Which Species to Save?

A Theoretical and Empirical Analysis on the Selection Process Involved with NGOs and Species Conservation

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ABBREVIATIONS

WWF - World Wildlife Fund for Nature

WCS - World Conservation Society

NGO - Non-Government Organization

IUCN - International Union for the Conservation of Nature and Natural Resources

ASPCA - The American Society for the Prevention of Cruelty to Animals

UN – United Nations

INTRODUCTION

In August 2007, Chinese scientists declared the Baiji dolphin extinct due to pollution in the Yangtze River (www.baiji.org). Its habitat had been destroyed. Several organizations were involved in the attempt to prevent the extinction of the Baiji. These included a number of fisheries research organizations and perhaps surprisingly, the American beer company Budweiser.

Nonetheless, international conservation groups were conspicuously absent from the effort to save the dolphin. Organizations that have an interest in cetacean conservation or species conservation generally, such as Greenpeace and World Wide Fund for Nature (WWF) were not participants in the recovery efforts. This raises a very interesting question. Why was a beer company motivated to attempt to conserve the Baiji dolphin but not major environmental organizations such as Greenpeace and WWF?

Both Greenpeace and WWF participate in projects protecting ocean wildlife. Greenpeace is world renowned for their anti-whaling and anti-dumping policies in the ocean. The later includes raising awareness of the hazardous effects water pollution creates for birds, mammals, and fish. WWF is known for protecting marine life as well. WWF has implemented conservation programs for both the common dolphin and the bottlenose dolphin. If these organizations are concerned about marine and aquatic life, why did both environmental groups choose not to collaborate with other organizations to protect the Baiji dolphin?

WWF and Greenpeace present themselves as non-profit, non-government organization, i.e. an NGO. This means these organizations do not in theory operate as profit-maximizing business, but as a charity ostensibly generating a public good. Nonetheless, what if non-profit organizations, such as WWF, were actually organized more like a profit-maximizing business? If so, how would these organizations view wildlife? An important question then arises. Are there other motives present when non-profit wildlife conservation organizations select species to conserve?

Do these wildlife organizations strictly operate as what they state, a selfless, non-profit organization? Do they opt to target those species that are in most need of conservation? Does the threat of extinction increase the likelihood of involvement by an NGO towards an endangered species?

It is however noticeable, considering the example of the Baiji dolphin, that these organizations do not protect all endangered species. This is understandable given the large numbers of recognized endangered species. Some economizing of effort is necessary. Hence, what are the prioritization mechanisms these organizations employ? Since WWF sponsors both a common dolphin and bottlenose dolphin and not the Baiji dolphin, does this reveal anything? A selection process by NGOs must be present when they select species for their conservation programs.

If an individual selects a specific stock on any exchange market, they would like to choose a stock which will provide the largest profit margin with the lowest risk involved. Do these conservation NGOs have the same approach with species? Will an NGO select a species which will attract large funding with low risk involved based on the endangerment level of a species? In effect, are the NGOs operating instead to maximize donor revenues and simply eschewing those species that are not good marketing prospects.

This leads into the research of this paper. Do non-profit organizations operate as a self-interested, profit maximizing business? Or do they operate as it is commonly believed, as selfless organizations enhancing the survival prospects of threatened species. The research investigates whether or not NGOs, focusing on wildlife conservation, select species which will attract the most amount of funding.

The topic on species selection for conservation has in fact, been rarely covered. The most relevant work has been done by Metrick and Weitzman (1996). The research focused on how the U.S. public sector selects species for conservation. This investigated the traits species possessed which made them desirable candidates to the U.S. government.

Another publication that is similar to this research was done by Smith (1985). His research question was "*why individuals support private environmental public interest groups*" (Smith, p132, 1985). In effect, what benefits an individual may receive from sponsoring an interest group. The research of Smith (1985) and Metrick & Weitzman (1996) are discussed below.

In order to study this question, research is conducted on two aspects. These are developing a theoretical framework and then using empirical modeling. The theoretical framework is based on two different sections. First, economic theories will be discussed to explore how an NGO may behave as a business. This incorporates the concepts of public choice, rational ignorance, rent-seeking, clubs, public goods, asymmetrical information, and brand name. Then, a two player game theory model is used. The model was designed to map out the interactions of an NGO and a donor. Both players must select a strategy (in this case an endangered species) based on cost and conservation benefits to maximize their pay-off.

The empirical aspect of the research uses two different statistical models to analyze the selection process conducted by two different NGOs. These are the WWF and the World Conservation Society (WCS). First, a logit/probit model is used to find out what qualities of species make it more desirable to WWF or WCS. This is done by taking a random sample of species from the International Union for the Conservation of Nature and Natural Resources (IUCN) and comparing it to what type of species WWF and WCS offer to protect. The second statistical model uses a discriminant analysis. This model will separate the type of species WWF and WCS are more likely to predict separately and simultaneously.

The outline of this research is broken down into the following format: Background information, Theory, Data, Discussion, and Conclusions. Each will be explained thoroughly.

The background information involves areas of literature, conservation organization, and biodiversity. A literature review is presented on relevant publications. The papers discussed range from economic theories to biodiversity

research. Explanations are given on why each publication is relevant to this research.

The next section examines three popular conservation NGOs. How the organizations operate, and historical campaigns (positive and negative) by these organizations are discussed. After this, a review of what biodiversity is and why it is important is explained. This outlines the differences between species based on ecological traits or charismatic traits and what each species may have to offer their environments. Subsequently, an examination of what the general public may know about biodiversity is presented. This looks at what the popular species the general public may choose to select for conservation are.

The theory section elaborates relevant economic theory and generates a two-player game-theoretic model. Explanations on the economic theories relevant to this research are given. The origins of each theory are outlined, such as who first presented the theory and what it was applied to. Each theory is defined and examples of its applications are provided.

After the theory review, an economic model is derived. This economic model is embedded into a two player game-theory model. This concentrates on a cost and benefit choice function between an NGO and an individual. After the two-player game, a combination of the economic theories and game are presented. This section will help link the actions of the players to economic theories.

A data section is presented. Two econometric techniques, the logit/probit model and the differential analysis model are explained. Initially the raw data is examined. This is to help shed light on what type of species appear more than others amongst the data sets. All data used is elaborated as to where each variable originates from and why it is being used. Both statistical applications are used to help explain what types of species a conservation NGO may select for protection. The results obtained will identify which independent variables affect the dependent variable(s). Problems encountered with the data will also be elaborated. This includes the options faced to treat some of these data problems.

After the statistical modeling, a discussion is presented. Interpretations of the data results will be provided. Finally, concluding remarks will be made on the research.

LITERATURE REVIEW

In this section, journal articles relevant to this thesis will be discussed. The journal articles which are reviewed cover the areas of endangered species preservation, interest groups, biodiversity, public choice theory, rational ignorance, club theory, asymmetrical information, and brand naming.

The starting point is how public policy is generated in democracies. This was initiated by Downs (1957). The main focus of this publication was to show that every individual has a private motive and a social function. Downs explains that the private motive and social function interact through the government and voters. The main goal of a politician is to gain office. This is a private motive. In order to win office, the politician will make promises about certain policies when elected. Though the actions of the politician may generate a beneficial social function, the initial drive of these actions was to please the voter in order to gain office.

Downs (1957) considered two settings. First, a world where there is perfect knowledge and it is costless to obtain this knowledge. The second setting establishes the world is not perfect. There is only imperfect knowledge and it is costly to obtain this knowledge.

In a world with perfect knowledge the government and voters act rationally and there is no cost to obtain knowledge. Actions by the government occur the way the government expects the voters to vote. Voters analyze each possible candidate in an election and choose wisely. The voter makes comparison not only based on future promises but on current government's actions. This means that the voter would compare current utility functions to a utility function of when each candidate was in office.

In the world with imperfect knowledge, the government does not always know what the voters may want, voters do not know everything that the government has done, and it is costly to obtain information. Due to the imbalance of knowledge, politicians are able to select information that they want the voter to know. The reason

this occurs is so the politician can make themselves appear successful and gain votes. Since it is costly for an individual to obtain new information, the individual will stay uninformed unless the benefits involved exceed the information cost.

In a voting scenario, a voter only benefits when the candidate they voted for wins the election. Downs states that realistically, unless the vote is a determining vote for an election, an individual's vote does not matter. It is irrational for a voter to obtain new information of a candidate when realistically, his or her candidate may not win. It is rational for the voter to stay uninformed and vote at random for a candidate.

Downs's paper is one of the first to directly address the issue of self-interest driving and individual's decisions. The consequences of an act are mainly to benefit the person who conducted the act. Could this idea of self-interest be applied to NGOs? The main act of an NGO directly benefits the organization? Downs's paper also discusses briefly about imperfect information. Individuals will only reveal information that makes themselves appear good to others. If NGOs also operate in a world of imperfect information, it would be tempting for an NGO to only reveal information that makes them seem altruistic.

The most important aspect of the paper is the idea of rational ignorance. In the voter scenario, the voter is better off to be *uninformed* due to the costs involved of choosing a candidate and that candidate winning the election. A similar phenomenon may exist for NGOs. Is it conceivable that the general public is uninformed on actions of an NGO? Many individuals may believe whatever a NGO may say because the costs involved of becoming informed are not worth the benefit.

Buchanan and Tullock (1962) published the *Calculus of Consent: Logical Foundations of Constitutional Democracy*. This book is the first publication to directly address the theory of public choice. There are four chapters of the publication. These are the conceptual frame work, realm of social choice, analysis of decision-making rules, and the economics and ethics of democracy.

The first section discusses the structural set up of the public choice. The two

main parts of this chapter focus on the subjects of individualism and rationalism. These two subjects explain or justify why an individual makes certain decisions. The outcome centers on how the person will always obtain the maximum benefit.

The second and third chapters observe human activity, generate a theory of constitutions, discuss unanimous voting, and elaborate the costs of decision making. The concept of majority voting is used to help explain public choice. With unanimous voting, everyone needs to agree on an issue, whether this is a bill being passed or a political candidate being elected. The difficulty of a unanimous vote is getting everyone to agree on the same topic, which is nearly impossible. Establishing a majority rule however, will not please everyone. Nonetheless the majority of the population of the vote will be satisfied. The idea of the median voter is derived. This shows that if politicians align their policies with the views of the average voter, they are able to please most voters. This is most likely to secure a majority for the politician.

The final chapter discusses the ethics in involved with specific economic and political actions. Some of the ethical topics focus around vote-trading, rent-control, and pressure from special interest groups. The concept of a good society is also discussed at the end. A concept of an individual, through the actions brought out by self-interest, create a good political society.

This publication is relevant for two reasons. This publication is the first to directly address the issue of public choice. It develops the idea that all actions created by an individual are influenced by self-interest. The goal in the end is to satisfy the individual. An individual wants to maximize their gain from any action they participate. This publication also expands on previous theories, such as rational ignorance. Buchanan and Tullock (1962) inspired future elaboration by other researchers on other concepts such as rent-seeking.

Tullock published *The Welfare Costs of Tariffs, Monopolies, and Theft* in 1967. The basic structure of the paper shows how lobbyists search for ways to attract government funding or avoid government imposed tariffs. The classic example of

this is when an individual may search for importing licenses to avoid tariffs placed on imports. Several individuals would be competing against one another to obtain this limited amount of rent.

Tullock (1967) is important because it is the first to derive the idea of rent-seeking. The theory will be applied to the research to see how NGOs may select different species. Do NGOs search for species which will attract funding just as individuals search for ways to obtain rent? That is, can an NGO earn a higher revenue stream (rent) simply be nominating species that attract more donor-revenue.

Krueger's publication of The *Political Economy of the Rent-Seeking Society*, in 1974, is another important publication of rent seeking. The main focus of this article was to observe the competition and usage of resources involved with importing licenses. Importing licenses are needed by firms in developing countries to import goods at a lower cost. Nonetheless, only a limited number of licenses are given out by the government. This initiates competition amongst potential licensees to obtain these licenses. This competition manifests rent seeking. Rent seeking occurs when an individual searches for ways to obtain these licenses at the lowest cost.

Due to these rent-seeking activities, Krueger (1974) investigated the welfare costs generated in this process. This entailed comparing the costs between rent seeking and basic import tariffs. What was found is that the rents involved with import licenses are relatively large and their welfare costs are equal to the basic important tariff. Nonetheless, due to the rent-seeking activities, the costs become higher than the usage of basic important tariffs.

Kruger (1974) is important because of its elaboration of the basic concept of rent seeking. Individuals are always searching for easier ways of saving money or earning extra profit. Also, this paper shows that individuals may participate in rent-seeking even though the outcome is less productive than not participating in rent-seeking.

Bhagwati (1982) published *Directly Unproductive, Profit-Seeking (DUP)*

Activities. This focused on lobbyists and outcomes of their profit-seeking activities. Bhagwati first reviews important publications focusing on different ways people may benefit from importing practices. This reviewed work done by Krueger (1974), plus Bhagwati and Srinivasan (1980) on premium seeking which occurs when people compete for a limited number of importing licenses. Also, previous work by Bhagwati and Srinivasan (1980) was reviewed explaining why people attempt to take a percentage of tariff revenues earned. Tariff seeking, which occurs when lobbyists seek protectionists trade tariffs, was studied by Brock and Magee (1978), Bhagwati (1980), Feenstra and Bhagwati (1982), and Findlay and Wellisz (1982). The last paper looked at non-trade profit seeking. This latter happens when lobbyists look for the many different ways in finding profit with least work done. This was pioneered by Tullock in 1967 and revised in 1980 and Posner (1975).

Bhagwati sums all of these rent-seeking techniques into one term, directly unproductive also D.U.P. (pronounced as dupe) activities. The reason they are known as unproductive is because these captured revenues do not directly or indirectly increase production at any level.

Bhagwati also designs a chart listing and comparing all the different authors work and possible outcomes which may be produced. Four different scenarios are derived followed by possible outcomes. They are as follows:

1. Initially Distorted and Finally Distorted Situations. These occur either through premium seeking, revenue seeking, or through smuggling and tariff evasion. The final outcome is where the seeking activities lower output and the tariff evasion may increase welfare.
2. Initially Distorted but Finally Distortion-free Situations. These may occur through legal tariff-destroying lobbying or tariff-destroying based on political bribes. Within these scenarios, the output could be positive or negative.
3. Initially Distortion-free but Finally Distorted Situations. These may occur either through monopoly seeking, tariff seeking and tariff evasion. Within this scenario, welfare does not increase but could fall.
4. Initially Distortion-free and Finally Distortion-free Situation. This occurs

with zero-tariff-outcome lobbying or theft. The scenario outcomes show a no increase or decrease in production or welfare.

Though the main focus of tariffs and imports of this paper are not really relevant, the concept though of profit seeking could be applied to the process on how conservation NGOs select species to protect. This research also reviews additional publications relevant to rent-seeking. Once again, this is another publication showing how individuals search for easy ways to earn or save money, even though if it is unproductive.

Buchanan (1965) published *An Economic Theory of Clubs*. Buchanan questions previous work done in club theory where authors took extreme views in scenarios of pure public and pure private goods. Buchanan's idea on clubs starts to look at consumption ownership-membership arrangements of these goods.

Buchanan explains that when an individual builds a good, i.e. a golf course, the individual absorbs a huge cost. Now if the person would like to offer the use of the good to other people, by selling a membership of the golf course, the individual is able to lower the initial cost of construction. So, the more memberships the owner allows, the lower the construction costs become for the owner. Also, with additional memberships, dues become for all members. Nonetheless, a trade off starts to occur between the size of the membership and the amount of pleasure one receives from the goods offered.

Buchanan discusses about the need of a membership cut off point, for all goods. An optimal size occurs when the benefit from the good equals the membership fee of an individual. When membership size starts to increases, everyone's usage of the goods becomes smaller. If membership keeps growing beyond the optimal size, then enjoyment of the good starts to decrease because too many members are using the good. When membership size of the golf course becomes too large, crowding starts to occur on the golf course, people have to wait longer at each hole because there are too many members, and this causes the members enjoyment to decrease.

The concept of the free rider is discussed in this publication. Free riding occurs when a non-member does not pay a fee for the use of a good supplied. When dividing membership costs, the factor of one individual not paying does not severally affect all other member's costs.

This publication is relevant to the research because it directly address the theory of clubs. With this publication, there is a basic understanding of what makes a club. Here, there is an understanding that a club is any organization which provides either a public good or a private good to a specific membership size at a cost. The concept of free-riding is discussed. A person who does not pay a cost for the good still benefits from the good. Is an NGO a club? Would species conservation be the same as providing a good to its members? Are there people who do not contribute anything towards an NGO and still benefit?

Sander and Tschirhart published *The Economic Theory of Clubs: An Evaluative Survey* in 1980. This article summarizes previous literature on club theory and discusses prospective ideas for future research in club theory. The foundation work in club theory was first formulated by Pigou in 1920 and Knight in 1924. These two authors were discussing membership size for public and private roads and how tolls should be placed on private roads to control the amount of users for it.

The authors review and explain one of Buchanan's popular Club Theory models. This model explains how the sharing of a private and public good, with homogenous membership, allows for utility to be maximized and how average net benefits per member are maximized.

The authors discuss Oakland's view on clubs but modify it into a general model for clubs. The only difference between Buchanan's model and the general theory model is the general model looks at both members and non-members. The general model also looks at how utility is affected through consumption of the good and crowding caused by all members and non-members.

The general model also discusses the difference between homogenous and heterogeneous memberships. In a homogenous model, all members pay the same fee. With heterogeneous membership (which is what the general model assumes) all members pay the same fees but total membership payments differ depending upon tastes. Other differences between homogenous and heterogeneous memberships exist, such as separate time spans, discrimination, costs, goals, stability.

Non-game and game theory approaches are employed in club theory. The differences between the two manifest in interactions, costs, population, and finance conditions. Similarities are found in areas of how individual members utilize public and private goods and the beneficial amount of clubs with homogenous membership.

According to the authors, the use of club theory can be applied to public utilities in areas of tariffs, transportation, and communication, community size, city size, local public goods, political coalitions, recreation, international organizations and alliances.

One major difference between this publication and Buchanan's is the idea of non-members interaction of goods offered. These non-members are known as free riders. Free riders occur when an individual does not pay a fee but still benefits from the good.

Buchanan, Sanders and Tschirhart papers on club theory are very interesting. Both publications explain a club as a business. An individual provides a good, i.e. golf course, to a set membership at a fee in order to cover the original cost of the good itself. In this research, NGOs provide species conservation for a membership fee. Nonetheless, instead of one good being provide for a member for one fee, i.e. a golf course, these organizations provide several goods at several different fees. This concept of a club providing several different goods at several different costs in something that has never been reviewed before in literature.

Brubaker published *Free Rider, Free Revelation, or Golden Rule?* in 1975. The paper starts to explore the variance of the different applications of free riding.

The author feels that previous literature on the concept of free riding is underdeveloped and the basic concept of free riding may go unnoticed in real world practices. The author explains that one individual out of a million makes no difference to the consumers of a particular good. The author does start to develop the concept of a forced rider. A forced rider is an individual who must participate or contribute towards a good whether it is beneficial or hurtful for them.

An example the author gives is centered on the U.S. judicial system. A problem occurs when an innocent person is convicted of tax evasion and the guilty party is acquitted from the crime. The innocent individual becomes the forced rider and the guilty party is a free rider. The wrongly convicted are forced to under go a "cost" of paying the tax penalties that were put on them. If the innocent person does not pay the tax penalties, they would be sentenced to jail. The innocent is forced to pay a fine which is hurtful towards them.

The concept of forced riders plays an interesting role within the paper. Taking a different perspective of the actions of an NGO, where might forced riders occur? Might forced riders occur within the organization? Could actions caused by an NGO effect people is specific areas?

Akerlof (1970) published *The Market for ¨Lemons¨: Quality Uncertainty and the Market Mechanism*. This is the first paper to fully discuss asymmetrical information. Asymmetrical information occurs when there is imperfect information between two or more individuals involved with a transaction of goods. Examples in the paper deal with the purchase of cars, insurance and employment markets. The example of the car market is the most popular. In this instance an individual selling a car is going to hide information from the buyer. The buyer, having less information than the seller suffers from asymmetrical information. Another area of discussion within the paper is how institutions will counter asymmetrical information for the consumer. Examples include offering guarantees on a product or by establishing a well known brand name. With guarantees and popular brand names, the confidence of the consumer is built up and they begin to trust the product supplied by the seller.

The basic concept of asymmetrical information is very interesting to incorporate into this research. Here is a theory which is popular with large businesses, i.e. banks, insurance companies, used car salesman, and it can also be applied to a non-profit organization. Asymmetrical information could be used by NGOs to reveal and hide any information to potential donors. Also, this paper will show how brand name is able to create, not diminish, asymmetrical information.

Spence branched off from asymmetrical information with the paper *Job Marketing Signaling* in 1973. Signaling is used when an uninformed individual sends out signals to get the informed individual to reveal information and help eliminate the asymmetry between the two. The author gives an example of this occurring between an employer and potential employee. An employer does not know relevant information such as productivity of potential employees. Given this, the employer will send out a signal, such as an offer of a higher wage to someone with a specific higher education. This presumes that higher education is a signal of higher productivity, and is a signal difficult to copy by employee's with low productivity. With the motivation of this offer of a higher wage, potential employees will reveal their education level in hopes of obtaining the higher wage. By revealing this hidden information, the asymmetry is dissolved between the two individuals.

Here, the idea of signaling is applied to job markets, but it could also be applied to an NGO. This research would question if NGOs send out signals to attract individuals. Are there certain phrases an NGO may use to attract potential donors?

Stiglitz (1975) approached asymmetrical information from a different perspective. Stiglitz published *The Theory of "Screening," Education, and the Distribution of Income* in 1975. The concept of screening occurs when an individuals bears a cost to obtain new information about the other party. By screening, the individual is able to obtain new values of the other party's productivity. The other party however, is unaware of this screening process and thus unaware of their new values. By screening, the informed individual benefits however, the social welfare outcome is sub-optimal.

Stiglitz gives an example of this between and employer and employees. The employer pays all individuals the same wage. The employer knows that the employees with higher education produce a higher output. If the employer bears a cost to screen all of the employees, they would be able to find every employees education value. The benefit comes from those with a higher education. Those who have higher education are being paid the same as those who do not. The employer is able to derive a benefit by the difference in current productivity compared to if the ones with higher education were paid a higher wage than others. Nonetheless, it is beneficial for the employer to keep this information private. If the employees were informed on the screening process, they would demand a higher wage.

This paper is similar to the concept of rent seeking. Could the idea of screening help show that an NGO is self interested? Would an organization screen different species to find different values and withhold this information from the public?

Klein and Leffler published *The Role of Market Forces in Assuring Contractual Performance* in 1981. The main focus of this article is on the concept of brand names. Consumers almost always have incomplete information on products of interest to them. These include a lack of information on the quality of the product, availability of the product, and competitor's prices of similar products. The one thing a consumer may rely on is the brand name of the company who offers the product.

The consumer is able to associate the company's reputation of the brand name. Given this consumer dependence on brand names, the company has an incentive to establish a positive reputation by providing a product which is better than other competitors. Understanding the concept of a brand name, how could NGOs use a brand name? Would an NGO want to select certain species to help develop a positive brand name more easily? These are interesting concepts to see if certain NGOs use asymmetrical information to help develop a brand name.

Tisdell, Nantha, and Wilson published *Information, Wildlife Valuation, Conservation: Experiments and Policy* in 2006. The publication presents a

willingness-to-pay model for preservation. Two different willingness-to-pay models are combined. One model shows a higher level species with basic information available about its ecosystem. The second gives a partial willingness to pay model of a lower level species. A predator-prey model is derived between the two species. From this model, a partial willingness-to-pay can be used to estimate values on different species with an ecosystem. The finds give partial willingness-to-pay values of the lesser known species. From this, an individual could apply these values to the species that depend on these values. That is, a partial value is assigned to the prey species. From this value, it can help develop another value for the predator species. The purpose of the model is to assist in finding values of species for policy issues when there are major time constrictions.

The relevance of this paper is not directly related to the findings, but the concepts for finding values of species in the wild. If values of species could be found for policy issues, who is to say that values for species are not present for conservation issues. Does this paper help establish any thoughts that an NGO may have certain preferences towards certain species?

Smith published "A *Theoretical Analysis of the "Green Lobby*"" in 1984. This paper develops a theoretical model of why individuals may support non-profit organizations. A review of different models by other authors are given to help lead into why people support non-profits. These four models are based around imperfect information, public goods, and contract failures. The model Smith presents is based on the idea of clubs. This is how people may derive some sort of benefit through an organization from sharing a cost of an excludable benefit.

The model set up by Smith looks at clubs from two different perspectives. One is viewed as an organization offering a good only to its members. A person may join a club because the good offered is only limited towards its members. The second view point addresses a lobbying perspective. People may contribute towards a lobby because the good is offered at a society wide level. The model also includes effects of a club member's donations. That is, how the member may perceive a benefit of a club from donating. This is dependent upon the perception of the donor.

The paper is relative to this research. First addresses a question similar to this research. Why do people support non-profits organizations? The findings are very similar to what this paper questions. Individuals support or join non-profits because the individual gains something out of the organization. Also, several theories that are used in order to make this correlation are used in this research. These theories focus on asymmetrical information, public goods, and clubs.

Christie, et al. (2006) investigated how information influences the preferences towards biodiversity. This article explored how informed individuals are about the biodiversity characteristics of different species. A focus group approach was employed to conduct the study. The group was given a questionnaire on policy issues and how they relate to the survival of individual species. Most of these people selected charismatic, popular species for protection.

After the first questionnaire, a workshop was given explaining biodiversity to the group. The workshop was given to study any changes of the group's preferences for species protection. After the workshop, the group is given another questionnaire to select species for protection. The group switched their choice from charismatic species to species which had higher biodiversity value. This was an outcome derived from being informed on what biodiversity is. An interesting part though is that people do care about species survival they have little idea on how it is achieved.

Christie et al. (2006) helps set up the game theory model for this research. The authors found out, at first, most people are uninformed and select charismatic species for protection. Nonetheless given the opportunity for an individual to become informed, this person will select species for protection based upon scientific reasoning, not charismatic characteristics.

Montgomery (2002) published "Ranking the Benefits of Biodiversity: An Exploration of Relative Values." Montgomery explains how previous research in wildlife conservation looks at individual species such as wolves in Montana or game ranching is South Africa instead of broader issues. She also discusses about how a

study done by Kellert revealed how people are more concerned with charismatic megafauna traits than biodiversity traits, i.e. bald eagles and grizzly bears compared to spiders and worms.

Montgomery (2002) focused on individual high-profiled species. Montgomery then considered the benefits associated with biodiversity with hypothetical species. The reason a hypothetical species was used was so that the individuals taking the survey will not associate the candidates with well known species. The benefits outlined were aesthetic, commodity-based, ecological, humanistic, recreation, symbolic, and ethical. The results revealed that ecological benefits are the most important to the public over all other options. Commodity and humanitarian based are moderately important while aesthetic, recreation, symbolic, and ethical were ranked lowest.

This article generated similar results as Christie et. al's (2006) paper. The authors demonstrate that when people are uninformed, they will select charismatic species for protection. Another reason is an individual might have personal favoritism towards a well known species. When an individual however, becomes informed of the biodiversity values of a species, they will base their decision on scientific not charismatic reasons. Again, this article helps to back up the logic used in the game theory section of this research between an uninformed and informed individual. The decision made by a subject towards a species depends on whether they are informed or uninformed.

Tisdell et al. (2006) published a paper on the willingness to pay for species protection. The research conducted surveyed 24 Australians. The survey included IUCN individual species endangerment ranking and only considered mammals, birds, and reptiles. Each individual was asked about the likability of each species and the amount a fixed budget funding, they would contribute for protection of each species. The study showed that when people are well informed, they will choose species based on scientific reasoning, not charismatic traits. The findings show that endangerment levels, not physical attributes, play a dominant role in allocating funding. Additional findings results were that as the species population size decreases and its threat-

ranking increases, the willing to pay also increases.

This publication is additional proof that when an individual is informed on a species, they will select it based upon scientific reasoning. Given specific levels of endangerment compared to the physical attributes of a species, the levels of endangerment are far more important to an individual. Choice when informed is different to choice when uninformed.

Metrick and Weitzman (1996) published "Patterns of Behavior in Endangered Species Preservation." The authors investigate how the U.S. public sector selects species for protection. In effect what traits do species have which them more attractive for the U.S. government to protect. The authors discuss how choosing a species to preserve through biodiversity can be broken up into three areas of value. These are commercial, existence, and contributory. When focusing on the data set, the authors used the traits of physical length, degree of endangerment, being a "higher form of life", and the uniqueness of a species. The "higher form of life" variable tested whether the species is a mammal, bird, reptile, amphibian or a fish. The uniqueness of the specie classifies the animal by seeing if it is a sub-species, species, or sole representative of the genus (monotypic). The authors use a logit estimation which reveals that as a species becomes larger and is considered a higher form of life, they are more likely to receive higher funding.

Metrick and Weitzman's paper is very similar to this current research. These authors discuss about how the U.S. public sector selects species to fund for conservation. This paper investigates how the non-profit sector selects species for conservation. Similar variables are used in the data set of this research as well. Metrick and Weitzman's paper is the only paper that has ever been covered dealing with the topic of how groups select species for conservation.

Weitzman (1998) wrote a paper on the topic of preservation of biodiversity titled "The Noah's Ark Problem." The Noah's Ark Problem arises because all the species in the world face extinction due to a flood coming soon. Noah would like to save all species but since there is only limited space on the ark, only a limited amount

of species can be saved. In this analogy Noah represents the conservation authorities and the ark represents a budget constraint. Due to a fixed budget constraint, how does one choose which species to preserve? The solution Weitzman shows is to develop a ranking criterion for optimizing biodiversity among species while given a budget constraint. The ranking system for specific species is based upon four traits. These are unique a species is from another, how much the species is liked, the improvement of the species' survivability, and the cost to improve the species' survivability.

This is an interesting paper. Here, the author presents a check list of biodiversity traits to show if a species is worth saving, given a fixed budget and limited amount of species to save. With a checklist in mind, what type of checklist would an NGO use? Would they prefer to have a checklist set to biodiversity value? Would the NGO use a checklist based on charismatic values?

In 2007, Clout and Russell published *The invasion ecology of mammals: a global perspective*. This research investigates the differences within several different mammal groups on species which are invasive and threatened. Their findings show that Artiodactyla, Carnivora, Lagomorpha, and Perissodactyla have the highest amount of invasive species. Further study shows what factor contribute to making a species invasive. Explanations are given on what impact these invasive species may have on their surrounding environment.

This publication is relevant for one main reason. Are there any similarities between which species are viewed as invasive and threatened towards this research? Does WWF and WCS tend to select species which Clout and Russell show as being threatened?

CONSERVATION ORGANIZATIONS AND IRONIC ACTIONS

1. What is an NGO?

Non-Governmental Organizations, also referred to as NGOs, are legal organizations, made up of private individuals, which work voluntarily and independently of government direction. The first official NGO dates back to 1945 with the formation of the United Nations Organization. Though there other welfare organizations existed prior to 1945 (such the SPCA formed in 1866) the U.N. is considered to be the first official NGO. The U.N. was created to help resolve international problems by giving advice unlinked to government influence (Wikipedia.org). In 1995, the U.N. estimated at least 29,000 operational international NGOs existed (fundraisingexpert.com). Today, over 40,000 international NGOs exist according to Global Civil Society (Wikipedia.org).

Many people today believe that NGOs have a positive influence on human and the environment. For example, the El Hayet Association for people living with H.I.V. operates in Algeria and fights for the working rights of individuals who are H.I.V. positive (Magharebia.com). Another example of an NGO's positive actions are those carried out by Greenpeace in China to help combat environmental contamination caused by mass production, estimated at US$200 billion a year (MSNBC.com).

This research focuses on wildlife conservation NGOs mostly. The emphasis is on what type of species they protect and the means they take to protect the species. Here, small and large NGOs will be discussed. What each organization chooses to protect and why they may select these species is outlined.

2. Small Conservation Organizations

The subject of small organizations arises in this research. What makes an organization small? How are these small organizations able to attract funding? What type of species may a small organization select to protect? Do they operate similarly to larger organizations? These questions will be explained below.

Small organizations usually tend to operate locally, or at most, within their own country. The reason an organization is small are due to constraints. Constraints are based on low funding or small membership size. With these limitations, they are only able to focus conservation on what problems already exist locally. It would not be wise if a small organization protects a species half way around the world, when it is much more effective to protect a local species. Examples of these types of organizations will be explained by using organizations which are located within New Zealand.

A limited amount of New Zealand's conservation projects are controlled by the government. A popular native wildlife conservation project conducted by the Department of Conservation (DOC) is on Little Barrier Island, north of Auckland (Hartley, 1997). Unlike surrounding predator-free conservation areas, DOC has limited public access to the island. Public fairies are unavailable and a permit must be obtained from DOC to visit the island. This is to help minimize predators hitchhiking with humans to the island, negatively impacting on the native wildlife.

There are an ample number of small, privately owned, organizations in New Zealand. Private kiwi sanctuaries managed by landcare trusts are believed now to exceed the area devoted to kiwi sanctuaries managed by the crown. Private owners must operate at a small budget for conservation. One popular method of creating sanctuaries is by converting property into a sanctuary. By doing this, individuals are able to plant native bush and release native species into their converted reserve. Nonetheless, financial problems do arise. The New Zealand government does not typically fund these private organizations (Hartley, 1997). What other methods may a small organization use to attract funding?

A popular tactic used for private conservation is to select popular native species, i.e. whales, penguins, kiwi birds. By selecting these species, the small organizations are able to market the species to the visitors. Marketing the species involves charging admissions to view the species or selling merchandise of the species. From the revenue earned, private conservationists are able to maintain their

private reserve. This is a classic example of eco-tourism (Hartley, 1997).

An example of personal farmland used for conservation is the Yellowed-eyed Penguin Conservation Reserve, located in Dunedin. This reserve offers nesting boxes to assist with penguin breeding. A popular attraction at the reserve is the penguin hospital. This hospital is designed to take care of penguins that have been injured or have fallen ill. The owner of this reserve selected penguins as a group to preserve because he knew it would attract customers. The penguin reserve has to generate sufficient revenue to cover its operating costs. Without a large donor base, marketing decisions become more commercially orientated. The owner knows that people are attracted to penguins, and so, will pay an admittance fee to view the birds (Hartley, 1997).

The Yellowed-eyed Penguin reserve is not the only organization which charges admission for funding. The Otorohanga Kiwi House is another example. This animal sanctuary is a popular reserve that assists in the breeding of rare New Zealand birds. The main source of funding comes from charging an entrance fee to the sanctuary and selling merchandise of species in the sanctuary (Moyle, 1995, cited in Hartley, 1997).

Not all private conservation projects are limited to New Zealand birds. One of the most popular examples of eco-tourism is the whale watching industry in Kaikoura. Privately owned boating tours, by the Maori community in Kaikoura, have exclusive rights to show tourists the various marine organisms. The marine fauna at Kaikoura includes several different species of whales, dolphins, fur seals, and albatrosses. No one else is allowed to enter the water other than the Maori community. This is to ensure the amount of trips on the water will not disturb the sea life (Hartley, 1997).

An interesting aspect of these small organizations is the way they attract funding. Since these organizations are relatively small, they cannot rely on donors providing sufficient amounts of funding to operate. Also, the government does not contribute funding either. These organizations take alternative actions to attract funding in order to work. They select species they know people are attracted to. The

organizations sell admittance tickets to view the species and sell souvenirs to the people in order to raise proper funding.

3. Large Organizations

Large organizations are able to operate at an international level. The reason they are able to do this is because of the larger amounts of funding received and a large membership size. Due to these two traits, the organizations are able to offer service to countries around the world.

Three large organizations (WWF, WCS, and Greenpeace) will be reviewed. A look into how they originated will ensue. Their statements will be given on what their personal goals are as well.

The World Wide Fund for Nature, also known as WWF, originally started in 1961 in Switzerland and was set up as a charitable trust (www.panda.org). The original members were involved in a Political and Economic Planning think tank with naturalists and executive business people (www.panda.org). WWF is said to be "the world's largest independent conservation organization with over 5 million supporters world wide" (Wikipedia.org). The original mission statement of WWF was said to be "conservation of world fauna, flora, forests, landscape, water soils and other natural resources by the acquisition and management of land, research and investigation, education at all levels, information and publicity, coordination of efforts, cooperation with other interested parties and all other appropriate means"(www.panda.org).

The Wildlife Conservation Society, WCS, dates back to 1895 in New York State. WCS is claimed as being "one of the first organizations in the United States" original objective was to "advance wildlife conservation, promote the study of zoology, and create a first-class zoological park." (en.wikipedia.org). WCS states their mission is to save "wildlife and wild lands through careful science, international conservation, education, and the management of the world's largest system of urban wildlife parks. These activities change attitudes toward nature and help people imagine wildlife and humans living in sustainable interaction on both a local and a

global scale. WCS is committed to this work because we believe it essential to the integrity of life on Earth" (http://wcs.org/sw-our_mission). Currently, WCS operates in 53 countries around the world.

Greenpeace originated in 1971 in Canada. The organization's first goal was to stop nuclear testing in Alaska. Greenpeace's original mission statement and still part of their current objectives involves changing energy solutions to prevent climate change, protecting the oceans from destructive actions, protecting ancient forests and the species within the forests, reducing and eliminating nuclear weapons, creating a toxic free future, and lastly, promoting sustainable agriculture and responsible farming (www.greenpeace.org). The organization has regional offices in 28 countries and operates in 42 countries around the world. From this information, it could be said their membership size is large.

Looking at the mission statements of each organization, they are all similar. Each organization wants to protect the environment either through protecting individual species, educating people on different species, or preventing harmful human interaction towards the environment. These organizations operate in at least 20 different countries. Their membership sizes are in the millions.

The following section highlights different ways these non-profits protect the environment, as well as the different methods used to inform the public or protect the environment.

4. Organizations and Incidents

WWF have been accused of operating too much as a business by corporate watch, a non-profit that monitors other non-profits (corpwatch.org). WWF is seen as behaving as a business because of past and future plans with popular corporations. One example occurred in 2007 with Barney's clothing store. When purchases were made from the store, a specific percentage of the purchase would be given to WWF (http://www.corpwatch.org/article.php?id=14878). This is not the only case of WWF cooperating with big brands, there are current operations in collaboration with the

soda company Coca Cola and technology company Nokia (en.Wikipedia.org).

One method WWF uses to inform people seems to be through corporate sponsorship. By making business negotiations with leading brand names, WWF is able to raise personal awareness. This should not be alarming. WWF operating as a business is the subject of this research. After all, many of WWF's original members were business people.

WCS has actions similar to a business as well. WCS cooperates with the Forests Now Declaration. The Forests Now Declaration is designed to protect forests from deforestation through the use of market-based actions (www.**forest**s**now**.org). By purchasing carbon credits, individuals are able to buy and sell potential carbon usage in the market. The concept of carbon credits is to help reduce carbon dioxide emissions that contribute to global climate change (http://en.wikipedia.org).

WCS is involved in eco-tourism with a number of governments. Eco-tourism is basically ecological based tourism. Eco-tourism occurs when individuals travel to destinations where flora, fauna, and cultural heritage are the primary attractions (en.wikipedia.org). WCS usually promotes eco-tourism through bird watching, such as in Thailand. The money spent by tourists is used to develop sanctuaries for the birds.

WCS actions question the degree to which they are non-profit. The organization is involved with many market-based transactions. This seems to differ little from some of the NZ examples above. There is a tendency to market certain species to attract funding for preservation.

Greenpeace has been known for acts of eco-terrorism. The Federal Bureau of Investigation (FBI) defines eco-terrorism as "the use or threatened use of violence of a criminal nature against innocent victims or property by an environmentally-oriented, subnational group for environmental-political reasons, or aimed at an audience beyond the target, often of a symbolic nature." (FBI.gov). A well know incident of eco-terrorism by Greenpeace took place against Shell Oil in 1995 when the Brent

Spar Oil Rig was boarded.

4.1 Brent Spar Incident

The Brent Spar (owned by Shell) was a floating oil rig in the Brent oilfield. In 1991, Shell decided it was time for Brent Spar to be decommissioned. The means by which the rig should be decommissioned however, was a problem.

The two major options considered by Shell were either to dismantle the rig inland or sink the rig in the Atlantic Ocean. Due to the size of the rig and materials i.e. heavy metals and oil within the rig, dismantling it would be too dangerous. The amount of toxins produced by the dismantling alone would be hazardous for both the workforce and the environment. Shell decided the best option would be to sink the rig. By sinking the rig in the North Fenni Ridge, the impact on the environment would be minimal (http://en.wikipedia.org).

In 1995, Greenpeace boarded the rig to prevent Shell from sinking it. This act of protest by Greenpeace was to bring public awareness to the actions of Shell. Greenpeace stated that by sinking Brent Spar, there would be detrimental effects to all aquatic life in the area. Greenpeace claimed to have taken samples from the rig to be tested for content. Greenpeace stated there were over 100 times as much oil left on the rig than what Shell claimed there was. That would be over 5500 tonnes of oil, still in the rig (en.Wikipedia.org).

Due to the protest by Greenpeace, Shell's profits were impacted. Also, employees at service stations began to be threatened. Given these negative effects generated by the Greenpeace protest, Shell had to change their demolition plans. Shell decided to tug the oil rig into shallow waters to be dismantled (en.Wikipedia.org).

During the dismantling process, Det Norske Veritas was hired to make a third party assessment of the contents within the rig. The third party revealed the estimates Greenpeace gave were inaccurate. Indeed, the statements made by Greenpeace were

knowingly false. Further investigation showed that this incident caused more environmental damage than Shell's original plan of sinking the rig. At the time of the incident, the protest made by Greenpeace, temporarily hurt their reputation and credibility (en.Wikipedia.org).

5. Small and Large

Reviewing the examples of the small organizations in New Zealand and comparing them to the example of large organizations, an interesting thing is noticed. The small organizations in New Zealand seemed to be more species focused than the large organizations. That is, the small organizations were interested in conserving local species such as whales, penguins, and kiwi birds.

Looking at the large organizations, they do not seem to be species focused but campaign focused. The large organizations seem more interested in operation strategies than conservation strategies. WWF was in search of how to promote their name through advertising with other companies. WCS was interested with collaborating with organizations using market based techniques. Greenpeace attracts attention to their causes through the use of eco-terrorism.

This research is not stating that smaller organizations are better than larger organizations, nor is this research claiming one tactic used by one organization is better than a tactic used by another. Nonetheless, there are similarities in the tactics used by both large and small organizations. The only difference is WWF, WCS, and Greenpeace are operating at a much larger level than the organizations located in New Zealand.

BIODIVERSITY VS. CHARISMA

When an individual observes a species, what type of traits stand out more than others? Is an individual more attracted to charismatic features, i.e. the facial expression of an animal? Perhaps the individual admires the biodiversity traits of the species, i.e. if it happens to be a top predator in its ecosystem. If a person had to decide which species to protect, would they make the choice based on charismatic or biodiversity reasons?

Scientists suggest that one should preserve species according to their biodiversity traits. Biodiversity is separated into three categories. These are ecological, genetic, and evolutionary (Westman, 1990). Each category will be explained and an example will be given.

What impact does a species have on its natural environment (Westman, 1990)? If the species is removed from its habitat, is the impact on its ecosystem large or small? Consider a scenario where there are two equally endangered species. Both species live in the same environment but only one can be saved. Which one to choose? One species is the top predator in its environment. It does not compete with any other species for survival. The other species competes daily for food sources. This species only eats plants, and there are several other species which are similar. Which one should an individual select?

The top predator should be selected. The biodiversity value of this species is much higher than the other species in its environment. If the top predator is removed, there could be a large negative impact on the surrounding environment. Since the top predator is no longer alive, the species that were hunted by the top predator may start to over populate. With this overpopulation, the food source of these species becomes naturally exhausted. By stripping the environment of food sources, other species start to starve and perish. This top predator has a huge role in its natural environment, and should not be removed. The other species may be ecologically redundant.

Second, what taxonomic group does a species fall under? How genetically

distinct is the species (Westman, 1990)? Does it belong to a highly speciose group or is it a "living fossil" and distinct from every other animal alive today? Suppose one had to choose between saving the blue or fairy penguin and the tuatara. The little blue penguin is one of 17 species of penguin in the family Spheniscidae while there are only two species of tuatara. They represent the sole living members of the order Sphenodontia. The tuatara is unquestionably the more evolutionarily important of the two species, so if we use the evolutionary criterion the tuatara would appear more worth preserving than the blue penguin.

Third, does the species show great potential for evolving? What is the likelihood of a species evolving even further (Westman, 1990)? In short the preservation of evolutionary fronts ought to be preferred over evolutionary dead-ends. Another scenario arises between two species, a vertebrate and an invertebrate. Again, only one of the two species can be selected, but which one? Invertebrates often are more genetically diverse and belong to more active evolutionary fronts. This suggests, all other things equals, that the invertebrate makes a greater contribution to biodiversity.

Charismatic traits of a species are based on a physical or emotional value. A scenario illustrating this would be, having to choose between an insect and a large, furry mammal. Most individuals regard large, furry animal as more physically attractive relative to the insect. An individual may select this large, furry mammal because of this charismatic appeal. An individual could also have some emotional connection with the large, furry mammal. The species may be associated with popular culture icons, as manifested in movies, television programs or consumer products.

Selecting a species based on charismatic features is not always the wisest choice. Nonetheless individuals may still select species with charismatic features because they may have more information on these species. In the next section, explanations on why an individual may tend to select specific species will be given. Would an individual select a species based on charismatic or biodiversity traits?

1. The Average Person and Biodiversity

What does the average person know about biodiversity? Do individuals understand why biodiversity is important? Would an individual know the impact a species with high biodiversity values has on the environment? When a person selects a species to sponsor, is the decision based on biodiversity reasons or charismatic reasons? Previous studies on whether people select a species for protection through either biodiversity or charismatic reasons have yielded interesting results.

Figure 1 below shows that even scientists are not well informed about endangered species. After a decade long assessment of the status of the world's amphibians, about ¼ still remain as data-deficient. Hence, even after this effort scientists are unable to state whether a significant number of amphibian species are threatened or not. Expecting members of the public to be well informed as to what is endangered when scientists themselves do not have all the information is unrealistic. It is thus appropriate to consider the average person is uninformed.

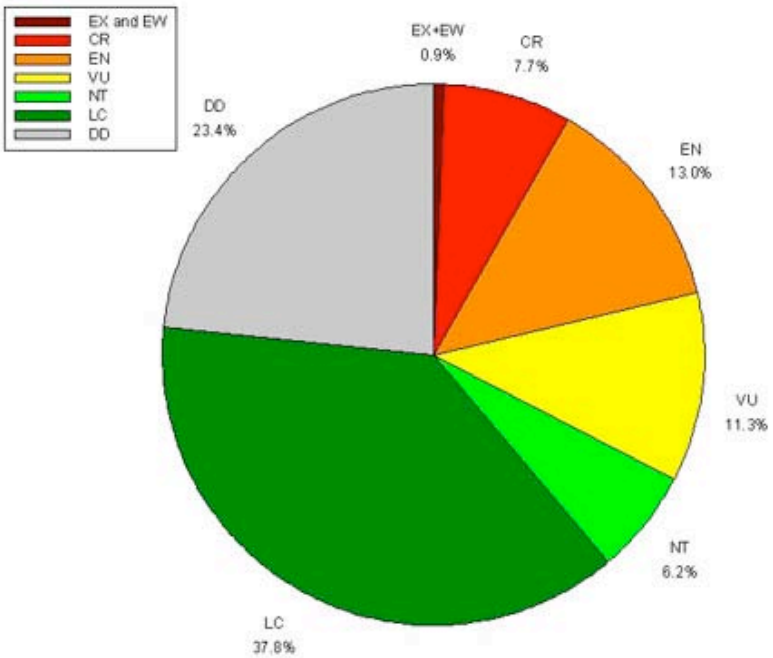


***Figure 1*:** Endangerment levels of Amphibians, retrieved from

http://www.globalamphibians.org/summary.htm

Metrick and Weitzman (1996) discovered that the US Federal Government showed a preference for saving charismatic species. Biodiversity traits did not seem to have much influence on funding decisions.

Publications by Christie et al. (2006) and Montgomery (2002) investigate what type of species individuals would prefer to select. After becoming informed, most individuals select species based on biodiversity traits (Christie et al. 2006). Montgomery (2002) found that individuals value ecological traits the highest, not charismatic. Presenting a species that no one has any information on, and no mental or physical attachment to, people favor biodiversity over charismatic traits (Montgomery, 2002).

When individuals are uninformed on species conservation, they will select familiar species, which tend to be charismatic species (Christie et al, 2006). When the individuals have the values of a species for its environment explained to them however, the individual will base their decision on biodiversity.

If organizations, such as WWF, are properly informing individuals of species conservation, then the species offered should have strong biodiversity traits. Species selected by these organizations should not necessarily have highly charismatic features. The following sections involve how an NGO may select a species to attract funding, as well as what type of species WWF and WCS tend to select for preservation.

THEORY

1. Public Choice Theory

Several different areas of economic theory apply to this research. Public Choice Theory informs much of this research. The foundation of Public Choice began in 1948 with the introduction of the median voter theory. If the politician deviates away from the ideas of the median voter, then the politician's likelihood of winning the election will be reduced (www.allacademic.com).

The most notable work within Public Choice was Buchanan and Tullock (1962). This book discussed voting, more specifically unanimous vs. majority voting. When voting, a unanimous vote should be the ruling factor in a decision. However, it is practically impossible to get everyone to agree on one topic. Therefore the authors suggested that a majority vote should be the ruling factor because it would please most of the voters (Buchanan and Tullock, 1962). Public choice theory states that everyone is influenced by self-interest (Buchanan and Tullock, 1962). Though the act may cause good, the initial driving force is how the act benefits the person who commits the act. Politicians align with the median voter to increase their chances of winning. A business operates to earn revenue and while other individuals are benefiting from these actions (supply of consumption goods), an individual's primary goal is to benefit themselves.

A good example of self-interest appears when an U.S. Presidential candidate starts to raise funding for their campaign. Organizations donate large sums of money towards a potential U.S. president for support. When the candidate becomes President, these organizations come back and start to pose questions such as "since I helped you win the election by donating funds to your campaign, what are you going to do for me?" So in return, the President will allocate resources or sign policies which benefit the organization who contributed to the campaign funding.

Another important part of public choice theory is the concept of rational ignorance (Downs, 1957). Rational ignorance occurs when people realize they are

better off being uninformed than informed. The reason for this is, when making a decision, a person endures a cost, time and resources, of becoming informed. If the cost is greater than the benefit to be gained, then the person is better off staying uninformed. A common example of rational ignorance is in the behavior of voters during an election (Bowler, 1990; Silva and Costa, 2006).

Another aspect of public choice is rent seeking, which was first discussed in depth by Tullock (1967). This explored the interaction between special interest groups and government spending. The main purpose of lobbying is to attract government funding to the specific interest group (Tullock, 1967).

Further work has been carried out by Bhagwati and Krueger on the topic of rent seeking. These experts also refer to rent seeking as "unproductive profit seeking activities" (Bhagwati, p989, 1982). A trade specialist, Bhagwati explains the reason rent-seeking activities are unproductive is they do not produce a positive income or output towards society. The only individuals who benefit, are those who rent-seek (Bhagwati, 1982). In other words, the money being earned by the organization only serves the organization itself.

Public choice, rational ignorance, and rent-seeking are all theories which relate to self interest. How does the individual benefit overall. What about the concepts of a business behavior? Are there any theories involving this? The theories involving clubs, public goods, asymmetrical information, and brand naming are all vital towards the business aspects of this research.

2. Club Theory

Club theory was first indirectly reviewed by Pigou and Knight in the 1920's and dealt with the concerns of highway congestion. To correct the problem of highway congestion, tolls were placed on the highway to limit usage, thus first solving a classic club problem (Sandler and Tschirhart, 1980). The theory on clubs deals with the concept of an organization selling either a public good or a private good, to a limited set of people, i.e. members.

Buchanan (1965) is the first publication directly studying club theory. The article focuses on organizations, goods, and membership size. Goods can be classed as either private or public. Private goods are those that are created at a cost and then provided to people, i.e., country clubs, swimming pools, tennis courts, etc. Public goods are those that are naturally provided, i.e., air, forests, beaches, and so on (Buchanan 1965).

Membership size is an important issue when goods are provided by an organization. The costs associated with the good, manufacturing and/or maintenance, are passed onto the members of the organization. If there is only one person in the organization, all of the costs are put onto the sole member. Now, if more people are allowed into the organization, the costs are shared equally between its members. So, as membership size increases, membership fees go down. Nonetheless there should be a membership cap for the organization, because if too many people join and use the good provided, enjoyment of the good decreases. For example, people start getting in the way of one another and frustration among members may cause level of enjoyment to decrease (Buchanan 1965).

The theory of clubs can illustrated with the example of a swimming pool. If a person made a swimming pool that only they would use, there would be a huge cost for this individual to absorb. Now, if the owner started to allow community members to use the pool, the owner could start charging the new users an admission fee to utilize the pool. However, if the provider allowed too many people to use the pool, then enjoyment at the pool would start to decrease. The line at the diving board becomes too long, there is not enough space to do laps, and people start bumping into one another. So it is important to find an upper limit on how many people can use the pool.

Public choice theory and club theory share a similar problem, membership sizes. Previous studies in public choice show that a small government is easier to manage than a large government. When a small government is in operation, a checks and balance system is in place. It is easier for the government's members and voters

to make sure everyone is doing their job properly and inefficiency is at a minimum. As a government becomes larger, it becomes difficult for its members to manage one another. Voters start to decide the cost of managing the government (Buchanan and Tullock, 1962).

Club theory demonstrates that when an organization becomes too large, it also becomes difficult to manage. It is easier for members to monitor each other when the club is smaller rather than larger (Buchanan, 1965) and (Sandler and Tschirhart, 1980). One problem which arises due to large organizations is the free rider problem. Free riders are people who do not contribute to a group of individuals but manage to benefit from the group (Buchanan, 1965).

Consider, for example, a university radio station operated by students. Let us say that the work a member must contribute is either for choosing the music selection or hosting a radio show. The benefit of doing so for the student, is access to new music and free social events, i.e., parties, food, alcohol, etc. Now when the group has 10 members, the club is small, and everyone has to contribute to make sure the radio station can operate properly. Since there are not that many members, people have to host 2 or 3 shows and work extra hard to find music to present to their audience. Over the years though, the radio station becomes popular and the membership grows from 10 members to 100 members. Now the membership size is well over what is required to make sure the station stays working. Record companies start sending in music samples in boxes, so there is no need to research extra music and since there is an abundance of members, not everyone can have a personal radio show. Since these students are still part of this radio club, they still get the benefits associated with the club. Even though they do not contribute by donating music or hosting a radio program, they still reap the benefits of free music, parties, food, etc. These extra members are what are referred to as free riders.

In addition to free riders, there are also forced riders. Forced riders are those that do not have a choice when an organization makes an action which affects individuals. People are forced to participate even though it may hurt them as an individual because it benefits a large group (Brubaker, 1975).

Consider, as an example, a new highway system that will pass through a residential area. During the process of producing this new highway system, several houses will have to be demolished due to the planned location of the highway. Though these people are compensated for the demolition of their homes, they really have no say in the matter, because the benefit of this new highway system for commuters outweighs the cost of relocating those that have to move.

3. Asymmetrical Information

The next theory of relevance to this research, asymmetrical information, was first discussed by George Akerlof in the publication of *The Market for Lemons* in 1970. Asymmetrical information occurs when one member has more information than another member. Given this, the member with the best information will only give out information that benefits them (Akerlof, 1970). A classic example of this occurs with used cars where the seller has more information than the buyer. Even if the car is a lemon, the seller will not tell the buyer, thus giving the impression that the car is a great buy, when it is not.

There are two additional parts to asymmetrical information: signaling and screening. Signaling was first introduced by Michael Spence in 1973 with *Job Market Signalling*. Signaling occurs when the informed party sends out information "signals" to an uninformed party, thus dissolving the asymmetry (Spence, 1973). A popular example of this occurs between an employer and a potential employee. Higher education can be used to signal higher productivity to employers.

Joseph Stiglitz's contributed towards asymmetrical information theory by introducing the concept of "screening". This occurs when the uninformed party takes on a cost in order to search through information of the informed party. An individual may only "screen" when the cost is lower than the benefit to be gained from the process (Stiglitz, 1975). This is common within insurance companies where the insurers are uninformed and the people applying for insurance are informed. The insurers will provide the potential client with a list of different policies associated

with the client's level of risk "by offering them to choose from a menu of alternative contracts where lower premiums can be exchanged for high deductibles." (http://nobelprize.org/nobel_prizes/economics/laureates/2001/public.html)

4. Brand Naming

Finally there is the topic of brand naming. Brand naming helps both the consumer and the company with product selection. First, more than not, "consumers always have incomplete information about product availability, quality, and alternative prices" (Klein and Leffler, 1981). The consumer has limited information to rely upon to trust the product(s) of the company/organization they are interacting with. Due to the limited information, there are also additional costs involved to investigate why the consumer should interact with the company. The concept of a brand name lets the consumer avoid this cost and base their decision on the reputation of the organization's name.

The company the brand name belongs to, of course, benefits. Klein and Leffler (1981) discuss the incentives involved for a business to have and maintain the best quality of their products. By investing time and resources into developing a popular brand name, the company is able to establish consumer trust, a foot hold, in the consumer market. (Klein and Leffler, 1981)

A good example of this is looking at athletic shoes. Why does one prefer expensive Nike shoes over a cheaper generic brand? Both could be made in the same country, even the same factory. Even the cost involved of producing the shoes out of the materials could be similar. But why do most rather choose Nike over generic?

Consumers select Nike shoes because they are seen in the consumer's environment more than the generic shoes are. Consumers notice top athletes performing and fund raisers sponsored by Nike more often than the generic shoe company. Nike also offers the latest state of the art footwear technology for the buyers, while the generic shoes only offer the basic footwear technology. If the consumer was interested in fully comparing the two shoes the costs of doing so are

relatively high. The reputation of the brand economizes on the search effort required by the consumer.

Given all this new information of the different economic theories involved in this research, it is important to note that each theory has never been applied to the topic of non-profit organizations and species conservation. Public choice theory and rational ignorance have mostly been applied to governmental voting systems. Club theory and public goods has been shown to work with an organization and a single product, not many. Asymmetrical information is usually applied to banking systems or parties in the business world looking to make a profit. Brand name is concept used by corporations to lure consumers to buy there product in order the corporation to earn large revenue.

ECONOMIC MODEL

How can the actions between a donor and a NGO be studied? What is the process and NGO may go through in order to select a species for protection? Why might a donor agree with species that an NGO wants to protect? Unfortunately these are questions that are not amenable to empirical analysis. The information on preferences and NGO actions is not in the public domain. This motivates the use of a game theory model to generate a theoretical framework.

This research uses game theory to model the interactions between an NGO and donor. To be more specific, the interaction between these two groups to select species for conservation. An economic model will be used to help derive a benefit function for each player wanting to contribute towards species conservation. The use of game theory model will be applied to help rule out possible scenarios amongst the players and help solve which game provides the maximum benefit for both players.

First, two players, P_1 and P_2, are introduced into the model. The players are similar in most parts of their life. Both are motivated to save endangered species. They have identical preferences and costs. They also face a budget constraint and can contribute only to one species before their budget is exhausted.

Next, two different species, S_A and S_B are introduced in to the model. With these two species, a player will decide which species to select. The species that is selected represents the player's strategy. S_A is the *a priori* desired species to be saved because it has the highest biodiversity value. For instance, if S_A disappears from its natural environment then ecosystem services will be compromised. Other species may also become endangered. Hence a fully informed individual would always select species A. S_B is the second candidate. It has a lower biodiversity value, possibly through the presence of close genetic relatives and it is ecologically redundant. A fully informed individual would not select this species.

Each species is regarded as a public good, hence each player's 'consumption' of the conservation benefit of saving a species does not affect the other player. The

strategic problem is that in order to save a species, both players have to select the same species. It will be assumed that neither player can by themselves, provide sufficient funds to save a species. Rather both players must co-operate and select the same species. Only then will sufficient resources be pooled to make a recovery plan for the species viable. This reflects the nature of NGO recovery programs. Resources are pooled from many donors in order to generate sufficient funds to make a project viable.

The pay-offs to each player then depends on the interaction of their strategies. In the models below, the combination of species values on the maximum benefit are derived as:

$$S_A + S_A = +$$
$$S_A + S_B = -$$
$$S_B + S_B = 0$$

$S_A + S_A$ is positive because it is the ideal species to save in all the models. When S_A is chosen by both players, a positive payoff ensues. When $S_A + S_B$ is chosen, there is a negative pay-off to each player results. The reason for this is not enough funding goes towards either species, so both become extinct. This is the worst possible outcome. $S_B + S_B$ generate a zero payoff. This occurs because even though a species was successfully saved, it is offset by the consequence of S_A becoming extinct. Not that the choice of pay-offs here are somewhat arbitrary, but preserve the ordinal scale the game requires. Saving species A is the Pareto-optimal strategy, saving species B is the second-best outcome, while failing to save any species is the worst possible outcome.

As stated above, for a species to be successfully saved, both players must simultaneously sponsor identical species. The gaming problem is that the players act simultaneously. They are unaware of what the actions are of the other player. This motivates the first game where neither player is informed about what is the species with the highest biodiversity value. In this game, the players select their strategy randomly.

Table 1: Payoff Matrix from Random Choice

		Player 2	
		S_A	S_B
Player 1	S_A	$S_A + S_A$	$S_A + S_B$
	S_B	$S_B + S_A$	$S_B + S_B$

When both players choose at random simultaneously, there is a 50% chance of selecting S_A and a 50% chance of selecting S_B. One day, a player could want to save S_A and the next day just as likely select S_B. Seeing the interaction between both players, they successfully save the Pareto-optimal species, S_A, 25% of the time, $S_A + S_A$. The second-best species, S_B, is selected 25% of the time by both players, $S_B + S_B$. Lastly, both players sponsor opposing species 50% of the time, $S_A + S_B$ or $S_B + S_A$. Again, when both players choose opposing species, both species perish due to inadequate funding. Note that the Nash equilibrium here cannot be updated by new information. If the players save S_B they are not aware that saving S_A would have yielded a higher payoff.

In the next model we introduce the option of becoming informed. What if the each player had a choice to become informed on which species is the important one to select? Instead of selecting at random (which leads to the Pareto optimal state only 25% of the time), they would be able to select the correct species all of the time. To become informed however, the players would have to incur a cost, C, to gain the new information on each species. The cost that a player would have to endure, represents time and resources used to become informed. C may range anywhere between:

$$0 \leq C \leq \infty$$

When C approaches 0, the cost of becoming informed decreases. As cost approaches infinity, cost for the individual becomes higher. This might occur if the species is data-deficient and the player would have to initiate their own scientific surveys to determine the conservation status and biodiversity value of the species.

This introduction of cost, C, generates a new model. This model incorporates

Informed vs. Uninformed, Cost, and the probability of selecting the correct species. Here, both players also still act simultaneously, not knowing what the other one's actions are.

Before establishing the next game model, it is important to find out when a player should become informed. The cost of becoming informed could become too high for an individual to bear. When does the cost function cause an individual to stay uninformed? It is important to set up limits to find when the players should become informed or stay uninformed. By using a mixed Nash equilibrium, it is possible to find the cost values for each player.

1. Player 1 options = $(1-p)(1-q)(S_{AA}-C) + (1-p)(q)(\frac{1}{2}(S_{AA})+\frac{1}{2}(S_{AB}) - C) + (q)(1-p)(\frac{1}{2}(S_{AA}) + \frac{1}{2}(S_{AB})) + (p)(q)(\frac{1}{4}(S_{AA})+\frac{1}{2}(S_{AB}))$

The above is the expected pay-off to player 1. If they are informed they select S_A. If they are uninformed, they choose their candidate randomly. Given the non-rivalrous consumption of the 'conservation' good, the pay-off $S_i+S_i = S_{ii}$, where $i=\{A, B\}$.

$(1-p)(1-q)(S_{AA}-C)$ signifies that both Player 1 and Player 2 become informed and select the desired species all of the time. $(1-p)(q)(\frac{1}{2}(S_{AA})+\frac{1}{2}(S_{AB}) - C)$ signifies that only Player 1 absorbs the cost of information and Player 2 stays uninformed and the desired species is saved half of the time. $(q)(1-p)(\frac{1}{2}(S_{AA}) + \frac{1}{2}(S_{AB}))$ signifies that Player 1 does not become informed but Player 2 does which again results in the desired species being select half of the time. Finally, $(p)(q)(\frac{1}{4}(S_{AA})+\frac{1}{2}(S_{AB}))$ shows that both players stay uninformed and the desired species is selected a quarter of the time. The reason S_{BB} is not in the equation is because its value is zero.

Differencing the above equation, it is possible to find the limit for when Player 1 should become informed.

2. $-(1-q)(S_{AA}-C) - q(\frac{1}{2}(S_{AA})+\frac{1}{2}(S_{AB}) - C) + (1-q)(\frac{1}{2}(S_{AA}) + \frac{1}{2}(S_{AB})) + q(\frac{1}{4}(S_{AA})+\frac{1}{2}(S_{AB})) = 0$

Again, differencing the above equation on Player 2's actions elaborate on the limits of when a player should become informed.

3. $-2((-S_{AA} - 2C + S_{AB})/ (S_{AA} - 2S_{AB})) = 0$
4. $C = ½ (S_{AA}) - ½(S_{AB})$
5. $-2((-S_{AA} - 2C + S_{AB})/ (S_{AA} - 2S_{AB})) = 1$
6. $C = ¼S_{AA}$

Observing equation 3, when Player 1's cost is equal to or below equation 4, then Player 1 should become informed. Observing equation 5, Player 1 should stay uninformed when their cost equals to or is greater than equation 6. Since the game has symmetrical players, the exact equation may be used for the limits of when Player 2 should become informed or stay uninformed.

Table 2: Payoff Matrix

		Player 2	
		Informed	Uninformed
Player 1	Informed	$(S_A - C) + (S_A - C)$	$(S_A - C) + (1/2\ S_A + 1/2\ S_B)$
	Uninformed	$(1/2\ S_A + 1/2\ S_B) + (S_A - C)$	$(1/2\ S_A + 1/2\ S_B) + (1/2\ S_A + 1/2\ S_B)$

Further elaboration of this payoff matrix shows:

Table 3: Elaborate Payoff Matrix

		Player 2		
		Informed	Uninformed (q)	Uninformed (1-q)
Player 1	Informed	$(S_A - C) + (Sa - C)$	$(S_A - C) + (S_A)$	$(S_A - C) + (S_B)$
	Uninformed (p)	$(S_A) + (S_A - C)$	$(S_A) + (S_A)$	$(S_A) + (S_B)$
	Uninformed (1-p)	$(S_B) + (S_A - C)$	$(S_B) + (S_A)$	$(S_B) + (S_B)$

But what does each scenario translate in to?

Though it may seem unclear what each possible scenario is interpreted as, all possibly interactions between the two players will be explained. These are that both players choose to be informed, one player becomes informed and the other stays uninformed, and both players stay uninformed.

First, when both players become informed, the possible outcomes show:

Table 4: Informed Payoff Matrix

		Player 2	
		Informed	Informed
Player 1	Informed	$(S_A - C) + (S_A - C)$	$(S_A - C) + (S_A - C)$
	Informed	$(S_A - C) + (S_A - C)$	$(S_A - C) + (S_A - C)$

When each donor took the cost in order to become informed, they always selected S_A 100% of the time. When both players are informed this becomes the best possible outcome for conservation. The benefits however, gained by the player may depend on the cost incurred. If the cost of being informed is too great then the game reverts to the game of uninformed players (Game 1)

The cost of becoming informed could become too high for an individual to bear. When does the cost function cause an individual to stay uninformed? It is important to set up limits to find when the players should become informed or stay uninformed.

Observing equation 3, when Player 1's cost is equal to or below equation 4, then Player 1 should become informed. Observing equation 5, Player 1 should stay uninformed when their cost equals to or is greater than equation 6. Since the game has symmetrical players, the exact equation may be used for the limits of when Player

2 should become informed or stay uninformed.

The next possible scenario in the second model shows when both players act simultaneously and one player becomes informed and the other player stays uninformed.

Table 5: Informed vs. Uninformed Payoff Matrix

		Player 2	
		Uninformed	Uninformed
Player 1	Informed	$(S_A - C) + (S_A)$	$(S_A - C) + (S_B)$
	Informed	$(S_A - C) + (S_A)$	$(S_A - C) + (S_B)$

When one chooses to be informed, they will always select S_A all the time for protection. The problem becomes evident though when the other player stays uninformed. The uninformed player will randomly select a species presented to them. In this model, S_A is saved 50% of the time while both species perish 50% of the time. This is an improvement in the conservation outcome to the uninformed game. Instead of S_A being saved 25% of the time, it is now saved 50%. The number of conservation-failures (neither species saved) remains the same.

Within this scenario, there is however a major problem for the informed party. What is the point of becoming informed? The informed player has no information on whether the other player is informed or uninformed. What is the point of becoming informed if the other player may be uninformed? Half of the time, S_A could perish. What is the incentive for the player to become informed if the outcome is negative half of the time? In this outcome, the informed donor bears a cost and loses half of the time while the other donor bears no cost and wins half of the time. In effect, the uninformed donor becomes an unintentional free-rider. They benefit from the informed player's decision but escape the cost.

The last scenario of the model occurs when both players stay uninformed. The

predictions for this show:

Table 6: Uninformed Payoff Matrix

		Player 2	
		Uninformed	Uninformed
Player 1	Uninformed	$(S_A) + (S_A)$	$(S_A) + (S_B)$
	Uninformed	$(S_B) + (S_A)$	$(S_B) + (S_B)$

When both players are uninformed it is no different from the model where both players act randomly. S_A is selected 25% of the time, the S_B is selected 25% of the time, while conflicting species are selected 50% of the time.

Assuming however that the cost of being informed is relatively high, a Bayesian Nash Equilibrium occurs when both players stay uninformed. The assumption of high information costs seems reasonable when scientists know very little about the status of a significant number of species. The cost of being informed for members of the public is likely to be even higher. When both players act simultaneously and stay uninformed, the probability of selecting opposing species is still the same as when just one player is informed. If uninformed, each player may view each species at equal value. S_A is worth as much S_B. So the question arises of why should a player become informed?

Also, when both players stay uninformed the cost involved with selection does not exist. The problem of bearing a cost *and* the correct species still not being selected is avoided. Even though S_A is selected 25% of the time and opposing species selected 50% of the time, the best action for both players to take is to stay uninformed, when acting simultaneously.

Given the past two games, the equilibrium occurred for both players when staying uninformed and acting randomly. Though S_A is only selected a quarter of the time, neither player incurs a cost where S_A is still not properly saved.

This motivates the development of the next game. Now instead of both players acting simultaneously, we allow one player to move first and the second player to observe this action. Given this, the second player is able to mimic the first player's choice. By mimicking the first player's choice, the possibility of conflicting species being chosen is eliminated. All outcomes have both players successfully selecting either S_A or S_B.

The rules of this game are still the same as the previous game. If a player becomes informed, they will always select S_A all of the time. Nonetheless, when informed, the player must bear a cost. If the player stays uninformed, the player has a 50/50 chance of selecting S_A or S_B. The only difference to this game is Player 1 moves first. After Player 1 makes their move, Player 2 is able to follow. Player 2 will always select whatever species Player 1 selects.

A general outline of this model maps out possible paths (figure 2).

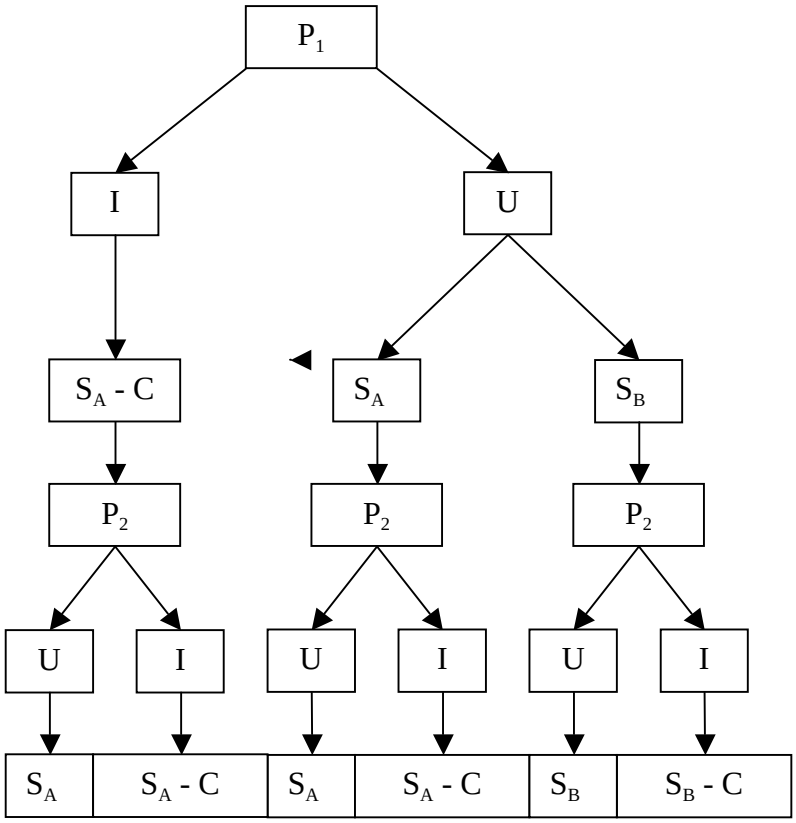


Figure 2: Follow the leader model

Looking at the new model, the first player can either become informed or stay uninformed. If the Player 1 chooses to stay uninformed, they will choose the correct species half of the time and the wrong species half of the time. Because of this, Player 2 faces an interesting decision, whether to become informed or stay uninformed. Also, since each player now can see one another's moves, a sub-game Perfect Nash Equilibrium can be derived.

First, exploring the possibilities of what may occur if the Player 1 stays uninformed. What are the options for Player 2?

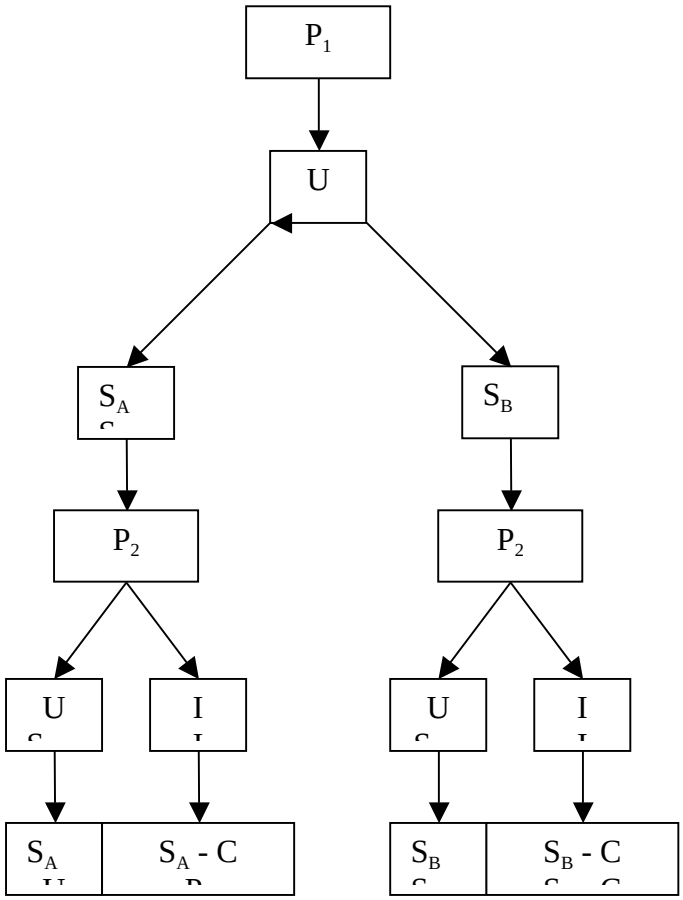


Figure 3: Uninformed follow the leader model

Observing the model above, when the first player stays uninformed there is a 50% chance of choosing S_A and the same chance of choosing S_B. Nonetheless, the second player comes across some interesting choices.

If Player 2 chooses to become informed, the wrong species is still selected for protection. The reason is Player 2 must select the same species as Player 1 to ensure at least one of the species survives. By becoming informed, Player 2 knows which species to select, S_A. Nonetheless, since Player 2 can see what Player 1 has selected, Player 2 must agree with Player 1. So, even though the Player 2 absorbed a cost to know which species to select, $S_{A,}$ they still must choose S_B.

If Player 2 chooses to stay uninformed along with Player 1, the outcome is still the same where S_B is selected by both players. Nonetheless, Player 2 bears no cost. Hence Player 2 is always better off being uninformed. They cannot benefit from this information if Player 1 has selected the wrong species. Further there is no point bearing the extra cost of being informed if player 1 has selected the appropriate species?

What course of action should Player 2 take if Player 1 is uninformed? Player 2 should stay uninformed in Player 1 stays uninformed. By becoming informed, Player 2 takes on a pointless cost. Since Player 1 acts at random, they may select S_B. So, if Player 2 became informed, they would also have to select S_B but at a cost. If Player 1 selects S_A, Player 2 was still going to mimic Player 1's actions. S_A would have been selected whether or not Player 2 became informed.

Now, what happens if Player 1 became informed? The actions are mapped out in figure 4 below:

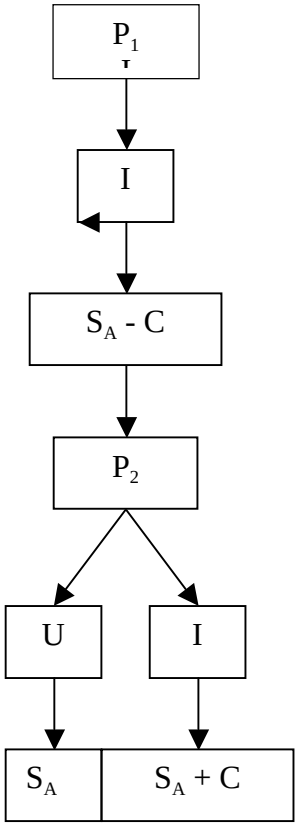


Figure 4: Informed follow the leader model

If Player 1 chooses to be informed, Player 2 may either stay uninformed or become informed. If Player 2 chooses to become informed, they will also choose S_A but undergo an unnecessary cost. Nonetheless, if Player 2 chooses to be uninformed, they bear no cost and will still choose S_A to save. The reason is Player 2 mimics what Player 1 chooses. So, if Player 2 chooses to be uninformed, the correct species will be saved and only Player 1 endures the cost.

By studying the model above, the highest conservation benefit is obtained when Player 1 becomes informed, Player 2 can see what Player 1 selects, and stays uninformed. This economizes and the need for everyone to be informed. Whenever Player 2 became informed, in any scenario, they always became worse off by taking on a cost. If Player 1 is informed and Player 2 is informed, then Player 2 endures an unnecessary cost. If Player 1 is uninformed and Player 2 is informed, only half the time the correct species will be saved and Player 2 still has to endure a cost, no matter which species is chosen.

The game showed Player 2 is always better off by being uninformed. Player 2 only has to mimic what Player 1 selects. This leads to an interesting theoretical result. An asymmetric information problem is inherent to this game. Only Player 1 (at reasonably low costs) should be informed. This generates no problems if Player 1 and Player 2 have the same preferences. Now consider whether Player 1 could manipulate this game.

Since Player 1 knows Player 2 mimics their actions, Player 1 is able to manipulate the game. Player 1 could select any species to protect and lead Player 2 to select that species. This model operates as follows in figure 5:

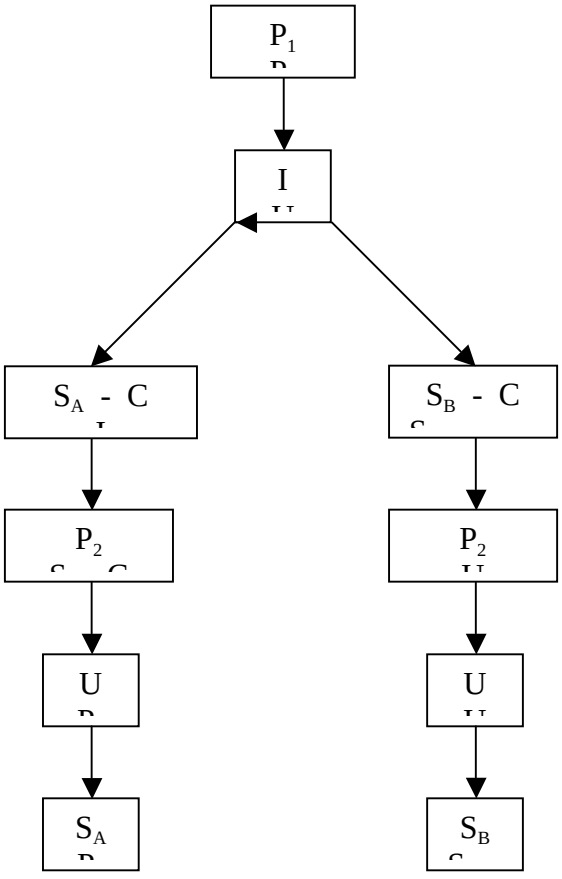


Figure 5: Informed follow the leader model 2

In the above model, the first player will always absorb a cost, C, and become informed. Player 1 becomes completely knowledgeable on which species is the most beneficial one to select. Player 2 is always better off staying uninformed and mimicking Player 1.

Player 1 is at a major advantage compared to Player 2. The advantage enables Player 1 to successfully select and protect whichever species they may prefer. If the first player thinks S_A is more desirable over S_B, then S_A will be successfully selected for preservation. If the first player thinks that S_B is more desirable in comparison with S_A, then S_B will be successfully selected. Since Player 2 is uninformed, they will never know that Player 1 is manipulating the game to their advantage. The only information Player 2 will have is either previous knowledge or whatever Player 1 wants to share with them.

Why would Player 1 want to select S_B over S_A? The question helps lead into the idea of why an NGO may select a charismatic species over the scientific species? Player 1 changes into the model as an NGO and Player 2 changes into the model as a donor. This is reasonable if we consider that the NGO has lower information costs than their donors. That is, with the scientific expertise within their staff, they can become informed at a lower cost than their donors.

The best way to look at this question is to think of it as a proper investment. An NGO is investing with a cost, C, to preserve a species. They know the donor will donate to whichever species the NGO selects. The donor, in effect, assumes that the NGO is an informed player and by mimicking the NGO's preferences, the maximum conservation benefit can be secured.

This result however depends on two assumptions. First, the NGO has the same preferences as the donor. Second, the NGO is more efficient at becoming informed about the status of threatened species. The first assumption may not hold if the NGO is more interested in maximizing donor revenue. The NGO can exploit the asymmetric information inherent to this game in two ways. First, it can deliberately nominate *low* information cost species for recovery programs. Such species may be

already well-studied and widely researched candidates. Such species are likely to be charismatic species. This means that the NGO can sustain the same flow of revenue but at a lower cost.

The second way is to select species that have a larger donor base. When the pool of interested donors increases, there is an increase in potential revenue to be attracted. This means that species that have a relatively wide distribution, say found ranging over several countries, have more appeal. The problem is that species that do have a wide range and generally, not endangered. Many endangered species have very limited ranges, which is why they are endangered.

Several questions though may have occurred through out the game theory modeling. Why is the donor better off staying uninformed? What motivates an NGO to select a charismatic species? Through the use of economic theory, the next section will help explain specific actions created by each player.

COMBINING THEORY WITH THE MODELS

In the previous two sections, detailed reviews of economic theory and economic modeling were discussed. The theory covers areas such as club theory, public goods, free riders, forced riders, public choice theory, asymmetrical information, and brand naming. Through the use of game theory, it was possible to map out the interactions between two players of a game. As the game developed, it was shown that one sub-game perfect Nash Equilibrium was for Player 1 to become informed and Player 2 to mimic Player 1's strategy. In this section, the combination of the theory and model further help elaborate on why the two players took their course of action in the game.

The original action arises, yet again, where there are two players who both would like to donate towards species conservation. The first player represents a group of individuals who took on a cost in order to become fully informed on the surrounding species. This group's actions were those covered by Player 1, the NGO. Also, there is a second player who represents a group of people who barely have any knowledge what so ever of species let alone species conservation.

Both players, wishing to contribute to species conservation, have the options of becoming informed or staying uninformed. By becoming informed, the player will be able to choose the correct species to save all the time but must absorb a cost by investing their personal time and resources with this new knowledge gained. The second option is for the player to stay uninformed. When uninformed, a player bears no cost and makes their selection at random. Also, it is important to note that when a player is uninformed, both species appear to have equal value to the uninformed party. That is, when choosing between species A and species B, both species appear to have equal conservation value to the uninformed player.

Before Player 1, the NGO, is discussed and linked to operating as a business, it is important to explain why the Player 2, the uninformed donor, took the course of actions in the models first. Questions arise such as why does the Player 2 choose to interact with the Player 1? Why does Player 2 trust the decisions made by Player 1?

Most importantly, why does Player 2 always choose to stay uninformed than become informed? These answers shall be identified by using the concepts provided by rational ignorance and brand naming.

The main question which surrounds Player 2, the uninformed donor, is why do they choose to stay uninformed when selecting a species? The answer to this lies within public choice theory, more specifically defined as rational ignorance. Rational ignorance occurs when one is better off to be uninformed and base their decisions at random than to bear a cost, become informed, and more than often, become worse off (Dawson, 1957; Buchanan & Tullock, 1962). This is true for the model. All outcomes for Player 2 were best when Player 2 stayed uninformed.

Reviewing the games where the players act simultaneously, a Nash Equilibrium would occur when both donors chose to become informed and select the correct species. This is Pareto optimal so long as the costs are not too high. Nevertheless, if costs are too high then both players will act from an uninformed basis. This transforms the game into one of incomplete knowledge (the payoffs are not known to either player). This requires the use of a Bayesian Nash Equilibrium for the solution. Players are prompted to choose their strategy randomly. Finally the models show that Player 2's benefits were always greater when staying uninformed. They cannot do better by becoming informed. There are two main reasons for this. These are the high costs associated with becoming informed and the possibility of becoming informed and the correct species still perishing.

Whenever Player 2 became informed, they had to incur a cost consisting of time and resources in researching to find which species is the "correct" one to select. Remember, Player 2 has very limited knowledge on which species to select. Given this limited knowledge, the costs of becoming informed start to exceed the benefit to be gained. Dawson (1957) states that as soon as the costs to be informed out weight the benefits to be gained, it is best to stay uninformed.

The second problem with becoming informed is how does Player 2 know if Player 1 will also be informed? In the games where Player 2 acts at the same time

and follows Player 1, Player 2's benefits are always greater when staying uninformed. Choosing to stay uninformed because the benefits are greater than being informed, is the behavior exhibited by rational ignorance (Downs, 1957 and Buchanan & Tullock, 1962). Player 2 cannot know if Player 1 is informed.

This species problem is very similar to the voter's problem given by Downs (1957). If an individual becomes informed at a cost, it is not necessary that the informed vote for a specific candidate cause the candidate to win, or even to be relevant (Downs, 1957). So, for a player to become informed and choose the correct species does not mean that the species will be selected and protected.

If one player becomes informed, there is always a risk that the other player will stay uninformed. Looking at the model where both players act simultaneously, the correct species will be selected 50% of the time while the other half of the time, both players select opposing species which causes both species perish, due to inadequate funding. Nonetheless, when both players choose to be uninformed, 50% either species will be saved, 25% of the time being species A and 25% of the time being species B, while 50% of the time both species will become extinct.

Once more, it is important to note that since both players are uninformed, they are unaware that species A is more desirable to save than species B. To both players, both species presented have equal conservation value.

Reviewing the model where both players act in sequence, Player 2 is still better off being rationally ignorant. Again, when players act in sequence, the second player will always mimic what the first player chooses. This is to ensure that at least one of the species will survive. It avoids the uncoordinated outcome where both species perish. If both players took on a cost to become informed, and chose the correct species then, the second donor took on a pointless cost. If the first donor stays uninformed, chooses at random, and chooses the wrong species to save, then the second donor should still stay uninformed. If the second donor picks up the cost and becomes informed, they still have to select the wrong species to ensure at least one species survives.

New questions arise in relation with rational ignorance for the second donor. If the donor is uninformed, how could they trust Player 1, the NGO? Even better, why does Player 2 choose to interact with Player 1? There must be several other first players, NGOs, in existence dealing with species conservation. Why does Player 2 choose to interact with the organization represented by the first player?

Player 1, the NGO, comes into play with the theory. Two things of Player 1 should be established. Player 1 took on a cost, C, to become fully informed. By becoming fully informed, Player 1 knows everything about both species, S_A and S_B. Also, Player 1 knows that Player 2 is uninformed and will follow Player 1's choice. How can this benefit Player 1? Through the concepts of rational ignorance, asymmetrical information, rent-seeking, and brand naming, Player 1's actions are able to be explained.

Since Player 2 is rationally ignorant and uninformed, and Player 1 is informed, Player 1 is able to lead Player 2. Player 1 knows that whatever species they select, Player 2 will follow. What kind of species Player 1 select in order to separate themselves from other species? What type of species might an uninformed person want to save?

Since Player 1 has more knowledge on species than Player 2, this causes an imbalance of information to occur. This imbalance of information is known as asymmetrical information (Akerlof, 1970). With this imbalance of information, Player 1 is able to select which information to reveal to Player 2 about the species and the organization itself (Downs, 1957) and (Akerlof, 1970).

Asymmetrical information first appeared in the game when a "follow the leader" approach was used. In the model, the Player 1 took on a cost to become informed about the species. By doing this Player 1 knew what the conservation value of the candidate species were and the ecological consequence if that species became extinct. The second player, being uninformed, may only be aware of a limited pool of endangered species, typically drawn from the more charismatic types. Due to this

imbalance with information of the species, the first player is able to lead the second player to select the species Player 1 prefers. If Player 1 has ulterior motives, they are able to hide them from Player 2 due to asymmetrical information.

Player 1 is able hide information such as, selecting a charismatic species. Player 1 would be able to hide the information concerning low biodiversity traits of the charismatic species. Player 1 would also be able to inflate the endangerment level of the species to Player 2. Due to this imbalance of information, Player 1 is able to lead Player 2 into believing the species that Player 1 selects, is wise.

In order to dissolve asymmetrical information, the uninformed person must get the informed person to release information. One way of doing so is known as signaling. Signaling, in the true form, occurs when the uninformed party will send out incentives for an informed party to reveal information (Spence, 1973). In a perfect world, the uninformed donor could dissolve the asymmetry by offering a donation to the most endangered species an organization sponsors. So, in order for the organization to receive this donation, they must reveal information on all species. By doing this, the donor has enough information to decide which species deserves the funding. Thus the asymmetry is dissolved.

Nonetheless, it is not a perfect world. Even though the donor offers a fund for the most endangered species, the organization still could not release all the information to the uninformed donor. Player 1 could send out a deceptive response to the signal. This deceptive response could convince Player 2 that the asymmetry is dissolved when it is not. The informed player could release information implying that the species is critically endangered. Nonetheless, the organization could still withhold information that reveals the species has little ecological or genetic value for conservation. Though the organization is releasing information to the uninformed for donations, the information is incomplete. The donor could be deceived in thinking the asymmetry is dissolved and the organization released all information.

Asymmetrical information also plays into one more area, screening. An uninformed individual could bear a cost in order sift through all of the information at

hand. Given the new informed individual, they are able to select which information is the most productive, thus dissolving the asymmetry (Stiglitz, 1975). Player 1 bore a cost, C, in order to become informed on what each species contributes. By becoming informed on the species, Player 1 is able to asses which species is most beneficial for the organization. So, as an organization becomes informed, they are able to select a species that would attract the most funding.

A similar process to screening is one called rent seeking. Rent seeking occurs when individuals search for potential revenue or profit, which requires little effort (Tullock, 1967), (Krueger, 1974), and (Bhagwati, 1982). The difference between screening and rent seeking is the individual is not necessarily uninformed. Also, within screening, one is searching for the most productive trait (Stiglitz, 1975). In rent seeking, the individual is searching for a trait that is not essentially productive but will attract revenue. The final outcome from rent seeking tends to be unproductive (Bwagwati, 1982).

Player 1, the NGO, is aware of the different species they could select to protect. Suppose the species chosen by the NGO is selected based upon its ability to attract the most funding with the least amount of work involved. Does the organization wish to endorse species that have stronger biodiversity characteristics or stronger charismatic features?

The charismatic species is the organization's best option. An uninformed individual will most likely be attracted to the species, making it easier to attract funding. Player 1 knows that Player 2 only has some information about the charismatic species, and no information on other potential candidates. Player 1 can exploit Player 2's limited information set to market such charismatic species. It will appear to confirm to Player 1, that is be a signal, that Player 1 is informed and shares the same preferences. This makes it easier to attract funds, irrespective of the conservation values of such species.

How could it be assumed that Player 2, the uninformed donor, will select a charismatic species? Previous studies show that an individual will base their decision

on scientific traits, not charismatic (Christie et al., 2006), (Montgomery, 2002) and (Tisdell et al., 2006). Nonetheless since the donor is uninformed, they most likely will base their decision on what they are already familiar with, charismatic features (Christie et al., 2006).

How is an uninformed donor able to choose a specific NGO to donate funds to? Through rational ignorance, asymmetrical information, and rent seeking, an NGO is able to establish a brand name.

A brand name proves to be influential when the consumer has limited information on a company and surrounding products (Klein and Leffler, 1981). By developing a brand name, a company is able to establish a niche in the market. In this model, the donor has limited information on species and the NGOs.

Since Player 2 chooses to be rationally ignorant about species, what evidence is there to show that Player 2 will not be rationally ignorant about the other player, NGO, involved with species conservation? What does the donor already know about the organization they wish to interact with? There are two things the uninformed party is able to use to select an organization. These are the reputation of the organization and the species they offer to protect.

What instruments may an uninformed donor use to select an organization? The uninformed party has an organization's reputation, known as a brand name, to base their decision on in order to select which player, organization, to donate money to. This organization's reputation is built up through their actions covered in mediums such as news (internet, television, print) and entertainment (shows, music, movies). Since the donor is uninformed, they are only going to be aware of the actions that are most heavily covered and advertised. The reason for this is that the donor is not going to try and find out what each and every action every organization has done in the past. This would be a huge cost for the uninformed donor. They may prefer to join organizations with credible reputations.

A business develops a strong brand name through positive investments and

successful advertising. Positive investments in the modeling occurred when an NGO took a cost to become informed on all species. Through screening and rent-seeking, the organization is able to select a species which an uninformed donor would prefer.

Successful advertising could be developed through the asymmetry problem. Since the organization has more information than the donor, the NGO is able to build up a strong brand name. The NGO would be able to hide damaging information, such as incidents where a species protection program may have not turned out so well. The NGO would be able to release positive information such as previous and current successful species conservation projects.

Though the concept of brand name is not evident in the model, it is a factor in a donor's decision making. If an NGO has a more reputable name amongst its competitors then it is easier for them to attract funding. More donors would recognize the brand name and associate it with positive species conservation.

Why does Player 1, the NGO, go through so much effort to attract funding? Why must the NGO constantly mislead the uninformed donor to sponsor a charismatic species? The answer is simple. The NGO acts out of self-interest.

Before this point is discussed, three points need to be made. First, the structure of the game theory model does not imply a preference for charismatic species by donors. Donors are principally interested in maximizing conservation outcomes. Second, this point is supported to a degree by the papers of Christie et al. (2006) and Montgomery (2002). Informed subjects do not manifest a preference for charismatic species. They prefer species with higher conservation values. Finally, NGOs do not as a rule market charismatic species on the basis they are charismatic but of low conservation value. They market charismatic species on the basis that they are endangered and need conservation projects to be saved.

To a degree an NGO must attract funding to make their work feasible. Selecting species of high conservation value ought to attract donors. Donors are motivated to mimic the NGO's strategy under the presumption the NGO is well

informed. This then generates a puzzle if NGOs are marketing charismatic species that are not of high conservation value. This may imply that the NGO is in fact, a revenue maximizing organization that exploits asymmetric information to attract extraordinary funding.

Consider the structure of an NGO as an organization providing a good to a set membership at a cost. This is the basic concept of the theory of clubs (Buchanan, 1965). In this research, the NGO is the organization, the good is species conservation, members are the donors, and the members' costs are the donated funds.

What type of good would species conservation be? Since an individual's enjoyment does not deteriorate when additional members enjoy the good, it is seen as a public good. Public goods occur naturally and are available to everyone. Many environmental amenities are seen as public goods (if not perfect public goods). Also, public goods have no limitations on the amount of people which are able to use them. As the amount of people who use the good increases, the value or enjoyment never changes (Buchanan 1965; Sandler & Tschirhart, 1980).

The interesting part of species being offered as a public good is that those selected for protection could be increasing or decreasing in the amount available. Standard public goods, such as air, are not varying in daily availability. The amount of air there is now should still be the same as the previous following days. With species conservation, though, the number of species present could deteriorate from the previous day to the following day. This is what makes species conservation an interesting public good to analyze. Unlike a standard public good (stock does not change), conservation entails a public good that is diminishing over time. This may offset some of the free-rider problems by persuading donors to contribute for strategic reasons.

To simplify the model, the game described above only had one uninformed donor but in reality there are millions of uninformed donors who donate towards species conservation. Now, no matter how many of these uninformed people choose to fund a specific species, the enjoyment level of that species survival never changes

amongst those who donated, and those who did not.

Species conservation compared as a single public good is not uncommon (Smith, 1984). Nonetheless, species conservation has rarely been treated as a multiple public good. Again, to simplify the model, only one charismatic species is offered in the modeling. In reality though, there are hundreds of different species offered. By offering many public goods to individuals, the organization is able to attract more funding.

If the organization only offered one good, only those who appreciate the good will pay a fee. A relatively small number of individuals may be attracted to a single species. Nonetheless, as the organization starts offering a variety of goods, a wider range of tastes are now included. Individuals have more options to choose from. Donors are able to select a specific species to protect. Increasing the amount of species protected would cause an increase in donors. Increasing the donor size, increases the amount of funding coming into the organization.

Since public goods are commodities that occur naturally, people who do not pay dues for the use of the good are still able to interact with the good. These people are known as either free riders or forced riders. Free riders are those who do not pay for the public good but still reap the benefits of the public good (Buchanan 1965 and Sandler & Tschirhart). Since free riders do not pay an information cost or select a species for conservation, they are not added into the model. Free riders do interact with NGOs in two different areas though.

First, free riders emerge where there are individuals who do not donate towards species survival. The people who donate towards species conservation benefit from the feeling of happiness that the species they sponsor is still alive. Nonetheless, those who do not donate towards species conservation are still able to benefit if the individual is happy the species is alive.

Secondly, free riders appear in the NGO itself. Free riders could start to appear when the membership size becomes larger than needed to operate. For

instance, say there are two different NGOs. These are a big one and a small one. The small NGO has limited number of members and most properly monitor itself. If not, the NGO will not properly carry out tasks and is doomed to fail. Nonetheless when an NGO becomes big, membership size is well over necessary. There are more than enough members to carry out the organizations tasks. People are now able to join the organization, not do any work, and still benefit from being part of the organization. The free riders could start to develop along with ulterior motives.

Forced riders occur when people must support a project that they do not essentially agree with (Brubaker, 1975). Here, a forced rider could occur in two different places.

A forced rider could occur within an organization. An individual may not agree with past, current, or future projects of the organization. Nonetheless, if the individual does not cooperate with the project they may be forced to leave the organization.

A forced rider could also be someone in another country who is affected by the actions of the NGO. For example, what if an organization selects to save a tiger population in Laos? This protection causes the tigers not to be hunted or killed under any circumstances. As a result, the tigers are no longer being killed by people, and the tiger population starts to increase above a normal size. When the tiger population begins to grow, food sources may start to become scarce for the animal. Due to this scarcity of food available for the tiger, they start roaming towards more rural areas where people live, in search of food. It may happen that a tiger attacks the children of a farmer in a rural area. The farmer has become a forced rider. He would have wanted to kill the tiger to save his family, but could not because of the tiger's protection.

Through the use economic theories and modeling, there is ample evidence of how an NGO behaves as a self-interested business, not a self-less non-profit organization. Nonetheless, this evidence is mainly centered on the assumption that NGOs select charismatic species. Previous publications have conflicting results. An

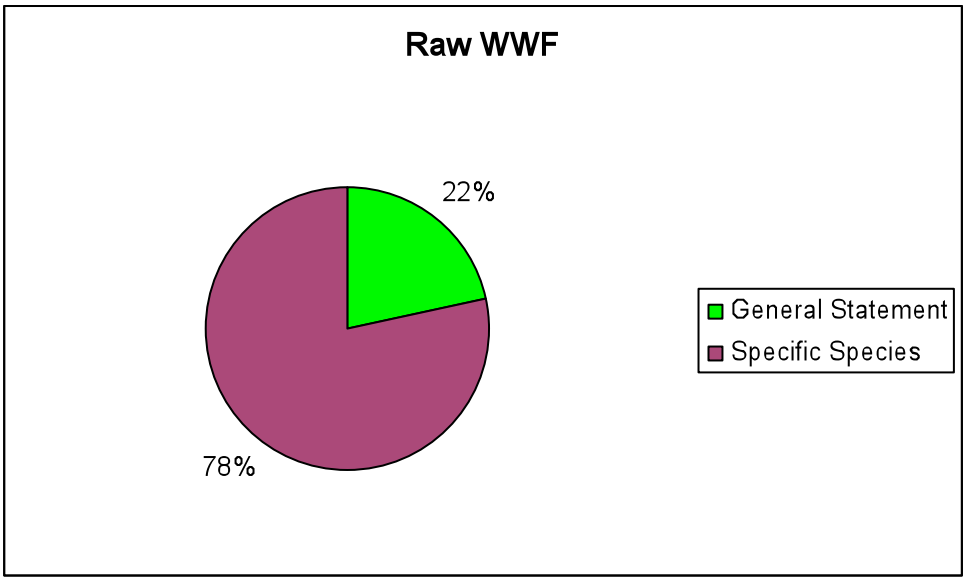
individual will select a species based on ecological importance (Montgomery 2002 and Tisdell et al. 2006). Others claim that when an individual is uninformed, they select charismatic species (Christie et al. 2006). The U.S. government tends to protect species based on charismatic traits, i.e. either the species is large or it is a mammal (Metrick and Weitzman, 1996). The following section is designed to test which species two popular conservation groups select for protection. Do they select species based on ecological, scientific importance, or do they select species which that are attractive?

EMPIRICAL ANALYSIS

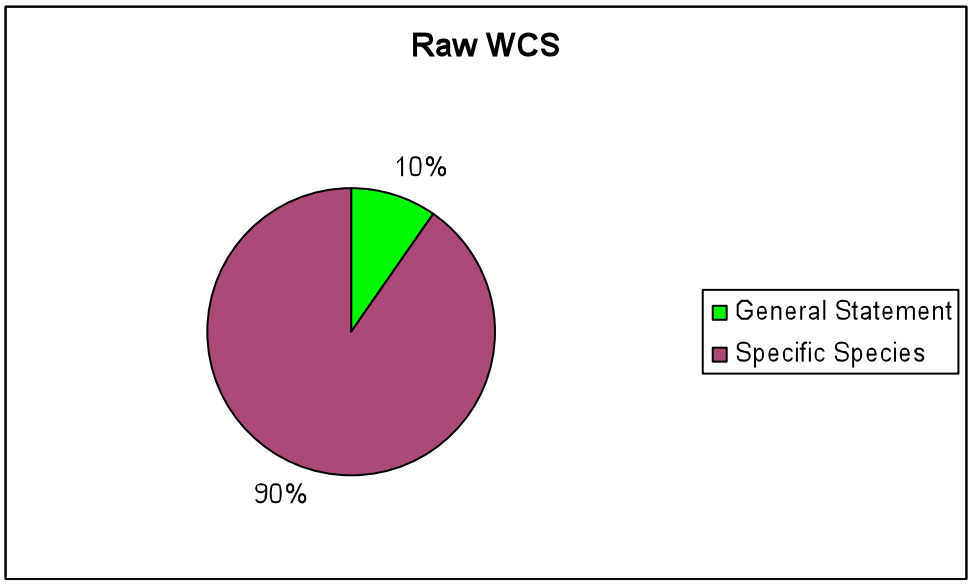
Before revealing the results of the empirical analysis, it is important to review what the data consists of and how the variables in the statistical modeling came to be chosen. Why certain variables were used over others that were obtained will also be explained. NGO data was based on the species marketed on their websites as requiring protection and deserving of donations. IUCN data was taken directly from the organization's website. The IUCN was used as the most authoritative source on endangered species globally (through their red-book lists). Other information sources are detailed below.

1. Raw Data

First, a look into all the original species taken from WWF and WCS are examined.



Graph 1: General vs specific information on WWF website



Graph 2: General vs specific information on WCS website

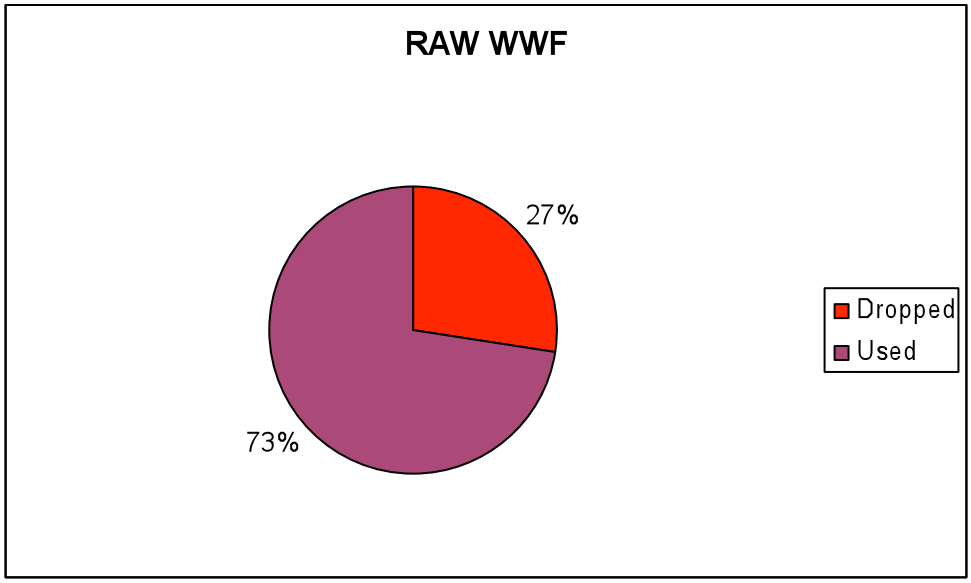
The pie charts represent all of the original data that was collected for both WWF and WCS. These charts represent every species that was mentioned on the websites of WWF and WCS.

The pie chart is separated into two segments. These are general statements about conservation and statements targeting specific species. General statements are certain plants and animals cited on the website but no reference to a specific species is made. This would occur if one of the organizations gave a class or order statement instead of a specific species. An example was WWF mention of the toucan bird. There are 17 different species of toucan with various endangerment levels. Which species of the toucan does the organization promise to protect? Due to the misinformation, these types of data cannot be used in the statistical modeling. Parenthetically, such general statements make it very difficult to verify that the NGO has succeeded or failed in its projects. Indeed, with the presence of species with low extinction risk in these general pools, some NGO success at achieving persistence is almost guaranteed.

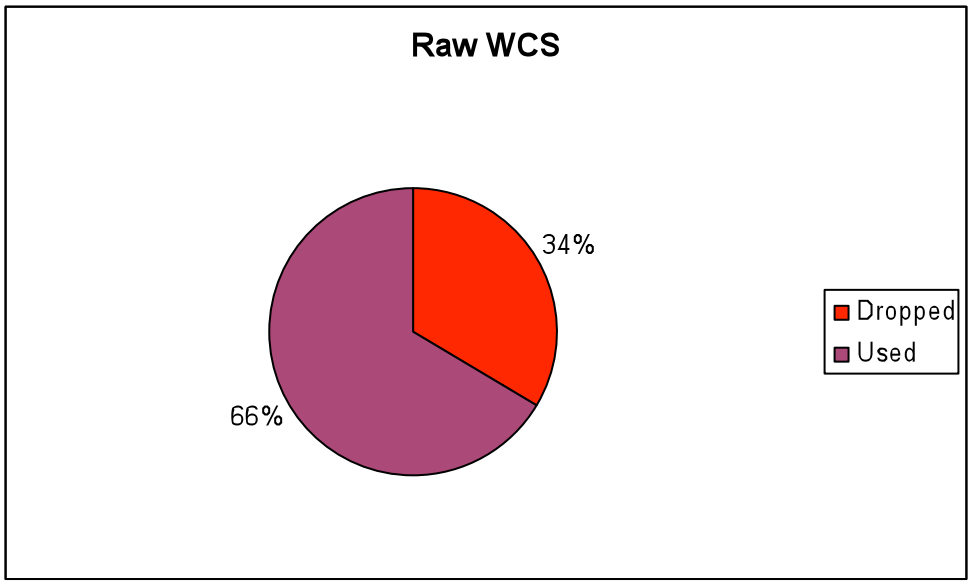
A specific species is straightforward. When the NGO mentioned an animal, they would state specifically what species the animal was. Data collected on specific species is used in the statistical modeling.

Looking at the pie charts above, 22% of the data collected from WWF were general statements. The data collected from WCS show a lower 10% of general statements given. This showed that for WWF, almost one in five instances are practically non-verifiable to a donor.

In addition to general statements, there was also incomplete information. All data with incomplete information were dropped. The data below represent data that was used versus data not used. Incomplete information occurs when either all the data needed for a specific species was unobtainable or a specific trait of many species had too much missing information.



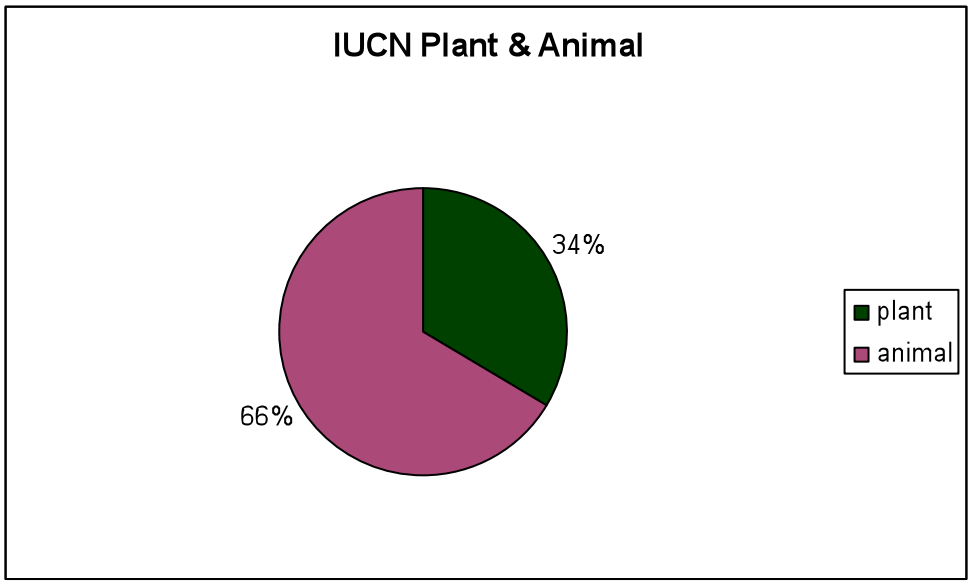
Graph 3: Percentage of usable data from WWF website



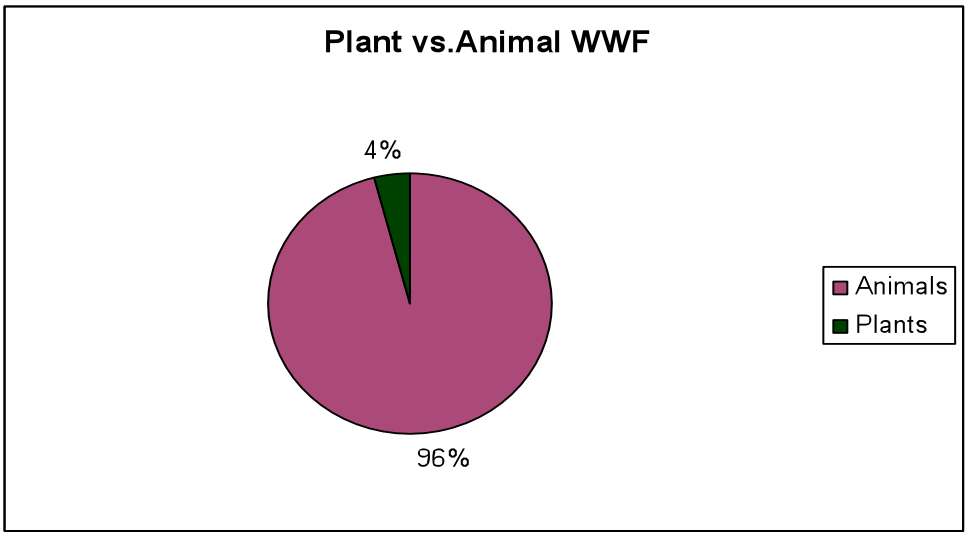
Graph 4: Percentage of usable data from WCS website

For the original data set of WWF, only 73% of the data obtained was usable. The amount of usable data collected from WCS was 66%. Nearly a third of all observations made, from both organizations, could not be used.

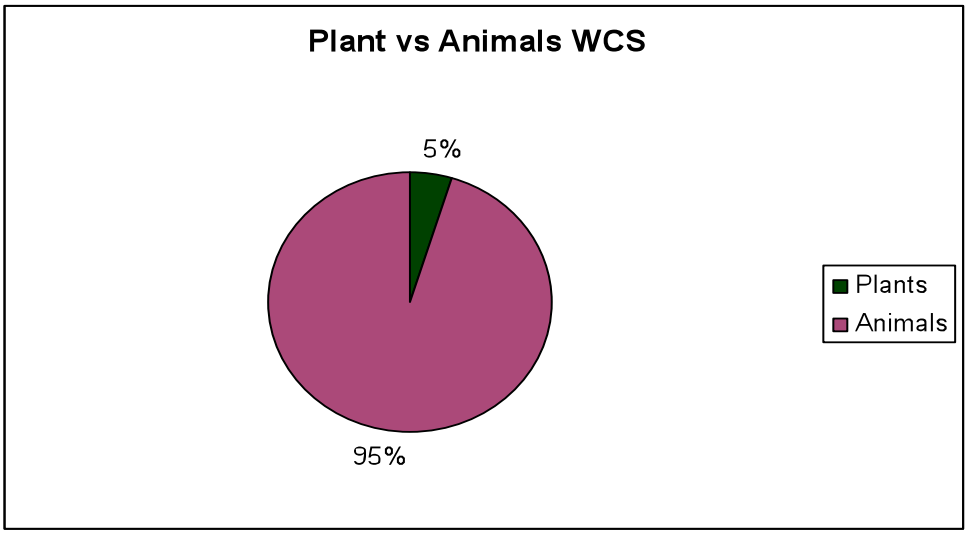
A comparison of species selected by WWF and WCS was made to an IUCN random sample. This is to investigate whether or not the conservation organizations show similar percentages of the different plants and animals compared to what IUCN has listed.



Graph 5: Percentages of plants in IUCN sample



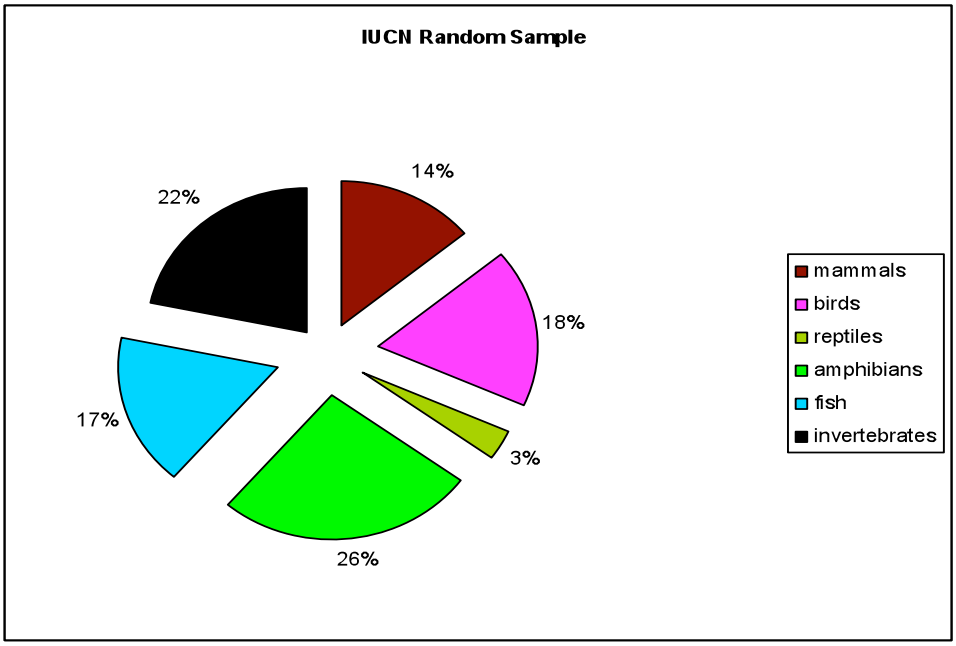
Graph 6: Percentages of plants in WWF data



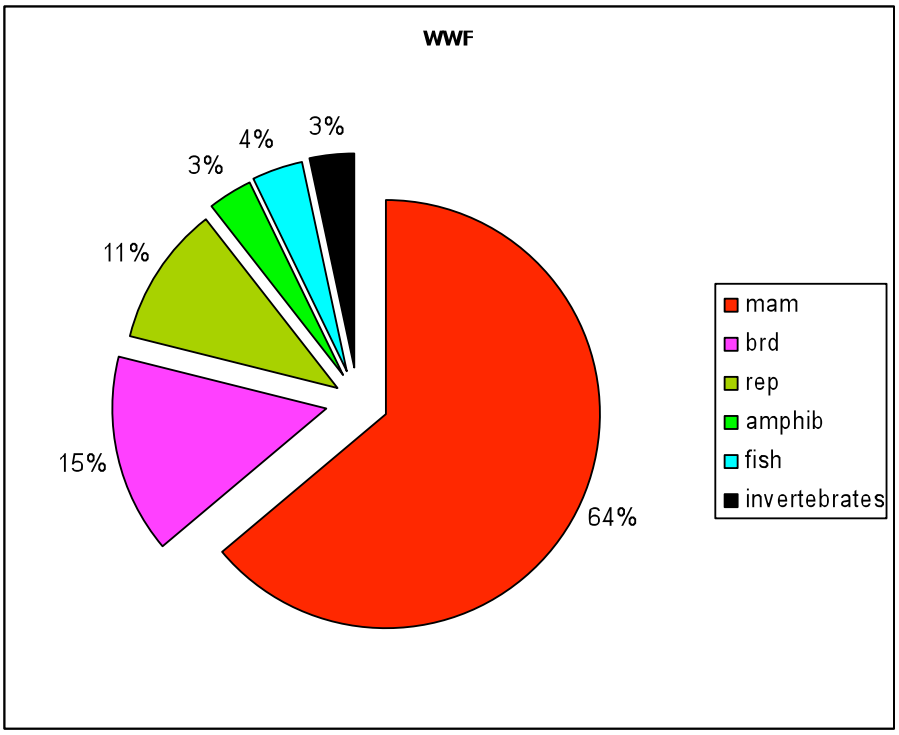
Graph 7: Percentages of plants in WCS data

The pie graphs reveal there are differences in the percentages of Plant and Animal species obtained from the WWF, WCS, and IUCN lists. 34% of data obtained from IUCN were Plants. WWF had a Plant size of only 4%, and WCS at only 5%. Hence, despite the IUCN recognizing that about one third of the planet's endangered species are plants, neither NGO showed the same interest. Due to the paucity of actual instances of plants captured in the NGO data, the study had to omit plants from the research.

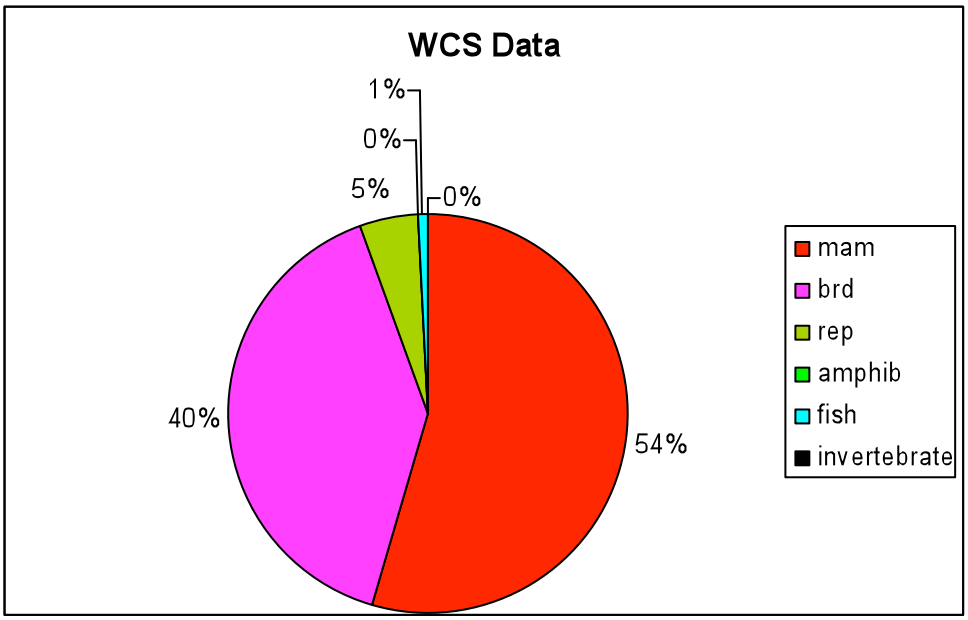
Next I considered taxonomic preferences amongst the animal groups. The IUCN random sample showed that almost one in five endangered animals are invertebrates, and almost one in four are amphibians.



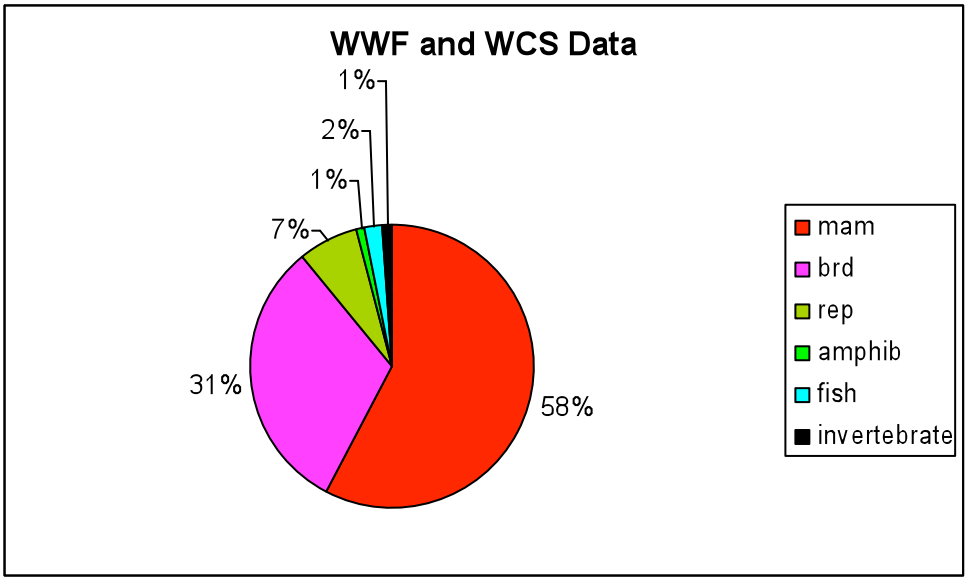
Graph 8: Classes of species in IUCN sample



Graph 9: Classes of species in WWF data



Graph 10: Classes of species in WCS data



Graph 11: Classes of species in WWF and WCS data combined

It is important to clarify the data shown above. First, all species from the data are only critically endangered, endangered, and vulnerable (least concern species are omitted). Second, all butterflies have been arbitrarily classified as honorary birds, following May (*pers comm*). Third, although invertebrates are not a class, it is compared against the split up of the vertebrate classes. Fourth, the data above purposely excludes the classes of gastropods and crustaceans since both WWF and WCS did not list any species from those groups. This understates the relative

importance of invertebrates.

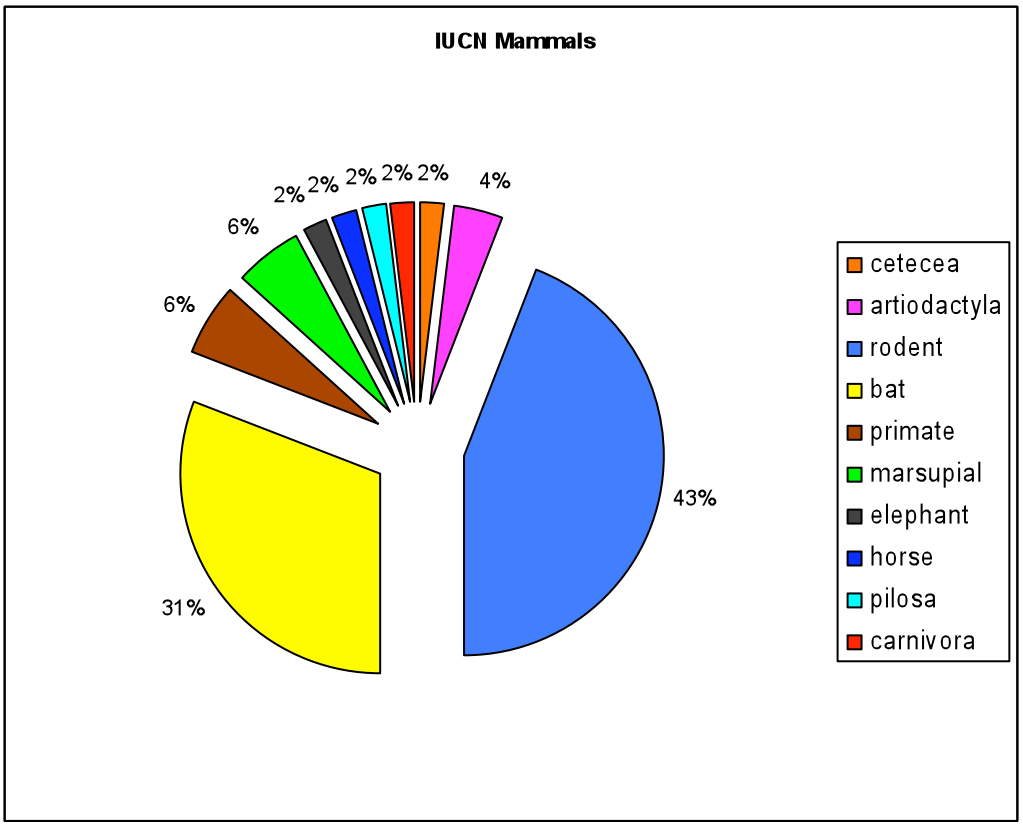
Studying the IUCN sample, there appears to be an even split up of the different groupings. Amphibians appeared the most on the random sample at 26%. The rest of the sample shows invertebrates at 22%, birds at 18%, fish at 17%, mammals at 14%, and reptiles at 3%.

The WWF data set shows that mammals appear the most at 66%. Following mammals are birds at 16%, reptiles at 11%, fish at 4%, and amphibians and invertebrates at 3%. The WCS data set shows that mammals also appear the most at 54%. Following mammals are birds at 40%, reptiles at 5%, fish at 1%, and amphibians and invertebrate less than 1%. In general we can say that the NGOs appear to show a preference for mammals and birds, despite these being relatively less important in the overall portfolio of endangered species.

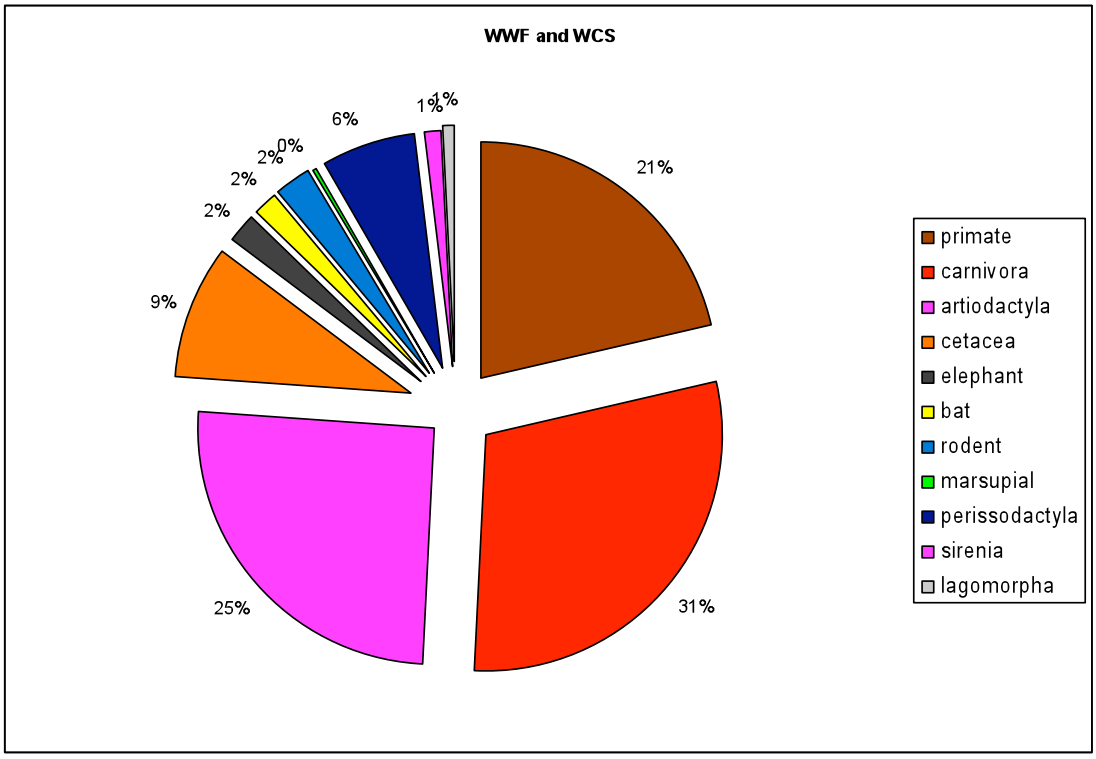
The WWF and WCS pie charts show the actual data used for the statistical modeling. A meticulous look can now be made on the data used. Both organizations protect more mammals than any other species at 58%. Following this, birds make up 32% of the combined data, reptiles at 7%, fish at 2%, and amphibians and invertebrates at 1% each.

Again, the species selected by WWF and WCS do not match those of the IUCN random sample. The species that appeared the most on IUCN were amphibians at 26% and invertebrates at 22%. Amphibians and invertebrates make up only 1% of the data from WWF and WCS.

This process can be taken one step further. Seeing how mammals make up a large percentage of WWF and WCS, what if the mammal category is broken down further from class to order. Would there be any relation to the mammals that appear on the IUCN sample towards the WWF and WCS sample?



Graph 12: Orders of mammals in IUCN sample



Graph 13: Orders of mammals in WWF and WCS data

The two orders that appear the most in the IUCN sample are rodents at 43% and bats at 31%. Nonetheless, these orders of species appear only on 2% of the data from WWF and WCS. This is not a fluke occurring in the IUCN sample. A study on the most endangered mammals was conducted and the findings show that the most endangered mammal species are in the order rodentia (Clout and Russel, 2007).

The three orders which appear the most for WWF and WCS are carnivora at 31%, artiodactyla at 25%, and primates at 21%. Both carnivora and artiodactyla appear only on 2% and primates only at 6% on the IUCN sample. Again, the WWF and WCS seem to be selecting species which do not appear as often on the IUCN sample.

Familiar species within the order carnivora include lions, tigers, and bears. Species that appear in the artiodactyla order are even-toed hooved animals. Even-toed hooved species are similar to animals one may find on a farm i.e. cows, sheep, pigs, and goats. Primates include species such as chimpanzees, gorillas, monkeys, lemurs, etc.

What does this analysis on the data show? The data obtained from WWF and WCS are a poor match for the species taken from IUCN. The species that appear the most on IUCN seem to appear the least on WWF and WCS. The species which appear the least on IUCN appear the most on WWF and WCS. The species which appeared the most on IUCN are usually viewed as pests, i.e. rats and bats. The species which appeared the most on WWF and WCS are usually viewed as charismatic species, i.e. lions, tigers, gorillas, giraffes, wolverines, etc.

Just looking at the basic orders, rodents and bats are relatively small in size when compared against gorillas, giraffes, and tigers. What are other reasons less rodents appear to be protected by WWF and WCS?

A major contributing factor of why not so many rodents are not protected is because they are viewed as a pest, an invasive species. Interesting though, a very small percentage of rodents are actually invasive.

Clout and Russell (2007) conducted research comparing which mammals are invasive and which are endangered. The data their study explores also takes a sample from the IUCN. For this research, five groups will be explored. These are artiodactyla, perissodactyla, carnivore, primates and rodentia.

Artiodactyla, even toed species i.e. goats, sheep, pigs, etc., have 217 different known species. Within this group, ~15% of these species are seen as invasive and ~35% are seen as threatened. The Carnivora, i.e. lions, tiger, bears, etc., have 245 known different species. Within this group, ~10% are seen as invasive and 30% are seen as threatened. The Primates, i.e. monkeys, gorillas, etc., have 357 different known species. Within this group ~5% are seen as invasive and ~30% are seen as threatened. Finally, the number of known rodentia species is 2096, less than 5% are invasive and ~15% are actually threatened. Why is this relevant?

Artiodactyla, carnivora, and primates all have higher percentages of invasive species than rodentia. The idea of rodents not being sponsored by WWF and WCS on the concept of them being a pest is misleading. One could argue that rodents do have a lower percentage of endangered species when compared to artiodactyla, carnivora, and primates. This may be true, however, what of the groups which have higher threatened percentages such as perissodactyla, odd toed animals?

From the study conducted by Clout and Russell (2007), 17 different perissodactyla were observed. Around 10% of these species are seen as invasive while 70% of the group are seen as endangered. Reviewing the IUCN data, about 2% of species within this group were picked up by random while 6% of the data by WWF and WCS had this group. Why are there less species picked up WWF and WCS within perissodactyla relative to other groups?

In general therefore, it is difficult to find matches to what the IUCN considers as needing conservation work, and those species marketed by NGOs as requiring conservation effort.

2. Statistical models

After explaining what the raw data is made of, it is now possible to discuss the statistical models used to study the data. Data collected for this research were analyzed according to two different statistical models. These were a logit/probit model, and a discriminant analysis model. In the first section the origin of the data used will be discussed. Following this, the set up of a logit/probit model and what the model is testing for will be explained. After the logit/probit model, the set up of two discriminant analyses will be explained and what the two tests invetsigated. After the results of the statistical analyses following all three models are revealed, these will be discussed to understand what the data means. Finally, issues with the data and analyses and their potential effect on the results will be addressed.

All data collected were derived from five sources. These are WWF, WCS, IUCN, Wikipedia.org, and zipcodezoo.com. The data collected from WWF and WCS relate to which species both organizations dedicate resources to protect. This information was collected by thoroughly investigating the websites of both organizations and taking information on every species they either protect directly or through a conservation program. A directly protected species is one a potential contributor can make a donation to specifically, i.e. panda bear, tiger, elephant, etc. Protection through a conservation program is carried out by protecting a habitat, i.e. a forest. Through protecting that specific habitat, several different species are protected within it.

The data collected from IUCN were organized based on several different criteria. These are classifying each species' endangerment level, identifying how many countries an individual species may be found in and what kingdom and class the species belongs to. A random sample of the species on the IUCN red list was taken for analysis.

The IUCN red list is made up of specific species data based on independent observations by researchers around the world. The independent researchers make an assessment on how endangered a species is by assessing its abundance and range, if

its habitat is increasing or decreasing, etc.

According to IUCN, there are eight endangerment categories. These are extinct, extinct in the wild, critically endangered, endangered, vulnerable, least concern/least threatened, not threatened, and data deficient. Also, researchers clarify which countries listed species are located in. IUCN also offers information on the classification of the species listed (kingdom, phylum, class, etc). That is, if the species is a plant or animal, vertebrate or invertebrate, mammal, bird, reptile, etc.

A random sample was also taken from the IUCN red list. The random sample was generated by using a random number generator, entering in a range to select a number from, then matching the randomly selected number with a number on the IUCN redlist. The species range only to the endangerment levels of critically endangered, endangered, and vulnerable.

This random sample is designed to help see what type of species appear on the IUCN. Do plants appear more than animals? Do vertebrates appear more than invertebrates? Do mammals appear more than birds? The random sample will be compared to the species taken from WWF and WCS. Do these organizations show similar percentages of what IUCN has? If not, what type of species would WWF and WCS protect preferentially?

The logit/probit model seeks out what traits may make a species more desirable to either WWF or WCS by comparing the IUCN random sample to the data taken from WWF and WCS. The discriminant analyses question what the differences in species traits are when both organizations choose different species and what similarities there are when both organization choose identical species.

2.1 Logit/Probit Model

The logit/probit model is used to study which species are more desirable for WWF and WCS. A dummy variable is set up as the dependent variable. The dependent variable specifies a yes or no remark of whether a genus of a species

selected from the IUCN sample is also on the WWF and WCS sample.

The independent variables take into account several different traits of the species. The first two independent variables look at the level of endangerment of the species. Is the species ranked as critically endangered or endangered by IUCN? The third independent variable observes the diversity of a species. Does the genus of the species contain a relatively high number or low number of other species within it? The fourth independent variable concerns how many countries an individual species may reside in. Does the species occur in a relatively large or relatively small number of countries? The last two independent variables deal with what type of class the species belongs to. Do the species selected tend to be mammals or birds?

The sample size of relevant observations is 395. Out of the 395 observations, 380 answered no while 15 answered yes to the dependent variable. That is, is the genus of the species from the IUCN random sample selected by WWF or WCS.

Table 7: Logit/probit results

Variables	***Coefficient***	***z-Statistic***
Constant	-4.676804	-4.900556**
Log(Countries)	0.939794	2.545209*
Log(Diversity)	-0.575318	-2.172461*
Critically Endangered	0.029463	0.034591
Endangered	0.176262	0.285774
Bird	2.596623	3.175643**
Mammal	1.950874	2.229340*

** indicates probability below 1%

* indicates probability below 5%

Pseudo R-squared	0.231126
Probability (LR stat)	4.94E-05
Log likelihood	-49.03423

What do the variables reveal? What types of species are more attractive to WWF and WCS? The variables which tested significant and positively related to the dependent variable were countries, birds, and mammals (table 7). The variable that tested significant and has a negative relationship to the dependent variable was the diversity of a species. Two variables that had a positive relationship to the dependent variable but did not test significant were both endangerment levels of the species. These were critically endangered and endangered. In effect these NGOs seem attracted to birds and mammals, especially where these species had a wide range. They do not appear to be influenced by the actual extinction threat facing the species.

Looking at the overall fit of the model, the pseudo R-squared indicates that 23% of the model has been answered by the variables used. Though this may seem not that impressive, the low level of the Log likelihood reveals a superb overall fit of the model itself.

2.2 Discriminant Analysis

The second model ran a discriminant analysis on the data. The discriminant analysis produces discriminant functions between two or more dependent variables. The discriminant function explains what may separate one dependent variable from the other dependent variable.

The discriminant analysis is designed to capture the differences and similarities between WWF and WCS. What type of species would WWF more likely select than WCS? What type of species would WCS be more likely to select than WWF? What similarities exist for species which both WWF and WCS select?

The discriminant analysis is processed twice. The reason is due to small specification differences. Both data sets use the following independent variables: Critically Endangered, Endangered, Mammal, Bird, Year, Countries, and Primate. The variables Critically Endangered and Endangered are classifying a species level of endangerment, ranked by IUCN. The variables Mammal and Bird identify which species is either a mammal or a bird. The variable Year measures the amount of time

which has past since the last reported field study to IUCN. The variable Countries counts the amount of countries a particular species may reside in. Finally the Primate variable identifies which species are primates.

The difference between the two data sets is the addition of one variable. The second data set will add the independent variable of Least Concern. Least concern is an endangerment ranking given my IUCN. If a species falls under this category, it is not threatened. The population size of the species is not under any immediate threat.

The variable testing species only picked up by WWF has 94 valid observations. The variable testing species only picked up by WCS has 225 valid observations. The variable observing which species both WWF and WCS pick up has 40 valid observations.

Table 8: First discriminant analysis results (coefficients)

Variable	Function 1	Function 2
Critically Endangered	0.470	-0.075
Mammal	0.025	1.552
Year	0.270	0.037
Countries	0.231	0.369
Bird	-0.895	1.150
Primate	-0.159	-0.080
Endangered	0.358	0.123

The results for the coefficients of the first analysis are detailed in table 8. What do both functions and values reveal? Function 1 compares the species only selected by WWF to the species only selected by WCS. All the variables with a positive relation to Function 1 are: critically endangered, mammal, year, countries, endangered. The variables negatively related to Function 1 are bird and primate.

Function 2 measures the similarities between both WWF and WCS when selecting identical species. All the variables with a positive relation to Function 2 are: Mammal, Year, Countries, Bird, and Endangered. The variables negatively related to

Function 2 are: Critically Endangered and Primate.

Table 9: First discriminant analysis results (z-statistics)

Variable	Function 1	Function 2
Bird	-0.790	0.005
Mammal	0.585	0.555
Critically Endangered	0.489	-0.250
Endangered	0.331	0.119
Year	-0.242	0.035
Primate	0.081	0.053
Countries	0.036	0.279

Taking the absolute value of each variable reveals the level of relevance, within the structure matrix (table 9). For Function 1, Bird has the strongest correlation towards the discriminant function. Following this variable from strongest to weakest association are Mammal, Critically Endangered, Endangered, Year, Primate, and the variable with the weakest correlation is Countries.

Nonetheless, the correlation values of Function 2 are different. The highest absolute value of a variable is Mammal. Following, from strongest to weakest are: Countries, Critically Endangered, Endangered, Primate, and the variable with the weakest correlation is Bird.

Table 10: First discriminant analysis classification results

Dependent Variable	Predicted Group Membership 1	Predicted Group Membership 2	Predicted Group Membership 3
Only WWF	23.4%		
Only WCS		92.2%	
WWF and WCS			7.5%

These percentages show the successful amount of prediction in each category (table 10). Only 23.4% of the species in WWF were correctly classified. 92.2% of the species in WCS were correctly classified. Of the species that were selected both

by WWF and WCS, 7.5% were correctly classified. An overall 66.8% of species were correctly classified.

A second discriminant analysis was used to see if any differences would show up by adding an additional endangerment variable of Least Concern. The discriminant function and all other independent variables remain the same.

Table 11: Second discriminant analysis results (coefficients)

Variable	Function 1	Function 2
Critically Endangered	0.365	-0.184
Mammal	0.126	1.565
Year	0.221	-0.019
Countries	0.269	0.373
Bird	-0.743	1.273
Primate	-0.164	-0.073
Endangered	0.224	-0.015
Least Concern	-0.285	-0.241

The results shown above (table 11) are similar to the previous discriminant analysis. The variables with a positive relation for Function 1 are Critically Endangered, Mammal, Year, Countries, and Endangered. The variables with a negative relationship to Function 1 are Bird, Primate, and Least Concern.

Looking at the coefficient values of Function 2, the variables which have a positive relationship to the discriminant function are Mammal, Countries, and Bird. The variables with a negative relationship to the discriminant function are Critically Endangered, Endangered, Least Concern, Year, and Primate.

Table 12: Second discriminant analysis results (z-statistics)

Variable	Function 1	Function 2
Bird	-0.769	0.063
Mammal	0.585	0.501
Least Concern	-0.577	0.040
Critically Endangered	0.469	-0.281
Endangered	0.326	0.093
Year	-0.234	0.052
Primate	0.80	0.046
Countries	0.043	0.271

Studying the relevance of each variable on Function 1, Bird has the strongest correlation followed by Mammal, Least Concern, Critically Endangered, Endangered, Year, Primate, and Countries (table 12).

Again, after taking the absolute values of each variable for Function 2, the results change. The discriminant variables in order of strongest correlation to weakest correlation are Mammal, Critically Endangered, Countries, Endangered, Bird, Year, Primate, and Least Concern.

Table 13: Second discriminant analysis classification results

Dependent Variable	Predicted Group Membership 1	Predicted Group Membership 2	Predicted Group Membership 3
Only WWF	23.4%		
Only WCS		92.2%	
WWF and WCS			7.5%

These results (table 13) are no different than the results shown from model 2.3 with the first discriminant analysis. 23.4% of the observations from only WWF were correctly selected. 92.2% of the observations from only WCS were correctly selected. Finally, 7.5% of the observations from both WWF and WCS were correctly selected. An overall 66.8% of the group cases were correctly classified in the second discriminant analysis.

3. Explaining the Data

What do all of these numbers reveal about the research? Thorough clarification is needed to understand what each independent variable has on the dependent variable. Both data results from logit/probit model and discriminant analyses models will be explained.

3.1 Logit/Probit

Reviewing model 1.1 (results in table 7), the logit/probit data studies what traits WWF and WCS look for in a species to protect. The dependent variable was designed to capture all genera from the IUCN sample that were also selected by WWF and WCS. Out of the six independent variables, four of them tested significant in relation to the dependent variable. These are Countries, Diversity, Bird, and Mammal. The variables Mammal, Bird, and Countries had a positive coefficient and the variable Diversity had a negative coefficient. What does this mean?

WWF and WCS are more likely to select a species if it is a bird or a mammal. If the species dwells in a relatively large amount of countries, then the species becomes more desirable to the two organizations. As the diversity of a species starts to decrease, or the amount of species within a genus is relatively small, these species have a higher likelihood of being sponsored by WWF or WCS.

The variables Critically Endangered or Endangered had a positive relationship with the dependent variable. Nonetheless, these two variables did not test significant. So, these endangerment levels are not a concern for WWF and WCS. It does not increase the species likelihood of being selected by either organization.

3.2 Discriminant Analysis

The discriminant analysis questions what the differences and similarities are between species selected by WWF and WCS. Two functions are presented. Function 1 represents the likelihood of WWF selecting a species relative to WCS selecting the

species.

The traits that make a species more desirable toward WWF and less likely for WCS are Critically Endangered, Mammal, Year, Countries, and Endangered. WWF is more likely than WCS to select a species that tends to be a mammal, or is ranked either critically endangered or endangered, or has not been assessed for a relatively long amount of time, and appears in a relative large amount of countries.

The variables that have negative values are Bird and Primate. These two variables show that WWF is less likely, or that WCS is more likely to select species that tend to be either a bird or a primate.

Function 2 represents what similarities there are when both WWF and WCS select the same species. Function 2 in table 8 shows both organizations are more likely to select the same species if it: tends to be a mammal or a bird, is in a relatively large amount of countries, a relatively long time has past since the last assessment, and if it tends to be ranked as endangered by IUCN. Both organizations are less likely to select a species if it ranked as critically endangered by IUCN or if the species tends to be a primate.

Table 9, the structure matrix, contains results illustrating another way of evaluating the data. The values shown are the z-statistics. The z-statistic shows relative importance of the discriminant variable on the discriminant function. After taking the absolute values of each variable, the higher the value, the stronger the correlation, the stronger the correlation, the more relevant the variable is on the discriminant function. The lower the value, the weaker the correlation, the less relevant that variable is to the function.

When looking at Function 1 in table 9, Bird has the strongest correlation followed by Mammal, Critically Endangered, Endangered, Year, Primate, and Countries. So, the variable, Bird, is more significant than the variable Mammal. Mammal is more significant than Critically Endangered. Critically Endangered is more significant than Year. Year is more significant than Primate. Finally, Primate is

more significant than Countries.

Bird has the strongest correlation on the discriminant function while Countries has the weakest correlation on the discriminant function. With this in mind, a choice of either organization selecting a species depends more on being a bird or mammal than the amount of countries the species is in or if the species is a primate.

Nonetheless, the correlation and z-statistic values of the discriminant variables change for Function 2. Mammal has the strongest correlation followed by, Countries, Critically Endangered, Endangered, Primate, Year, and Bird. Both organizations are more likely to select a species if it is a mammal or is not critically endangered. They are less likely to make a decision based on if the species is a bird or the when the last assessment of the species was made.

There are two variables which had a major change. Bird, having the strongest correlation in Function 1, has the weakest correlation in Function 2. Being a bird plays more of a role when each organization separately chooses a species rather than choosing the same species. The countries correlation has increased between Function 1 and Function 2. Having the weakest correlation in Function 1, Countries had the second strongest correlation in Function 2.

In table 10, the classification results reveal the percentages of each observation being correctly classified. Group 1 represents the amount of species only selected by WWF. 23.4% of these species were correctly classified. Out of the total sample of 94 observations, only 22 of those observations were correctly classified. Group 2 represents the species only selected by WCS. 92.2% of these were correctly classified. Out of 255 observations, 235 were correctly classified. Finally, Group 3 represents the species selected by both WWF and WCS. Only 7.5% were correctly classified. Out of 40 observations, only 3 were correctly classified. Overall, only 66.8% of the species were correctly classified in the discriminant analysis.

A second discriminant analysis is used to see if there are any changes in values of the discriminant variables. By adding an extra endangerment level, are there any

significant changes to the coefficients and z-statistics? Looking at tables 11 and 12, there are some changes between values of the discriminant variables.

In table 11, the discriminant variables Critically Endangered, Mammal, Year, Countries, and Endangered positively affect Function 1. Though the values of the coefficients may have changed slightly, the results are still similar to Function 1 in table 8. If the species tends to be ranked as critically endangered or endangered, is a mammal, appears in a relatively high amount of countries, or the last time the species has been assessed is relatively long, it is more likely to be protected by WWF.

The negative values for Function 1 are still bird and primate, along with the new variable added, least concern. WWF is less likely to select a species that tends to be a bird, primate, or if it has been ranked least concern by IUCN.

For Function 2, the variables Mammal, Countries, and Bird are still positively related. No changes of signs occur between the results in tables 8 and 11. Both, WWF and WCS select identical species if it tends to be either a mammal or a bird, or if it appears in a relatively high amount of countries. Critically endangered is still negatively related which means both organizations are less likely to select a species with an endangerment ranking of critically endangered. The new variable, Least Concern, also has a negative value. If the species has a ranking of least concern, both organizations are less likely to protect it.

By adding the new variable, Least Concern, the coefficient for Year, Primate, and Endangered have changed for Function 2. The three had a positive sign in table 8 but now have a negative sign in table 11. So, both organizations are less likely to select a species that is a primate, is ranked as endangered, and as the amount of time increases since last assessed.

Looking at table 12, Function 1's significance values do not change compared to those of table 9. Bird still has the highest correlation with the discriminant function. Following, Mammal is more significant than Least Concern. Least concern is more significant than Critically Endangered. Critically Endangered is more

significant than Endangered. Endangered is more significant than Year. Year is more significant than Countries. Again, the higher the significance value, the more relevant the discriminant variable has on the discriminant function.

Looking at Function 2 in table 12, there are changes between four variable's correlation values. Mammal has the strongest correlation, just as it did for Function 2 in table 9. A change occurs though for values of Critically Endangered and Countries. In table 9, Function 2, Critically Endangered had the second strongest correlation and Countries had the third strongest correlation. In table 9, Countries now has the second strongest correlation and Critically Endangered now has the third strongest correlation. Endangered still has the fourth strongest correlation. The relevance of the Bird variable has increased. In table 9, Bird had the weakest correlation. Now, the variable has increased to the fifth strongest correlation value. Though the Year correlation value has increased slightly, it is still ranked as having the sixth strongest correlation. Primate's correlation value has changed to a weaker correlation. Least Concern has the weakest correlation to the discriminant function. Again, as the correlation becomes relatively high, the stronger the importance of that variable on the discriminant functions.

Throughout both the discriminant analyses, similarities in variables occur. If the z-statistics were separated into two separate categories, relevant and irrelevant, which variables occur to be relevant more often? Relevant results are those that score the four highest z-statistics. The irrelevant results are those for which the z-statistic scores are lower than the top four variables. Function 1 in table 8 and in table 11 both have variables Bird, Mammal, and Critically Endangered constantly testing significant. Both Function 1s state that WCS is more likely than WWF to select birds for protection. WWF is more likely to select a mammal or a species which is critically endangered than WCS.

The variables Mammal, Countries, Critically Endangered, and Endangered constantly tested significant in each Function 2. *Both* organizations are more likely to select a species that tends to be a mammal, appears in a relatively large amount of countries. Both organizations are less likely to select a species that is critically

endangered or endangered.

The results found do support the idea that NGOs base their selection more on physical aspects than ecological traits. Being a mammal or a bird does improve the chances of species being selected by WWF or WCS. If the species' endangerment levels are high, this does not help them get sponsored by an NGO. An NGO will select a species for which less risk is involved to protect.

Questions concerning problems with the data may have popped up. Why were only mammals and birds tested? How come the species weights were not tested? The next section will analyze all the data obtained for this research. Explanations will be given on why certain variables were not used in the statistical modeling.

4. Observing the Raw Data

Observing the results given from each statistical program, certain concerns may arise. One might question the data used. Why were only mammal and bird variables used? Could the sample size differences between WWF and WCS skew results? The purpose of this section is to analyze all of the data obtained. Why might have certain variables been dropped or not used in the statistical modeling? While examining the data, could any new information not picked up by the statistical modeling, be revealed?

4.1 Problems with Weights

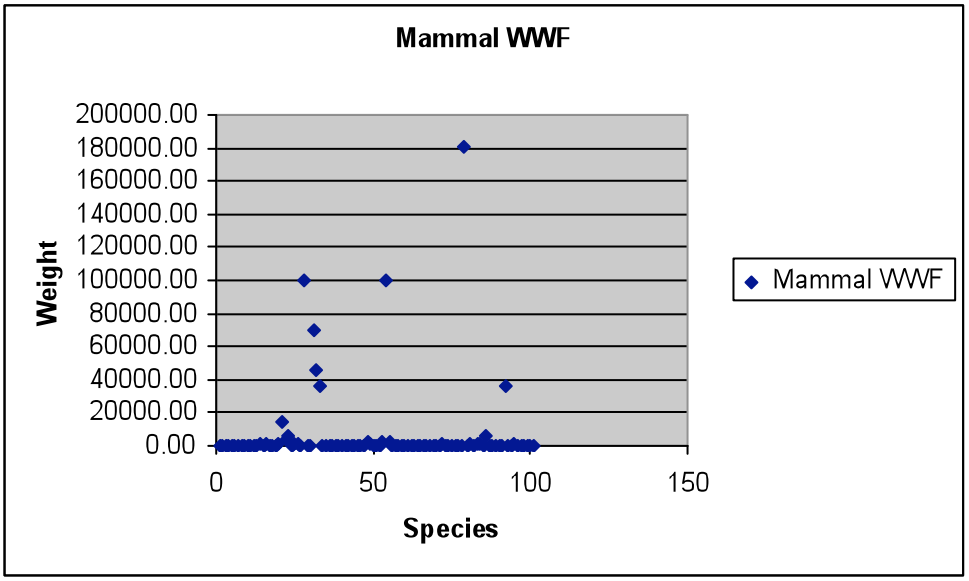
It is important to clarify why species' weights were not used in the statistical modeling. Metrick and Weitzman discovered that the US government will select large mammals to protect (Metrick and Weitzman, 1996). If they were able to test this, why could the research not provide similar results?

Using the weights of species would have greatly complicated the modeling. First, not every species' weight was obtainable. If a variable concerning species' weights were used, there would have been a severe drop in usable species

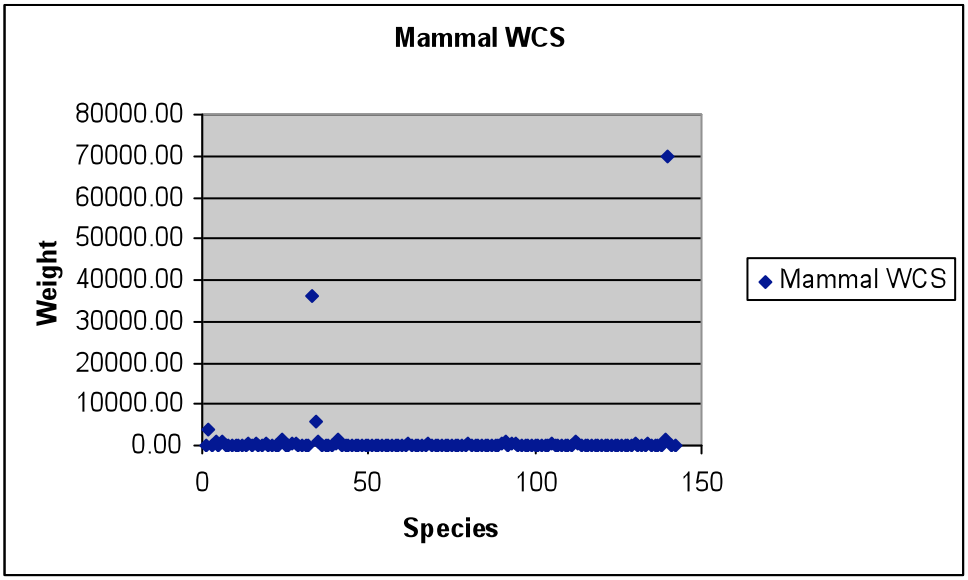
observations. Second, weights for the species in the IUCN random sample were not found. So, it would have been difficult to prove or disprove any similarities, in weights, of species between the different organizations.

Though the weights of the species could not be used in a statistical model, it does not mean a basic scatter plot of species weights could not be questioned. An investigation will start by only looking at species' weights from WWF and WCS. All other factors will be ignored i.e. endangerment levels, diversity, number of countries, etc. Only mammal's and bird's weights will be examined.

Below are scatter plots of the different species' weights for mammals.

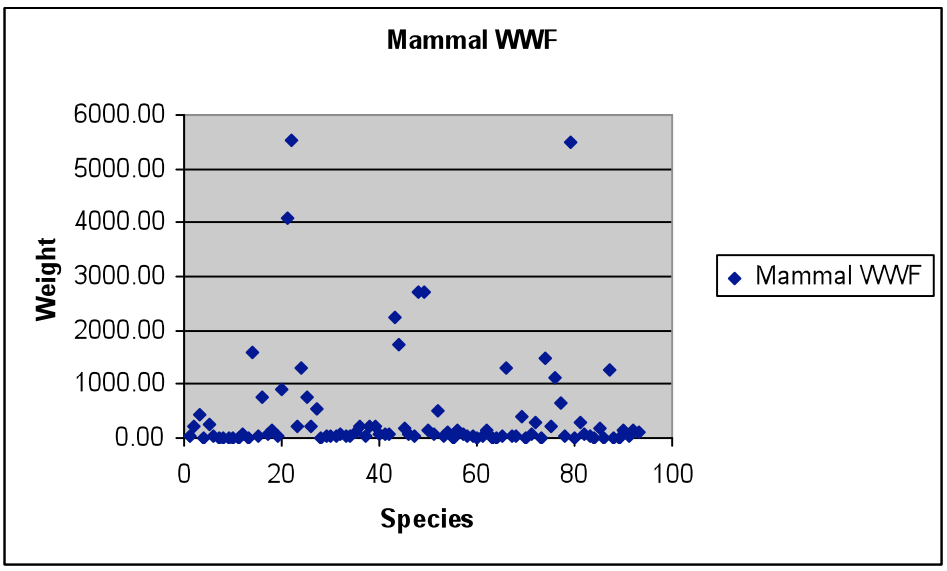


Graph 14: Scatter Plot of mammal species' weights in WWF data

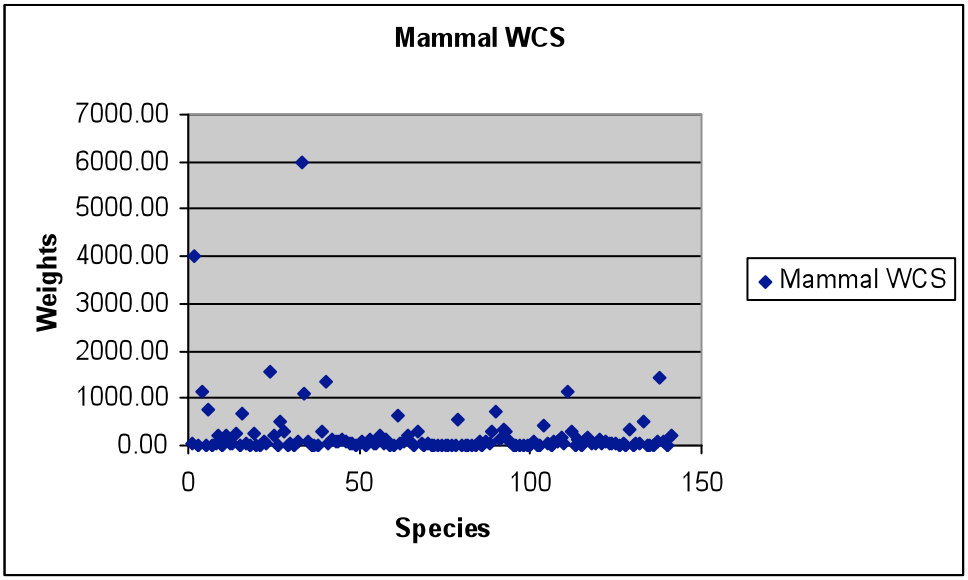


Graph 15: Scatter Plot of mammal species' weights in WCS data

The WWF dataset contained 112 different species of mammals originally. From this amount, only 101 mammal species' weights were obtainable. The WCS dataset contained 233 different species of mammals. Of this 223, only 142 had specified weights. The mean weight for WWF mammals was 6206.35 kilograms and the mean weight for WCS mammals was 964.44 kilograms. Observing the data above, large mammals, such as whales, increase the mean weights of the mammals. In order to get a closer look at the species weights, all mammals over 10,000 kilograms are removed.

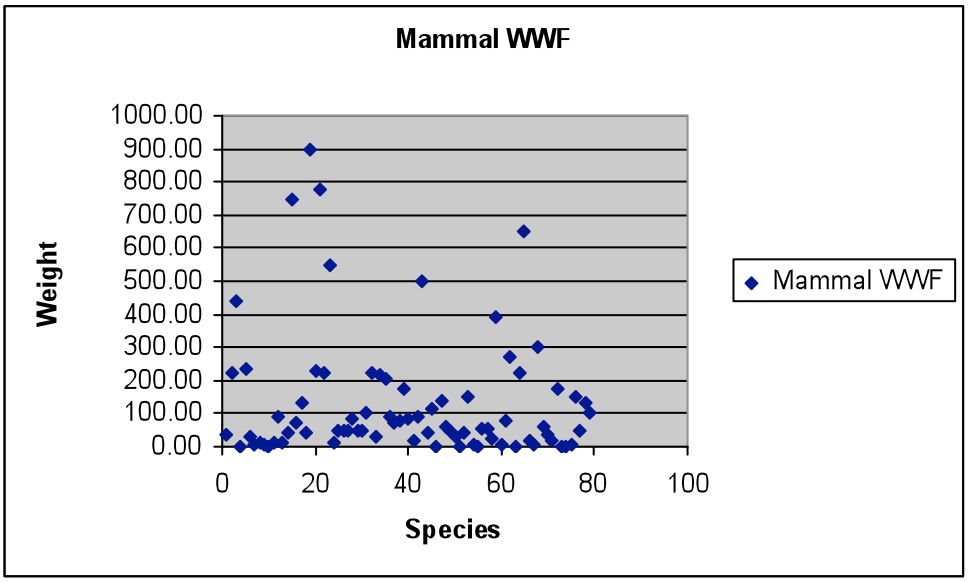


Graph 16: Scatter Plot of mammal species' weights <10000kg in WWF data

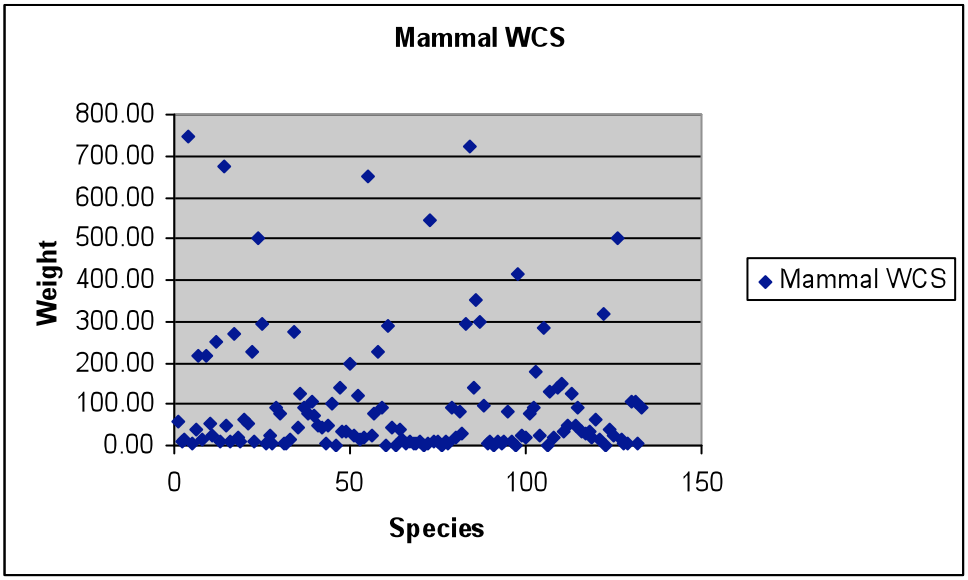


Graph 17: Scatter Plot of mammal species' weights <10000kg in WCS data

After the removal of species weighing more than 10,000 kilograms, there still appear to be several species over 1000kg. The mean weight for mammals from WWF is 465.20kg. The mean weight for WCS mammals is 221.06 kg. There still seem to be many species under 1000kg. To see these weights, all mammals over 1000kg are removed from the scatter plot.



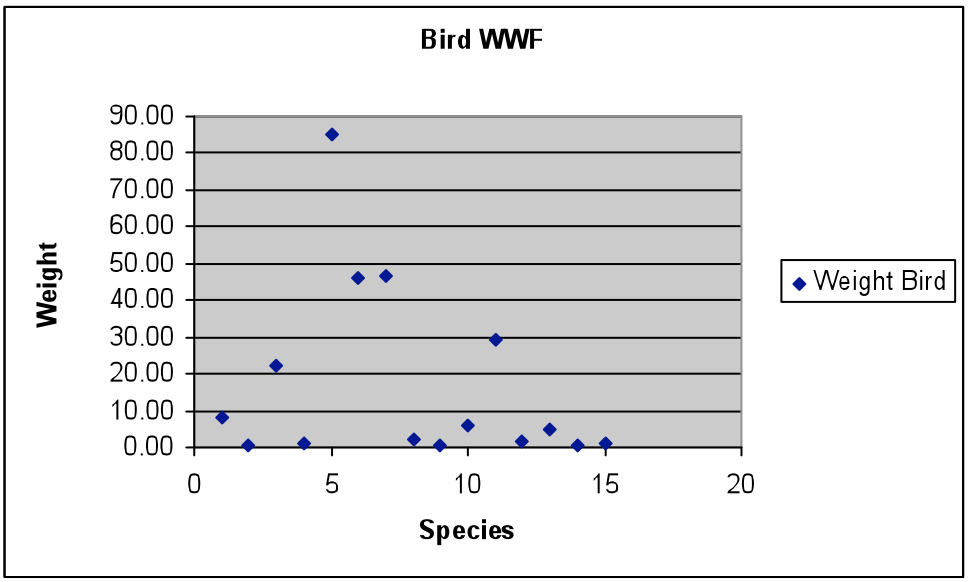
Graph 18: Scatter Plot of mammal species' weights <1000kg in WWF data



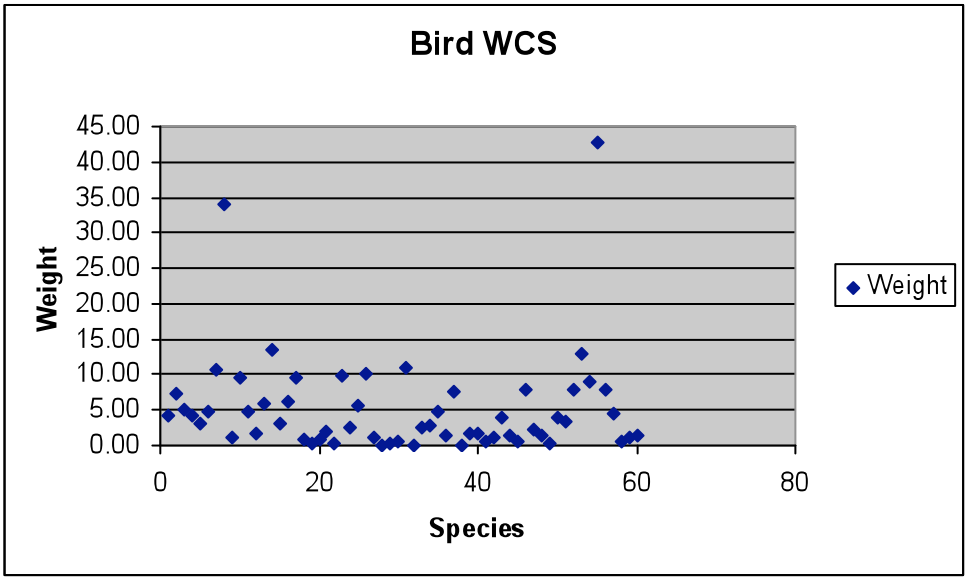
Graph 19: Scatter Plot of mammal species' weights <1000kg in WCS data

These scatter plots still show that there are a large number of species sponsored by WWF and WCS whose weights exceed 100kg. Species sponsored by WWF show a mean weight for mammals of 132.48kg. For WCS, the mean weight is 100.06kg.

What are the weights of the birds sponsored by each organization? The WWF dataset included 15 birds, out of 24, for which weights were obtainable. WCS had 60 birds, out of 163, observations that had weight values.



Graph 20: Scatter Plot of bird species' weights <100kg in WWF data



Graph 21: Scatter Plot of bird species' weights <100kg in WCS data

WWF had an average bird weight of 17.04kg. Over a third of the birds selected by WWF are over 10kg. One species is the second largest bird in the world at 85kg. Birds protected by WCS had an average weight of 5.18kg. This mean weight is lower than the species protected by WWF but the organization is still selecting birds that are over 10kg. Though the physical features cannot be revealed, it is noticeable that there are relatively large birds selected by both organizations.

Sadly, these variables do not reveal anything significant. The scatter plots do show that each organization sponsors animals which are large. However, since weights of the mammal and bird species from IUCN were not available, no comparison can be made to the weights of these species.

Though the weights could not be compared properly to IUCN, what might the different class and order of species be? Could this help elaborate on the weight? Could different species be identified as larger or smaller species to each other?

DISCUSSION

What has this study revealed about conservation NGOs? Does favoritism occur towards one group of species over another by NGOs? Why would NGOs have a selection process? How are the NGOs able to hide this selection process from others?

When comparing the raw data from WWF and WCS against IUCN, an interesting revelation occurs. The percentages of species which WWF and WCS select are different than the percentages of species which are on the random sample taken from IUCN. Further investigation into what types of mammals are selected by each organization are strikingly different. Rodents and bats appear the most on the IUCN random sample while artiodactyla, carnivora, and primates appear the most on the data from WWF and WCS. That is, relatively small species appear more often on the IUCN sample where as relatively large species appear more often on the WWF and WCS data set.

A selection process is present amongst the conservation NGOs sampled in this research. A logit/probit model was used to compare what types of species on the IUCN random sample are more desirable towards WWF and WCS. The results showed that WWF and WCS prefer to select species that appear in a high number of countries, have a relatively low diversity within the genus, and tend to be birds or mammals.

Two discriminant analyses were used to compare the species selected by WWF and WCS. Both show WWF is more likely than WCS to select species which tend to be mammals and/or are critically endangered. WCS is more likely than WWF to select a species which tends to be birds. Interestingly though, the results start to differ when observing an individual species that both WWF and WCS select. Both organizations tend to sponsor identical species if they are a mammal, it appears in a relatively high number of countries, and the species is not critically endangered or endangered.

Why would WWF and WCS select species with these criteria? Why would species in serious threat of extinction, i.e. amphibians or rodents, not be the predominant species selected by these organizations? Why does WWF and WCS prefer to select groups of animals that tend to be mammals and birds, and tend to be neither critically endangered of endangered?

WWF and WCS select these species because they know these species will attract more funding, or revenue, than amphibians and rodents. That is, these organizations treat species conservation more as a product to earn revenue than a responsibility to protect the environment. These large organizations tend to behave more as a business than a non-profit.

Imagine conservation NGOs as an investment firm. These organizations would like to select a species which is highly desirable by the general population, requires little effort to maintain, and would be able to attract large amounts of revenue.

The NGO, like any other business, does not want to make a risky investment where money could be lost. This could be why WWF and WCS prefer to select species that are not critically endangered and endangered. By selecting a species with a high risk of extinction, there is a greater chance of failure by the NGO. If the species were to become extinct, the NGO's reputation (and hence brand name) would be under threat. Donors may think the NGO is not successful in protecting species and may withdraw funding towards the organization. When funding begins to decrease, the NGO may not have enough funding to continue species conservation.

Species, in effect, earn an NGO a rent. They merely have to nominate the candidate and given sufficient reputation, donor funds will be attracted. This perhaps explains why WWF and WCS are keen to compete on the protection of some low concern mammals. To the uninformed donors, these are attractive options. For NGOs they are a cheap signal to communicate their concern about the environment.

By selecting species which uninformed people are more attracted to, it is

easier for an organization to obtain funding from these people. If an organization were to sponsor large amounts of rodents, it would take more time and effort to collect the information to assess status and develop conservation projects. They would have to bear higher costs and perhaps higher risks of failure.

By selecting species which appear in a large number of countries there could be more people which are familiar with these species. The more people who are familiar with the species, the more people are interested in conserving the species (a scale effect).

How would an organization know which species will attract more funding? Why do the donors want to protect species which are not highly threatened? Through the concepts of rational ignorance, asymmetrical information, and rent-seeking these questions can be answered.

Rational ignorance occurs when an individual chooses to be uninformed. The reason for being uninformed is the costs involved of becoming informed out weight the benefits to be earned if informed. Since donors are rationally ignorant, that is, uninformed, there is a large amount of asymmetrical information between the donor and the NGO.

The informed group is able to select which information they would want to reveal and hide from the uninformed donor. Information that could be revealed is the level of endangerment of a species (albeit this may be exaggerated). Nevertheless, the organization could conceal the fact that the species' is not ecologically important, genetically diverse.

The data showed there is a selection process conducted by the organizations towards selecting species. These processes are known as screening and profit/rent-seeking. By using these techniques, conservation NGOs take on a cost in order to find which species are able to attract the most funding with the least amount of effort involved of protecting the species. Large organizations are able to select charismatic species and present them as superior species to the uninformed.

An argument does arise though with these finding. The funding earned by advertising charismatic species may generate additional funding for other species. A spill over effect would take place within the species conservation. Each species may have a donation limit. When the limit is reached, the excess funding is rellocated to a different species in need of it. This however implies some duplicitous behavior by NGOs. In this sense, they are using funds for projects that are not sanctioned by the donors. It is beyond the scope of this research to test for such behavior.

CONCLUSION

This research provides an explanation for why the Baiji dolphin was neglected by many large NGOs. At a statistical level, it suffered the problem of being extremely endangered and found in one country only. There is little evidence that elevated extinction threats motivate the interest of these large NGOs. Nonetheless, the fact it is a mammal and was neglected is a little surprising. From a donor-revenue basis however, the species may just have been too risky. Failure was likely and this may have impacted the reputation of these organizations. Budweiser however is not an NGO nor dependent on a conservation reputation to attract revenues. Its interest as a sponsor is perhaps more understandable. Such sponsorship may improve its project in the Chinese beer market even if the project failed.

The literature review, game theory model, and statistical testing all highlight the problem of information. In so far as NGOs can act as an efficient (low cost) source of information on endangered species, Pareto optimal outcomes can be obtained. An environmental NGO does 'good' by solving the information and co-ordination problem inherent to the game. The problem is that the solution here necessarily generates an asymmetric information problem. Donors have a little information about some charismatic species and no information about the bulk of endangered species (which are actually plants, invertebrates and amphibians). This situation can be exploited to maximize donor revenue rather than maximize conservation outcomes.

Such exploitation is more likely to exist in large NGOs. The reason derives from club theory. In small organizations there are limited objectives. For instance, in New Zealand, the Brown Teal Trust has the straightforward and simple aim of saving the brown teal (pateke). The organizations are small and self-monitoring is effective. Both free-riders or forced-riders problems can be kept to a minimum. As the organization gets larger, then free-riding problems are going to become more pressing. There are two possible solutions. One is to keep the NGO at an optimal size (for a club) to ensure that its mission can be performed.

Given that large NGOs have global memberships in the millions, it is hard to conceive that they are restraining their size to solve a public good (conservation) allocation problem. The second solution is thus to keep expanding and change focus to donor revenue maximization. In effect, each species becomes a quasi private good with unique 'brand' characteristics attached to the NGO's reputation, i.e. the panda and WWF or Greenpeace with whale conservation∫. If an individual wished to donate money towards great panda conservation, they would immediately think of WWF due to the donor's familiarity with WWF's panda. The NGO markets these to gain revenue. Each species has a different rent attached to it, based on largely charismatic properties to uninformed donors. Hence, there is competition amongst NGOs for donor funds to save popular mammalian species (eg. the tiger).

The idea of NGOs searching for potential funding does not only occur in wildlife conservation. In 1999, when over 200 NGOs sent aid and resources to Albania to help refugees from mass genocide in Kosovo. Why did so many NGOs flock over to Albania? Undoubtedly these NGOs provided important aid, but were all 200 NGOs needed in Albania? Were there not other countries also in need of aid that some of these NGOs could have focused on in 1999? One journalist commented that these NGOs did not solely go over to help the Kosovo refugees. One of the reasons for going to this well-known crisis zone was to attract large amounts of funding (civilsoc.org).

Although NGOs appear to be working purely with the best intentions, many people question their practices and the means in which they contribute to society. A French NGO, known as Zoe's Ark, recently got into trouble in early 2008 with the government of Chad with regards to a child adoption program. The organization was going to send 103 injured orphans from their war-torn homes to new families in France. It was however revealed that the organization had been falsifying documents claiming the children had no families when, actually, 91 out of the 103 children had been living with at least one relative (CNN.com).

Conservation organizations offer protection for species such as pandas, giraffes, and even clown fish because they know charismatic species will attract the

most funding. Organizations are aware most people are uninformed and are willing to donate to charismatic species, even when not greatly endangered. Seeing as the donor is uninformed, they are unaware that the organization is selecting species based on charismatic features rather than biodiversity features.

If an individual makes an investment of $1 towards a company's stock, as a share holder, they have the right to view the accounting practices to see how their $1 is being used. Nonetheless when an individual makes a donation towards an NGO, they will most likely just receive a letter of thanks from the organization. The nature of these NGOs makes monitoring costly to donors, and with vague aims promulgated means that verification is nearly impossible.

In conclusion, this thesis has highlighted that there is a basic information problem attached to conservation. Most donors are in an uninformed state, albeit if they become informed they switch preferences towards species of higher conservation value. NGO's are able to solve this information problem by specializing in the generation of conservation information at lower cost. This makes it optimal for donors to be uninformed and trust the NGO. If the NGO is relatively small, then club theory suggests monitoring will be effective and preferences well understood. As NGOs become larger, then the scope to exploit this asymmetric information increases. The NGO can market charismatic species of low concern to donors as if they have high conservation value. In effect, each species is presumed to have a rent associated with it and conservation projects get orientated to these high-rent candidates. This reduces conservation outcomes but expands the revenue and size of the NGO. In this sense, the NGO is no longer filling the function originally justified by this research's models. Nonetheless, this asymmetric information problem appears to be able to persist given the much weaker monitoring possible of NGOs, and the 'difficult to verify' program goals outlined by large NGOs.

REFERENCES

1. Akerlof, George A. (1970) "The Market for "Lemons": Quality Uncertainty and the Market Mechanism", *The Quarterly Journal of Economics*, Vol.84 No. 3, pp.488-500

2. Bhagwati, Jagdish N. (1982) "Directly Unproductive, Profit-Seeking (DUP) Activities", *The Journal of Political Economy*, Vol.90 No.5, pp.988-1002

3. Bowler. (1990, April 1). "Irish Voter Rationality: The 1987 Irish General Election Revisited", *Economic And Social Review*, Vol.21 No.3, 251-268

4. Buchanan, James M. (1965) "An Economic Theory of Clubs", *Economica*, Vol.32 No.125, pp.1-14

5. Buchanan, James M. & Tullock, Gordon (1962) "*The Calculus of Consent: Logical Foundations of Constitutional Democracy*", Anna Arborb: University of Michigan Press

6. Christie, Mike, Hanley, Nick, Warren, John, Kevin, Murphy, Wright, Robert & Hyde, Tony (2006) "Valuing the diversity of biodiversity", *Ecological Economics*, Vol.58 No. 2 pp.304-317

7. Clout, Mike N. & Russell, James C. (2007) "The invasion ecology of mammals: a global perspective", *Wildlife Research*, Vol.35 No.?, pp.180-184

8. Downs, Anthony (1957) " An Economic Theory of Political Action in a Democracy", *The Journal of Political Economy*, Vol.65 No.2, pp.135-150

9. Krueger, Anne O. (1974) "The Political Economy of a Rent-Seeking Society", *American Economic Review*, Vol.64 No.3, pp.291-303

10. Metrick, Andrew & Weitzman, Martin L. (1996) "Patterns of Behavior in

Endangered Species Preservation", *Land Economics*, Vol.72 No.1, pp.1-16

11. Montgomery, Claire A. (2002) "Ranking the benefits of biodiversity: an exploration of relative values", *Journal of Environmental Management*, Vol.65 No.3, pp.313-326

12. Sandler, Todd and Tschirhart, John T. (1980) "The Economic Theory of Clubs: An Evaluative Survey", *Journal of Economic Literature*, Vol.18 No.4, pp.1481-1521

.

13. Silva E.G. and Costa, J.S. (2006). "Are voters rationally ignorant? An empirical study of Portugese local elections", *Portugese Economic Journal*, Vol.5 No.1, pp. 31-44

14. Smith, V. Kerry (1985) "A Theoretical Analysis of the "Green Lobby"", The American Political Science Review, Vol.79 No.1, pp.132-147

15. Spence, Michael (1973) "Job Market Signaling" The Quarterly Journal of Economics, Vol.87 No.3, pp.355-374

16. Stiglitz, Joseph E. (1975) "The Theory of "Screening," Education, and the Distribution of Income", *The American Economic Review*, Vol.65 No.3, pp.283-300

17. Tisdell, Clem, Nantha, Hermanath S., and Wilson, Clevo (2006) "Information, Wildlife Valuation, Conservation: Experiments and Policy", *Contemporary Economic Policy*, Vol.24 No.1, pp.144-159

18. Tullock, Gordon (1967) "The Welfare Costs of Tariffs, Monopolies, and Theft", *Western Economic Journal*, Vol.5 (June 1967), pp.224-232

19. Weitzman, Martin L. (1998) "The Noah's Ark Problem", *Econometrica*, Vol.66 No.6, pp.1279-1298

Internet References

20. Information on the Baiji Dolphin, http://www.baiji.org/expeditions/1/overview.html, September 1, 2007

21. Information on WWF, http://www.panda.org/news_facts/newsroom/wwf_quick_facts.cfm, October 1, 2007

22. WWF Mission statement, http://www.panda.org/about_wwf/who_we_are/index.cfm, February 1, 2008

23. Greenpeace Mission Statement, http://www.greenpeace.org/international/about/our-mission, February 1, 2008

24. Information on Brent Spar, http://en.wikipedia.org/wiki/Brent_Spar, March 1, 2008

25. Information on WCS, http://en.wikipedia.org/wiki/Wildlife_Conservation_Society, October 1, 2007

26. WCS Mission Statement, (http://wcs.org/sw-our_mission), February 1, 2008

27. Definition of NGO, http://fundraisingexpert.com/ngo.htm, February 1,2008

28. Information on U.N., http://en.wikipedia.org/wiki/U.N.#History. February 15, 2008

29. Information on ASPCA, http://en.wikipedia.org/wiki/American_Society_for_the_Prevention_of_Cruelty_to_Animals, February 15, 2008

30. Information on Carbon Credits, http://en.wikipedia.org/wiki/Carbon_credit, March 1, 2008

31. Information on Eco-tourism, http://en.wikipedia.org/wiki/Eco-tourism, March 1, 2008

32. FBI definition of Eco-terrorism, http://www.fbi.gov/congress/congress02/jarboe021202.htm, June 1, 2008

33. Duncan Black's Median Voter Theorem, http://www.allacademic.com//meta/p_mla_apa_research_citation/1/9/7/0/2/pages197028/p197028-1.php, December 1, 2007

34. Information Qoute for Screening, http://nobelprize.org/nobel_prizes/economics/laureates/2001/public.html, November 1, 2007.

35. Source of Kosovo Comment, http://www.civilsoc.org/resource/sins.htm, September 15, 2007

36. Corpwatch Information, www.corpwatch.org, March 1, 2008

37. Corpwatch Information on WWF, http://www.corpwatch.org/article.php?id=14878, March 15, 2008

38. Zoe's Ark Information, http://www.csmonitor.com/2007/1228/p07s02-woeu.html, February 15, 2008

Data Reference

39. WWF data, www.wwf.org, September 15, 2007

40. WCS data, www.wcs.org, October 1, 2007

41. IUCN random sample, www.iucnredlist.org, October 15, 2007

42. Butterflies states as honorary birds, Sir Robert May, SCB Meeting, Hilo, HI, 2001