professor

I have read this thesis and recommend its acceptance:

Accepted

Associate Vice President for Research and Dean of the Graduate School

ACKNOWLEDGMENTS

I would like to thank Dr. Richard Jones and Dr. Carlton Wendel for their time and helpful advice.

A special thanks to my family for their understanding and support.

ABSTRACT

THE EFFECTS OF THE SEA WORLD TALENTED AND GIFTED ENDANGERED SPECIES PROGRAM ON THE KNOWLEDGE OF SEVENTH GRADERS

SHARRON BRAUN

DECEMBER 1997

This study was conducted to determine if cognitive gains were made by seventh graders after participation in an endangered species program conducted by Sea World. Fifty-seven students attending a private school participated in the study. After pre-instruction with materials provided by Sea World, the students participated in a four-hour instructional tour of Sea World conducted by Sea World personnel. Data analysis of pre- and post tests included mean, standard deviation, and ANOVA. Post test scores showed a significant difference between the means of the pre test and post test. Results in the standard deviation show more consistency in student scores on the post test.

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# CHAPTER I

# INTRODUCTION

The field trip is considered by many the mainstay of augmenting various science education programs. It is by no means a new educational trend. Evidence of teachers taking students to the natural environment can be traced to Socrates. Long before textbooks, Socrates used learning by experience as a way of communicating knowledge. However, administrators often raise questions about the value of these experiences. They express concerns about the loss of in-school instruction, expense, and liability. For instance, are there conceptual gains in students knowledge? If so, do the gains offset these concerns?

There is ample evidence in the literature that field trips benefit the student. This is well documented beginning in the early 1900's with John Dewey (1916). He proposed that students learn through direct experience. His emphasis was on knowing through doing. Therefore, he saw experiential learning in nature as a more effective tool than classroom instruction. Psychologist Jean Piaget (1972) promoted active discovery learning. He emphasized that in order for discovery learning to take place, the child must experience the event. So it is seen that leaders in progressive education believe that the learner must be actively involved in the learning process. The field trip exposes the student to direct learning experiences.

## Rationale

An ancient Chinese proverb states, "Tell me and I forget. Show me and I remember. Let me do it and I understand." This proverb seems tailor-made to defend learning that occurs outside the classroom. Recent studies on the brain show that children learn best if they are immersed in an interactive, real world, complex experience (Pool, 1997). Howe and Warren (1989) report that out-of-class learning enhances critical thinking by providing real problems. Knapp (1992) states that use of natural experiences beyond the school setting expands and enriches learning. It is this kind of non-passive learning that is exemplified by Resnick's constructivist theory (1989). He believes that learning is closely related to the situation in which it takes place. According to Zielinski (1987), field trips bridge the gap between abstract ideas and the real world by involving students in observation and thinking.

Work by Wright (1980) shows that students who participate in hands-on programs in a museum setting scored higher on science achievement than students that received classroom instruction only. Henderson (1987) concludes that significant gains in scores are made by students who participate in various forms of outdoor education. One study (Howie, 1974) focuses on knowledge acquisition in the field setting. Howie concludes that any outdoor program is beneficial if the students have received preparation before-hand. A similar study by Gennaro (1981) suggests a positive correlation between pre-visit instruction combined with the field trip. Falk, Martin, and Balling (1978) report that the novelty of the setting of a field trip has bearing on gains in student knowledge. They found that adjustment to novel settings interferes with learning. However, in a study conducted by Peltier (1987), college students reported that their most powerful learning experiences occurred in settings outside the classroom. Peltier (1987) concludes that a great majority of significant learning comes from experiences in which we actively engage students in learning in settings such as field trips, internships, or research projects.

This study is designed to assess the effectiveness of a field trip to Sea World on the knowledge of seventh graders.

## Definitions

Socioeconomic: The socioeconomic group in this study contains no individuals that qualify for free and reduced lunch programs.

## Research Question

Are cognitive gains made by seventh grade students participating in Sea World's talented and gifted program on endangered species?

## Limitations

The sample in this study is homogenous and is comprised of 57 students. There is no control to use for comparison. The test instrument is new and constructed specifically for the program from materials supplied by Sea World. There will be no field testing of the instrument prior to use. It will be difficult to make comparisons to similar studies.

While all classes will have the same instructor for pre-instruction, there will be three different instructors at Sea World.

# CHAPTER II

## REVIEW OF LITERATURE

The origin of active learning used by today's educators can trace its foundation to 18th century beginnings with the philosophy of Jean Jacques Rousseau. Rousseau felt that the student should learn what he could from nature and not from books (Rousseau, 1762/1957). Rousseau believed that a student developed and refined knowledge in relation to the environment. It was critical that a student learn from direct experience, from sense perception, rather than acquiring secondhand knowledge. Rousseau was only the beginning of a long line of progressive educators that believed the student has a natural desire to learn and that learning has little meaning in isolation.

One of the first educators who attempted to put Rousseau's teachings into practice was Johann Heinrich Pestalozzi, a Swiss educational reformer. Pestalozzi (1801/1898) believed that a student's mind received information through observation and experience. The information was then used to compare the former observations, and conclusions were drawn from this. He believed students should learn through activity, placing emphasis on spontaneity. Pestalozzi developed a doctrine of "Anschauung" which was an operational process based on direct concrete observation. Because he believed that knowledge was based on sense perception, he provided opportunities for his students to learn from objects in their environment. Followers of Pestalozzi interpret this with various sayings such as:

from the known to the unknown, from the simple to the complex, from the concrete to the abstract (Kilpatrick, 1951). Under the influence of Pestalozzi, educators in England and the United States began to change from the formal verbal methods.

Incorporating Pestalozzi's view of education into his own, Friedrich Wilhelm Froebel began his style of education in Germany. In The Education of Man (1883), he declared that the aim of education was to help the child's mind grow naturally. Froebel's teaching rested on the fundamental principle that the starting point of all that we see, know, or are conscious of is action, and therefore, education must begin in action. Froebel wanted his students to have a simple life in the midst of nature. Much of his teaching was given in the field. The outdoors became his boundless textbook (Shirreff, 1976). Froebel had particular influence on the education of the young by organizing kindergarten where children learned through activity and play. Froebel's ideas on educating were adopted in the United States and many other countries.

One of the most notable advocates of progressive education in the United States was John Dewey. In The School and Society (1900/1990, p. 11), Dewey states, "Verbal memory can be trained in committing tasks, a certain discipline of the reasoning powers can be acquired through lessons in science and mathematics; but, after all, that is somewhat remote and shadowy compared with the training of attention and of judgment that is acquired in having to do things with a real motive behind and a real outcome ahead." The influence of Froebel is seen in chapter five of The School and Society

(1900/1990) which is devoted solely to the educational principles that Froebel espoused. Dewey opposed the traditional method of learning by memory under the authority of a teacher. He believed that a student needed to interact with the environment in order to gain knowledge that could be applied to future situations.

Dewey (1900/1990) expresses the importance of experience and its relation to learning in two conditions: (1) the need that the child shall have in his own personal and vital experience a varied background of contact and acquaintance with realities, social, and physical. This is necessary to prevent symbols from becoming a purely second-hand and conventional substitute for reality. (2) The need that the more ordinary, direct, and personal experience of the child shall furnish problems, motives, and interests that necessitate recourse to books for their solution, satisfaction, and pursuit. Otherwise a child approaches the book without intellectual hunger, without alertness, without a questioning attitude, and the result is the one so deplorably common: such abject dependence upon books as weakens and cripples vigor of thought and inquiry...(p. 112).

Progressive educators believed in contextual learning. They believed learning, like life, had little meaning as isolated bits of information. Only when learning occurred within an environmental context did it become meaningful. This principle has been borne out in recent studies by Caine and Caine (1994). Their research into brain based learning has shown that multiple complex and concrete experiences must be present if meaningful learning is to take place. Caine and Caine believe that all students must be provided with an accumulation of the correct experiences. They content that all learning is experiential and that teachers need to "orchestrate the immersion of the learner in complex, interactive experiences that are both rich and real" (p. 113). They believe there are two ways students process information. They describe these systems as "taxon" (p. 42) and "locale" (p. 44). The taxon system represents the traditional model of memory…lists of items that do not depend on specific context. An example they give of this type memory is how students recall the steps of turning on a computer without understanding what is happening inside the computer to cause it to begin working. The locale system is a mapping system. The locale memory deals with a spatial memory system. It is this system that helps us make connections from prior experiences to new situations. The beliefs held by Caine and Caine reflect some of the view held by Gagne and White (1978). Gagne and White propose that recall of knowledge is a direct function of how experiences interlink in memory with other episodes. Field trips that are well planned should provide the immersion of Caine and Caine with the clear episodes of Gagne and White to give the student experiences that improve retention of skills and knowledge.

One of the earlier studies on the effectiveness of the field experience on learning was conducted by Schellhammer (1935). A one-year study was undertaken in a New York high school with two groups of freshmen. Groups were switched half-way through the study, the experimental group becoming the control. In both cases, the group receiving the field trip scored higher. The structure of Schellhammer's study showed that the experimental group averaged 3.63 more correct answers out of fifty than did the control group. In further study, it was found that the field experience was especially beneficial to the "slower" students.

In 1979, Gross and Pizzini studied the effects of combining advance organizers and field experience on upper elementary students. They concluded that teachers who incorporate field experiences into the science curriculum "should involve the learner in classroom instruction activities designed to facilitate concept formation to be emphasized in a field experience" (p. 330). This, they reasoned, maximizes learning for the amount of the time students spend in the field. Gennaro (1981) also found that exposing students to advance organizers benefited a museum experience. The advance organizers included study sheets, demonstrations, and active learning experiences. The students having pre-visit instruction were able to correctly answer 7.7 more questions on a 50-item test than those who did not.

In a study on field experience and long-term memory in a geography unit, Mackenzie and White (1982) studied two groups of students participating in trips to beaches, cliffs, and mangroves. One group had a field guide to read, and the teacher dominated the experience by pointing out specifics. Members of this group were recipients of information. Members of the second group were participants. They were required to record observations, answer questions, and participate more actively in exploring the environment. It was found that the field work of group two improved initial learning above the usual level. Group two showed a 90% retention compared to group one's retention rate of 58%. A control group showed a 51% retention rate. The study concluded that active experience in the field aids recall of facts and skills.

Wendling and Wuensch (1985) studied elementary students who received either traditional classroom lectures, lab experiences in the classroom, or field trips. Their results showed that students who had hands-on experience learned more than those who had only lecture, and that those students who participated in a field experience learned more than those who did not. Stronck (1983) compared the effects of a highly structured tour of a museum to that of a less structured tour on students' learning and attitude in grades five, six, and seven. He found that the students on the structured tour show significant gains in knowledge when compared with the students on the unguided tour. The mean score of a ten-item test for the students on the guided tour was 5.18, while the mean score for the students on the unguided tour was 3.65. He also found that the less structured tour produced a more positive attitude toward the museum.

Flexer and Borun (1984) conducted a study at The Franklin Institute Science Museum to see if the framework of a participatory museum exhibit would facilitate subsequent classroom learning about simple machines. Middle school students in the study were assigned to one of four different treatments. The four groups were the control, exhibit only, lesson only, and exhibit followed by lesson. To maintain consistency each group of students received a lesson instructed by the same museum educator. The lecture was limited to fifteen minutes and included simple demonstration materials. Overall, it was found that all students that visited the museum scored higher on the content of simple machines than the control group. The groups that did not receive the lesson were unable to identify the machines by name. The researchers related this to students not reading museum labels. In a questionnaire for the students on the museum experience, all students perceived themselves as learning. Flexer and Borun concluded that participatory experiences supplement classroom learning and stimulate interest in learning, and that the experience that produced the greatest gain in knowledge was a lesson with the exhibit. This study did not find an advantage of having the instruction before or after the exhibit.

A study to assess the influence of field activities as compared to classroom contained activities in an earth science course was conducted by Kern and Carpenter (1986). The researchers looked for student gains in two categories: a knowledge category and a higher order category. In knowledge or simple remembering of facts there was little difference. The class means were 36.11 for the experimental group and 36.50 for the control group. The results in the higher order category showed significant differences between the two groups. The experimental group mean score was 14.17 compared with the control group's 6.14. Kern and Carpenter interpreted these results as a good indicator that when exposed to active learning in the field, students demonstrate a better ability to analyze and synthesize knowledge. Students exposed to the field experience have an enhanced ability to apply the information acquired.

Wise and Okey (1983) studied the impact of various teaching techniques on achievement. One of the methods was a presentation mode in which the field trip was included. Results of this study found that field instruction was more effective than the traditional classroom approach in science. Falk and Balling (1982) have completed several studies on the effect of novel situations on learning. In a study of third and fifth graders, students were presented the same information in two different settings. One experimental group was taken by bus to a nature center. The control group completed the activity in a wooded area directly behind the school. Analysis of the data showed that both groups made cognitive gains, supporting the idea that single visit field trips are beneficial. The interesting data in this study showed that the younger students showed more gain in the more familiar close-to-school environment, while the older students showed more gain in the more novel setting of the nature center. In a review of on and off task behavior, it was shown that third grade students attended to the setting in the familiar setting, while the fifth grade students were more often on task at the nature center. The authors suggest that the younger students be taken on field trips that provide moderate amounts of novelty. Taking older students to a more novel setting is a more worthwhile activity. All students in this study had a positive attitude toward outdoor experiences.

In another study, Falk and Balling (Leary, 1996) tested the outcome of a structured visit to a zoological park. The students were divided into five groups. Two of the groups were control. One of the control groups did not go on the trip. The other control group went with no pre-trip orientation. Of the groups that received pre-trip instruction, one was taught the concepts and facts that they were expected to learn from the trip. The second group was given instruction in how to observe the animals. The third group was instructed on practical points of the trip such as transportation, how long it would take to get there, where the gift shop was located, and where to get lunch. This third groups scored higher on cognitive tests than any of the other groups. Behavioral observations showed this was the most relaxed of the groups because the personal agenda questions had been answered. The overall results of the trip demonstrated that students learn a great deal on a well structured trip. Design and execution of the trip are very important if positive results are seen.

In Teaching in the Outdoors, Hammerman, Hammerman, and Hammerman (1985) state that children six to twelve years old learn concepts best when teachers use the outdoors as a way to bring meaning to learning. They state that children learn more rapidly when the experiences are firsthand. Knowledge that is gained in this manner is retained longer than facts learned to satisfy test requirements. "Whether or not youngsters actually understand what they are saying frequently goes undetected, since the ability to use a word correctly is accepted as evidence that learning has, in fact, taken place" (p. 10).

Hammerman states problem solving and the joy of discovery are enhanced by extending learning beyond the classroom walls. L. B. Sharp is quoted by Hammerman to underline the basic tenet of learning outdoors…"Teach outdoors that which can best be taught outdoors, and teach indoors that which can best be taught indoors" (p. 13).

# CHAPTER III

# METHODS

## Subjects

The students in this study were seventh graders enrolled in an Episcopal school in Fort Worth, Texas. They represented a homogenous group of 57 eleven- and twelve-year old students with similar cultural and socioeconomic backgrounds. There were 31 girls and 26 boys. No minorities were represented. The students were divided equally among three classes taught by the same instructor. The instructor was the researcher.

## Procedure

The week before the field trip, the students worked in cooperative learning groups on activities provided by Sea World. The activities they engaged in were from the booklet All About Endangered Species (1993), a Sea World publication. Each class session was 45 minutes. The program at Sea World was four hours. The students were divided into three groups, each with Sea World personnel as instructors. Two school chaperons accompanied each group.

The pre- and post tests covered material from All About Endangered Species. Tests were given prior to the beginning of the activities and upon returning from Sea World.

## Instrument

The instrument was designed by the classroom instructor to assess gains in knowledge about endangered species, causes of extinction, and species survival plans. This instrument was developed specifically for this study since there are no previously developed instruments. The test consisted of 21 matching, two short answer, and identification of six extinct and extant species. These items represented cognitive goals expressed in the Sea World publication All About Endangered Species.

## Classroom Activities

Students participated in activities designed by Sea World one week prior to the field trip. The classroom teacher introduced endangered species concepts, and the students worked cooperatively on all other assignments in the unit. In their groups, they became familiar with vocabulary that was used throughout the unit. Supporting this was an activity entitled Bioaccumulation Relay (see Appendix A). This enabled the students to see the results of toxins in the food chain. In the relay, each set of students took on the role of aquatic species in the food chain. Beginning with the species lowest on the chain, a relay was set up to collect poker chips (food). Each successive species had to pick up twice as many chips as they had been handed. At the end of the relay, a discussion was held on the buildup of toxins, and how they come to be concentrated in the top of the chain.

Each groups learned how to construct breeding groups in a Species Survival Plan. In an activity entitled "Breeding for Survival" (see Appendix B), the groups were given a set of manatee name and logic cards. The students used the clues on the cards to establish breeding groups. In this exercise, the students faced special issues about husbandry, reintroduction, and public education.

Enlarging on the Species Survival Plan, students learned how to construct a karyotype and how to apply this to a breeding program to prevent inbreeding. The activity "Matchmaker, Matchmaker" (see Appendix C) provided the students with the chromosomes of a Cuvier's beaked whale in which cooperative groups placed in descending order of size.

There were discussions and activities on wildlife products, and how consumerism of these products affects wildlife populations. This exercise, "Purchase Power" (see Appendix D), explored how product information is important when making purchases. The impact of man on habitat loss was explored by studying a day in the life of a young Florida panther in an activity entitled "It's a Tough World in the Wild" (see Appendix E).

Each student selected an endangered or extinct species from a listing designed by Sea World. Through research, students became experts on the species. The results of their research were shared with the class. This activity concluded class work on the unit.

## Field Trip Activities

Students visited Sea World. Each group had a Sea World instructor who explained the various stations at the park. The students saw some of the species that were studied in class. Under the direction of the Sea World instructors, students participated in problem solving activities designed to show the impact of man on these species.

## Evaluation

Pre- and post tests (see Appendix F) were analyzed for cognitive gains. A total of 36 questions were scored. Each correct answer received one point. Data analysis of the pre- and post tests included mean, standard deviation, and analysis of variance.

# CHAPTER IV

## RESULTS

Results as related to student learning were derived by comparing the pretest and post test raw scores. The results of these raw scores and the percentage scores can be seen in Appendix G. Mean, standard deviation, and analysis of variance (ANOVA) were used for statistical analysis. The results of the mean and standard deviation are shown in Table 1. It can be seen that the mean improved by seven points. Results in the standard deviation show more consistency in student scores on the post test.

Table 1.

Mean and Standard Deviation for Pre/Post Tests.

| | N | Mean | Standard Deviation |
|---|---|---|---|
| Pretest | 58 | 20.6 | 5.7 |
| Post test | 58 | 27.6 | 4.5 |

In testing for significance using ANOVA, the critical value for F was 3.92, with a calculated value of 53. The difference between the means was significant.

# CHAPTER V

# CONCLUSION

This study suggests that students do show cognitive gains from participation in Sea World's endangered species program. The program was a valuable adjunct to the school curriculum. The facilities and opportunities that were unavailable in a school setting stimulated an interest in learning in a manner that was more stimulating than single classroom activities. It is beneficial to transport the student to the area which is being studied for the greatest impact. Here students physically link the class lesson with the "real-world" activity.

It is important to give attention to the structuring of activities to include advance organizers. The classroom instruction received beforehand is an integral part of a successful field experience. Pre-trip activities make the field experience more understandable and more meaningful. The Sea World publication, <u>All About Endangered Species</u>, provided comprehensive small group activities that were an excellent bridge to the concepts that Sea World personnel covered during the field trip. The activities stimulated an interest in learning concepts in a manner that was engaging for the student.

The amount of time spent at each location and group size helped reduce distractions caused by the novelty of the setting. The students were given approximately fifteen minutes to visually explore and become familiar with each setting before instruction began.

Although it was not the purpose of this study to survey attitudes of students, many expressed positive attitudes toward the program. At the end of the field trip, students were asked to evaluate their experience. The following are seven students' impressions of the field trip.

Student 1: "I give Sea World an A. I thought it'd be boring, but I learned a lot of good facts. I also realized that the reason so many animals die is terrible. I'd like to try to help. They really get through to people. I hope it (Sea World) can get more animals and attract more people, so they can see how great the animals around us really are."

Student 2: "The Sea World program was fun and educational. I learned a lot. Some good points were when we went to the shark tank and the white whale tank. In the shark tank, I learned that in one year, 25 people die from sharks, 100 are bitten, and 100,000,000 sharks are killed by people. Another thing I learned was that hammerhead sharks must swim continuously to breathe. When they rest, they pick up speed and glide. To be a trainer, you should go to college. The best course to take would be psychology...not oceanography."

Student 3: "The tour of Sea World was very interesting, and I learned some things that I didn't know. I learned the difference between seals and sea lions, and I also learned how much food the animals we saw ate. Something else that I learned is that Beluga whales can mimic sounds because of their blowhole."

Student 4: "I enjoyed looking at all the animals up close. I specifically enjoyed the dolphins and the sharks. The instruction was boring except at the walrus/sea lion/otter exhibit."

Student 5: "It was interesting because it taught the animals neat things and they had cool exhibits. Also you can enjoy petting the dolphins and going through the ocean water exhibits. I really enjoyed watching the sea lions, walrus, and American freshwater otters. The last thing was the bird exhibit, which was cool because you could see any bird up close which was neat.

Student 6: "I thought Sea World was educational but boring. It was not very interactive except for the dolphins.

Student 7: "Sea World was great. I wish we had a different guide. Ours didn't talk loud enough. She wasn't very excited about what we were doing. I don't think she liked us."

From student post test scores and student comments, it can be seen that the Sea World program was successful. It is important to address student concerns about trip length, snacks, and gift shop opportunities before reaching Sea World. The Sea World program does not provide a snack bar or gift shop opportunities. There are water fountains throughout the park and rest stops were allowed. Organizers of the field trip will want to make arrangements for other beverages and snacks.

It is also important to be aware of the individual differences of instructors at Sea World. In student and chaperone observations, it was seen that some instructors had a better rapport with the students and communicated concepts in a more understandable manner. This is a variable that cannot be controlled when there is more than one group of students.

As an extension of the classroom, field experiences are valuable to learning. In order to maximize the amount of time spent on a field trip, instructional activities should be designed to facilitate concept formation that is the focus of the field experience. This reflects what Dewey (1916) realized when he said, "We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great deal of difference. And any environment is a chance environment so far as its educative influence is concerned unless it has been deliberately regulated with reference to its educative effect" (p. 19).

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APPENDICES

APPENDIX A

BIOACCUMULATION RELAY

# Bioaccumulation Relay

**OBJECTIVE**

Students will be able to describe what happens when toxins build up in the prey eaten by predators at the top of the food chain.

**MATERIALS**

- ❑ poker chips or marbles
- ❑ playing field

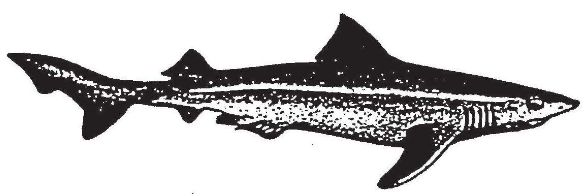
## ACTION

1. Review the concepts predator, prey, and food web with your students. Remind them that a predator is an animal that eats other creatures. Prey are the animals a predator eats. A shark is a predator, and a fish or seal is its prey. Explain that a food web is the interaction of lifeforms and how energy moves within an ecosystem. A food web contains a number of food chains—how energy is passed from one organism to another. For example, phytoplankton (small plants that float or drift in an ocean's currents) get their "food" or energy from the sun. When they're eaten by fish, the energy passes to the fish. The fish are eaten by a seal, who's in turn eaten by a shark. With each step along the food chain, the consumer obtains a bigger chunk of energy.

2. Place the poker chips at the end of the playing field. Instruct the students to count off in fives. Have each number form a line and establish a starting line. Going down the line, appoint these animals in order to each set of students: phytoplankton, krill, squid, fish, and shark.

3. Explain that this is a relay race. Each student must run down to the end of the field and pick up twice as many poker chips as they're handed. For example, the phytoplankton will run down first and pick up one poker chip. They'll run back and hand it to the krill. The krill runs down and picks up one more chip giving them two. They hand these off to the squid. The squid must pick up two more chips giving them four. They hand these off to the fish. The fish must pick up four more giving them eight. They hand these off to the shark who must pick up eight more for a total of sixteen.

4. When the game is over explain that each poker chip represents a toxin in the water. Ask students what happens to top predators that consume prey with toxins in their tissues? (they ingest large doses of the toxins) Explain that this is called bioaccumulation. Although it might seem that any toxins that enter the ocean would be diluted in the water, they actually become very concentrated as they're passed along the food chain and through the food web, posing a serious threat to the survival of predators.



Because sharks are slow growing and a single female produces only a few hundred pups in a lifetime, depleted populations may take years to recover.

## APPENDIX B

## BREEDING FOR SURVIVAL

# Breeding for Survival

**OBJECTIVE**

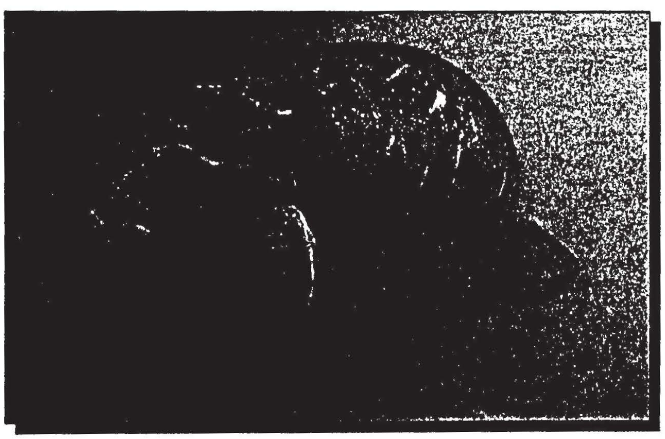
Students will use information about individual manatees to place them in breeding groups.

**MATERIALS**

- ❑ copies of page 12 (one per six students), cut into individual sets of cards

**ACTION**

1. Ask students to share their ideas on how to breed wild animals in captivity. Tell them that keepers try to make the best matches between animals by studying the information in a *studbook*. Explain that a studbook is a comprehensive record of all births, deaths, and interinstitutional transfers of a particular species. This helps the keepers keep track of which animals are related to one another so they won't breed them. Too much inbreeding damages the genetic strength of a species. Point out that keepers also need to know something about each animal's personality and which individuals they do and don't get along with.



Florida manatees that are rehabilitated by Sea World's Rescue and Rehabilitation program are released.

2. Divide the class into groups of six students. Tell them that they're going to be groups of manatee keepers that are developing new breeding groups for this endangered species.

3. Give each group a set of manatee logic cards and a set of manatee name cards. Have them divide the manatee logic cards among themselves. Explain that the logic cards are "clues" to determine which manatees should be put together. Remind students that they'll need to work together and concentrate to keep all the information straight.

4. Students use name cards during the activity to place the manatees in three breeding groups, each containing at least one male and four to five females. Direct students to put the name cards in three stacks as they work. Have them double check their groups against the logic cards to make sure they aren't making inappropriate groupings.

5. When students have finished creating breeding groups, review their groupings and allow discussion between groups as to why their breeding groups would or wouldn't be good choices.

Deeper Depths:
Have your students work in groups to develop a Species Survival Plan (SSP) for manatees. An SSP is an intensive effort to help an endangered species. Included in an SSP are an education component (how will you educate the public about this species' plight? exhibit signs? special classes? documentaries? brochures?), breeding plan (what other institutions will you work with? will you send your animals there or vice versa?), a husbandry plan (how will you feed and house the species?) and a reintroduction plan (where will they be released? how many? what sex ratios? how will they be protected and monitored?).

Many zoological parks such as Busch Gardens in Tampa, Florida have breeding programs for gorillas.

**ANSWER KEY:**
**Possible groupings**

| 1 | 2 | 3 |
|---|---|---|
| Rube (M) | Dock (M) | Bink (M) |
| Sheba | Lotus | Oma |
| Bea | Blossom | Cleo |
| Ruby | Isis | Dawn |
| Skipper | Dolly | Star |
| Rock | Reva | Oscar |
| Ethel | Delta | Rosie |

| 1A | 2A | 3A |
|---|---|---|
| Rube (M) | Dock (M) | Bink (M) |
| Lotus | Dolly | Skipper |
| Blossom | Rosie | Rock |
| Oscar | Oma | Bea |
| Ruby | Star | Isis |
| Sheba | Cleo | Reva |
| Dawn | Ethel | Delta |

# Manatee Name and Logic Cards

| | | |
|---|---|---|
| Ethel | Delta | Rosie |
| Oma | Star | Dolly |
| Cleo | Bea | Dawn |
| Sheba | Isis | Reva |
| Blossom | Ruby | Lotus |
| Dock (M) | Rube (M) | Oscar (M) |
| Bink (M) | Rock (M) | Skipper (M) |
| Skipper and Rock don't get along with Oscar | Skipper is Lotus' son | Blossom is so young, she needs to stay with Lotus |
| Dock is aggressive toward all other males | Rock is an immature male | Oscar is an immature male |
| Skipper is an immature male | Dawn is Dock's daughter | Ruby and Bea are aggressive toward Dock |
| Ruby and Dolly don't get along | Sheba is Dock's daughter | Sheba and Bink were unsuccessful at breeding with one another |

# APPENDIX C

## MATCHMAKER, MATCHMAKER

# Matchmaker, Matchmaker

**OBJECTIVE**

Students will be able to piece together a karyotype and explain what it is and how it is used in breeding endangered animals.

**MATERIALS**

- ❑ sheets of karyotype pieces (one per student)
- ❑ construction paper
- ❑ scissors
- ❑ glue

## ACTION

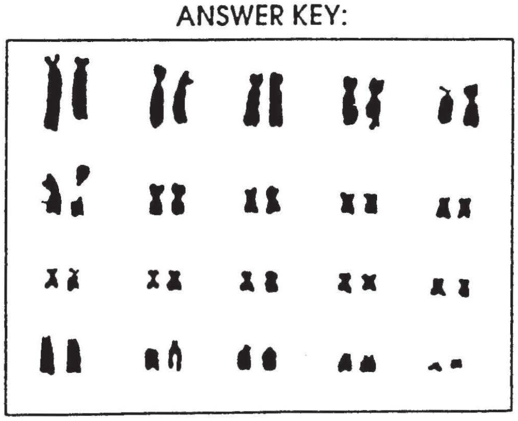
1. Explain to students that a chromosome is the part of a cell which contains the genetic material or genes that are the units of heredity. Our chromosomes make us who we are, by dictating our hair and eye color, height, build, etc. When breeding endangered species, we want to not only increase the population, but also maintain a strong, healthy population that is self-sustaining. Chromosomes hold the secret to the health and future of a species.

2. Show students a *karyotype* and explain that it's a picture of the chromosomes made by using dyes and special techniques. Studying chromosomes helps geneticists enhance the breeding potential of a species by making sure the individuals are the same species, but not closely related to each other (inbreeding can weaken the species). Karyotypes also help determine if individuals are of the same subspecies.

3. Point out that the chromosomes are laid out in like-sized pairs. Use an overhead projector to demonstrate how to match one or two pairs. Explain that on a finished karyotype, the chromosomes are laid out in descending order of size.

4. Give each student a sheet of Cuvier's beaked whale karyotype pieces and a piece of paper. Have students cut out and put chromosomes together and glue them onto the paper in descending order of size as in the answer key.

ANSWER KEY:



**Deeper Depths:**

Have students research the karotypes of endangered species. Have them compare the genetic work done on human karyotypes to that done on endangered species.

# Karyotype Pieces

# APPENDIX D

# PURCHASE POWER

# Purchase Power

**OBJECTIVE**

Students will be able to study objects and decide if it would be a good environmental decision to purchase them.

**MATERIALS**

- ❑ one copy of pages 24 and 25
- ❑ paper (one piece per student)
- ❑ pencils (one per student)

**BACKGROUND INFORMATION**

There are no right or wrong answers to this activity. Oftentimes, consumers purchase items and don't realize that they may be contributing to endangered or threatened species. This activity is designed to inform students of their purchasing power and inspire them to learn more about the products they buy. Throughout the activity, please encourage students to discuss their personal feelings about purchasing various items.

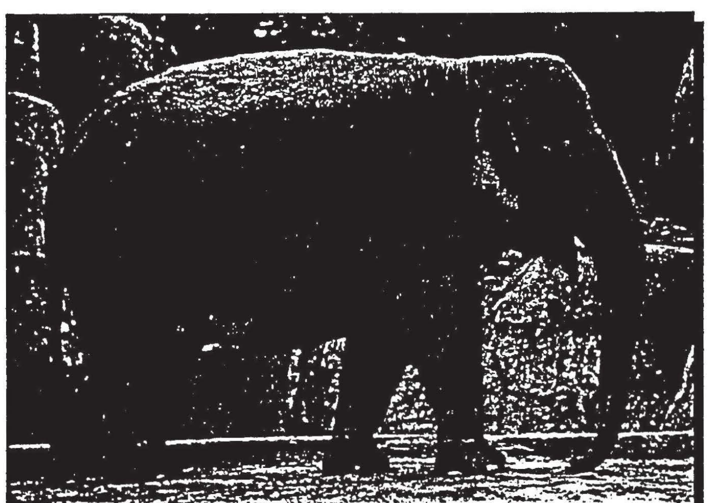
**ACTION**

1. Make copies of pages 24 and 25 and cut into individual cards.

2. Ask students to number a piece of paper from 1-16.

3. Hold up a product card and identify the object. Ask students to write "yes" or "no" on their paper to indicate whether they think purchasing this item would contributing to endangering or threatening a species. If they don't know, encourage them to guess.

4. When everyone has finished, review each item. Ask for a show of hands "yes" or "no." Read the information on pages 22 and 23 to your students, then ask them to vote again. Point out that some people believe that no animal product is "OK," whether it was raised on a ranch or not. Ask students to think about how they feel about animals that are raised to create wildlife products.



Asian elephants, like the animal above, are endangered due to habitat destruction, while African elephants are endangered because they're hunted illegally for their tusks.

**brain coral:** Coral reefs take hundreds of thousands of years to create. The presence of a reef creates a habitat for a number of highly specialized species. It also affects the habitat on shore by protecting the beach from intense wave action. As coral becomes more popular as a decorative item and in jewelry, the future of the reef community is threatened.

**teak bowl:** Teak trees grow in rain forests. Although salt and pepper shakers don't require much wood to make, large numbers of teak trees are being taken to fill the growing demand for teak furniture of all kinds. How do you think mass cutting of teak trees affects a rain forest habitat and the plants and animals that live there?

**eelskin wallet:** Often, eelskin products are actually made from the skin of hagfish. Some eels and hagfish are farmed for commercial purposes such as this, others are taken through mass-fishing techniques. Such large numbers are taken in unmonitored harvests that many species are likely to go extinct just as many species of shellfish became extinct when their shells were used to make buttons.

**conch shell:** Most of the shells you see used on jewelry boxes, lamps, and other objects weren't just "found" lying on the sand. To get the "perfect" shells needed to make a quality item, the animals are killed for their shells. When a shelled animal dies in the ocean, its shell might be used as a shelter by other animals or be broken down and added to the habitat's sand supply. When shells are simply removed from the environment by people, this important cycle is broken.

**ivory jewelry:** Ivory comes from the tusks of animals, mostly African elephants. Although they're protected by law in many African nations, the demand for ivory has made poaching worth the risk for some people. In 10 years, half of the African elephants on earth were killed for their tusks. The United States government has banned ivory from being sold in this country, but some people may have jewelry or other ivory items predating the ban.

The pangolin is an endangered species from Africa. It's endangered because of habitat destruction, insecticides, and for its scales which are used for medicinal purposes.

**cow-leather belt:** Leather comes from the hides of cattle killed for food.

**tortoise shell hair ornament:** Tortoise shell actually comes from sea turtles. They've been hunted to the edge of extinction for their meat, oil, skin, and shells. It's illegal to bring most sea turtle products into the United States, but many Americans visiting foreign countries don't know this.

**natural sea sponge:** Divers in small villages make their living collecting and cleaning sponges to sell.

**rattan basket**: the fibers used to make this item are the spiny stems of certain palms found in rain forests in Southeast Asia and Australia. About one sixth of the rattans are grown on plantations, but more could be produced this way since these shade-loving plants would do well planted alongside trees in fruit orchards. Because they also do well in secondary forests, they might become an important crop in forests that have been heavily logged.

**cloves, cinnamon, vanilla spices**: These are three examples of spices that are harvested from rain forests. However, since the whole tree doesn't need to be cut down to obtain these products, they're a good example of how harvesting goods from the rain forest can actually help preserve the habitat. If the forests were cleared, we wouldn't be able to get the spices.

A Species Survival Plan (SSP) has been developed for the palm cockatoo. Sea World and Busch Gardens participate in this SSP program.

**elephant hair bracelet:** All elephant products are illegal in this country, but natives on the streets of some African cities sell them to unsuspecting tourists who try to bring them home.

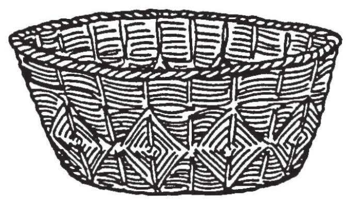
**snake skin watchband:** Some types of reptile skin are approved for use in this country, but there are endangered species that are carefully protected. Know what you're buying! When in doubt, contact the U.S. Fish and Wildlife Service or the United States Customs Service.

**boar's bristle hairbrush:** The bristles are taken from the hides of hogs processed for food.

**ostrich feather duster:** The feathers are taken from farm-raised birds.

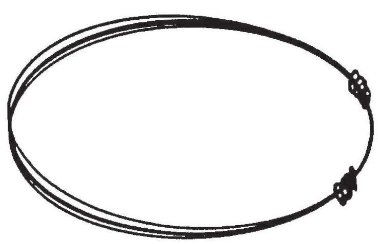
**tropical fish :** Again, it's a matter of knowing how your fish got to the store. Some are raised by breeders in this country. Other fish, though, are collected from their natural habitat. This is sometimes done by a vacuum device, but in poorer nations people have found that they can make a lot of money by gathering a lot of fish quickly. To do this, they wait until low tide, then pour a chemical into the tide pools. The chemical paralyzes the fish, and they can scoop out what they want. They revive the fish in collecting buckets, but leave the tide pools poisoned and the other inhabitants dying.

**cactus:** It's alright to purchase most small cacti, but very large ones may have been taken illegally from their habitats. Some cactus, like the saguaro, are protected by law. Be aware of who you're buying plants from; make sure they're a reputable dealer.

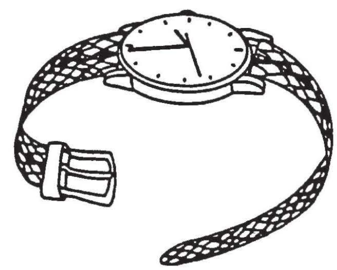


rattan basket

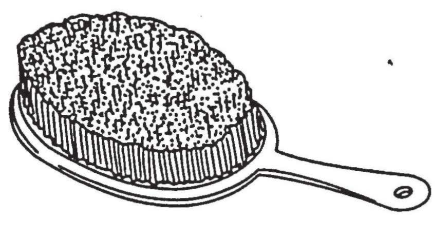

cloves, cinnamon, vanilla spices



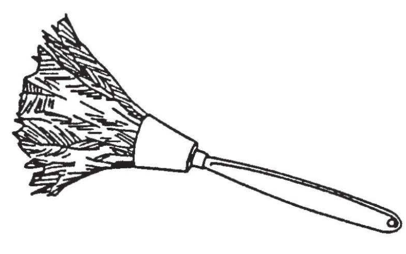
elephant hair bracelet



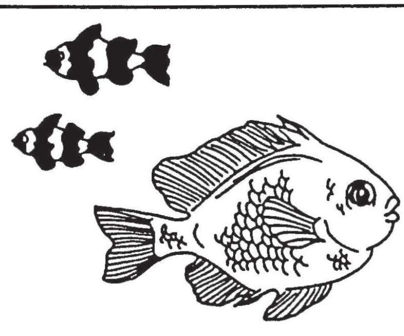
snake skin watchband



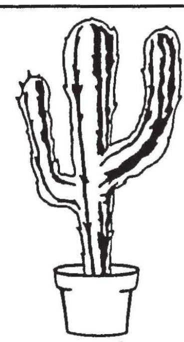
boar's bristle hairbrush



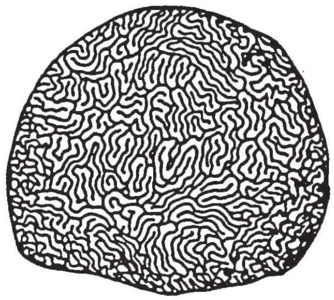
ostrich feather duster

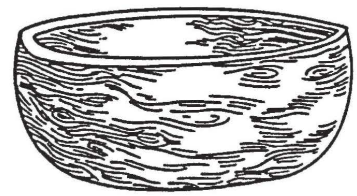


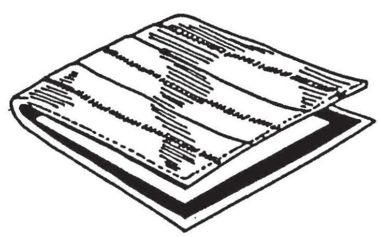
tropical fish

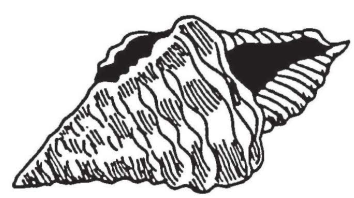


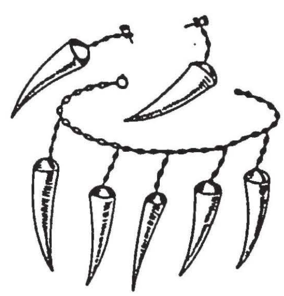
cactus

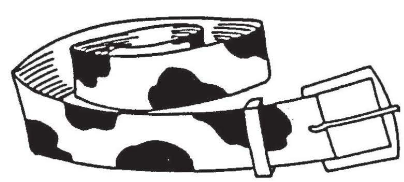

brain coral

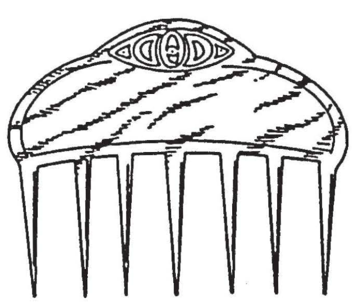

teak bowl

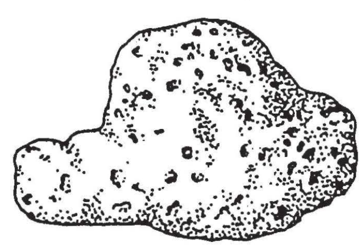

eelskin wallet


conch shell


ivory jewelry


cow-leather belt


tortoise shell hair ornament


natural sea sponge

APPENDIX E

IT'S A TOUGH WORLD IN THE WILD!

# It's a Tough World in the Wild!

## OBJECTIVE

Students will discover the ways habitat loss and human activity can impact the behavior and survival of the Florida panther.

## MATERIALS

- ❑ one copy of page 35
- ❑ one 9" x 12" rectangular piece of poster board
- ❑ one smaller piece of poster board, cut into a circle
- ❑ one brass paper fastener
- ❑ scissors
- ❑ glue

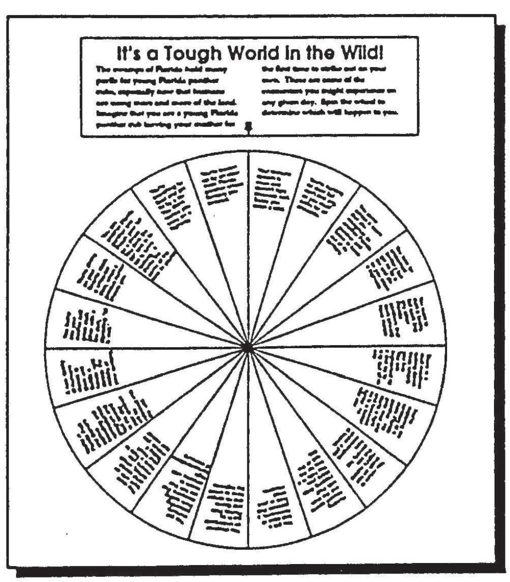
## ACTION

1. Make a spinner using the pieces on page 35. See sample below. Cut out the title box (including the arrow) and glue it across the top of the poster board. Then cut out the pie chart and glue it to a corresponding circle of poster board. Attach the pie chart loosely to the rectangular poster board using a brass paper fastener through its center. Make sure the pie chart can spin freely.

2. Have each student in the class take a turn using the spinner. Ask them to determine the various influences that cause each outcome.

   Choices include:
   1. Habitat loss due to human activity
   2. Direct human contact
   3. Indirect human contact
   4. Natural behavior

Sample of pie chart spinner



# APPENDIX F

# PRE- AND POST TESTS

# ENDANGERED SPECIES TEST

NAME______________________________DATE__________PERIOD_________

## ENDANGERED SPECIES TEST

Place the number of the word that most correctly completes the sentence in the blank to the left.

1. Biodiversity
2. Captive breeding
3. Conservation
4. Decompose
5. Deforestation
6. Ecology
7. Ecosystem
8. Manatee
9. Extant
10. Extinct
11. Food web
12. Karyotype
13. Overpopulation
14. Overhunting
15. Poaching
16. Pollution
17. Predator
18. Prey
19. Species
20. Species Survival Plan
21. Threatened

______ 1. Likely to become endangered.

______ 2. Too many individuals inhabiting an environment.

______ 3. The genetic variability of living organisms on our planet.

______ 4. The study of the interrelationships among living things and their environment.

______ 5. Killing more animals than the species' population can replace through natural breeding rates.

______ 6. A program for managing captive populations of endangered animals.

______ 7. The genetic variability of living organisms.

______ 8. A diagram showing complex interconnections of "who eats whom" in an ecosystem.

______ 9. Harmful elements that alter an environment in a negative way.

______ 10. A unit of plants, animals, and nonliving components of an environment.

______ 11. An animal that eats other animals.

______ 12. Taking care of our environment by wisely managing its resources.

______ 13. The process of clearing away trees.

______ 14. A group of plants or animals that are genetically similar.

______ 15. A species currently represented by living creatures.

______ 16. Illegal hunting or collecting.

______ 17. An animal eaten by another animal.

______ 18. A planned breeding in a protective facility to increase the species' population.

______ 19. No longer existing on the Earth.

______ 20. The process during which organic material is broken down by microscopic organisms.

______ 21. A picture of chromosomes made by using special techniques.

Short answer: answer each question as completely as possible.

1. Explain what happens when toxins build up in the prey eaten by predators at the top of the food chain.______________________________________________

______________________________________________

______________________________________________

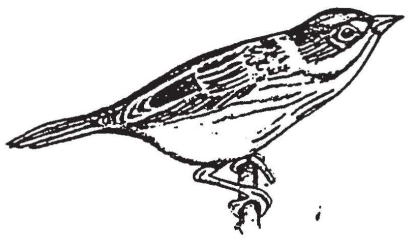
2. List three factors that must be considered when grouping animals for breeding.

1.______________________________________________

2.______________________________________________

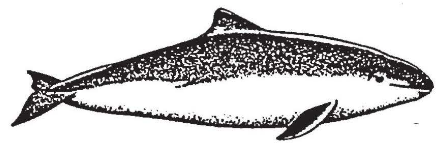
3.______________________________________________

Identify the animals pictured below. Circle the word if it is extinct or extant.



Name________________________

Extinct Extant

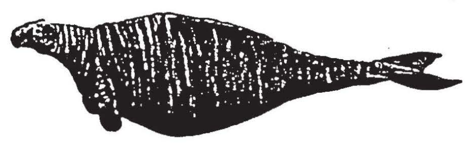


Name________________________

Extinct Extant

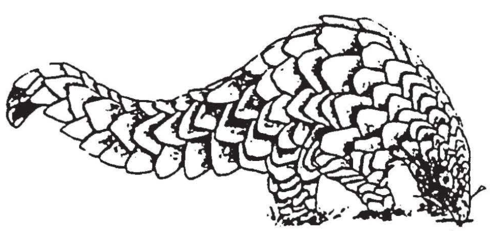
Name________________________

Extinct Extant



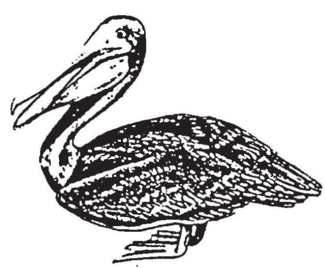
Name________________________

Extinct Extant



Name________________________

Extinct Extant



Name________________________

Extinct Extant

# APPENDIX G

# RAW AND PERCENTAGE RESULTS OF PRETEST AND POST TEST

| Raw and percentage results of pretest and post test | | | | |
|---|---|---|---|---|
| Student | Raw pretest | Percent pretest | Raw post test | Percent post test |
| 1 | 10 | 27 | 24 | 65 |
| 2 | 17 | 46 | 21 | 57 |
| 3 | 24 | 65 | 28 | 76 |
| 4 | 20 | 54 | 28 | 76 |
| 5 | 30 | 81 | 31 | 84 |
| 6 | 17 | 76 | 35 | 95 |
| 7 | 25 | 68 | 28 | 76 |
| 8 | 11 | 30 | 24 | 65 |
| 9 | 20 | 54 | 24 | 65 |
| 10 | 27 | 73 | 31 | 84 |
| 11 | 24 | 65 | 30 | 81 |
| 12 | 21 | 57 | 25 | 68 |
| 13 | 31 | 84 | 36 | 97 |
| 14 | 5 | 14 | 24 | 65 |
| 15 | 29 | 78 | 34 | 92 |
| 16 | 25 | 68 | 31 | 84 |
| 17 | 22 | 59 | 25 | 68 |
| 18 | 19 | 51 | 24 | 65 |
| 19 | 26 | 70 | 31 | 84 |
| 20 | 22 | 59 | 34 | 92 |
| 21 | 22 | 59 | 29 | 78 |
| 22 | 15 | 41 | 32 | 86 |
| 23 | 21 | 57 | 24 | 65 |
| 24 | 15 | 41 | 29 | 76 |
| 25 | 29 | 78 | 35 | 95 |
| 26 | 20 | 54 | 32 | 86 |
| 27 | 16 | 43 | 22 | 59 |
| 28 | 22 | 59 | 24 | 65 |
| 29 | 22 | 59 | 30 | 81 |
| 30 | 23 | 62 | 32 | 86 |
| 31 | 18 | 49 | 29 | 78 |
| 32 | 12 | 32 | 28 | 76 |
| 33 | 29 | 76 | 90 | 81 |

| Student | Raw pretest | Percent pretest | Raw post test | Percent post test |
|---|---|---|---|---|
| 34 | 22 | 59 | 30 | 81 |
| 35 | 28 | 76 | 33 | 89 |
| 36 | 17 | 46 | 25 | 68 |
| 37 | 14 | 38 | 26 | 70 |
| 38 | 20 | 54 | 28 | 76 |
| 39 | 23 | 62 | 31 | 84 |
| 40 | 14 | 38 | 24 | 65 |
| 41 | 25 | 68 | 32 | 86 |
| 42 | 28 | 76 | 26 | 70 |
| 43 | 23 | 62 | 35 | 95 |
| 44 | 24 | 65 | 29 | 78 |
| 45 | 20 | 54 | 25 | 68 |
| 46 | 21 | 57 | 23 | 62 |
| 47 | 25 | 62 | 29 | 78 |
| 48 | 5 | 14 | 17 | 46 |
| 49 | 24 | 65 | 26 | 70 |
| 50 | 15 | 41 | 22 | 59 |
| 51 | 10 | 27 | 22 | 59 |
| 52 | 23 | 62 | 33 | 89 |
| 53 | 23 | 62 | 35 | 81 |
| 54 | 22 | 59 | 20 | 54 |
| 55 | 17 | 46 | 26 | 70 |
| 56 | 19 | 51 | 19 | 51 |
| 57 | 21 | 57 | 31 | 84 |