INTEGRATIVE COMPLEXITY OF COASTAL RESOURCES MANAGEMENT:

EXAMINING TRADEOFFS BETWEEN ECOSYSTEM PROTECTION AND RESOURCE USE

By

Mary E. Allen

August 2018

Director of Dissertation: Dr. David K. Loomis

Major Department: Coastal Resources Management

ABSTRACT:

The management dilemma of use versus protection is a complex issue, and like most complex issues, it does not lend itself to a simple or simplistic solution. This dissertation research examined the connection between integrative complexity, value orientations, and attitudes toward coastal resource use and protection. These are important topics within the human dimensions of coastal resources management that can help us understand the cognitive processes people use when thinking about acceptable tradeoffs regarding the biophysical environment and use of that environment. Integrative complexity is a concept that indicates the simplicity versus complexity of a person's thinking process. A person who perceives nuance and subtle differences typically scores higher on an integrative complexity measure, whereas those who view the world as black and white score low on integrative complexity. The limited research into the linkages between integrative complexity and components of the cognitive hierarchy, as applied to coastal resource management, inspired this research. Florida-licensed recreational saltwater anglers were sent an online questionnaire. Of the three quantitative integrative complexity measures that were developed, the self-classification vignettes best segmented the anglers into low to high levels of integrative complexity. These integrative complexity levels were used in hypothesis testing. Based on the literature, it was hypothesized that higher integrative complexity thinkers would hold pluralistic value orientations, moderate attitude extremity, and higher acceptability of tradeoffs between use and protection. While much of the results showed mixed support for the alternative hypotheses, there were consistent patterns in the direction of value orientations, attitudes and acceptability of tradeoffs across

integrative complexity levels. Overall, high integrative complexity anglers demonstrated ecocentric value orientations, more support for protection-oriented management actions, and higher acceptability for tradeoffs involving an increase in resource protection. Low integrative complexity anglers demonstrated relatively more anthropocentric value orientations, more support for use-oriented management actions, and higher acceptability for tradeoffs involving an increase in resource use.

INTEGRATIVE COMPLEXITY OF COASTAL RESOURCES MANAGEMENT:

EXAMINING TRADEOFFS BETWEEN ECOSYSTEM PROTECTION AND RESOURCE USE

A Dissertation

Presented to the Faculty of the Coastal Resources Management Program

East Carolina University

In Partial Fulfillment of the Requirements for the Degree

Doctor of Philosophy

In Coastal Resources Management

By

Mary E. Allen

August 2018

INTEGRATIVE COMPLEXITY OF COASTAL RESOURCES MANAGEMENT:

EXAMINING TRADEOFFS BETWEEN ECOSYSTEM PROTECTION AND RESOURCE USE

By

Mary E. Allen

APPROVED BY:

DIRECTOR OF
DISSERTATION:____

David K. Loomis, Ph.D.

COMMITTEE MEMBER: ____

Jennifer L. Bowler, Ph.D.

COMMITTEE MEMBER: ____

David G. Kimmel, Ph.D.

COMMITTEE MEMBER: ____

Cliff G. McCreedy

COMMITTEE MEMBER: ____

Kevin O'Brien, Ph.D.

COMMITTEE MEMBER: ____

Paige P. Viren, Ph.D.

DIRECTOR OF
COASTAL RESOURCES MANAGEMENT PROGRAM:

____

Siddhartha Mitra, Ph.D.

DEAN OF THE GRADUATE SCHOOL: ____________________________________

Paul J. Gemperline, Ph.D.

ACKNOWLEDGMENTS

Many individuals were involved throughout my doctoral research and are deserving of credit. I would like to express my deepest appreciation and gratitude to my committee chairman and Ph.D. advisor, Dr. David Loomis, for his patient guidance, mentorship, friendship, and genuine good nature. Dave was a constant source of encouragement and support during my graduate study at East Carolina University, and I am sincerely grateful for everything he has done for me. His commitment, dedication and daily guidance have made possible my development and growth as a student, researcher, and individual. I am truly fortunate to have had the opportunity to work with him.

I would like to thank my committee members for the friendly guidance, thought-provoking suggestions, professional insight, and general collegiality that each of them offered to me over the years. Dr. Paige Viren provided me with various opportunities to enhance my research experience and grow in my professional career, as well as friendship and advice on life. Dr. Kevin O'Brien provided invaluable advice and spent countless hours with me talking about statistics and experimental design. I had the pleasure of working with Cliff McCreedy on National Park Service projects and learning about "real-world" coastal management issues. Dr. David Kimmel offered expertise in coastal-marine ecology, provided moral support and a sense of humor. Dr. Jennifer Bowler was my social psychology professor and introduced me to a range of theories and literature.

I would also like to thank East Carolina University for the support and funding that was provided to me during my time in Greenville, especially Dr. Hans Vogelsong, Dr. Sid Mitra, and Dr. David Griffith. In addition, I would be remiss if I did not thank the exceptional staff of the Institute for Coastal Science and Policy, Kay Evans, Cindy Harper, and Shelia Ellis. I am also indebted to the Florida Fish and Wildlife Conservation Commission and the Florida recreational saltwater anglers who participated in this study.

Finally, nobody has been more important to me in the pursuit of this endeavor than my family and friends. I am grateful for their endless love, patience, tolerance, and understanding throughout the course of my doctoral studies. Thank you to my parents, Tom and Julie Allen, and my brothers, Carter and William, whose love and guidance are forever with me in whatever I may pursue. I wish to express a special thank you to Ari, Casey Nolan and family, my fellow colleagues, friends and North Carolina family—Alyson Flynn (Lewis), Michael Flynn, Richard and Suzanne Lewis, Cale Galloway, and Jennifer Jones—lots of love to you all.

TABLE OF CONTENTS

LIST OF TABLES

PAGE

LIST OF FIGURES

PAGE

1. INTRODUCTION

Coastal ecosystems provide the public with a variety of benefits that are rich in social, cultural, and economic value (e.g., aesthetic value, fisheries, recreation and tourism). These benefits, known as ecosystem services, are both tangible and intangible, and are created by particular sets of ecological conditions and processes that are explicitly tied to social value (Loomis & Paterson, 2014; Moberg & Folke, 1999; Ranganathan et al., 2008). Society depends on a range of ecosystem services, including the provision of clean water and clean air, food production, recreation, tourism, natural hazard protection, infrastructure and housing, and fulfillment of cultural, spiritual, and intellectual needs (Ranganathan et al., 2008). The ways in which these services are valued are diverse, and these values form the basis for how people interact with the coast and respond to coastal issues. Different people will have different preferences for ecosystem services. This implies that the acceptability of management actions will depend on society's perceptions regarding the relevant costs and benefits that are received from different services. However, cost-benefit assessments are not at all straightforward; rather, they are complex because people generally differ in their values, beliefs, motivations, abilities and constraints regarding various ecosystem services. Ultimately, coastal zones are valuable and sensitive areas characterized by complex and interconnected social, ecological, economic and political systems.

Debates regarding how coastal and marine resources should be managed often occur because society holds a mix of differing values such as the desire to protect wildlife habitat and species populations, while at the same time, have access to recreation opportunities and the benefits of using natural resources. Multiple and competing goals are typical of issues referred to as "wicked" problems and "messy" situations (Lachapelle, McCool, & Patterson, 2003). Controversy over protection of species and their critical habitat pits preservation-oriented environmentalists against the use values and goals of coastal developers, residents, and tourists. Proponents of protected area designations are often at odds with those who value the consumptive use of natural resources. For example, consider the conflicting values of endangered species protection versus the public's desire for beach access to and recreational use of natural resources. On one hand, expanding critical habitat area for the protection of a threatened or endangered species (e.g., green sea turtle, piping plover) would likely result in decreasing levels of beach access and recreational use for the public (e.g., beach camping, ORV driving). This would likely have impacts on the number of jobs available to those who provide tourism and hospitality services to visitors, and further impact the local economy. On the other hand, while increasing levels of beach access and recreational use could boost tourism revenue and economic benefits, it would likely result in minimizing ecosystem protection or potentially incur negative impacts to species and their natural habitat. To a large extent, these debates center on preservation versus use value orientations (Stern & Dietz, 1994). These values are guides and determinants of social attitudes, ideologies, and behavior (Rokeach, 1973). Social value systems are not clear-cut; rather, they are diverse and multidimensional, leading to a range of possible societal responses to a single management action. Thus, the challenge of balancing societal goals to protect the ecosystem, while also having access to or use of natural resources is much more complex than just “use versus protection”.

Coastal Resources Management Dilemma

Coastal and marine resources have a long history of being treated as open access resources that belong collectively to everyone. For instance, the “freedom of the seas” principle is based on the notion that oceans are too immense to be harmed by human impacts and therefore, unlike land, need no protection or property designation (Ostrom, 1990). Fish living in public waters are considered a common property resource and are held in trust to be managed for the public by state and federal agencies (Fletcher & Wallace, 2001). In the absence of established property rights or territories, open access resources are susceptible to the commons dilemma (Hardin, 1968). Commons dilemmas are resource situations where there are conflicts between individual and collective rationality and between short-term and long-term gains or losses. Similarly, open access resources often create social dilemmas whereby each individual receives a higher payoff for a socially defecting choice (e.g. catching as many fish as possible) than for a socially cooperative choice (e.g. fishing in a sustainable manner) (O’Connor & Tindall, 1990). Although individuals are better off in the long-term if everyone cooperates, enticing short-term incentives for defecting and avoiding personal loss typically can result in unsatisfactory outcomes for all. Thus, there is a rationale for governments to intervene.

The management of coastal resources has evolved over time in relation to shifts in society's values and desires. In the past, there were numerous uncontrolled opportunities for natural resource use and the belief that resources were inexhaustible. This belief faded as the need for natural resource management became recognized, but support for the way resources would be managed was split between biocentric and utilitarian views (Kennedy & Thomas, 1995). Over the years, value priorities shifted from a resource conservation focus to an environmental protection focus. These shifts occurred in response to historical events and trends such as population growth, economic expansion, transportation, more efficient communication, and technological advances. By the 1970s, emerging research on pollution and population growth ignited societal concern over threats to the environment and humanity. Along with the environmental movement came the enactment of numerous environmental laws, and additional governmental agencies and institutions were established to address the public's concerns and to identify solutions. Scientific knowledge expanded into numerous disciplines and conservation professions became increasingly specialized. But today, with unprecedented and intensifying pressures to our natural resources, the traditional arguments in support of ecosystem protection alone are not sufficient to address contemporary issues.

This situation represents the coastal management dilemma, which simply states that there are no solutions to one problem that do not at the same time violate some other management goal or constraint (Lachapelle et al., 2003). This dilemma is clearly reflected in various enabling legislation, such as the Coastal Zone Management Act (CZMA) of 1972 and the National Environmental Policy Act of 1970. These laws are political expressions of natural resource values explicitly derived from the social system (Kennedy & Thomas, 1995). Recognizing the increasing conflict between protection and use of our nation's coastal zones, the CZMA (1972) declared that it is national policy to "preserve, protect, develop, and where possible to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations" (16 U.S.C. 1451). Under the CZMA, coastal management programs are directed to "achieve wise use of the land and water resources, giving full consideration to ecological, economic, cultural, historic, and aesthetic values". In addition to the CZMA, many other national policies have broad directives, such as the National Park Service Organic Act of 1916, which authorizes both conservation and visitor enjoyment, and the National Marine Sanctuary Act of 1972, which calls for environmental protection balanced with public access, recreation and tourism, economic development, cultural uses, and more (Austin et al., 2004; Chasis, 1985).

The primary governing law for fisheries management in the United States is the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 1979. The overall objective presented by the MSA is to establish conservation and management measures, which are "necessary and appropriate for the conservation and management of the fishery, to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery." Due to the complex and challenging nature of this objective, the MSA has been amended several times over the years and continues to be the subject of controversial debate and litigation. In 1990, tuna and other highly migratory species became regulated under the MSA with the goal "to build domestic fisheries with a focus on efficiency and economic growth" (NMFS, 2010). As fish stocks continued to decline, many conservationists argued for an amendment to better protect fishery resources. In 1996, Congress passed the Sustainable Fisheries Act (SFA), amending the MSA to make several changes regarding bycatch and the conservation of fish habitat. Additionally, equal treatment provisions dictated that conservation efforts by NMFS allocate harvest restrictions fairly and equitably among the commercial and recreational fishing sectors. The enactment of the SFA signifies a turning point in fisheries management, with goals shifting from a policy focused on the fishing industry, to a policy that made ecosystem protection its primary purpose. In addition, more recent amendments arising from the 2006 MSA Reauthorization, called for an immediate end to overfishing through the use of annual catch limits and accountability measures, encouraged market-based fishery management through limited access, and mandated increased international cooperation.

Clearly, any effort that attempts to prioritize various management goals in a satisfactory manner that meets the dual mandate dictating coastal resource management actions is complicated. Managers, largely, must manage not just for the resource itself, but also for the social values that are attached to and are derived from that given resource. That is, we manage our resources with respect to what society prefers and will benefit from. Still, this must be done with caution, as any positive benefit or gain is likely linked to some environmental cost or risk. As Hardin (1968) described in the "Tragedy of the Commons", collective rather than individual behavior can significantly harm a resource, as each minor individual act is cumulative. An individual may think that his or her behavior is rational because the marginal benefit outweighs the marginal cost. Collectively, however, marginal costs will exceed marginal benefits. Thus, it is not possible to maximize environmental protection, and at the same time maximize public access and use (Hardin, 1968).

On a global scale, increases in the demand for ecosystem goods and services that resources provide have meant that more stringent policies that regulate their use are being implemented more frequently (Caddy, 1999; Holling & Meffe, 1996; Ostrom et al., 1999). Management actions are taken to guide a system towards achieving desired goals and objectives (which are socially derived) but are usually subject to a set of externally imposed constraints (Davidson, Wood, & Griffin, 2009). There are many formal and informal social constraints that exist throughout society on how people should, and do, interact with resources and ecosystems, on the distribution of rights to access, and responsibilities for stewardship (Lertzman, 2009). Limitations on human activities are necessary for the future of effective functioning of natural resources and the wellbeing of people dependent on them. However, such restraints can also impose significant and immediate levels of stress upon individuals, industries, and communities to such an extent that their ability to adapt, tolerate or prosper under a new policy is compromised (Machlis & Force, 1988) and the resource itself can be left unprotected (Marshall, Marshall, & Abdulla, 2009).

One example illustrating the management dilemma is the designation of marine protected areas (MPAs). To help protect and restore coastal and marine resources, and to conserve biodiversity and cultural heritage sites (e.g., shipwrecks), many scientists and resource managers promote the use of marine protected areas (Jamieson & Levings, 2001). The term “marine protected area” encompasses a wide range of ocean management systems whose classification includes multiple uses, closed areas, marine reserves, harvest refugia, and other various designations (Agardy, 2000). While these designations differ in terms of specific regulations and restrictions, they all impose some level of excludability or area-based management on the use of ocean resources.

Over the past several decades in the U.S., there has been a dramatic increase in the number of MPAs established at all levels of government, and more than 1,600 federal and state/territory sites exist today. These conservation efforts were set-forth with two Executive Orders creating the Coral Reef Task Force (1998) and National System of MPAs (2000). The task force recommended designating special areas, including “no-take” zones. Since then, important questions remain on how MPAs affect local, regional, and national stakeholders who depend on the ocean for their livelihood and wellbeing. MPAs are typically justified with reference to ecological priorities, but they also have significant social, cultural, and political implications. Numerous policy alternatives exist concerning the combination of activity types and use levels that are allowed or restricted within a protected area boundary. For example, under the National Marine Sanctuaries Act (1972), marine sanctuaries have been established for areas such as the Florida Keys and Monterey Bay. Most of the national marine sanctuaries are marine protected areas that restrict a few specific activities but allow others to continue. For instance, recent actions quadrupled the size of the Papahānaumokuākea Marine National Monument. The designation prohibits fishing near the northwestern Hawaiian Islands and has spurred tremendous debate over imbalance between the protection and use of marine resources. With this action, the total number of MPAs now cover 26% of U.S. waters and no-take MPAs cover 13% of U.S. waters (NOAA, 2016), mostly in the Central and Western Pacific Ocean.

It has been shown that social, cultural, economic, and political factors can be more influential in shaping the success of marine reserves than biological or physical factors (Fiske, 1992; Mascia, 2004; Pomeroy, Mascia, & Pollnac, 2007), and positive attitudes towards MPAs are necessary for successful management (Dahl, 1997; Himes, 2007). The multiple stakeholders of MPAs are diverse, and as such, people respond differently to MPA decisions. From a social perspective, MPAs inevitably bring with them disagreements over the situational appropriateness of particular allocation norms (equity, equality, need) (Deutsch, 1975), as well as issues concerning the fairness associated with the decision-making process (procedural justice) and with the allocation of the resource itself (distributive justice).With any change in the level of restriction and type of consumptive or non-consumptive use, there are bound to be contentious distributional issues among the different interests involved (Holland, 2000). For example, some people will view “no-take” marine reserves as favoring non-consumptive use values (e.g. diving, nature viewing, research) over consumptive use values (e.g. fishing, energy extraction). Commercial fishing interests have been quick to point out the costs stemming directly from the reduction in fishable waters and the resulting displacement of fishing effort (Mascia & Claus, 2009). Recreational fishing groups emphasize the economic losses, in terms of angler expenditures and multiplier effects, which could result from such marine reserve designations (Southwick, 2009). Similarly, stakeholder groups may benefit or be burdened disproportionately depending on the location of a MPA. For example, if a MPA is sited in state waters (i.e. within three miles from shore), inshore commercial and recreational fisheries could potentially incur the higher cost, while offshore commercial fleets could receive some of the benefits (Sanchirico, Eagle, Palumbi, & Thompson, 2010).

People value both the use and the preservation of natural resources, but the challenge is in defining appropriate levels of each. These parameters must also consider policy mandates, biophysical processes, and the feasibility of achieving any desired condition. Tradeoffs between natural resource protection and use objectives are inevitably associated with the delivery of ecosystem services. However, many of the associated problems that arise are due in large part to an inadequate theoretical understanding of the people living in and/or benefiting from those ecosystems. Management questions cannot be answered with biophysical information alone. Answers to these questions are normative and involve standards that are exclusively judgments made on factors that are socially and politically desirable. We must first understand what the public considers to be the acceptable condition of an ecosystem given a desired set of ecosystem services, and what tradeoffs between resource use and protection are acceptable.

Ecosystem Services

The concept of ecosystem goods and services has become central to the discussion about the dependence of humans on nature and what that means both socially and economically (Costanza & Farley, 2007). A primary management goal of today focuses on how to maintain specific ecosystem services for future generations, while at the same time allowing the current generation to use and benefit from them. This goal is rooted in an ecosystem-based management approach (EBM). The ecosystem-based management (EBM) paradigm moves beyond how people impact the environment to consider how people are part of ecosystems and also benefit from their services. Since 2010, EBM has been a lead directive in U.S. Ocean Policy (i.e., NOAA's Generation Strategic Plan and the Final Recommendations of the Interagency Ocean Policy Task Force), and now directs agencies to incorporate ecosystem services into federal planning and decision-making (OSTP, 2015). The EBM approach goes beyond the tendency to investigate the natural world from a rigid, single bio/physical scientific perspective that has resource "protection" as its goal. Rather, it calls for a balance between environmental, economic, social, and cultural factors in both the research and management context to provide more flexible and meaningful insights for coastal resource management strategies (Lubchenco & Sutley, 2010; Weinstein et al., 2007). While shifts toward ecosystem-based management may employ adaptive and flexible management regimes, the values, theories, methodologies and tools of the old paradigm have not been completely discarded. Implementing EBM requires an interdisciplinary and collaborative effort that places questions of human uses and values at the center of their approach (Campbell et al., 2009; Kennedy & Thomas, 1995; Machlis et al., 1994; Sanginga et al., 2010).

Ecosystem goods and services have been defined as the conditions and processes through which natural ecosystems, and their associated species, sustain and fulfill human life (Moberg & Folke, 1999). Examples include provision of clean water and clean air, maintenance of livable climates (carbon sequestration), pollination of crops and native vegetation, as well as fulfillment of people's cultural, spiritual, and intellectual needs. Ecosystem services are also described as the benefits, both tangible and intangible, created by particular sets of ecological characteristics that are explicitly tied to social value (Dore & Webb, 2003; Olsson et al., 2004; Ranganathan et al., 2008; Turner et al., 2003). In other words, ecosystem services are the outcomes of ecosystem functions that yield value to people.

The ecosystem service values relative to marine and coastal resources are diverse. They are founded in the public's desire to conserve, recreate in, consume, profit from, and preserve marine and coastal environments. These values originate in society's ongoing interactions with the coast and coastal issues and are then expressed through the democratic process to those who make law and develop legislative policy. Some ecosystem processes produce multiple outcomes, for example nutrient cycling in a wetland can result in cleaner water. Nutrient cycling is therefore a service indirectly utilized by humans, while provision of clean water is a direct service and a benefit. Recreational activities, such as bird watching, provided or enhanced by the existence of a wetland and related features are also a benefit.

Initiated by the United Nations in 2001, the Millennium Ecosystem Assessment (MEA) offers an appraisal of the world's ecosystems and the services that they provide. The MEA created an organizational framework for ecosystem services commonly used today, whereby ecosystem services are categorized into provisioning, regulating, cultural, and supporting services (de Groot et al., 2010; Fisher et al., 2008; Millennium Ecosystem Assessment [MEA], 2005). *Provisioning services* are products obtained from ecosystems that people can use for their benefit, such as food, fresh water, and timber. *Regulating services* are the benefits provided from the management of ecosystem functions, including water purification, carbon sequestration, and pollination. C*ultural services* are the benefits that people derive from ecosystems that are not material in nature. These services include spiritual and religious values, aesthetic values, recreation and eco-tourism, education, and cultural heritage. *Supporting services* do not benefit people as directly, but are critical natural processes required for the other ecosystem services to be produced, such as nutrient cycling and soil formation.

Ecosystem services, in turn, influence human wellbeing in areas such as health and basic material requirements (MEA, 2005). Daily et al. (2009) observe that the intent of understanding and valuing natural capital and ecosystem services is to make better decisions, resulting in better actions relating to the use of land, water, and other elements of natural capital. This contributes to understanding the costs and benefits of alternative management actions being identified.

Valuation of Ecosystem Services

The October 7, 2015 Presidential Memo, *Incorporating Ecosystem Services into Federal Decision Making*, "Directs agencies to develop and institutionalize policies to promote consideration of ecosystem services, where appropriate and practicable, in planning, investments, and regulatory contexts." Research has attempted to value the social costs and benefits of conserving biodiversity and ecosystem services (e.g., Balmford et al., 2002; Chan et al., 2006; Daily et al., 2000; Goldstein et al., 2006; Turner et al., 2003). Much of this research has focused on economic methods and concepts such as Total Economic Value (TEV), presenting a framework for the monetization of ecosystem goods and services (e.g., Costanza et al., 1989; Daily et al., 2009). TEV of an ecosystem habitat is derived by valuing all direct-use, indirect-use, and non-use values (Barbier, 1989). Contingent valuation (CV) and gross income comparison are commonly used methods in determining a dollar value for the conservation of a species or ecosystem (Farber et al. 2002). Common to most valuation studies is the estimation of consumer surplus or welfare often expressed as willingness-to-pay (WTP). It is often applied in the context of public goods such as air and noise pollution, or used in damage assessments and cost benefit analyses for various types of development projects (Bateman et al., 2011). Using the contingent valuation method, a hypothetical market for a non-market good or service is created by asking people how much money they would be willing to pay for that particular benefit (Mitchel & Carson, 1989). The goal of contingent valuation is to elicit from people what they would be willing to pay to protect some environmental asset or what they would have to be paid to give it up (Berk & Fovell, 1999).

Non-market valuation techniques have also gained traction in valuing quasi-public goods, in particular, determining values associated with recreation. These studies typically estimate the recreational values associated with a range of environments and activities. However, many of these studies often tend to focus on a single activity, rather than attempting to look at values for ecosystem services as a whole. Valuation is also challenging because ecosystems are “systems” with feedbacks, time lags, nested processes and other complex dynamics.

Assigning monetary values such as dollars to ecosystem services is a defensible strategy that can aid in the challenge of allocating limited resources among competing demands. Monetization also has the advantage of expressing impacts in the same units of measurement as the cost of response measures, which in turn facilitates the comparison of the costs and benefits (Frankhauser et al., 1998). Yet, there are still criticisms in valuation techniques and needs for improvement. Major issues with valuation methods concern the validity of WTP estimates for environmental benefits, inconsistency and bias (Pearce & Turner, 1990). Valuation is a challenge because many of the associated costs and benefits are not part of the traditional economy or traded in markets (Vaze, Dunn, & Price, 2006). For instance, ecosystem services are sometimes confused with biodiversity. Biodiversity, which refers to the variability among living organisms within species, between species, and between ecosystems, is not itself an ecosystem service. Rather, biodiversity is an underlying component that contributes to the quality and social value of ecosystem services. The way in which people value biodiversity is captured under the ecosystem services of “ethical” and “existence” values. Other ecosystem services that are directly dependent on key components of biodiversity include food, genetic resources, timber, biomass fuel, and ecotourism.

Due to the challenging nature of ecosystem valuation, many ecosystem services are often not recognized or considered in the decision-making process (Brander, Van Beukering, & Cesar, 2007). Societal preferences are often overlooked in decision-making and most evaluations focus on obtaining objectively measurable, biophysical (e.g. Chan et al., 2006) or economic estimates (e.g. Costanza et al., 1997; Martin-Lopez et al., 2012). Preferences are important because they reflect people’s priorities and help with the interpretation of their actions. Filling this gap is of utmost importance because discounting important ecosystem services can contribute to the gradual loss of some of the essential, communal life support services such as climate regulation, carbon storage, cultural heritage, aesthetics, erosion protection and waste disposal. Explicitly accounting for these benefits, using a range of social and economic metrics would reveal hidden costs and benefits to many current practices and yield decisions that most readily reflect the true value of the natural environment to society. Actual measurements of ecosystem services should be split into a) the capacity of an ecosystem to provide a service (e.g., how much fish can a lake provide on a sustainable basis), and b) the actual use of that service (e.g., fish harvesting for food or for use in industrial processing). Measurement of the importance (value) of that fish in terms of nutrition value, a source of income and/or way of life is then part of the human value domain.

Although economic valuation methods have significant potential to advance policy and the conservation of ecosystem services, there are other legitimate methods that have been applied to topics such as recreation satisfaction, tourism, human wellbeing, storm surge protection, commercial activity, or public health. Specific research on areas like the social benefits of coastal restoration, hazard mitigation, and public preferences for shoreline management is also being conducted. These research topics, although not traditionally considered under the ecosystem services title, are in fact ecosystem services. They represent a broader picture of ecosystem service valuation that can be recognized and utilized. Identifying the reasons and motivations of people help managers understand which services are relevant for different stakeholders and which tradeoffs need to be addressed when making decisions.

For example, information about value orientations are important because they can be determinants of more specific attitudes that can help explain patterns of human behaviors toward coastal resources (Vaske & Donnelly, 1999). For instance, people may demonstrate a range of depreciative or conservative behaviors toward a coral reef, depending on how they use the resource. Research in the tourism sector shows that SCUBA divers are more likely to have protectionist orientations toward coral reefs, so a manager seeking to encourage conservation-related behaviors may want to target these groups (Briggs, 2005). This type of information is additional evidence that can support economic valuation methods such as travel cost, willingness to pay, and other techniques by offering a cognitive component. Incorporating other perspectives can reveal hidden aspects that can significantly alter the way resources are managed.

Tradeoffs

Another important consideration in evaluating ecosystem services is the notion of tradeoffs. Tradeoffs arise because people's interests vary and so they value different aspects of the same system (Hicks et al., 2009). However, many attempts to identify ecosystem service tradeoffs have tended to oversimplify and ignore the distribution of benefits between diverse groups and individuals within society, thus failing to identify who benefits and who loses in the flow of ecosystem services (Daw et al., 2011). Balancing the delivery of a range of services is particularly critical for coastal and marine ecosystems, which face growing human populations and development, increasing associated impacts, and declining ecosystem services. Coastal and marine systems can be especially challenging given the general absence of property rights and desire to access resources, in addition to multiple uses, conflicting goals and regulations.

A principal difficulty is in determining how much impact or change should be allowed in environmental resources, the quality of ecosystem services, and the extent and direction of management actions. The issue is emphasized by the threshold effect, which refers to the "tipping point" at which a system may change abruptly into an alternative state (Scheffer et al., 1993; Scheffer et al., 2001). Understanding the conditions under which thresholds are likely to be crossed and what mechanisms underlie threshold behavior is critical. In an ecosystem, an ecological threshold describes the point at which there is an abrupt change in quality or characteristic, or where small changes in a driver may produce large responses in an ecosystem. With regards to ecosystem-based management, we must be able to determine specific thresholds that, once crossed, move the system away from the "desired state". Some change in the environment is inevitable, but sooner or later the amount, nature, or type of change may become unacceptable to society. Thus, more pressing questions for management are what ecosystem conditions do people desire, and at what point does the amount of change to an ecosystem become too much or surpass the limits of acceptable change? The answers to these questions are multifaceted and involve societal choices and negotiation of values and aims.

One way in which ecosystem service tradeoffs and thresholds have been modeled is based on production theory, which considers how different inputs produce different levels of outputs, typically expressed as production functions. When applied to ecosystem services, production functions are models that translate the structure and functioning of ecosystems into the provision of ecosystem services (Daily & Matson, 2008; Sanchirico & Mumby, 2009; Tallis & Polasky, 2009). Production functions have been used to value non-market ecosystem services that can be considered as inputs into the production of goods and services with market value (e.g., seagrass habitat as nursery grounds is an input into fisheries), but also applies to services that are not readily connected to market outcomes. An important consideration is that there may be many potential ecosystem service outcomes and benefits that can arise from a given set of inputs. This provides a basis for examining which outcomes are optimal in terms of providing the combination of services that are important to society.

Ecosystem service outcomes can be analyzed graphically by producing a Production Possibility Frontier (PPF) to evaluate tradeoffs (Figure 1). In the context of ecosystem-based management, this involves some quantification of the ecosystem services produced across a range of potential management actions (e.g., all possible MPA siting options, all possible harvest regulations). The axes of the graph correspond to levels of ecosystem services and each point corresponds to the outcomes from a given set of management actions that are known or estimated to produce amounts of each service. In the PPF, all points on the curve are points of maximum productive efficiency, whereby one service cannot be further increased without a cost in terms of the other service. All points inside the curve can be produced but are productively inefficient (also referred to as Pareto Efficiency), and all points outside the curve cannot be produced with the given, existing resources. Points that lie to the extreme left or right on the curve are attainable but at the cost of the other service. A balance between services is achieved in the middle of the curve. This ecosystem services "frontier" depicts management options that provide for the optimal delivery of the two or more services (Guerry et al., 2007; Polasky et al., 2008; Smith et al., 2012).

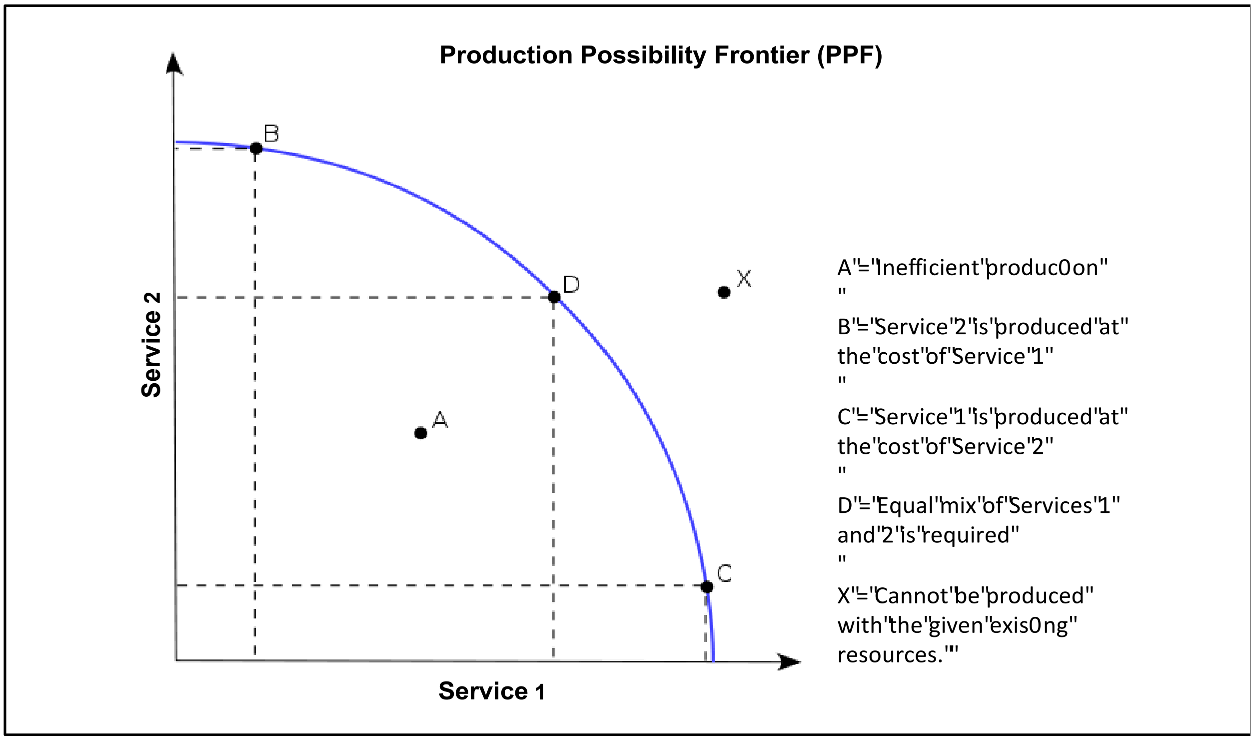


Figure 1. Production Possibility Frontier (PPF).

The production function is just one example of an approach to evaluating tradeoffs among ecosystem services. Most applications of an ecological production function modeling approach have been done at small scales or for a single ecosystem service. Challenges in ecosystem services valuation lie in our relatively limited knowledge of ecosystem complexity and interrelationships among multiple services. Researchers also acknowledge that it is difficult to accurately estimate production functions and in particular, define what is meant by “societal preference” (Tallis & Polasky, 2011). This is an important point to consider given the diversity of social values, perceptions and preferences related to coastal and marine uses.

Stated preference and choice experiments are other methods used to study tradeoffs. Oh and Ditton (2006) investigated differences in anglers’ preferences for management restrictions using a stated preference choice approach and follow-up scenario analysis. This method elicits preferences with a set of hypothetical choice sets that include the most important decision attributes and levels of those attributes (Boxall et al., 1996; Louviere, Hensher, & Swait, 2000). This assumes that individuals make rational decisions on multi-attributes of items viewed simultaneously (Schroeder & Louviere, 1999). Oh, Ditton, Gentner, and Riechers (2009) suggested that this approach is useful for understanding how individuals make tradeoffs among regulatory attributes in light of changes in their expectations.

DPSER Framework

Managing for ecosystem services while illuminating tradeoffs is rooted in the ecosystem-based management approach. A more integrated approach to coastal resources management considers the interrelationship of social, cultural, economic and environmental processes in both the research and management context to provide more meaningful insights for coastal resource management strategies. The *Drivers-Pressures-State-Ecosystem Services-Response* (DPSER) model integrates human dimensions and biophysical information into a framework that illustrates the complex interactions of human dimensions with ecosystem services (Kelble et al., 2013). These interactions represent a causal network and are ultimately involved in management tradeoffs. Throughout the model, humans are implicit but most directly involved in their *Response* (Figure 2). The DPSER model is an altered version of the *Drivers-Pressures-State-Impacts-Responses* (DPSIR) model, which was developed as a means of structuring and organizing indicators in a way that was meaningful to decision makers (Smeets & Weterings, 1999; OECD, 2003). However, a key issue of the DPSIR framework was “the lack, so far, of efforts to find a satisfactory way of dealing with the multiple attitudes and definitions of issues by stakeholders and the general public” (Svarstad et al., 2008, p. 116). By focusing on *Impacts*, the DPSIR model implied only negative environmental consequences of the human/environment interface and did not explicitly include *Ecosystem Services* or the positive benefits humans derive from those services and the ecosystem.

In the DPSER model (Figure 2) developed by Kelble et al. (2013), *Drivers* are factors that result in pressures that in turn cause changes in condition of the system. Drivers can be any combination of natural (e.g., climate variability) and anthropogenic (e.g., coastal development) forces that are the underlying cause of change in the coastal marine ecosystem. *Pressures* are the particular manifestations of *Drivers* within the ecosystem, and include physical, chemical, and biological factors (e.g., coastal pollution, habitat loss and degradation, or fishing effort) that can be mapped to specific drivers. For example, coastal development can result in increased coastal armoring and the loss of associated intertidal habitat.

State refers to the condition of the physical, chemical, and biological attributes of the coastal environment. Attributes include descriptive characteristics of the environment that can be measured, such as chemical concentrations or the size of populations. Measurable attributes are used to objectively assess the status of the ecosystem condition (e.g., an abundance and diversity of fish found in an estuary can help illustrate a healthy habitat) and also include the characteristics that define ecosystem services (e.g., recreational fishing).

Ecosystem Services are the benefits that humans derive from the ecosystem. The value of ecosystem services is related to environmental conditions, and can be measured and reported in monetary, cultural, or social terms. Ecosystem service values can inform decisions that involve tradeoffs between environmental and other social objectives and between competing objectives (Farber et al., 2006; Yoskowitz et al., 2012). *Ecosystem Services* depend on the *State* of coastal and marine resources. People are not just a *Pressure* on the *State* of the environment; they also act to enhance the environment and the benefits that it provides to society.

Responses are actions that people take when there are changes in the condition in the environment (*State*) or in the *Ecosystem Services* provided. This component represents a feedback mechanism through which human activities can alter *Drivers*, *Pressures*, *States*, or *Ecosystem Services*. The *Response* component reflects decisions based on what people perceive about *Ecosystem Services*, the *State* of the environment, *Pressures* and *Drivers*, and the changes these cause in the ecosystem.

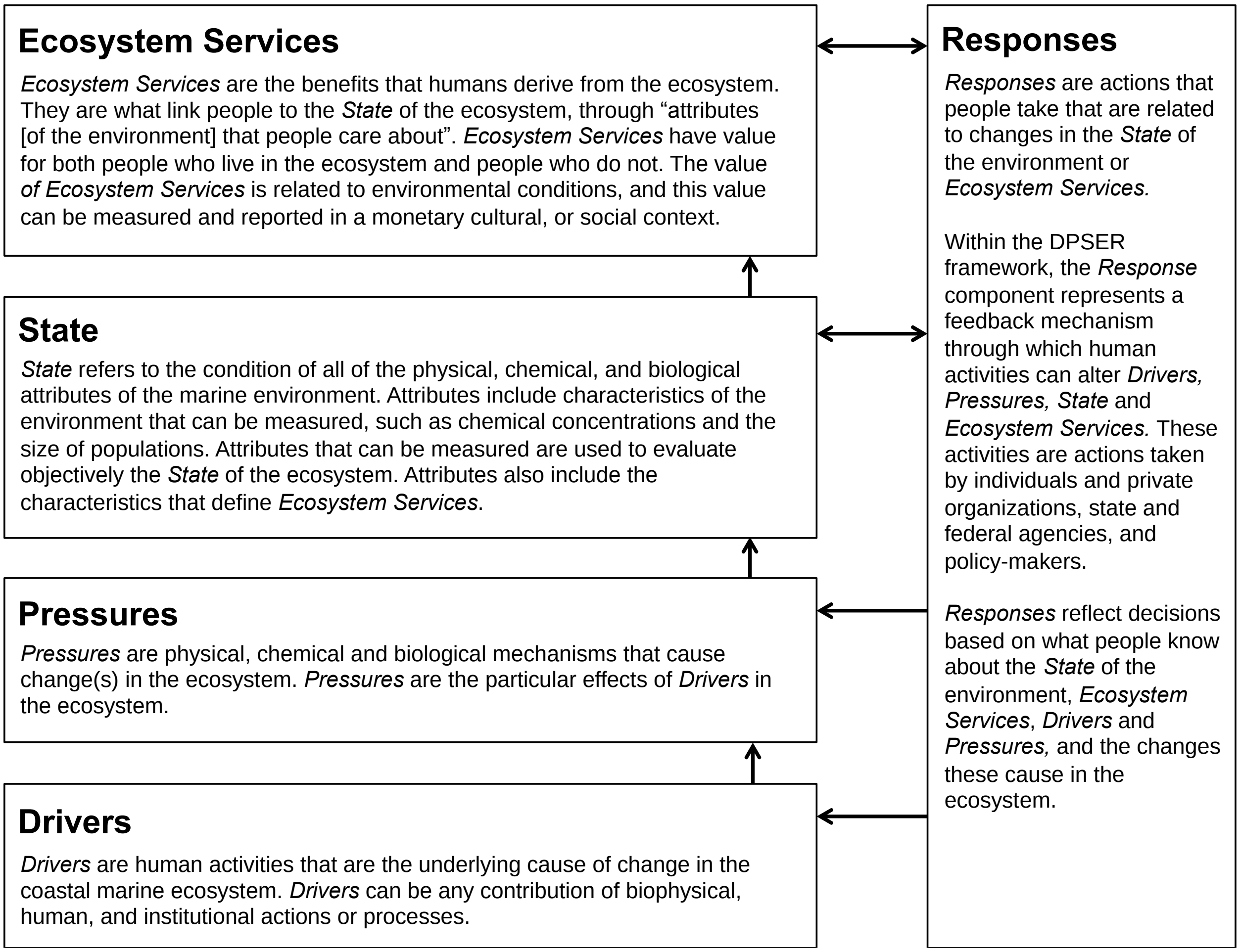


Figure 2. Drivers-Pressures-State-Ecosystem Services-Response (DPSER) framework.

The DPSER framework represents an important step towards integrating diverse scientific information and capturing a more holistic understanding of the complex interactions between the biophysical and human dimensions of the ecosystem. The incorporation of ecosystem services is central to ecosystem-based management and active efforts to sustain services that meet society's needs and values. As Bell and Morse (1999) argued, the "sustainability" of ecosystem services cannot be measured in "absolute, traditional, reductionist terms" because it oversimplifies complexity and risks reducing a variety of relevant and legitimate views and understandings to the dominant mindset of the scientist. Rather, sustainability is a highly complex concept, which is "dependent upon the various perceptions of the stakeholders in the problem context" (Bell & Morse, 1999, p. 100).

Any debate around what is an acceptable compromise between social and biophysical objectives requires an honest acknowledgement of the tradeoffs involved in achieving management outcomes. An open and integrative approach to acknowledging tradeoffs and embracing complexity starts with the assumption that no single discipline recognizes all dimensions of an issue (Hirsch et al., 2011). The use of such an approach would help recognize and expose ways in which people with particular perspectives not only have partial views of the complexity of issues, but also tend to oversimplify or take for granted the ways in which others understand complexity. A deep understanding of *integrative complexity* considers the interaction of multiple perspectives and diverse ways of knowing.

Moving Forward

Communication with the Public

The discussion above raises questions concerning the public's views on various environmental issues, how they perceive the relationship between resource use and protection of those resources, and which factors they consider important in their evaluations or decisions regarding that relationship. In the face of controversial and uncertain issues, such as climate change, or with conflicting goals, such as the desire to continue fishing while protecting critical fish species from over harvesting, the public often challenges the "experts" (i.e., managers, scientists). The typical response from the experts is the need to "educate the public", in an effort to change their attitudes and behaviors such that they will then agree with the "expert". This is a persistent yet ineffective management strategy for addressing a diverse public. Simply providing facts or information will not automatically lead to changes in attitudes or behavior. A public informed of ecological "facts" is not necessarily a public that will more frequently side with the experts. Education and outreach are indeed important but are simply not enough to change the public's attitudes, behaviors, or lifestyles (Gigliotti, 1990). This is because people tend to consciously or unconsciously select new information that confirms their beliefs, rather than changes their lifestyles to any great degree (Bright & Tarrant, 2002; Tesser & Leone, 1977). Also, human behaviors are largely driven by human values and needs, which provide people with motivations to act. For many, the connection between lifestyle and today's environmental problems is not strong enough for people to make personal changes. Different stakeholders can perceive different benefits (sometimes complementary but also competitive) from the same ecosystem process outcomes.

Education and outreach programs used to foster environmentally "responsible" behavior are often implemented within a non-theoretical framework and are generally information-intensive (Gigliotti, 1990). These programs assume that by providing people with information on an issue (e.g., endangered species protection, overfishing or global warming) and encouraging the development of attitudes that support "responsible" activities (e.g., recycling or not touching corals), behavior will change. This communication strategy is known as an "information deficit model" of behavior change and is endorsed by a number of scientists (De Young, 2000; Weaver, 1991). Delivering new knowledge to people can enhance their awareness of environmental issues and of the environmental impacts of their behavior (Steg & Vlek, 2009). This is especially true for messages that are perceived as logical and relevant to the person, and that capture their attention (Scannell & Gifford, 2013). However, the relative success of such programs will vary, in part, according to a person's "integrative complexity" or ability and motivation to think about issues in multidimensional ways. Not all people view these matters in the same way or have the desire or ability to do so. Further, the ability of individuals to see all or several sides of an issue also depends on factors that influence attitudes, such as values, emotions, and beliefs; a person's motivation can be influenced by several factors, such as the personal relevance of the issue (Bright & Tarrant, 2002). People may not be motivated to think about issues that are inconsistent with their beliefs and preferences.

Understanding How People Think

The "resilience" of coastal ecosystems and societies requires the "capacity to undergo some changes without crossing a threshold to a different system regime" (Walker & Salt, 2006, p. 32). Too much use of natural resources would change the state of the natural ecosystem, whereas too much resource protection would severely limit society's use and enjoyment of those resources. Resilience will depend on a balanced state of the coastal zone and how people interact with the environment, and how they respond to management actions. What is needed in shifting societies toward resilience is not just new tools and technology, policies, or programs, but also an open mind to diverse and evolving social values, attitudes, interests and preferences. Since human values toward natural resources change over time and space, we need to be flexible in our thinking and acknowledge that people are embedded in dynamic, interconnected social and ecological systems. These systems are complex and adaptive, and resilience requires the capacity to undergo some changes without crossing a threshold to an undesirable state or system regime (Walker & Salt, 2006). Therefore, the social acceptability of tradeoffs between the use and the protection of natural resources is of utmost importance to coastal resource management.

It is also important to understand the underlying nature of the public's concerns regarding social acceptability of coastal resource policies, in an attempt to predict acceptability of proposed practices (Thomassin et al., 2010; Winter et al., 2002). Knowing how people think about issues involving tradeoffs and how they accept certain management conditions can help us to determine how changes in the desired state of the physical ecosystem will affect its delivery of services, and vice versa. Along with understanding the acceptability of certain management decisions, it may be a necessary prerequisite to understand how people cognitively process the issues surrounding coastal resource management.

Fundamental attributes typical of complex policy and management problems include: multiple aspects that interact in complex, often unpredictable ways; no simple, easily achievable solutions; scientific uncertainties; a large number of participants or stakeholders with different, often conflicting, zero-sum priorities and perspectives; either active conflicts or the remainder of past conflicts; competing claims for leadership and/or authority; nonexistent, confusing, inappropriate, or overlapping regulatory and management mechanisms; and poorly defined, unstable decision-making processes (National Research Council, 1997). To address the wide range of dynamic and often conflicting social values and judgments, effective and longitudinal management of changing coastal ecosystems requires an adaptive, holistic approach. This involves recognition of the complex nature of problems and incorporation of flexible management approaches. There are no simple answers, there is no single answer, and there is a dynamic set of relationships that change with time and in response to situational changes. Decision processes should capture and emphasize multiple values of ecosystem services for management to be responsive to diverse and changing needs.

Many of the challenges faced are related to communication, human behavior and motivation, and how people organize to deal with them. Of critical importance to management and communication with the public is having a better understanding of the relevant audiences, by knowing which ecosystem services are valued and the conditions under which they are desired. This type of information speaks to "what" people prefer and expect, but it is also important to know "how" people think about such related matters and subsequently evaluate what is acceptable. This can be understood by determining the "integrative complexity" of human thought processes.

Furthermore, many of the significant changes in U.S. society have involved the shifting of seemingly unmovable and highly consequential attitudes. Among the most notable of these transformations were the shifts in public attitudes toward natural resources management during the 1960s – 1970s from utilitarianism to protectionism. Present day, those attitudes have shifted toward the integration of both use and protection orientations. Accordingly, the study of attitudes has been used in a variety of natural resource management situations, such as restoring wildlife (Brooks et al., 1999; Enck & Brown, 2002) and wildlife management activities (Bright & Barro, 2000; Koval & Mertig, 2004; Lee & Miller, 2003; Teel et al., 2002). However, McCleery et al. (2006) contend that many of the authors of natural resource management studies that utilize the attitude construct either do not understand or have failed to properly communicate attitudes and their social psychological frameworks, especially when examining attitude-behavior linkages. As people tend to hold certain attitudes to view issues in a positive or negative way, the efficiency of management strategies largely depends on how well they are accepted by various stakeholders.

This dissertation adopts an interdisciplinary systems research approach. Kennedy and Thomas (1995) demonstrate that the social, political, economic, and natural systems are all interconnected, and are driven by social values. They stress that natural resource values originate or are endorsed solely in the social system. This model is the heart of coastal resources management and exposes how any appropriate management decision must be made in consideration of multiple dimensions. Machlis et al. (1997) also support this interdependency in their human ecosystem approach to ecosystem-based management, which integrates relevant social, as well as ecological patterns and knowledge into the analytical process. The reason behind assessing a human ecosystem is to treat the relationships between humans and their environments in terms of flows between critical natural, socioeconomic, and cultural resources, social institutions, social cycles, and social order and organization. Focusing on the relationships between individuals and their larger ecological and social context allows for a better understanding of whom amongst a broader society, benefits from the relevant ecosystem services and how they interpret such environments.

Purpose of Research

The purpose of this dissertation is to examine the role of integrative complexity in evaluations of coastal resource issues, value orientations, and attitudes toward the use versus protection of coastal resources. These are important topics within the human dimensions of coastal resources management that can help us understand the cognitive processes people use when thinking about acceptable tradeoffs regarding the biophysical environment and use of that environment. Due to the often controversial and complex nature of many coastal resource issues, our understanding of the human-nature interrelationship can be improved by determining not only *what* people think and know, but also *how* they think about issues. More specifically, it is insufficient to simply understand what attitudes are relevant to coastal resource management; it is necessary to understand how people are thinking about the issues surrounding coastal resources.

Through the lens of integrative complexity, we may better understand the various levels to which people view coastal issues and how they may respond to management alternatives. Integrative complexity is a concept that indicates the simplicity versus complexity of a person’s mental frame and perceptual skill. A person who perceives nuance and subtle differences typically scores higher on an integrative complexity measure. Those who view the world as black and white score low on integrative complexity. Understanding how people think about management issues and decisions is critical for success in effective communication with the public and in implementing management actions deemed acceptable by the public. The use of integrative complexity can provide an even more intricate understanding of the public's perceptions of an issue, and the factors influencing the acceptance of managing coastal resources. The proposed research will examine (a) the complexity with which people think about coastal resource issues, and (b) the underlying values people hold that influence attitudes and acceptability of management alternatives.

2. LITERATURE REVIEW

In 1953, the political philosopher, Isaiah Berlin, published *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*. Berlin references a Greek poet named Archilochus who said, "The fox knows many things, but the hedgehog knows one big thing." Berlin expanded on the fable saying that the world could be divided into two categories: 1) the hedgehog who views the world through a single defining idea; and 2) the fox, who draws upon wide experiences and for whom the world cannot be boiled down to a single idea. What the fox sees, that the hedgehog does not, is that the world is much more integrated and complex than he can imagine. The strength of the hedgehog is in his focus and central vision. The power of the fox is in his flexibility and openness to experience. The hedgehog never wavers, never doubts. The fox is more cautious, more pragmatic, and more inclined to see complexity and nuance.

Like the hedgehog and fox parable, integrative complexity represents the intricacy and structure of a person's thought processes in evaluating information and making decisions. The literature on integrative complexity is multifarious and relates to many other lines of research from various disciplines. Because the emphasis of its work is on the structure of thought rather than its content, the closest relatives of integrative complexity are cognitive complexity (Bieri, 1955) and cognitive structure theories (Scott, Osgood, & Peterson, 1979). The direct line of development proceeds through conceptual systems of information processing (Harvey, Hunt, & Schroder, 1961), conceptual complexity (Schroder et al., 1967), to integrative complexity (Suedfeld & Tetlock, 1977). The following review is primarily focused on integrative complexity and how research on the construct has developed and been refined. The review expands to cover cognitive hierarchy theory and other constructs that are relevant to integrative complexity.

Cognitive Style and Complexity

The basis for cognitive complexity theories can be attributed to Kelly's (1955) Personal Construct Theory, which proposed that we construe the world and everything in it (i.e., elements) in terms of bipolar personal constructs. Kelly's construct is a bipolar dimension (e.g., desirable vs. undesirable, like me vs. not like me) that consists of the results from an individual's process of "constructing or "interpreting" events. He considered dimensions in terms of similarity and contrast, and specifically noted that construct systems are often fragmented and even illogical (Kelly, 1955). According to Kelly, a dimension (construct) emerges when two events or objects are viewed as similar and a third is viewed as dissimilar. Dimensions are presumed to relate to each other in terms of ordinal hierarchical relationships, but these relationships may be limited to certain areas (domains). The number of dimensions that a person uses to come to a conclusion is a measure of the person's cognitive complexity (Kelly, 1955).

Bieri (1955, 1961, 1966; Bieri et al., 1966) elaborated on cognitive complexity by focusing on the effects of an individual's cognitive orientation on the judgments he or she makes. Bieri discussed differentiation of the construct system both in terms of an individual's cognitive structure, and in terms of how the individual construed the social world. According to Bieri, the degree of differentiation reflected its *cognitive complexity-simplicity*. The degree of cognitive complexity is related to the number of cognitive dimensions available to an individual. In Bieri's test, participants assigned a number from -2 to +2 on various constructs of a variety of objects or people. Those high in complexity were expected to show more diversification in scoring among the different dimensions. Furthermore, Bieri maintained that, since individuals involve constructs for making predictions, those who were more complex and had greater versatility in the construct system would have greater predictive efficiency than those who were more simple and less versatile.

Other studies have viewed cognitive complexity as a style, process or system. Messick (1984) defined cognitive style in terms of consistent patterns of "organizing and processing information (p. 61)", and Kagan, Moss and Sigel (1963) defined it as "stable individual preferences in mode of perceptual organization and conceptual categorization of the external environment (p. 74)". Werner's developmental psychology (1957) suggested that increased differentiation and hierarchical integration enable the individual to adjust flexibly "to changing local circumstances and, at the same time, to maintain a long-range stability of performance" (Werner, 1957, p. 126). Following the work of Kelly, Crockett (1965) conceptualized cognitive complexity as being the hierarchical organization of an individual's construct system within the interpersonal domain of events and experiences. Crockett (1965) viewed an individual's construct system as dynamic rather than static, and maintained that construct systems undergo change in order to aid the individual in the anticipation of events. In terms of personal perception, an individual's constructs function to form impressions of others.

Cognitive Sophistication

Similar to cognitive complexity, several studies have used the term "cognitive sophistication". Glock et al. (1975) measured cognitive sophistication by an individual's intellectual interests, openness to new ideas, and willingness to risk uncertainty and ambiguity. Bobo and Licari (1989) tested cognitive sophistication as a mediating link between education and political tolerance. Cognitive sophistication was measured by the number of correct answers to a ten-word vocabulary test, originally used by Krosnick and Alwin (1987). It was assumed that a rich vocabulary was an indicator of intelligence (Krosnick & Alwin, 1987; Thorndike & Gallup, 1944; Zimmerman & Woo-Sam, 1973). Accordingly, a richer vocabulary indicated greater sensitivity to new information and an ability to reorganize ideas in more complex ways as situations demand.

Conceptual differentiation (Gardner, 1953) deals with an individual's tendency to place reality within a structure that allows them to go through the act of perceiving more easily (Gardner, 1953). If someone tends to classify objects into a relatively large number of mutually exclusive categories, they are said to show a high degree of conceptual differentiation. When someone uses few categories, they are exhibiting a low degree of differentiation. Gardner found that people use this level of cognitive process in several situations and tend to be consistent with their various cognitive styles. Gardner's work suggests that an individual will show one level of cognitive process and maintain that level for other situations.

Conceptual Complexity

“Conceptual complexity” grew out of the earlier, more general ideas of Harvey, Hunt, and Schroder (1961) who were initially interested in conceptual structures of information acquisition and processing. In this earlier work, “system” operations were more discontinuous and progressed through stages. They were defined in terms of content and behavioral directionality, and were less systematically related to situational or social factors. Schroder, Driver, and Streufert (1967) refined operations for conceptual complexity that are based on organizational properties allowing for the examination of empirical relationships and interactions between both content and structure. Their work abandoned the idea of discrete stages in favor of a continuum and deemphasized developmental aspects. While content reflects the “what”, structure reflects the “how” of thought and action. Structure “builds and rebuilds the concepts that we use to understand our world” (Streufert, 1997). Conceptual complexity makes explicit the perception of connections among the dimensions. Schroder, Driver, and Streufert (1967) described four conceptual levels of information processing: low, moderately low, moderately high, and high integration indices (Figure 3).

Low integration is characterized by categorical, black and white thinking. When conflict exists, it is quickly minimized and resolved. Ambiguity is not tolerated and people in this level fail to see alternate resolutions or interpretations. The more absolute the rules of integration, the more generalization of functioning within a certain range, and more abrupt or compartmentalized the change when it occurs. Low integration individuals tend to perceive the world in terms of their own beliefs and ignore subtle situational changes and alternate interpretations. This form of complexity is commonly used as a defense mechanism referred to as “projecting”, where conflicting attitudes tend to be misperceived or warded off, and the perception of others is overgeneralized.

At the *moderately low integration* level, an individual is able to conceptually generate more alternatives than in the previous level. However, the individual lacks the ability to relate or organize differentiated rules. Differentiation occurs within a single dimension, but not across dimensions. This leads to the problem of choice and ambiguity, where there is no fixed rule for what is right or wrong. Consequently, there is ambivalence and a lack of consistency in decision-making. An individual can understand two or more ways of perceiving a situation, but the two evaluations are compartmentalized, and the person fails to utilize one schema. Individuals at this level tend to perceive the world in terms of one's self versus other. This leads to an absolutistic orientation toward others who, when seen in a position of potential control are "warded off".

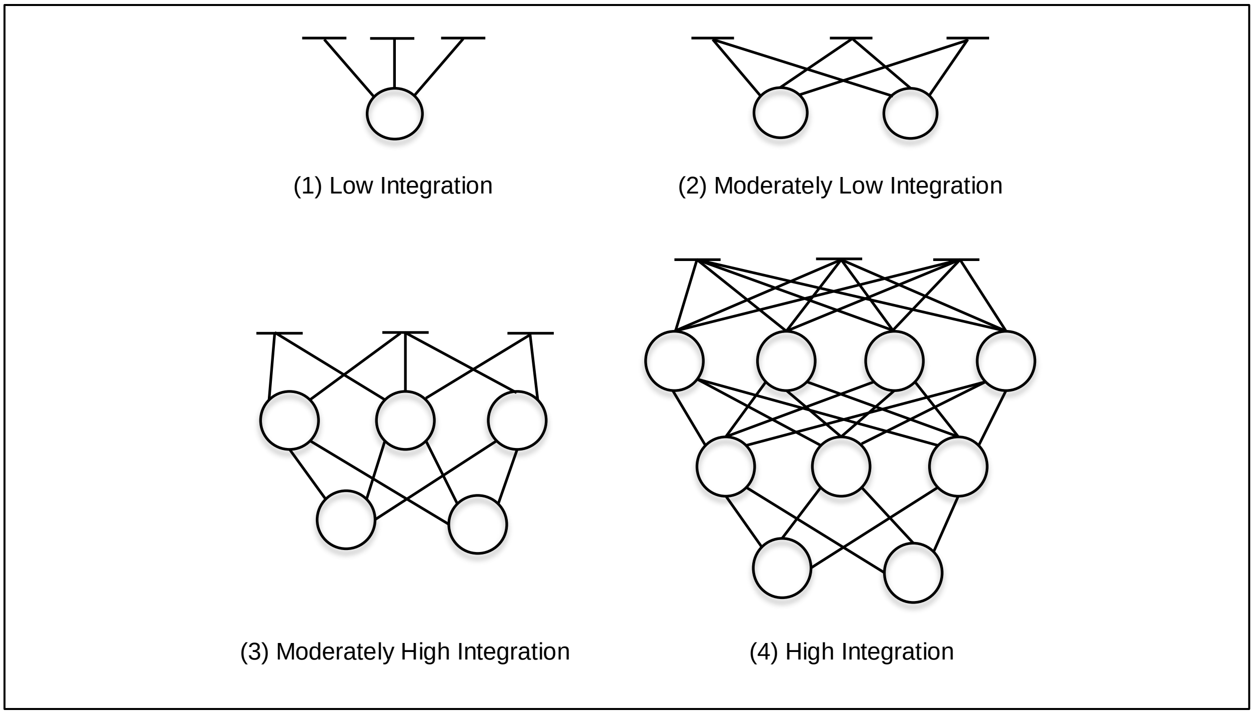


Figure 3. Conceptual integration levels of information processing (Schroder, Driver, & Streufert, 1967).

At the *moderately high integration* level, the conceptual system is less deterministic and more flexible. Despite the amount of uncertainty, individuals at this level are open to alternative perceptions. Much more information is sought before resolutions are made, and the individual will weigh the effects of taking different views. The presence of choice allows for a person to be self-reflective, rather than be anchored in the past or on established rules. At this level, an individual can make comparisons and relations. Not only is the individual highly differentiated, but other people are equally differentiated. This enables the capability of "perspective taking", which is the process of imagining oneself in the role of others.

At the *high integration* level, an individual perceives a diverse world filled with many alternatives. Individuals at this level can generate or apply flexible rules that systematize a large and differentiated body of information. With high integration, the individual is less externally constrained and highly effective in adapting to a complex, changing situation. There is a greater ability to identify complex relationships across multiple dimensions and to generate alternative patterns or novel responses.

Later versions of conceptual complexity, such as interactive complexity theories (Streufert & Streufert, 1978; Streufert & Swezey, 1986) viewed complexity as specific to various experiential domains. Further, they showed more interest in environmental mediators between potential (i.e., trait, style) complexity and behavior, in refining the construct of complexity (e.g., into flexible and hierarchical integration), and in the relevance of complexity to social psychology (e.g., attitudes, social perceptions). Cognitive style theories generally focus on conceptual complexity as a combination of flexibility, need for cognition, and tolerance for ambiguity, uncertainty, and lack of closure. The concept has been shown to be related to some specific personality factors, including authoritarianism and dogmatism (Schroder et al., 1967) and moral reasoning level (de Vries & Walker, 1986). Such correlations support the classification of conceptual complexity as a type of cognitive style (Suedfeld & Coren, 1992). Alternatively, Suedfeld and Coren (1992) suggested that conceptual complexity could be viewed as a mental ability or possible dimension of intelligence. While their results showed significant associations between conceptual complexity and divergent thinking, relatively weak relationships were found with other factors of mental ability (i.e., verbal ability, componential intelligence). Overall, complexity may, in part, be a trait, but not necessarily an unchangeable one.

Integrative Complexity

Integrative complexity is an offshoot of conceptual complexity and has been referred to as the "state component", whereas conceptual complexity is the "trait component" (Suedfeld, Tetlock, &

Streufert, 1992; Suedfeld, 2010). The crucial difference between conceptual and integrative complexity is in the emphasis on complexity's dynamic qualities, the conditions under which it changes, and the effects of those changes on information processing and decision-making (Suedfeld, 1992). Integrative complexity studies consider complexity of thought shown in a particular situation and context, and in the relations between such complexity and a wide variety of environmental, interpersonal, and internal factors. As a state variable, integrative complexity is viewed as the level of complexity with which an individual approaches a specific issue, problem or situation at a specific time, rather than as a stable trait. For example, Suedfeld, Bluck, and Ballard (1994) found that an individual's level of emotional involvement with an issue or situation is positively correlated with one's level of integrative complexity. An earlier study by Pratt and Hunsberger (1992) supported these findings. Their research suggested that people involved in personally salient problems exhibited higher levels of integrative complexity. This research is also consistent with Suedfeld's (1992) work, which indicated that when an issue grabs hold of an individual's emotions, the individual is prompted to engage in more intense and careful decision-making.

Integrative complexity is based on one's capacity and willingness to (a) acknowledge the legitimacy of contradictory perspectives on a problem, and (b) integrate those contradictory considerations into an overall judgment or decision (Schroder et al., 1967; Streufert & Streufert; 1978). When an individual thinks about an issue or event in both a complex and multidimensional manner, and also relates varying perspectives, values, and beliefs with one another he or she is thought to be integratively complex. Individuals who think about issues in a simple and unidimensional manner are considered less integratively complex.

Tetlock (1989) defines integrative complexity in terms of two cognitive structural components, differentiation and integration. *Differentiation* refers to the number of distinct characteristics or dimensions of a problem or issue that an individual takes into account during decisionmaking (Bright & Barro, 2000; Tetlock, 1989). A person who sees an issue in "black and white" terms or is able to see only one side of a topic, has little or no differentiation on that issue. A person who sees at least two or more dimensions to an issue shows higher differentiation in their thinking (Bright & Barro, 2000; Streufert & Swezwy, 1986; Tetlock, 1989). A highly differentiated approach would potentially include contradictory aspects of an issue.

Integration refers to the development of complex connections among the differentiated characteristics (Schroder et al., 1967; Tetlock, 1985). These connections are determined when individuals recognize that an issue is not simple, and they refer to tradeoffs between alternatives, synthesize alternatives, or refer to higher-order concepts that subsume multiple perspectives (Suedfeld, Tetlock, & Streufert, 1992). A high degree of differentiation is therefore necessary but not sufficient to determine integrative complexity (Tetlock, 1989). Rather, the number and type of cognitive rules used for interrelating the dimensions of differentiation are most important. For example, a person using four dimensions in their thinking may do so by compartmentalizing the dimensions, ordering them hierarchically, and failing to see their interrelationships (low integration); whereas a person using only two or three dimensions may use the dimensions simultaneously, apply them in different and complex combinations, and use them to compare possible outcomes (high integration) (Schroder et al., 1967).

Research recognizes that integrative complexity can shift and change, and increase or decrease based on environmental demands or lack thereof (de Vries & Walker, 1987; Suedfeld, 1988; Janis, 1989; Wallbaum, 1993; Tetlock et al., 1994; Gruenfeld, 1995; Gruenfeld, Thomas-Hunt, & Kim, 1998; Gruenfeld & Preston, 2000). Vannoy (1965) suggested that complexity tends to respond to a variety of intervening variables such as intolerance of ambiguity, congeniality, and academic aptitude. Tetlock (1983) found that a person’s level of accountability for an issue was positively correlated to that individual’s level of integrative complexity. The greater the level of accountability, the more effort an individual puts into his or her decisions. Tetlock's research subjects had higher levels of integrative complexity in a situation where they were under great scrutiny, than at times when the individual was less responsible or accountable for the outcomes of the situation.

Integrative complexity has been shown to be directly tied to critical thinking, creativity, decision making and problem-solving skills (Tuckman, 1965; Schroder et al., 1967; Streufert & Streufert, 1978;

Suedfeld, 1988; Tetlock et al., 1993). Prior studies have suggested that individuals with higher levels of integrative complexity make decisions with better outcomes as opposed to individuals with lower levels of integrative complexity, especially in complex decision-making situations (Guttieri et al., 1995; Myyry, 2002; Pancer et al., 2000; Suedfeld & Leighton, 2002; Tetlock 1983, 1986). Research on divergent thinking suggests that validation increases the tolerance for new alternatives. Individuals may initially reject a proposal but begin to actively search for new alternatives, strategies, and more creative solutions (Nemeth & Rogers, 1996; Van Dyne & Saavedra, 1996). Suedfeld and Granatstein (1995) further described integrative complexity as referring to, "the extent to which decision-makers search for and monitor information, try to predict outcomes and reactions, flexibly weigh their own and other parties' options, and consider potential strategies" (p. 510).

Wallbaum (1993) concluded that integrative complexity was a useful tool for examining political decision-making. Integrative complexity was linked with an individual's ability to be a "cognitive manager," responding to specific situations with an appropriate level of integrative complexity. In general, Wallbaum found that moderation was a dominant factor in crisis or conflict situations requiring agreement and cooperation, due to higher levels of integrative complexity. Interestingly, he also cited previous research that found in situations of "group think" or high stress, the level of complexity decreased (Wallbaum, 1993).

Suedfeld (1988) suggested that people who are more integratively complex not only make good decisions, but also have a sixth sense to know the level of complexity that is necessary for any given decision-making situation. However, maximum integrative complexity may not always be the optimal tactic to employ when making decisions. The concept of optimal levels of integrative complexity has been addressed in a number of studies (Janis & Mann, 1977; Suedfeld, 1992). It takes time to think through all the scenarios in a given situation, and time is a limited resource for the vast majority of decision-makers (Suedfeld, 1992). Decision-makers may not want or have the ability to take the time to consider the entire variety of scenarios (Suedfeld, 1992). Furthermore, those who observe decision-makers may view the time it takes to consider a variety of scenarios as indecisiveness on the part of the decision-makers

(Tetlock et al., 1993). Observers and decision-makers alike could also perceive the process to be too time consuming for the importance of the issue (Suedfeld, 1992). For example, there are many day-to-day decisions that can be made quickly and without a great deal of reflection and thought (e.g., choosing between chocolate or vanilla ice cream).

Ideology and Reasoning

A wide range of political and controversial issues has been the focus of early integrative complexity research. A majority of those studies involved issues that have strong polar dichotomies, such as abortion, political affiliation, and foreign policy. Tetlock (1981, 1989) examined the political affiliation of members of the United States Congress to determine if conservative members of Congress were more or less integratively complex on political issues than liberals. Other issues examined using the construct include the reasoning of members of the British House of Commons (Tetlock, 1984), American versus Soviet foreign policy-makers (Tetlock, 1985, 1988), Middle East leaders during the Persian Gulf Crisis (Suedfeld, Wallace, & Thachuk, 1993), public attitudes toward nuclear weapons (Kristiansen and Matheson, 1990), debates over slavery in the antebellum South (Tetlock, Armor, & Peterson, 1994), and arguments used by members of student political groups (Suedfeld et al., 1994).

Research indicates that decision-makers generally find tradeoffs unpleasant and use a variety of tactics to avoid confronting them (Abelson & Levi, 1985; Einhorn & Hogarth, 1981; Jervis, 1976; Tetlock, 1986). People who prefer simple solutions to tradeoff problems that minimize mental effort and strain are presumed to be “cognitive misers” (Fiske & Taylor, 1991; Tversky, 1972). Thus, cognitive misers may selectively expose themselves to unchallenging or like-minded discourse. One reason why tradeoffs are unpleasant is because tradeoffs can be difficult to justify to the public in general, and almost impossible to justify to those who feel they have received the “short end of the stick” (Tetlock, 1986). A series of content analysis studies found that senators with liberal and moderate voting records were more likely to engage in complex, tradeoff forms of reasoning than conservative senators (Tetlock, 1981, 1983, 1984; Tetlock, Hannum, & Micheletti, 1984). Liberals and moderates more frequently acknowledged that policies they favored had potential drawbacks, and that policies they opposed had potential benefits. They were also more likely to see policy making as a matter of weighing competing interests and values. In contrast, conservatives were more likely to view competing proposals as rigid, black and white terms, with only good outcomes coming from proposals they endorsed and bad outcomes from proposals they opposed. The simple solution of denying one element while bolstering the other, a process that Festinger (1964) called the "spreading of alternatives", suffices to resolve the dissonant reaction (Abelson, 1959).

In discussing his findings, Tetlock (1983) suggested that those senators who held multiple and conflicting values would be more likely to engage in more complex reasoning. Since liberals and moderates are more likely to assign similar levels of importance to the values of freedom and equality, they should experience more of this value conflict and therefore demonstrate higher levels of integrative complexity. Conservatives, on the other hand, are more likely to value freedom over equality, and should experience less value conflict and therefore demonstrate lower levels of integrative complexity.

Tetlock (1984, 1986) attempted to explain individual differences in political reasoning using the value pluralism model. The value pluralism model asserts that (1) underlying all political ideologies are core values that specify what the ultimate goals of public policy should be, and (2) ideologies vary in their high priority values, as well as in the degree to which these values conflict with each other (Tetlock, 1986). Tetlock (1989) suggested that high levels of integrative complexity are linked to greater use of fundamental values in guiding thoughts about an issue.

Gruenfeld (1995) examined the influence of group status (majority versus minority) as well as political ideology and unanimity of opinion within groups on levels of integrative complexity. She conducted an archival analysis of Supreme Court opinions, looking at integrative complexity of minority and majority opinions that were written in cases of non-unanimous decisions, as well as majority opinions written on behalf of unanimous vs. non-unanimous decisions, during eras where the court was liberally-dominated or conservatively-dominated. For non-unanimous decisions, integrative complexity was lower for opinions authored by justices in the minority as opposed to those written by majority members. Contrary to Tetlock et al. (1984), she found that liberal and conservative justices did not differ in overall integrative complexity, and unanimous opinions were less complex than non-unanimous opinions written by the majority. Gruenfeld concluded that group status is an important situational factor that influences integrative complexity levels on policy reasoning and suggested that cognitive flexibility could be another factor to consider.

The cognitive flexibility hypothesis, based on Nemeth's (1986) research on divergent thinking, suggests that majority members, attempting to understand why minorities might hold a different view, are more likely to engage in effortful information processing (Gruenfeld et al., 1998). Accordingly, when individuals in the majority are exposed to a minority influence or viewpoint, they may initially reject the viewpoint and begin searching for new alternative perspectives, strategies, and creative solutions to counter the minority viewpoint. This process may increase awareness of multiple perspectives and in turn, lead to an increase in integrative complexity. Individuals in the minority, on the other hand, may show more convergent thinking, only focusing in on their position against the majority's position, and as a result, may lead to lower levels of integrative complexity (Gruenfeld et al., 1998).

Research also suggests that attitudes may be formed as a consequence of differentiation and integration of information relevant to a particular domain (Burtz & Bright, 2007; de Vries & Walker, 1987). Attitudes that are structurally simple are expected to be more categorical. The more complex the attitude, the broader the range of information that is perceived as relevant. It has been suggested that moderate belief systems were characterized by more complex belief systems regarding an attitude object than were extreme attitudes (Burtz & Bright, 2007; Bright and Manfredo, 1996; Linville, 1982). More moderate attitudes are linked to higher levels of integrative complexity. This was supported by the findings of Carroll and Bright (2009), who found that individuals who recognized the tenability of competing sides to an issue are more likely to have more moderate attitudes about the topic than those who view the same issue from one perspective (Bright & Barro, 2000; Burtz & Bright, 2007). As Tetlock (1989) observed, a higher level of integrative complexity was associated with a pragmatic, open-minded, and nonpartisan worldview.

Coping with Change and Stress

Suedfeld (1992) proposed a model related to stress and coping, which predicted a nonlinear relationship between environmental stressors and information processing, particularly focusing on how decision-makers address problems they are facing. This "cognitive manager" model suggested that decision-makers (e.g. leader of a country) would "allocate cognitive resources in accordance with cost-benefit considerations" (Suedfeld & Granatstein, 1995, p. 511). This model further suggested that decision-makers, consciously or unconsciously, would devote time gathering information resources and decision aids, based on the extent that a problem seems worthy of such an investment and is likely to lead to an optimal solution (Suedfeld & Granatstein, 1995). Pruitt and Lewis (1975) showed that low integrative complexity characterizes policy-makers who adopt competitive initiatives in which little consideration is given to the perspective of the other side, whereas high integrative complexity characterizes those who seek compromise agreements and take into account the interests of both parties.

Studies scoring archival materials for integrative complexity have shown an occurrence of the "disruptive stress effect", which is a steep reduction in complexity accompanied by a "stage of exhaustion" or the depletion of cognitive resources for dealing with a stressful event (Suedfeld, 2010). For example, the complexity of intergovernmental communications decreases as countries move deeper into a crisis that eventually leads to war (Suedfeld & Tetlock, 1977; Suedfeld, Tetlock, & Ramirez, 1977). This was not found to occur in crises that are resolved by a compromise solution (Suedfeld & Tetlock, 1977). Individual governmental and military leaders show equivalent patterns as a function of war stress (Suedfeld, Corteen, & McCormick, 1986), as do members of nongovernmental elites (Porter & Suedfeld, 1981; Suedfeld, 1985). Another example of disruptive stress is a decrease in integrative complexity as the individual nears death (Suedfeld, 1985; Suedfeld & Piedrahita, 1984). These studies support the disruptive stress hypothesis, whereby complexity levels increase with stress levels up to an optimum level of arousal, but then subsequently lead to decreased complexity. Thus, "if the challenge is too severe, too persistent, occurs simultaneously with too many other demands, or if cognitive resources are depleted through fatigue, illness, fear or other adversities, complexity decreases" (Suedfeld & Tetlock, 2001, p. 294).

Previous research generally shows stress-related arousal to be accompanied by more selective attention or "cue utilization" (Easterbrook, 1959; Hockey & Hamilton, 1983). Unlike earlier studies, however, Suedfeld and Bluck (1993) found that subjects on average responded to negative life events with increased or stable complexity. These findings were attributed to a difference between the cognitive effects of personal and individual life changes, and dramatic large-scale stressor events. According to this study, personal life events do not appear to reduce integrative complexity, as do stressors that permeate a larger societal context. Researchers emphasize that different patterns of complexity do not necessarily imply differences in successful coping, but particular changes or levels may be appropriate in various circumstances (Suedfeld, 1992; Suedfeld & Bluck, 1993). It is possible that remaining stable or increasing in complexity has better payoffs in the area of personal life problems than in confronting political decisions. Alternatively, de Vries (1991) found that individuals were less complex in discussing events to which they felt they had adjusted well than in describing events associated with poor adjustment. In the latter case, this pattern was tentatively attributed to a Zeigarnik effect, which describes how people tend to find it easier to recall a task, and the details surrounding it, when they feel like they have begun to undertake it but have been unable to complete it (Zeigarnik, 1927).

Natural Resources Management

The use of integrative complexity in natural resources management has been limited. Bright and Wyche (1998) looked at the effects of coursework in environmental education on college students' level of integrative complexity regarding the Endangered Species Act. Findings suggested that those who took coursework in environmental education had more complex reasoning on the Endangered Species Act and related tradeoffs than those who had not. In a similar study, integrative complexity was found to increase with higher knowledge about plant and wildlife protection when paired with moderate attitudes (Bright & Barro, 2000).

In a study on wildfire management perceptions, findings implied that increased integrative complexity results in higher levels of acceptance of management actions (Carroll & Bright, 2005). Carroll and Bright (2009) later discovered that integrative complexity served as a moderator in the relationship between value-laden basic beliefs about wildfire management and attitudes toward prescribed fires. However, their results suggested that the nature of the moderation depended on the value considered. This relationship is further supported by Czaja, Bright, and Cottrell (2016) who found that the strength of the relationship between an individual's values and their attitude toward prescribed fire, in the context of mountain pine beetle infestations, depends on their integrative complexity regarding that issue.

Measurement of Integrative Complexity

Traditional Methods

Traditionally, researchers have measured integrative complexity using either existing text or by generating new text through a Paragraph Completion Test (PCT). The PCT method instructs respondents to complete sentence stems by writing an essay that describes their attitudes and beliefs about a given issue. The coding procedures for assessing integrative complexity were originally developed by Schroder, Driver, and Streufert (1967) and later refined and expanded by Baker-Brown et al. (1992). The coding process requires that at least two trained raters (often three or more are used) evaluate the essay and agree on a score based on the Conceptual Integrative Complexity Scoring Manual (Baker-Brown et al., 1992). The coding entails an assessment of the extent to which the two structural dimensions, differentiation and integration, are present in the text. Differentiation is evident by written references to more than one dimension of a problem or more than one perspective on an issue. Integration can exist in several different ways. One type of integration is the recognition of interactive causality—that is, the logic that how "A" affects "B" depends on levels of "C". A second type of integration involves the systematic effort to understand why people view the same issue in different ways. A third type of integration involves the recognition of value tradeoffs.

Integrative complexity is measured on a scale of 1 (low score) to 7 (high score). This scale represents different levels of integrative complexity. A score of 1 represents low differentiation and low integration, where the issue is seen in only black and white terms. A score of 3 represents moderate differentiation, but low integration. In this case, the individual can see at least two varying perspectives of a situation, yet the person is unable to make connections between or among the perspectives. A score of 5 represents moderate differentiation and moderate integration. This indicates that the individual acknowledges not only multiple viewpoints, but also that there is a moderate level of interactions and tradeoffs among the alternatives. A score of 7 represents both high differentiation and high integration, suggesting that the individual also has deeply held basic values between the alternative issues (Baker-Brown et al., 1992). Intermediate scores of 2, 4, and 6 can be assigned if raters have difficulty deciding on a score. Table 1 provides examples of passages and their coding score for integrative complexity.

Table 1. Example of passages about species protection and integrative complexity coding scores.

Score	Passage
1	I feel that we should try to leave life and animals that are in their own habitats alone and try our best to protect them and the environment around them.
3	We have to find a balance between the environment and population. It's important to maintain the wildlife and plant life of the wilderness, but people also need jobs. I feel that animals will move to other habitats if man interferes with their areas.
5	I believe in protecting the diversity as long as it is done with a reasonable budget and fiscally responsible management. The problem with programs like this is that they take on a life of their own. If an endeavor such as this can be done without being overdone, than I am for it. But experience tells me otherwise.
7	To a degree, yes, we must monitor the ecology. However, the government simply seems to go overboard sometimes, as it does in every area it touches. Too many administrative programs exist; some conflict; all are expensive. The idea is a good one, but it seems we go about things in an all or nothing fashion. On the one hand, we need to consider the effects of wildlife on the natural ecosystem and if they are an important part. There are moral and philosophical issues related to our roles as managers and/or stewards of nature versus simply another part of it. We have evolved to the place where we can determine the degree that a species or animal affects the other living things it interacts with. But there are so many problems we need to deal with that are equally or more important. We need to curb the human problems worldwide—especially overpopulation—or this question will one day be moot.

Note: Scores of 2, 4, and 6 represent midpoints between the above scores are provided to enable raters to score items between the primary levels noted above. Adapted from Bright and Barro (2000).

The original PCT was problematic in that it could not assess situational changes in integrative complexity and lacked external validity (Koo, Han, & Kim, 2002; Suedfeld, 1992). The methodology has been extended to allow complexity to be assessed using archival documents and other “real world” written and verbal statements (Koo, Han, & Kim, 2002). Researchers, such as Tetlock et al. (1993), have also assessed complexity using Picture Story Exercises. This method presents participants with ambiguous pictures and asks them to write descriptions about the pictures. The written statements are then coded for integrative complexity using similar procedures as the PCT. The content analysis approach continues to be the most popular method of assessing integrative complexity, and the majority of research related to integrative complexity has utilized this approach to analyze archival data (Lee and Peterson, 1997). While the PCT coding measure has been found to be reliable and to have reasonable construct validity (Baker-Brown et al., 1992; Tadmor et al., 2009; Tetlock, 2009), researchers acknowledge that relying on trained human coders can be expensive, time-consuming, or systematically biased (Conway et al., 2014; Tetlock et al., 2014). Efforts to find a “gold standard” methodology are attempting more advanced techniques, such as developing automated measures and algorithms (Tausczik & Pennebaker, 2010; Conway et al., 2014; Young & Hermann, 2014), but unresolved issues persist with those methods as well.

Carroll and Bright (2010) identified four drawbacks of the PCT methodology. First, the measurement process can be time consuming and requires significant effort by both the respondents and raters. The raters must rely on the *Manual for Coding Integrative Complexity* (Wallbaum, 1993). This issue has also been noted to be a reason for low response rates in previous studies using a mail survey (Bright & Barro, 2000). The second issue relates to how well the respondents understand the instructions for completing the survey. Respondents must understand to include opinions, valuations, or judgments in their essays. The third issue to consider is that the scoring process is quite time consuming. In addition to reading the essays, raters must discuss scores and their reasons for giving that score. Raters must work cooperatively and come to an agreement on appropriate scores. Finally, the qualitative nature of the research makes it unfeasible to use on a larger scale or to generalize the results.

Development of an Integrative Complexity Scale

To address the shortfalls of previous measurement methods, Carroll and Bright (2009, 2010) developed a fixed-item scale to measure integrative complexity. The authors discussed several advantages to the use of the scalar measure. First, the scale is easier for respondents to complete and may lead to higher response rates. Second, the scale enables integrative complexity to be used more broadly across social science studies. Third, larger sample sizes can be obtained, which allows for results to be generalized to a population. Fourth, scoring is more systematic and quantifiable, and overcomes the challenges associated with translating qualitative data into quantifiable measures. Fifth, the scalar measure allows for the concept's use in theoretical models of attitudes and behavior.

Carroll and Bright's scale was designed to measure the two primary components of integrative complexity, differentiation and integration. Differentiation is conceptualized as the extent to which a respondent recognizes alternative sides to an issue. In the traditional PCT model, the numbers of "for" (positive) and/or "against" (negative) statements written about an issue were counted from within the essay. High differentiation was indicated by an equal, or near equal, number of arguments "for" and "against" an issue. In the scale method, respondents list a number of positive and/or negative arguments to an issue. Differentiation is measured as a value between 0 and 1, based on the ratio created by the number of arguments "for" versus arguments "against" the issue. The smaller number is divided by the larger to obtain the integration score. A value of zero reflects no differentiation and a value of 1 reflects the highest level of differentiation. For example, in a theoretical study, a respondent could provide up to five arguments for both "for" and "against." If the respondent provided four answers "for" an argument and three "against", the differentiation ratio would be equal to 0.75.

Integration is conceptualized as how well the respondent recognizes interrelationships between the different sides of the issue and is linked to the relative strength, as perceived by the respondent, of the arguments on both sides. It is the relative consistency in the perceived strength of the "for" versus "against" arguments. The integration score is also a ratio between 0 and 1. The smaller mean is divided by the larger mean to obtain the integration score. To continue the example, the respondent could identify the weakness or strength of the arguments by using a scale with 1 = “extremely weak” and 7 = “extremely strong”. If the respondent mean score for the “for” arguments was six and the mean score for the “against” was three, the integration score would be equal to 0.50.

The overall integrative complexity score is the product of the differentiation and integration scores. The final calculation for integrative complexity is also a value between 0 and 1. In this example, the overall integrative complexity score would be 0.75 x 0.50 = 0.375, or 0.38. Equal weight is given to both components, which is consistent with the traditional method of measurement using the PCT. Carroll and Bright (2010) tested the scale and found that there was a high correlation with the PCT and that the scale appeared to be a functional substitute. They observed that it was not an exact measure of integrative complexity, but a measure that seemed to reflect and correlate well with the results obtained from the traditional PCT scoring methodology. In related research, Carroll and Bright (2009) did note that further research in the scale’s structure would be appropriate. For instance, determining which type of leading question should be used for the differentiation section, to ensure that the different dimensions are being identified. They also recommend potentially using different scales to measure integration. Instead of “strong” or “weak,” perhaps use “important/not important” or “true/untrue.” This could provide a better evaluation, based on the research objectives. Others have argued that descriptions need to include “specific psychological conditions in which they do things”, thus “providing more condition-qualified, ‘local’ contingent, and specific characterizations of persons in contexts” (Mischel, 1990, p. 117).

Burtz and Bright (2007) note that one of the difficulties of exploring integrative complexity is in the creation of the open-ended essay. In their study on wildfire management, they included a description of the issue to assist respondents in their responses about wildfire. It has been suggested that more control in the research, by controlling the amount of information presented, may contribute to further development of the theory. Along the same lines of inquiry, researchers could create Likert-type scales to test for integrative complexity using closed-ended response categories.

Hawkins (2011) developed an integrative complexity index that relies on respondent self-classification. Four dimensions of integrative complexity were measured to comprise an additive index: information seeking, active listening, creative/novel problem solving, and position moderacy. The index was designed to segment respondents into unique integrative complexity subgroups based on four questions used to collect responses for each of the four dimensions. The four responses to each item in the index are ordered from least (score = 1) to most (score = 4). To determine integrative complexity, the scores for all four items are added to determine a cumulative score ranging from 4 to 16. Scores between 4 and 6 indicate "least integrative complex" thinkers; scores between 7 and 10 indicate "moderate integrative complexity"; scores between 11 and 13 are "very complex"; and scores between 14 and 16 are "highly complex". The index provided a decent indication of integrative complexity, although the reliability and validity analyses for the index suggested the need for modification. Hawkins (2011) suggested that statements representing the four dimensions could be better worded, or that other combinations of characteristics may be better predictors of integrative complexity. He also recommended more attention to operationalizing the integrative complexity dimensions of integration and differentiation in an index measure.

Integrative Complexity and the Cognitive Hierarchy

There is a link between integrative complexity and other fields of cognitive study. Research suggests that integrative complexity is related separately to both values and attitudes, which are components of the cognitive hierarchy (Carroll & Bright, 2009). The cognitive hierarchy theory provides a foundation for understanding concepts underlying the process of human thought to behavior, such as values, basic beliefs, attitudes, norms, and behavioral intentions, and examines the relationships among them. These cognitions build upon one another in what has been described as an inverted pyramid or hierarchy (Figure 4) (Fulton et al., 1996; Vaske & Donnelly, 1999). Each level of the hierarchy is predicted to have some influence on the next. More specific constructs in the cognitive hierarchy include attitudes and norms.

Values, which make up the foundation of the cognitive hierarchy, can be defined as fundamental enduring beliefs that are used to evaluate the desirability of specific modes of conduct or outcomes (Rokeach, 1973; Fulton et al., 1996). Values are relatively stable, abstract representations of basic human needs, and therefore, are limited in number and difficult to change. For instance, Rokeach (1973) identified 36 values (e.g., happiness, freedom, ambition, and honesty), while Schwartz (1992) identified ten value domains (e.g., universalism, achievement, power). Fundamental values, such as those identified, act as guiding principles in our lives (Rokeach, 1978), and are thought to influence attitudes and behavior toward specific aspects of our environment (Fishbein & Ajzen, 1975). Behaviors, which are at the top of the hierarchy, are described as many in number, quick to change, and dependent upon the context of a specific situation.

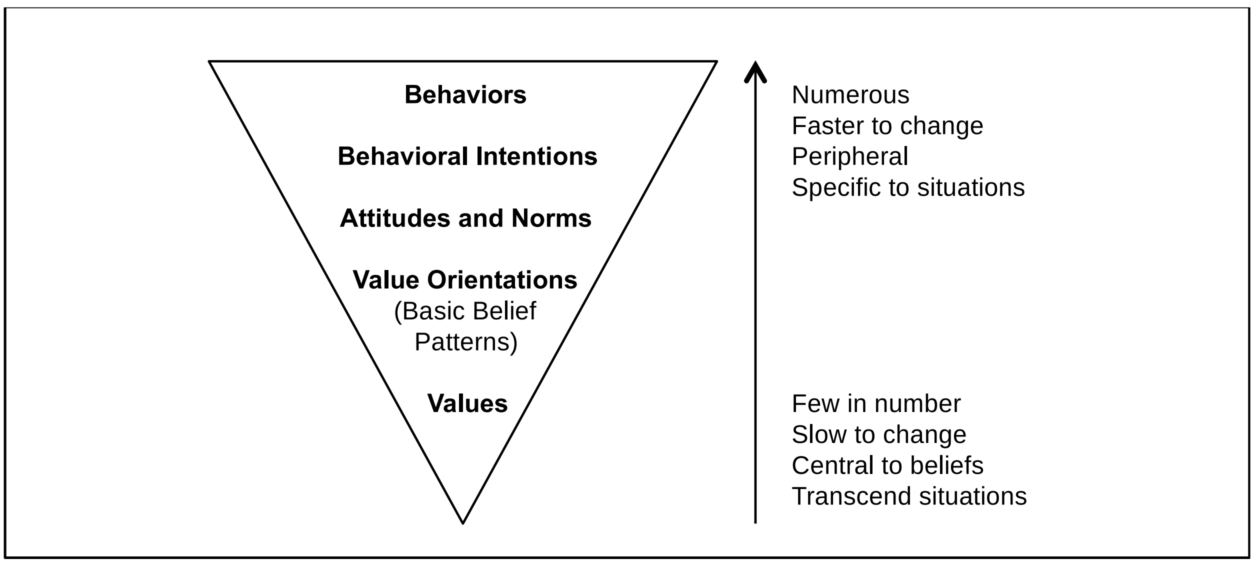


Figure 4. The cognitive hierarchy model (Vaske & Donnelly, 1999).

Because values are abstract, they are difficult to link to more specific cognitions or behaviors but are given meaning by higher-order cognitions. At the next level in the cognitive hierarchy, are value orientations. Value orientations refer to patterns of multiple basic beliefs about general issues, such as natural resources or recreation (Bright et al., 2003). Value orientations are derived from an individual's basic fundamental values, formed during the socialization process, and are somewhat stable in adults

(Stern & Dietz, 1994). They also tend to vary across individuals, social-structural groups, and cultures (Stern & Dietz, 1994). In the cognitive hierarchy model, value orientations impact individual behavior by guiding attitudes and norms specifically related to that behavior (Vaske et al., 2001; Bright & Burtz, 2006; Manfredo, 2008). For instance, natural resource value orientations provide consistency and organization among a broad spectrum of beliefs, attitudes, and behaviors regarding natural resources.

Attitudes are positive or negative evaluations of some topic, while norms are judgments about what is appropriate in a specific situation (Wittmann et al., 1998), or standards that individuals use to evaluate whether behavior or conditions should occur (Vaske & Whittaker, 2004). Attitudes and norms are the direct antecedents and best predictors of behavioral intentions, or intentions to engage in a specific behavior (Ajzen & Fishbein, 1980; Manfredo, 2008; Vaske, 2008). They can also serve as a mediator between value orientations and behavioral intentions (Ajzen & Fishbein, 1980). The theories of reasoned action and planned behavior (Ajzen & Fishbein, 1980; Ajzen, 1985) offer a basis for explaining how attitudes and norms influence behaviors and the variables that affect the strength of this relationship.

The cognitive hierarchy model has been used in many natural resource contexts such as determining and measuring wildlife values (Fulton, Manfredo, & Lipscomb, 1996), and explaining an individual's willingness to support various resource management strategies (Vaske & Donnelly, 1999). These natural resource studies have suggested that components of the cognitive hierarchy are influenced by or related to integrative complexity (Carroll & Bright, 2009). The following review provides an overview of research implicating a relationship between integrative complexity, value orientations and attitudes.

Values and Beliefs

Tetlock (1989) suggested that high levels of integrative complexity are linked to greater inclusion of fundamental values in guiding thoughts about an issue. In terms of environmental issues, numerous studies have examined the relationship between values, general and specific beliefs, intentions, and environmentally responsible behavior (Joireman et al., 2001; Nordlund & Garvill, 2002; Schultz &

Zelezny, 2003; Stern & Dietz, 1994; Stern et al., 1999). Most of these studies were based on Schwartz's (1992, 1994) universal value system or on social value orientations used in social dilemmas (McClintock, 1972; Messick & McClintock, 1968). Schwartz (1992, 1994) proposed a general classification of 56 values. Each of these values was rated on a 9-point scale reflecting the relative importance of the values as "a guiding principle in one's life." Schwartz (1992) found ten motivational types of values, which could be plotted in a two-dimensional space that comprised four separate value clusters. The first dimension, openness to change versus conservatism, distinguishes values that stress independence, such as self-direction and stimulation, from values that emphasize tradition and conformity. The second dimension distinguishes social or self-transcendent values, such as universalism and benevolence, from those that pursue personal interests or self-enhancement, such as power and achievement. This dimension is labeled as self-transcendence versus self-enhancement. Research shows that especially the self-transcendent versus self-enhancement dimension is related to different kinds of beliefs and pro-environmental behavior (Stern, 2000; Nordlund & Garvill, 2002; Thøgersen & Ölander, 2002; Hoffman & Slater, 2007).

Another line of research is expectancy-value theory, which aims at predicting attitudes from beliefs (Fishbein & Ajzen, 1975; Eagly & Chaiken, 1993). According to the model, beliefs are represented as the sum of the expected values of the attributes ascribed to an attitude object. Expected values consist of two components: 1) expectancy, which is the subjective probability that the attitude object is characterized by the attribute, and 2) value, which is the evaluation of the attribute (positive or negative). To predict an attitude, the expectancy and value terms associated with each attribute are multiplied together and then the products are added (Ajzen & Fishbein, 1980). Expectancy-value theories generally explain motivation as a combination of an individual's needs and the value of various goals in the person's environment. Atkinson (1957) developed a model depicting the strength of a given motivation to be a multiplicative function of the strength of the motive, the expectation of an action's probability of success, and the value of the possible outcome. The model has been applied to studies on choices and performance related to information seeking (Eccles & Wigfield, 2002; Savolainen, 2012)

Political party affiliation and ideology are frequently studied variables in relation to environmental attitudes and beliefs. In general, research has shown that politically liberal or progressive individuals tend to be more environmentally aware and concerned (Tognacci et al., 1972), but these findings have not always been consistent. In the context of climate change, research has found polarization of climate change opinion along politically partisan lines (Jacques et al., 2008; Leiserowitz et al., 2011; McCright & Dunlap, 2011). McCright and Dunlap (2011, 2008) showed that Democrats and liberals had greater belief in and more concern about climate change than Republicans and conservatives. Other research has shown that liberals perceived greater risk from global warming than conservatives (Leiserowitz, 2006), that Democrats were more likely than Republicans to support government actions to reduce carbon emissions (O'Connor et al., 2002), and that being more liberal was related to support for climate change mitigation policies indirectly through worldview and environmental beliefs (Dietz et al., 2007).

Research has suggested that the extent to which individuals concerned with the environment view the world in ways that are fundamentally different from those who are less concerned with the environment (Dunlap & Van Liere, 1978, 1984). The connection between fundamental values and attitudes toward environmental issues is the orientation of those values toward the environment. Value orientations refer to general patterns of basic beliefs that give direction and meaning to fundamental values (Fulton et al., 1996; Vaske & Donnelly, 1999). Stern (2000) argued that three different value orientations affect environmental beliefs: an egoistic, a social-altruistic, and a biospheric value orientation. People with an *egoistic* value orientation will especially consider costs and benefits of pro-environmental behavior for them personally. When the perceived benefits exceed the perceived costs, they will have an environmentally friendly intention and vice versa. People with a *social-altruistic* value orientation will base their decision to behave pro-environmentally or not based on perceived costs and benefits for other people. Finally, people with a *biospheric* value orientation will mainly base their decision to act pro-environmentally or not on the perceived costs and benefits for the ecosystem and biosphere as a whole. All three of the value orientations provide a distinct basis for beliefs related to behaviors in the environment. In general, pro-environmental beliefs, intentions, and behavior appear to be positively related to social-altruistic and/or biospheric values and negatively to egoistic values (Stern & Dietz, 1994; Van Vugt et al., 1995; Stern, Dietz, & Guagnano, 1998).

Research on social dilemmas makes a distinction between pro-socials or cooperators and pro-selves or non-cooperators (Van Vugt, Van Lange, & Meertens, 1996; Gärling et al., 2003; Joireman, et al., 2001). People with a pro-social value orientation focus on optimizing outcomes for others, whereas people with a pro-self value orientation focus on optimizing outcomes for themselves. Various social dilemma studies have studied the role of value orientations in explaining behavior (e.g., Liebrand, 1984; Kramer, McClintock, & Messick, 1986; Parks, 1994; Van Lange & Liebrand, 1989). In studies on pro-environmental behavior, people who give priority to collective or pro-social values have stronger pro-environmental beliefs and are more willing to engage in diverse types of pro-environmental behavior than people who give priority to individual or pro-self values (Joireman et al., 1997; Cameron, Brown, & Chapman, 1998; Joireman et al., 2001; Gärling et al., 2003).

In some research, value orientations have been studied by looking at an individual's environmental ideology and concern. An environmental ideology is derived from an index score made up of questions pertaining to an individual's fundamental value orientation. The New Environmental Paradigm (NEP) developed by Dunlap and Van Liere (1978, 1984) is commonly used to measure value orientations to the environment and is based on the belief that human survival is dependent on the health of the environment. The NEP assesses beliefs about humans' ability to upset the balance of nature, the existence of limits to the growth of human society, and the human right to dominate the natural world. A revised version of the scale, the New Ecological Paradigm Scale, was developed to measure an individual's ecological worldview (Dunlap, Van Liere, Mertig, & Jones, 2000). Value orientations toward wildlife have been reliably measured by asking individuals how strongly they identify with biocentric or protectionist belief statements (e.g. "wildlife should have equal rights as humans") and utilitarian or use beliefs about wildlife (e.g. "wildlife should be used by humans to add to the quality of human life") (Bright et al., 2000; Fulton et al., 1996). In many studies, these basic beliefs have reliably and consistently factored into value orientation continuums such as the biocentric-anthropocentric continuum (Shindler, List, & Steel, 1993; Vaske & Donnelly, 1999) and the protection-use continuum (Bright et al., 2000; Dougherty et al., 2003; Fulton et al., 1996).

An anthropocentric or use orientation reflects human-centered or utilitarian views of the nonhuman word (Eckersley, 1992). This approach assumes that providing for human use and benefit is the primary goal of natural resource allocation and management regardless of whether uses are for commodity (e.g. timber), aesthetic or physical (e.g. natural areas and recreation) benefits. Natural resources are viewed as materials to be used by humans, and there is little recognition that nonhuman aspects of nature are valuable in their own right or for their own sake (Scherer & Attig, 1983). A use orientation emphasizes the instrumental value of natural resources for humans rather than any inherent worth of these resources.

In contrast, a biocentric value orientation is a more nature-centered or eco-centered view. This approach views the environment, species and preservation of natural resources to be most important. Human needs and desires are still important but are viewed within a larger perspective. A protectionist orientation assumes that environmental and natural resource objects have instrumental and inherent worth, and that human uses and benefits are not always most important. In a natural resource management context, these inherent values are to be respected and preserved even if they conflict with human-centered values (Thompson & Barton, 1994; Vaske et al., 2001). According to Kennedy and Thomas (1995), all human value orientations toward nature are ultimately devices of the mind and therefore, are fundamentally anthropocentric. They proposed a conceptual model of natural resource value orientations ranging from human-dominant to human-mutual environmental values. While their model offers a somewhat different perspective, what it represents is quite similar to the value orientations measured by anthropocentric/biocentric scales.

Steel et al. (1994) noted that biocentric and anthropocentric value orientations are not mutually exclusive. Rather, they can be arrayed along a continuum with biocentric orientations at one end and anthropocentric orientations at the other end. The midpoint of the continuum represents a mixture or balance of the two extremes (Shindler et al., 1993; Steel et al., 1994; Vaske & Donnelly, 1999). Some studies, however, have questioned the use of a single continuum. Bruskotter and Fulton (2007) examined fisheries-related value orientations comprising a single, anthropocentric-biocentric continuum. Although they found some support for their hypothesis, a series of confirmatory factor analyses suggested their conceptualization could be too simplistic.

Manfredo and Fulton (1997) compared wildlife values in Colorado and Belize, and found inconsistent results between the two samples. The single protection-use continuum was evident in the Colorado sample but did not emerge for the Belize sample. For the Belize respondents, both wild land rights and use value orientations were held simultaneously. In their discussion, the authors suggested that as cultures become more "cultures become more technologically complex, and citizens become more removed from interaction with wildlife, their values regarding wildlife become more simplistic and less complex" (Manfredo & Fulton, 1997, p. 63). Individuals with value orientations favoring wildlife use and wildlife benefits held more favorable attitudes towards hunting and fishing than individuals with value orientations favoring wildlife protection and wildlife existence.

Other studies have focused on value orientations based on wildlife beliefs, utilitarianism, and mutualism. Fulton, Manfredo, and Lipscomb (1996) identified eight basic wildlife belief dimensions, which could be explained by two factors: a benefits-existence orientation and protection-use orientation. Benefits-existence orientation was measured through beliefs about wildlife experiences and wildlife bequest, existence and education values. Protection-use orientation consisted of fishing/anti-fishing, hunting/anti-hunting, wildlife rights and wildlife use beliefs. Both value orientations were useful predictors of attitudes toward hunting and fishing. Following the approach used by Fulton, Manfredo, and Lipscomb (1996), Teel et al. (2005) and Teel and Manfredo (2009) identified four unique value orientation types using the utilitarian and mutualism value orientation scales. *Utilitarians* hold an ideological, traditional view of "domination" or human mastery over wildlife that is associated with prioritization of human wellbeing over wildlife and a positive regard for treatment of wildlife in utilitarian terms. Utilitarians are classified as individuals who score greater than 4 (high) on the utilitarian value orientation scale and less than or equal to 4 (low) on the mutualism scale. *Mutualists* reflect an egalitarian ideology that views wildlife as part of an extended family, capable of living in relationships of trust with humans and deserving of rights and caring. Mutualists are classified as those who score greater than 4 (high) on the mutualism scale and less than or equal to 4 (low) on the utilitarian scale. *Pluralists* hold both a mutualism and a domination orientation (i.e., they score high on both scales). *Distanced* individuals do not express either a mutualism or a domination orientation (i.e., they score low on both scales). This could indicate that they are less interested in wildlife-related issues or that wildlife-related issues are less salient to them.

Consistent with the cognitive hierarchical framework (Vaske & Donnelly, 1999), value orientations have shown a relatively consistent relationship in predicting attitudes toward natural resource management across social and cultural variations. For example, a biocentric orientation predicted attitudes toward sustainability of forest management among the general public and recreationists in Canada (McFarlane & Boxall 2000, 2003); preferences for forest management among national and local publics in the United States (Steel et al., 1994); and support for wilderness preservation policies in the United States (Vaske & Donnelly, 1999). Attitudes, in turn, create a predisposition to act, but translation of attitudes into specific actions may also be influenced by personal capabilities and contextual factors (Stern, 2000).

Attitudes

Eagly and Chaiken (1993) define an attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (p. 1). Other investigators (e.g., Ajzen & Fishbein, 2000; Ajzen, 2001) also support this definition. In Eagly and Chaiken's definition, psychological tendency is internal to the individual and evaluating refers to all kinds of evaluative responses: overt, covert, cognitive, affective, or behavioral. These evaluative responses differ in valence (positive or negative direction) and strength, and are those that express approval or disapproval, favor or disfavor, liking or disliking, approach or avoidance, attraction or aversion, or similar reactions.

Schroder et al. (1967) claimed that attitudes are typically described in terms of the magnitude and direction of their contents. Cognitive structural processes, however, should affect the way in which content is assimilated, organized, processed, and expressed. Attitudes may be formed as a consequence of the differentiation and integration of dimensions of, and perspectives on, information relevant to a particular domain (Burtz & Bright, 2007; de Vries & Walker, 1987). According to Fishbein and Ajzen (1975), attitudes toward performing a behavior are influenced by salient behavioral beliefs that a person takes into account when deciding how to behave. Within the complexity framework, it is assumed that conceptually simple attitudes are based on a narrow range of highly salient information. Information that does not fit, or is inconsistent with, the existing attitude is only minimally perceived and utilized or readily discounted and discarded. Hence, attitudes that are structurally simple are more categorical, and therefore, expected to be less complex. The more complex the attitude, the broader the range of information that is perceived as relevant.

Attitude Direction. Attitude valence (direction) is the most basic measure of an individual's attitude toward an object or behavior. For example, Tetlock (1983) found that conservative and moderate politicians were less integratively complex than liberal politicians on many policy issues. This suggested that right-wing politicians were more rigid in their thinking about political issues than left-wing politicians. Tetlock referred to this observation as the "rigidity of the right" hypothesis. As an alternative explanation, Tetlock (1984) suggested that differences in integrative complexity were due to the majority—minority status of each political party.

Other studies have observed no significant differences in integratively complex thinking between individuals with positive and negative attitudes. Dillon (1993) compared the integrative complexity of prochoice and prolife arguments about abortion and found that both groups tended to debate at a relatively low level of complexity. Similarly, de Vries and Walker (1987) found no relationship between attitude direction and complexity of thinking about capital punishment. Therefore, the relationship between an individual's level of integrative complexity and one's general position on an issue appears to be weak.

Integrative complexity may be a value-neutral concept that describes not what someone thinks about an issue (i.e., attitude direction), but how someone thinks about an issue.

Attitude Extremity. The strength of an attitude may play a more important role than attitude direction. In addition to direction, attitudes vary in levels of extremity. An individual may feel extremely favorable or unfavorable attitudes toward something, moderately favorable or unfavorable, or neither favorable nor unfavorable. Although attitude strength has often been discussed throughout the literature, it has been vaguely defined as a construct. Researchers have used several indicators of strength, including extremity, ambivalence, and importance. Still, most research supports the notion that attitude strength affects a person's ability to predict subsequent behaviors, where strongly held attitudes are more likely to guide related behavior than weakly held attitudes (Petty & Krosnick, 1995).

The ability of an attitude to predict behavior is dependent in part on the attitude's ability to bias perceptions of the attitude object and the behavioral context (Woods, Rhodes, & Biek, 1995). Strong attitudes can influence information processing and judgment in the sense that they make it more likely that certain information will come to mind, or that certain decisions will be rendered. In return, one function of knowledge is to help maintain strong attitudes. Attitudes are typically considered strong when they are resistant to change and persistent over time. Knowledgeable people with strong attitudes are careful, expert processors of new information, but their processing is biased to bolster and protect their favored attitude position. This close-minded orientation generates considerable stability and persistence in attitude judgments. Thus, the study of attitude strength plays an important role in understanding the public's perceptions, thinking and decision-making processes.

Research has found a significant relationship between attitude extremity and integrative complexity (e.g., Burtz & Bright, 2007; Bright & Manfredo, 1995; Carroll & Bright, 2009; de Vries & Walker, 1987; Linville, 1982; Tetlock, 1989). Burtz and Bright (2007) found no significant differences in integrative complexity according to attitude direction but found that the extremity with which individuals held their attitudes was related to integrative complexity. In their study on wildfire management, the highest level of integrative complexity was found for individuals whose attitudes toward the issue were of low extremity (i.e., middle of scale). Individuals that recognize the perspectives of competing sides to an issue are more likely to have more moderate attitudes about the topic than those who view the issue in black and white terms (Bright & Manfredo, 1995; Linville, 1982). For instance, Bright and Manfredo (1995) found that moderate attitudes toward a variety of natural resource management issues are characterized by higher cognitive complexity than are extreme attitudes.

Ambivalent attitudes appear when people have both positive and negative perceptions of the same attitude object (Kaplan, 1972; Thompson, Zanna, & Griffin, 1995). For example, ambivalent attitudes might form as a result of an individual's understanding about the tenability of contradictory arguments for an issue, a characteristic of integratively complex thinkers (Tetlock, 1983). Individuals who think in a highly complex way about an issue may also be more ambivalent about that issue than people who think about an issue in a noncomplex way.

Bright and Tarrant (2002) found that college students who had moderate and ambivalent attitudes toward the Endangered Species Act (ESA) wrote significantly more integratively complex essays about the issue than did students who had nonambivalent attitudes. Students who were ambivalent toward the ESA recognized several sides to an issue and may have felt relatively strongly about both sides. The connection between integratively complex thinking and moderate attitudes supports the notion that moderate attitudes are characterized by more complex belief systems than are extreme attitudes (Bright & Manfredo, 1995; Linville, 1982). Integrative complexity was not related to the direction of students' attitudes toward the ESA or its personal importance to them. The weak relationship between attitude direction and integrative complexity suggests that public perceptions of endangered species protection are more complex than simply determining who is right and who is wrong. Furthermore, students who were enrolled in an environmental university writing course showed a significantly greater increase in integrative complexity about the ESA than did students enrolled in a non-environmental university writing course. Similarly, Carroll and Bright (2009) found that individuals who recognized the tenability of competing sides to an issue are more likely to have more moderate attitudes about the topic than those who view the same issue from one perspective. As Tetlock (1989) observed, a higher level of integrative complexity was associated with a pragmatic, open-minded, and nonpartisan worldview.

The importance of an attitude or attitude object is a significant and often examined characteristic. A number of studies have made it clear that more extreme attitudes can be very stable, consequential, and difficult to change. As Hovland (1959), Hyman and Sheatsley (1947) and others have pointed out, extreme attitudes appear to change only rarely in the course of life, even when elaborate influence campaigns are framed to induce shifts. An individual tends to attach a sense of concern, caring, and significance to an attitude (Krosnick, 1988). As suggested by Fazio (1986), the relevant attitude must be cognitively accessible when evaluating an attitude-object. The frequency of activation, the distinctiveness of the attitude, and the extent of links between the attitude and other psychological elements can determine this accessibility. Since important attitudes are frequent in thought (Wood, 1982), are typically extreme (Brent & Granberg, 1982), and are linked to other psychological elements (Judd & Krosnick, 1989), they are likely to be highly accessible. The importance of a person's attitude toward an issue has been shown to be positively related to how thoroughly that person searches for specific information (Krosnick et al., 1993) and elaborates on it (Petty et al., 1995). Further, Bright and Manfredo (1995) found that the effect of available information about a natural resource issue on choice behavior prediction was moderated by the personal importance of the management issue. These studies suggest that when personal relevance is high, respondents will be more inclined to access stored information and elaborate on new information when formulating an attitude.

Attitude Certainty. Attitude certainty is defined as "the degree of certainty or confidence a respondent has in his or her judgments about an attitude object" (Antil, 1983, p. 409). Research suggests that attitude certainty can moderate the attitude-behavior relationship. Attitudes held with certainty tend to be resistant, persistent, and influential on people's thoughts and behavior (Bassili, 1996). Tormala and Petty (2004) found that individuals certain of their attitude towards a new exam policy were more likely to criticize an effort to change those attitudes. Sample and Warland (1973) found that individuals who were certain about their attitudes toward student government elections showed greater consistency between their attitudes toward voting in the elections and the actual behavior than individuals with low attitude certainty. In the context of consumer behavior, actual purchasing behavior can be affected by the certainty with which individuals believe they are able to judge the outcome of purchasing a product (Robertson et al., 1984), or by their overall confidence in an attitude object or brand (Howard & Sheth, 1969).

Attitude certainty has been shown to be associated with information processing, where increases in certainty are associated with decreases in processing activity (Maheswaran & Chaiken, 1991; Wan & Rucker, 2013). According to Maheswaran and Chaiken (1991), certainty might signal a reduced need for additional information, which then lowers attention to any new information and reduces the likelihood of being influenced by it. Eagly and Chaiken (1993) suggested the "sufficiency principle", which asserts, "people will exert whatever effort is required to attain a 'sufficient' degree of confidence that they have accomplished their processing goals" (p. 330). Relevance elevates the amount of judgmental confidence people need to have in their own attitudes and/or the confidence they need to have in the validity of a message (Eagly & Chaiken, 1993).

Several studies have investigated the moderating effect of knowledge. Pierce, Lovrich, Tsurutani and Abe (1989) found that individuals with higher levels of environmental knowledge held attitudes toward environmental policies that were more consistent with their fundamental values. Tarrant, Bright, and Cordell (1997) also found support for the external moderating role of knowledge between values and attitudes towards wildlife species protection. Bright and Barro (1999) further hypothesized that a positive relationship between knowledge about plant and wildlife species protection and integratively complex thinking would exist. Other researchers, such as Bobo and Licari (1989), measured cognitive complexity as a function of objective knowledge about a topic. They found that knowledge or cognitive sophistication increased willingness to support the rights of disliked groups. Unlike these other studies, however, McFarlane and Boxall (2000) found that knowledge of forest-related facts had no moderating effect on the relationship between value orientation and attitudes towards forest management practices.

Knowledge can be directly assessed as how much a person knows about a topic, but it has also been quantified indirectly. One approach, for example, has been to measure mediated communication or the variety of sources a person uses to obtain knowledge. Mirel (1998) points out that analyzing complex tasks requires seeing more than a single path. When interacting with information, O'Malley (1986) describes how a person needs access to integratively complex information, adjustment of the presentation to fit the current goals and info needs, views of the problem from multiple viewpoints, and an understanding of the relationships between info elements. Research suggests that information consistent with a preferred judgment conclusion is less likely to initiate intensive cognitive analysis than is information inconsistent with that conclusion (Ditto & Lopez, 1992). Kruglanski (1980, 1990), Kruglanski and Webster (1996) argued that because the information-processing system has no natural termination point, motivations or "epistemic goals" could affect judgment outcomes by delaying or accelerating the "freezing" of the epistemic search. He suggested that the desire to reach a particular judgment conclusion (i.e., the need for specific closure) results in individuals engaging in a more extensive search for alternative explanations (i.e., delayed freezing) when incoming information is inconsistent with the desired conclusion than when it is consistent with the conclusion. In a similar manner, Psyzczynski and Greenberg (1987) argued that when individuals encounter information with unfavorable implications for the self, they are more likely to generate multiple hypotheses for testing, search more extensively for mitigating information, and devote greater processing capacity to evaluating relevant evidence than when confronted with more favorable information.

Both personal relevance and knowledge are important variables in terms of understanding relationships within the cognitive hierarchy. These findings are also pertinent to Petty and Cacioppo's (1986) Elaboration Likelihood Model of persuasion and attitude change. According to their model, people vary in how carefully and extensively they elaborate about a message and the position or behavior it is arguing. The model suggests that people are more likely to elaborate on a message when they have both the ability and motivation to process the message. Elaboration in this sense refers to relating a message to information stored in memory and self-generating information that is unique to the original message.

Accordingly, individuals who are knowledgeable (i.e., ability) about an attitude object and have a high degree of personal relevance (i.e., motivation) associated with that object should be more likely to elaborate when forming an attitude towards that object.

The studies reviewed suggest that attitudes towards natural resource issues are not simple, unidimensional constructs. Rather they are complex and multifaceted, and influenced by a diverse range of value orientations and beliefs. Extensive cognitive studies, such as those discussed above, emphasize the importance of studying people's value orientations and attitudes to have a better understanding of their responses to natural resource management issues.

3. SIGNIFICANCE OF RESEARCH

Contributions to Theory

Development of Integrative Complexity

Part of this dissertation aims to develop and to improve an objective measure of integrative complexity. Measures of integrative complexity are typically based on two criteria: 1) the number of sides or dimensions that people view related to an issue (differentiation), and 2) extent to which they connect or integrate those dimensions (integration). It is apparent in the literature that differentiation and integration are basic and necessary components of integrative complexity. However, a major shortfall is that the traditional qualitative method of measurement of integrative complexity level (i.e., text analysis or Paragraph Completion Test) is a lengthy process that requires onerous effort from both the researchers and respondents, and thus is unfeasible to use on a larger scale or to generalize the results. These methods are not at fault though, because people are likely to be more aware of “what” they are thinking than “how” they are thinking. Thus, developing ways to capture people’s cognitive processes is an “integratively complex” process in itself, and asking a person how he or she is thinking would not be useful.

Tetlock, Metz, Scott, and Suedfeld (2014) acknowledge the need for new ways of measuring integrative complexity and stress the need for refinements in the meaning of the construct. Research highlights the necessity of distinguishing between dialectical differentiation, in which there is a genuine tension or conflict between perspectives, and elaborative differentiation, in which the individual may be simply listing reasons why he or she is right and opponents are wrong (Tetlock & Tyler, 1996; Conway et al., 2008). It also highlights the importance of distinguishing between hierarchical integration, in which the individual offers a fixed interaction or tradeoff rule for combining two perspectives, and flexible integration, in which the individual recognizes the need to improvise different combinatorial rules in different situations. Van Hiel and Mervielde (2003) suggested that the content analysis measure of integrative complexity might be “primarily understood in terms of differentiation” (p. 798) because it frequently results in lower scores (scores of 3 or less), and as such, integration is not often assessed. More generally, however, there is a need for a more practical and direct approach that is also objective and practical in its use (Tetlock et al., 2014).

There are several characteristics of integratively complex thinkers that commonly arise in the literature. Integratively complex thinkers are generally open to different points of views and exhibit creative problem solving (Schroder et al., 1967; Tetlock & Kim, 1987). In decision-making, individuals with high integrative complexity tend to refrain from jumping to conclusions and are more willing to change their minds in response to contradictory evidence (Tetlock, 1983, 1985). Integratively simple thinkers, on the other hand, are less likely to agonize over decisions because they are more likely to believe their view is the most dominant option that does not require consideration of tradeoffs.

Characteristics of integrative complexity are also reflected in “cognitive flexibility”, which refers to the ability to break old cognitive patterns, overcome functional fixedness, and thus, make novel or creative associations between concepts (Guilford, 1967; Schank & Abelson, 1977; Gruenfeld et al., 1998; De Dreu et al., 2008; Nijstad et al., 2010; Sligte, de Dreu, & Nijstad, 2011). Suedfeld and Granatstein (1995) described integrative complexity as referring to, “the extent to which decision-makers search for and monitor information, try to predict outcomes and reactions, flexibly weigh their own and other parties’ options, and consider potential strategies (p. 510).” Cognitive flexibility is necessary for effective problem solving and creativity, and allows individuals to use the regulatory strategy of reappraisal (Kloo et al., 2010). Creative problem solving is the ability to “synthesize various heterogeneous elements to converge into a unique, original production” (Barbot, Besançon, & Lubart, 2011, p. 63). Creativity involves both divergent thinking (Guilford, 1956; Kim, 2006), which is the exploration of many original ideas, and convergent thinking (Kim, 2006), which is the integration and combination of elements convergent in order to elaborate the best and most creative idea possible for implementation (Myszkowski et al., 2015). Flexibility is adaptive as it allows people to efficiently switch between different behaviors and strategies in the face of novel situations and environmental demands. This involves an active open mind encompassing reflection, seeking and processing information that disconfirms one's belief, and the willingness to change one's beliefs in the face of contradictory evidence (Stanovich & West, 1997, 2007).

In this study, alternative approaches to the traditional content analysis will be developed to systematically measure the two dimensions of integrative complexity and subsequently determine an overall integrative complexity score using an a-priori approach that builds on theory. Particular interest is in the extent to which the measures met criteria for validity and theoretical generativity. The measurement approaches are designed to be situation-specific and relevant to respondents. The first approach will explicitly measure the two dimensions of differentiation, and integration. Responses to each dimension will be used to create differentiation and integration indices that will be combined into an overall integrative complexity score. The second approach will measure integrative complexity using a series of vignettes in which differentiation and integration are presented together in a narrative form. Each vignette is a description using different combinations of varying levels of differentiation and integration. Finally, the third approach will measure integrative complexity using a surrogate measure of cognitive flexibility. Cognitive flexibility is a common correlate of integrative complexity in the literature. Four dimensions of flexibility will be measured to comprise an additive index: openness to change, active listening, perspective taking, and information seeking. The index is designed to segment respondents into unique integrative complexity subgroups (low to high) based on questions used to collect responses for the dimensions.

Connections to the Cognitive Hierarchy

The literature reviewed indicates a relationship between integrative complexity, attitudes, and value orientations. This makes sense because strongly held attitudes can create strong biases in information processing and resist change. If attitudes determine what an individual will see, hear, and think about it, then it is reasonable to expect integrative complexity to have some influence in this process. The proposed research will investigate the relationship between integrative complexity and these constructs of the cognitive hierarchy.

This study will also contribute to the conceptualization and operationalization of attitude strength. While it has been argued that stronger attitudes are more closely related to behavior than moderate attitudes, attitude "strength" has been vaguely defined and examined in various ways. Based on the literature reviewed, limited research has examined how attitude-strength may consist of multiple dimensions (Raden, 1985; Krosnick et al., 1991; Bright & Manfredo, 1995). Determining the cumulative effect of attitude-strength dimensions on predictive validity requires more attention between these dimensions. Therefore, this study will examine the certainty, direction, and extremity of attitudes toward coastal resource management alternatives. These two dimensions have been shown to have significant concurrent effects on the ability of attitudes to predict intentions and behavior, with attitude-certainty being a slightly stronger predictor than attitude extremity (Bright & Manfredo, 1995). Along with the dual effects of certainty and extremity, low positive correlation between these two variables has indicated that multiple measures of attitude-strength may improve the quality and usefulness of attitude strength regarding natural resource issues. For example, does a strong attitude toward a management strategy predict support of that strategy better than a weak attitude? Does attitude strength play a role in the ability to accept tradeoffs (e.g., natural resource use versus protection of those resources)?

Tradeoffs

Methods used for the valuation of ecosystem services have merit, but there are still problems over how to value environmental assets. First, since valuation data can help to inform the policy process, additional information must be collected to address other questions. For instance, what is relevant and what is not? What sorts of tradeoffs need to be considered? How should one balance the long run against the short run? Second, the valuation of tradeoffs has been mostly based on monetary values. Monetary values such as dollars are a metric with which people have a lot of practice and therefore, seem reasonable to use for a scale. However, monetary estimates at face value cannot be assumed to reflect the true value of some ecosystem service or benefits received by society. Consequently, there are validity issues in valuation methods that need addressed.

Different value structures may represent higher order needs (e.g., quality of life) or may represent more fundamental subsistence needs (e.g., resource acquisition). These value structures may reveal different types of attitudes toward the way natural resources are managed. Links between attitudes, values, and complexity of thought have been considered in Tetlock's (1986) analyses of policy issues, and in Rokeach's (1973) research on value confrontations. Tetlock (1986) found that people often relate policy issues to values with conflicting implications for the issue. In the context of coastal resources management, debates revolve around differing values and interests concerning the environment and the proper relationships of humans to their natural surroundings. These views in turn may be connected to conceptions about how the management of resources ought to be provided for now and in the future.

One potential barrier to addressing environmental issues is the motivation of some people to justify the existing system and defend the status quo by downplaying or denying problems with the system, and therefore negate the need to take action to change the system (Feygina et al., 2009). Jost et al. (2003) showed that justification motivation was more common among conservatives than liberals, and conservatives were less likely to acknowledge environmental threats or climate change issues. By engaging in motivated reasoning, people often perceive the world and the information they are presented with in ways that agree with their existing values and ideological commitments. This suggests that people are not only motivated to adopt ideological belief systems to satisfy their needs, but that they will also process information in ways that help to bolster these belief systems (Wood & Vedlitz, 2007).

This study will contribute to the current understanding of tradeoffs and integrative complexity in two ways. First, value orientations and attitudes will be investigated to understand how individuals think about issues and tradeoffs between resource use and protection according to their level of complexity. Multidimensional choices require tradeoffs, and tradeoffs cannot be made without value intensities (Sniderman et al., 1991). Considering a person's ideological position, it may also be possible that a person's beliefs about how ecosystem services should be managed would be influenced by the way that person thinks in consideration to tradeoffs. Environmental change and conflict are often entrenched with "us versus them" battles but can be better explained by complex and interlaced sets of drivers, including the historical, institutional, and social contexts of certain value systems and actions.

Second, this study will also contribute to the measurement of tradeoffs. Integrative complexity is generally regarded as a state variable or a function of the situation. Similarly, the nature of making tradeoffs is multidimensional and not a simple task. When measuring tradeoffs in relation to complexity, it is important to include variables that are relevant and specific to the population of interest. As Rossi and Berk (1997) stated, "if you ask a simple question, you get an overly simple answer" (Rossi & Berk, 1997; p. 35) because it does not allow individuals to reveal the full complexity of their reasoning. Techniques such as conjoint analysis show how people make complex decisions based on multiple factors (Luce & Tukey, 1964; Dennis, 1998).

Research has also shown how different situational factors that define a given context influence evaluations for what is acceptable. Studies suggest that questions regarding acceptable management actions be framed specific to a particular place and purpose (Wittmann et al. 1998; Zinn et al. 1998). In these studies, three levels of specificity influenced normative beliefs about wildlife management actions: incident extremity (what an animal has done); response extremity (what managers propose to do to the animal); and wildlife species (i.e., beavers, coyotes, mountain lions). For instance, destroying any of the three wildlife species was considered unacceptable when the context involved the animal simply being seen in an area. Acceptability of destroying all three wildlife species increased as the impact severity of the context increased (Whittmann et al., 1998). This study will use a similar approach to investigate the acceptability of tradeoff alternatives for the use of coastal resources and the protection of those resources.

Applications to Coastal Resources Management

The integrative complexity with which people think about coastal and marine resource management issues can contribute to a greater understanding of public perceptions of proposed or established policies (Burtz & Bright, 2007). Integrative complexity can provide resource managers with important information regarding how people think about coastal resource issues and management. Society operates in a changing environment and many issues have multiple facets (i.e., social and environmental implications), depending on an individual's perspective. The use of integrative complexity can help managers to be aware of the diverse ways in which people view an issue and be prepared to address them. This information can play a role in guiding management decisions on topics that produce strong, polarized positions among stakeholders.

Integrative complexity can also serve as a tool to use in developing communication strategies. If management agencies understand the level of complexity with which stakeholders view particular issues, the proper content can be developed for more effective dialogue. According to Clute (2000), there are implications for framing messages in appropriate contexts and levels of complexity. When an individual is exposed to information at a higher level of complexity than they typically function, they will often simplify the input and revert back to their preferred level of integrative complexity (Hunsberger et al., 1992). The application of integrative complexity in coastal and marine resources management can aid in communication by first assessing at which levels of complexity individuals are functioning, and then by focusing on information dissemination at or near these complexity levels to correspond to the respective audience (Carroll & Bright, 2005). Knowledge of how individuals view and interpret issues can help resource managers understand how the public will respond to certain actions.

4. CONCEPTUAL FRAMEWORK

The conceptual framework for this study is based on the relationship between integrative complexity and attitudes, beliefs, and values as they apply to coastal resource management issues (Figure 5). Much of the research on public perceptions of natural resource issues focuses on these constructs as separate measures. This study builds on existing literature by examining the connections and interrelationships among these constructs, and by expanding the study and application of integrative complexity and cognitive theory to coastal resource management issues. In addition, this study contributes to the measurement methodology of integrative complexity by developing and testing new quantitative measures.

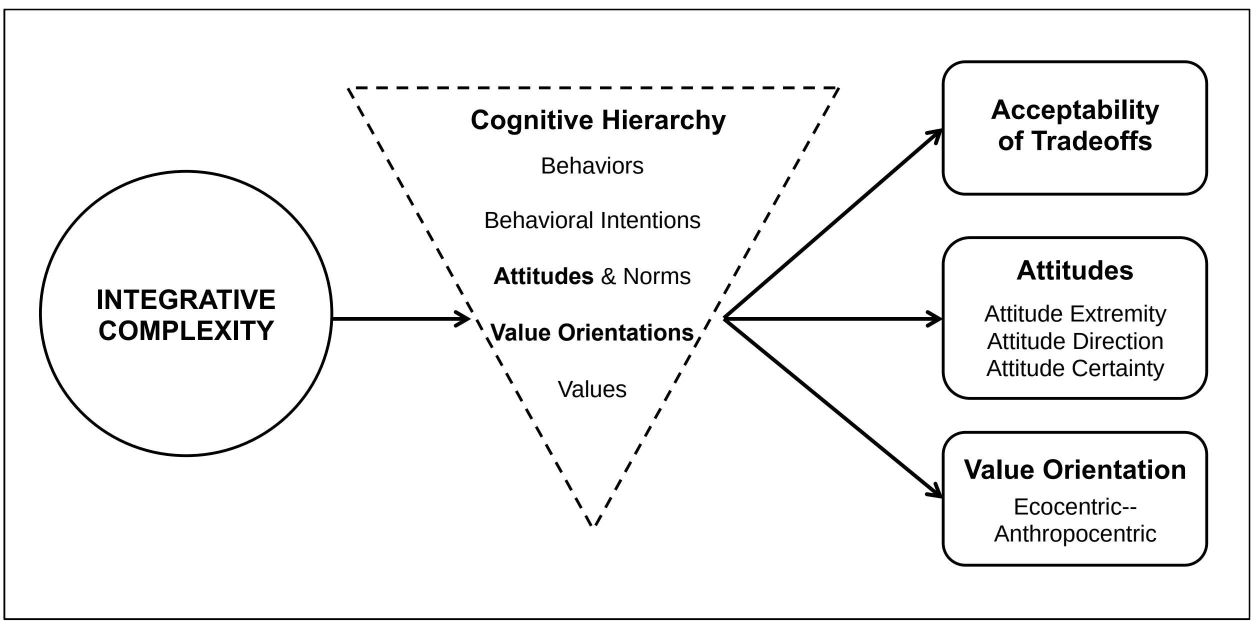


Figure 5. Conceptual framework linking integrative complexity to the cognitive hierarchy.

Research Objectives

The overall goal of this research is to examine how complexity of thinking relates to public perceptions of coastal resource management priorities for resource use and/or protection of those same resources. This involves developing an alternative and functional method for measuring integrative complexity and to apply it to coastal resource management issues. Furthermore, to examine how people’s cognitive hierarchy of values, beliefs, and attitudes vary according to integrative complexity level. Following previous research in integrative complexity and cognitive theory, it is expected that people with higher integrative complexity will think about issues from a broader perspective and be more accepting of tradeoffs.

In order to accomplish these goals, specific objectives and hypotheses have been identified.

Objective 1: To examine integrative complexity of thought regarding management priorities for the use versus protection of coastal-marine resources.

Objective 2: To determine how value orientation differs according to level of integrative complexity.

Objective 3: To determine how attitudes toward use versus protection differ according to level of integrative complexity.

Objective 4: To examine integrative complexity as a moderator in the relationship between value orientations and attitudes toward coastal resources management priorities.

Objective 5: To examine the role of integrative complexity in shaping acceptance of management tradeoffs between use and protection of coastal-marine resources.

Integrative Complexity Measurement

The first objective aims to examine integrative complexity of thought regarding management priorities for the use and/or protection of coastal-marine resources. To achieve this objective, several alternative measures of integrative complexity will be developed and used to identify varying levels of integrative complexity among resource users. Integrative complexity is the independent variable of primary interest and will be used to test hypotheses in subsequent objectives. As conceptualized by previous researchers, the level of integrative complexity is based on two dimensions of an individual's thinking process. The first dimension of integrative complexity is *differentiation*, which refers to a person's ability and willingness to recognize multiple sides or dimensions of an issue, and believe they are relevant to or should be considered in decisions. Someone who sees one side of an issue exhibits low differentiation, whereas one who sees two or more sides shows higher differentiation (Bright & Barro, 2000; Tetlock, 1989). Levels of differentiation are indicated by the number of dimensions (sides or arguments) recognized by the perceiver, the diversity of those dimensions, and the extent to which those dimensions are perceived to be independent or dependent of each other. The individual must first be able to demonstrate an adequate amount of differentiation before that individual is capable of integrating those dimensions (Tetlock, 1989). The second dimension of integrative complexity is *integration*, which refers to the ability and willingness to recognize and generate interconnections between different perspectives or multiple dimensions that are acknowledged in the differentiation stage of measurement (Wallbaum, 1993). Low scores of integrative complexity reflect low differentiation and integration (dichotomous black and white thinking), moderate scores reflect moderate differentiation but no integration (recognition of divergent viewpoints but no means of tying perspectives together), and high scores reflect both high differentiation and integration (explicit attempts to deal with contradictions, to understand their sources, and to cope with their consequences). Measures of differentiation and integration will be combined into an integrative complexity index designed to segment respondents into unique subgroups (low to high levels of integrative complexity).

The second measure of integrative complexity will be developed based on dimensions of cognitive flexibility, which involves the four dimensions of being open to change, active listening, perspective taking, and information seeking (Nemeth, 1986; Gruenfeld et al., 1998; Nijstad et al., 2010). These dimensions are typical characteristics of integrative complexity frequently described in the literature (Tetlock et al., 1993; Gruenfeld & Kim, 1998; Suedfeld, 2010). *Open to change* refers to a person's willingness to incorporate diverse views into one's own thinking, and the willingness to change one's beliefs. Reflection involves active listening (Vince, 2002) and perspective taking, which facilitates observation from multiple angles to produce cognitively elaborate and complex solutions (Linder and Marshall, 2003). In the context of a discussion or debate, *active listening* involves expressing interest in a speaker's message (McNaughton et al., 2007), giving undivided attention to the speaker (Rogers, 1980), refraining from judgment (Garland, 1981), and encouraging the speaker to elaborate when appropriate (Paukert, Stagner, & Hope, 2004). *Perspective taking* is the process of adopting another person's viewpoint, beliefs, goals, and intentions in order to interpret their actions (Parker & Axtell, 2001). *Information seeking* refers to a process in which people seek out a wide variety of information and perspectives to inform their decision-making (Schroder, Driver, & Streufert, 1967). The process is inherently interactive as people seeking information "direct attention, accept and adapt to stimuli, reflect on progress and evaluate the efficacy of continuation (Nel, 2001 p. 25)". Information seeking is more proactive information consumption, while information processing is reactive or passive information-taking behavior (Kim & Grunig, 2011). According to McGuire (1974) and Chaffee (1986), seeking intensity is primarily determined by perceptions of information need, accessibility, and usefulness. This involves weighing perspective topics against personal interests, available information and time constraints (Kuhlthau, 1991). According to the literature reviewed, integratively complex thinkers are open to diverse views and will seek out more information to better understand an issue. Thus, an individual who uses a variety of communication outlets regarding an issue will gain a deeper, richer understanding of that issue. On the other hand, simple thinkers are less tolerant of diversity and selectively attend to and process information in ways that confirm their existing belief systems. Therefore, simple thinkers are less likely to engage in diverse communication outlets.

The third approach will measure integrative complexity using a set of vignettes in which differentiation and integration are presented together in a narrative form. Each vignette is a short description of the type of thinking a person may incorporate and is based on different combinations of varying levels of differentiation and integration. Each combination will represent four increasing levels of integrative complexity ranging from low to high. This is a more direct approach, in which respondents will be asked to read each vignette and then choose the one description that best explains their thinking.

Hypotheses

Value Orientations

High levels of integrative complexity have been characterized by the infusion of broad fundamental values applied to a specific issue (Baker-Brown et al., 1992; Tetlock, 1989). Tetlock et al. (1984) found support for examining values according to integrative complexity. Conservative value oriented politicians were observed to view competing proposals in rigid, black and white terms and tended to overlook the potential for negative outcomes stemming from their favored policy choices. However, results for value-integrative complexity are mixed, as Tetlock (1984) also found that more moderate British politicians exhibited higher levels of integrative complexity than those of Parliamentarians to their ideological left.

Following the approach used by Fulton, Manfredo, and Lipscomb (1996), this study will examine the ecocentric—anthropocentric value orientation continuum. Value orientations describe worldviews and fundamental beliefs about the environment. An *ecocentric* value orientation describes the extent to which an individual views nature and its components as being on equal footing, or having similar rights to existence, as humans. This orientation includes bequest and existence values of nature, which refer to the importance of knowing that healthy populations of species currently exist in the state and ensuring these populations exist for future generations (Bright et al., 2000). An *anthropocentric* value orientation is the extent to which an individual holds a utilitarian view towards nature. This orientation believes that the primary significance of nature lies in its value to humans. An anthropocentric view also incorporates values of freedom or the extent to which people have the right to access coastal resources with little or no government restrictions. The two dimensions will be used to determine whether an individual has an ecocentric, anthropocentric, or pluralist (both ecocentric and anthropocentric) value orientation.

If both ecocentric and anthropocentric value orientations are similar in strength, this may indicate a value conflict or more pluralistic view. This is similar to what is described by Tetlock's (1986) Value

Pluralism Model, which suggests people can endorse high priority values that have conflicting evaluative implications for specific issues. For example, a fisherman may value the opportunity to catch a fish while at the same time appreciate the inherent right of that species to co-exist with humans. On the low end of the spectrum, a distanced or neutral value orientation may indicate less interest in coastal resource issues and that such issues are less salient (Bright et al., 2000; Suedfeld et al., 1994). It may also indicate that, for whatever reason, their values may not be oriented strongly toward coastal resources and their management.

These findings and the lack of studies examining value orientations and integrative complexity outside of the political science realm suggest that more research is in order. To determine how value orientation differs according to level of integrative complexity (Objective 2), the following hypotheses will be tested:

Ho1: There is no significant difference in the direction of value orientation according to level of integrative complexity.

Ha1: Individuals with a pluralist value orientation exhibit higher levels of integrative complexity than individuals with anthropocentric or ecocentric value orientations.

Ho2: There is no significant difference in the extremity of value orientation according to level of integrative complexity.

Ha2: Individuals with less extreme value orientations exhibit higher levels of integrative complexity than individuals with more extreme value orientations.

Attitudes

Attitudes have been suggested to influence our behavior in part by shaping our perceptions of the world around us (Abelson, 1988; Allport, 1935; Fazio, 1986). A strong attitude has the ability to bias perceptions of an issue or behavioral context of focus, and to resist change. If an attitude affects what an individual will see, hear, and think about it, then it is reasonable to expect integrative complexity to have some influence in this process. In this study, the strength of attitudes toward management strategies will be measured in terms of attitude certainty, attitude direction, and attitude extremity. These components will be used to examine the nature of attitudes and determine if respondents with higher levels of integrative complexity have more moderate attitudes toward coastal resources management priorities than respondents with lower levels of integrative complexity who exhibit extreme attitudes (Objective 3).

Previous research suggests that both attitude certainty and attitude extremity are two important dimensions of attitude strength (Bright & Manfredo, 1995; Raden, 1983). *Attitude certainty* refers to the degree of certainty or confidence an individual has in his or her judgments about an attitude object (Antil, 1983). *Attitude extremity* refers to the notion that attitudes vary not only in direction but also in degree of favorableness or unfavorableness (Newcomb et al., 1965). An individual may feel extremely favorable or unfavorable toward something, moderately favorable or unfavorable, or neither favorable nor unfavorable. Early research considered attitude extremity and attitude certainty as being equivalent (Osgood, Suci, & Tannenbaum, 1957), but later research does not (Krosnick & Abelson, 1992; Krosnick et al., 1993). While people who hold extreme attitudes generally hold them with high levels of certainty, people with moderate attitudes often vary in the certainty with which they hold those attitudes (Gross et al., 1995). Some people may also hold moderate attitudes and be unsure of those attitudes, whereas others may be very sure about their approximately neutral attitudes.

Tetlock (1986) found that individuals who expressed confidence in the correctness of their issue stance demonstrated less differentiated thoughts and weaker conceptual integration, both of which are signs of low integrative complexity. People who were less confident in the correctness of their stance demonstrated higher integrative complexity, whereas those who were more confident in the correctness of their stance demonstrated lower integrative complexity. In the context of coastal resources management, this study will examine attitudes toward management actions that prioritize the use of and access to resources, versus the protection of resources. The following hypotheses will test whether attitude certainty and priority provide an overall measure of attitude strength, and whether attitude certainty differs according to integrative complexity level:

Ho3: There is no significant relationship between attitude certainty and priority towards the use versus protection of coastal resources.

Ha3: There is a positive and moderate relationship between attitude certainty and priority towards the use versus protection of coastal resources.

Ho4: There is no significant difference in attitude certainty toward the use versus protection of coastal resources.

Ha4: Individuals with higher attitude certainty exhibit lower levels of integrative complexity than individuals with less attitude certainty.

Research has also found a significant relationship between attitude extremity and integrative complexity (e.g., Bright & Barro, 2000; Bright & Manfredo, 1995; Burtz & Bright, 2007; Carroll & Bright, 2009; de Vries & Walker, 1987; Linville, 1982; Tetlock, 1989). Linville (1982) found that moderate attitudes toward an attitude object were characterized by more complex belief systems regarding that attitude object than were extreme attitudes. Similar results from de Vries and Walker (1987) indicated that moderate attitudes toward capital punishment were accompanied by higher integrative complexity of thought about the issue than were extreme attitudes. In the context of natural resources, Bright and Barro (2000) found that high levels of integrative complexity were characterized by moderate attitudes toward the Endangered Species Act. Both researchers noted that it is not the attitude direction, but the extremity with which one holds a particular attitude that has a measurable and predictable relationship with integrative complexity. While no relationship has been found between attitude direction and integrative complexity, individuals who think with higher integrative complexity may be more supportive of management alternatives because they recognize multiple sides of an issue. Those who think with lower integrative complexity may be less supportive of management alternatives because they consider just one side of an issue. Thus, the following hypothesis predicts:

Ho5: There is no significant difference in the direction of attitudes according to level of integrative complexity.

Ha5: Individuals with attitudes supporting coastal resource management actions exhibit higher levels of integrative complexity than individuals with attitudes opposing coastal resource management options.

An alternative viewpoint, the ideologue model, predicts that strong commitment to any ideology is associated with lower complexity (Palmer & Kalin, 1991; Rokeach, 1960; Suedfeld et al., 1994). Individuals who wish to accommodate a range of values and attitudes must use more complex thinking to reconcile these diverse positions than individuals whose ideology is less heterogeneous (regardless of the content of the ideology). Based on the literature reviewed, it is reasonable to expect that a strong or highly formed attitude will be more accessible to judgments about a relevant topic. Accordingly, the following hypothesis predicts:

Ho6: There is no significant difference in the extremity of attitudes according to level of integrative complexity.

Ha6: Individuals with moderate attitudes toward coastal resource management options exhibit higher levels of integrative complexity than individuals with extreme attitudes toward coastal resource management options.

Integrative Complexity as a Moderator

Research has shown that integrative complexity is related to both values and attitudes. Accordingly, it follows that level of integrative complexity will affect or moderate the relationship between value orientations and attitudes. A moderator is a variable that affects the direction and/or strength of the relationship between an independent and dependent variable (Baron & Kenny, 1986; Tarrant et al., 1997; Vaske, 2008). As previously identified by Carroll and Bright (2009), integrative complexity may function as a moderator to the relationship between value orientations and attitudes in the cognitive hierarchy. This would mean that individuals who are more integratively complex possess attitudes that are more consistent with their value orientations. To determine the presence of moderation, there must be a significant interaction between integrative complexity and value orientation (Baron &

Kenny, 1986; Vaske, 2008). The following hypotheses will test integrative complexity as a moderator in the relationship between value orientations and attitudes (Objective 4):

Ho7: There is no significant relationship between value orientation and attitude toward coastal resources management options.

Ha7: Ecocentric value orientations are positively related to attitudes supporting resource protection, and anthropocentric value orientations are positively related to attitudes supporting resource use.

Ho8: Integrative complexity has no significant effect on the relationship between value orientation and attitude towards coastal resources management options.

Ha8: Integrative complexity has a significant moderation effect on the direction and magnitude of the relationship between value orientation and attitude towards coastal resources management options.

Acceptability of Tradeoffs

This research aims to examine the role of integrative complexity in shaping acceptability of management tradeoffs between use and protection of coastal resources (Objective 5). Tradeoffs between resource use and ecosystem protection involve consideration of important values that conflict. Some people are reluctant to accept the existence of tradeoffs, and thus rely on mental shortcuts to reduce dissonance. This type of thinking is characteristic of low integrative complexity. In contrast, people who think with high integrative complexity are more likely to acknowledge and accept that there are multiple tradeoffs involved in complex management decisions. Because integratively complex individuals are more tolerant of dissonant or unbalanced cognitions (Crockett, 1965), it would be expected that they would be more accepting of management actions involving tradeoffs between resource use and resource protection. To determine how acceptability of tradeoffs is related to level of integrative complexity, the following hypothesis will be tested:

Ho9: There is no significant difference in acceptability of management tradeoffs according to level of integrative complexity.

Ha9: Higher levels of integrative complexity are associated with higher acceptability of management tradeoffs between resource use and protection, as compared to lower levels of integrative complexity associated with lower acceptability of tradeoffs.

The examination of tradeoffs involves identifying the important factors and characteristics of coastal resources management that affect acceptability of management tradeoffs (Objective 5). The factors considered are to be broad enough to cover the key issues that might be important to different respondents, but easy enough to provide useful feedback. Because the management dilemma involves tradeoffs between the use of coastal resources and the protection of those same resources, the factors chosen for this study are components of management alternatives for resource use and resource protection. These are categories that reflect the kinds of choices related to the management dilemma. Each of the factors has characteristics that vary in levels of intensity (decrease, no change, increase). The factors include marine protected area closed to fishing, protection of fish populations, access to recreational fishing areas, and length of the recreational fishing season.

The factors will be evaluated simultaneously rather than individually. A technique based on a factorial design will be used to assess how various combinations of use/protection factors influence an individual's acceptance of management alternatives, and to determine the relative importance of various levels of those factors. By employing a factorial design, a large number of attributes and levels can be included without overwhelming the respondents (Gan & Luzar, 1993). This approach also enables the estimation of each factor's effect on the dependent variable (acceptability of management alternatives) and two-way interactions. The following are hypotheses testing the individual effects of four independent factors, integrative complexity, and their interactions on acceptability of management alternatives.

Ho10: Factors of resource use have no significant effect on the acceptability of management alternatives.

Ho11: Factors of resource protection have no significant effect on the acceptability of management alternatives.

Ho12: There is no significant interaction between use and protection factors on the acceptability of management alternatives.

Ho13: There is no significant interaction between factors and integrative complexity on the acceptability of management alternatives.

5. THE FLORIDA COASTAL MARINE REGION

The coastal marine region of Florida and the Florida Keys is the location of focus in this dissertation research. Florida has 825 miles of coastline since it is a peninsula bordered by the Atlantic Ocean on the east, the Gulf of Mexico on the west, and Florida Bay to the south (Florida DEP, 2017). In addition to these areas, Florida also has an abundance of bays and estuaries associated with the state's river systems that add many miles to the state's beaches and coastline. These coastal and marine areas are extremely productive ecosystems and have major features that attract millions of people to Florida annually. Thus, the Florida region represents a unique coastal socio-ecological system that offers an array of diverse ecosystems, threatened and endangered species, tourism, recreation opportunities, and many other ecosystem services. Yet, at the same time, the region is pressured by increasing population growth and human activity, and is vulnerable to sea level rise, climate change, and various other stresses. Changing the amount of impact of human activities on coastal resources entails changing the amount of costs and/or benefits. By understanding and managing competing uses and tradeoffs in environmental conditions, a greater proportion of human benefits provided by coastal ecosystems can be sustained. The sustainability of ecosystem services in Florida will depend on maintaining the desired conditions of the coastal-marine ecosystem, while also addressing the pertinent drivers, pressures, social and political responses. The interrelationship of these processes, using the Florida Keys as an example, is illustrated by the DPSER (Drivers-Pressures-State-Ecosystem Services-Responses) model (Figure 6).

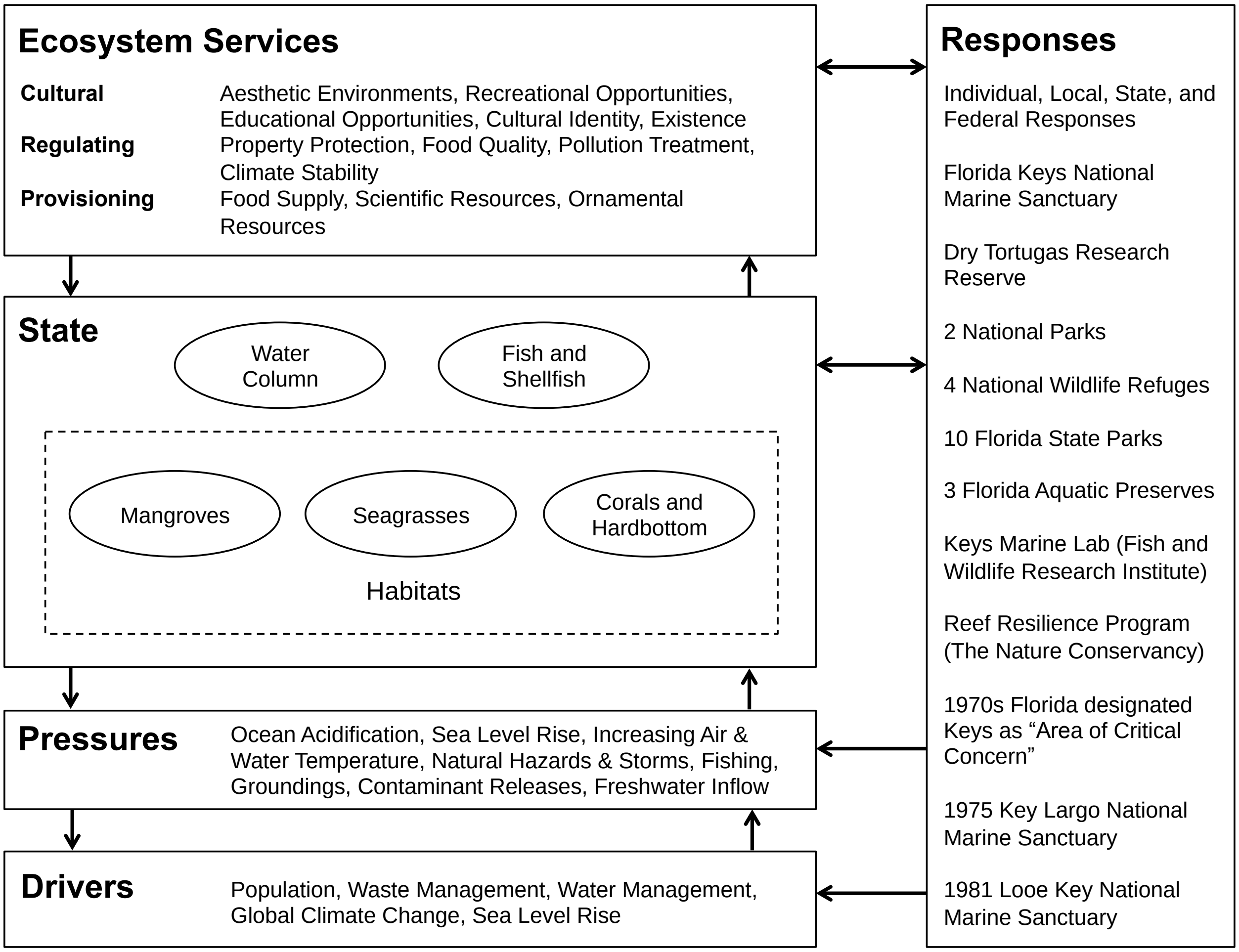


Figure 6. DPSER model of Florida Keys coastal and marine ecosystem.

The Florida Keys are located in Monroe County, the southernmost county in the United States. The Keys are comprised of a chain of calcium carbonate islands extending 220 miles southwest from the southern tip of Florida and forming the southeastern margin of Florida Bay. There are 46 inhabited islands in the Florida Keys, connected by 42 bridges of the Overseas Highway running from Miami to Key West. Florida's coastal and marine resources comprise some of this nation's most diverse and productive ecosystems, supporting a range of important ecosystem services. The Keys are adjacent to the third largest barrier reef in the world, extending over 480 km. This complex ecosystem contains more marine species than any other region in the U.S., including approximately 100 species of coral and 400 species of fish. The reef also buffers the shoreline as natural breakwaters. In 1990, the Florida Keys

National Marine Sanctuary and Protection Act established a Sanctuary and Advisory Council to protect, manage and conserve 9,500 km^2 of coastal and ocean waters surrounding the Keys (Donahue et al., 2008; Shinn, 2008). The Keys also contain 4 National Wildlife Refuges, 2 National Parks, 2 Ecological Reserves, 10 State Parks, Botanical Sites and Aquatic Preserves, and over 20 endangered species, including two species of coral (Elkhorn and Staghorn), the building blocks of reefs (US GAO, 2007; Donahue et al., 2008).

Ecosystem Services

Ecosystem services are central to the identity of Florida. The value of ecosystem services is dependent upon the environmental conditions or state of the coastal marine ecosystem. As identified by the Millennium Ecosystem Assessment (2005), ecosystem services are classified as cultural, regulating, and provisioning services. Cultural services are the non-material benefits obtained from ecosystems including Florida's aesthetic environments, existence of wildlife, educational opportunities, and cultural identity. Most notable are the state's recreation opportunities such as diving, snorkeling, swimming, wildlife and scenic viewing. In 2008, approximately 60% of Keys residents regularly participated in activities such as fishing, boating, snorkeling, diving, beach activities, and wildlife observation (Leeworthy & Morris, 2010). In 2007-2008, approximately 3.3 million visitor-trips were made to the Keys, and recreation was the purpose for 92% of those visits (Leeworthy et al., 2010).

In Florida, recreational saltwater fishing is a major ecosystem service, enjoyed by over a million participants annually and supports a multi-billion-dollar industry (Tringali, et al., 2008). Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), and common snook (*Centropomus undecimalis*) are among the most popular fisheries in Florida (NOAA, 2014). Red drum, also called redfish, red bass or reds, are a long lived (40-year lifespan) and large (adults >1 m length, 20 kg weight) species common in the Gulf of Mexico and southern North Atlantic Ocean (Chagaris, Mahmoudi, & Murphy, 2015). The red drum fishery is predominantly recreational and focused on sub-adult fish (ages 1-4 years) that remain in estuaries and inshore waters and are easily accessed by anglers. Red drum are one of the most popular targets for anglers due to its perceived attributes as a sportfish, year-round availability and widespread distribution. Management of red drum in Florida is considered successful. Overfishing of red drum in the late 1980s led to several emergency closures established to reduce fishing pressure. In 1989, the slot limit of 18-27 inches, the bag limit of one fish per person and a closed season from March to May were put in place. Since then, red drum stocks have rebounded and are currently meeting the Florida Fish and Wildlife Conservation Commission's management goal of 40% escapement in most parts of Florida. Escapement is the proportion of fish that survive through age four relative to the fish that would have survived if there was no fishery.

Common snook is one of Florida's most popular gamefish even though snook only occur in the southern portion of the peninsula. They are found in estuaries, adjacent rivers, and in nearshore waters of the western Atlantic (Muller, Trotter, & Stevens, 2015). The snook species that occur in Florida are located at the northern extent of their geographical distribution and can experience thermal stress when water temperatures decline in winter months. Prolonged cold conditions in January of 2010 produced many reports of snook cold-kills and led to a statewide snook closure until September of 2013.

Spotted seatrout is managed for both commercial and recreational fishing in Florida. Management of spotted seatrout in Florida began in the late 1980s when the fishery was declining. The management goal for this species is a 35% spawning potential ratio (SPR), which is the number of fish that survive to spawn given the actual fishing mortality compared to the number that would live to spawn in an unfished population. Stock assessments, which were conducted in 2003 and 2006, showed the spotted seatrout population as relatively stable. The 2010 stock assessment showed that spotted seatrout exceeded the 35% SPR goal in the northeast, southeast, and southwest management regions (Murphy, Chagaris, & Addis, 2011).

The Florida Keys are world renowned as diverse and spectacular fishing grounds and a principal reason why the state legislature declared Florida "Fishing Capital of the World" (www.fwc.state.fl.us). With prime access to both the Atlantic Ocean and Gulf of Mexico, the coral reefs and seagrass flats make the Florida Keys a mecca for coastal- and marine-based activities. Tourism is a major component of the

Keys' economy and has stimulated over $2.2 billion in local Keys production and supported over 32,000 local jobs (Leeworthy & Ehler, 2010). For instance, tourism encompasses a variety of sectors such as transportation (charter boats, buses, taxis, etc.), accommodations (hotels, bed and breakfasts, campgrounds, etc.), attractions (beaches, state and national parks, festivals, etc.), food and restaurants, specialty retail outlets (souvenirs, dive shops, fishing tackle and bait supply, etc.), and visitor information centers.

Provisioning services and goods are products obtained from ecosystems such as food supply, freshwater, fiber, ornamental resources, biochemical resources, and genetic resources. The Florida Keys is also home to more than 500 fish species, including 389 that are reef associated (Stark, 1968), and thousands of invertebrate species, including corals, sponges, shrimp, crabs and lobsters. The recreational fishery encompasses a diversity of species, such as gray snapper (*Lutjanus griseus*) and spotted sea trout (*Cynoscion nebulosus*). The fishery for the Caribbean spiny lobster (*Panulirus argus*) is the single most economically valuable fishery in Florida and the Caribbean, and in Florida the recreational lobster fishery accounts for 20% of all lobster landings (Ehrhardt et al., 2010).

Clear tropical waters and unique coral reef environments are some of the benefits that have drawn people to the Keys. These are examples of regulating services, which are benefits obtained from regulation of ecosystem processes such as protection of property from coastal storm damages, safe seafood quality, water filtration, and carbon dioxide sequestration. Coral reef, mangrove, and seagrass ecosystems provide help to maintain water clarity and quality by providing direct and indirect services such as waste assimilation, water purification, nutrient cycling, and shoreline protection. These ecosystems also function as important spawning, nursery, breeding and feeding areas for a multitude of organisms. Being one of the most species-rich habitats, coral reefs are important in maintaining a diverse range of biological and genetic resources.

State of the Ecosystem

The coastal and marine ecosystems in Florida and the Florida Keys consist of coral reefs, seagrass beds, and mangroves. There are functional differences among these ecosystem types, but they are all connected to one another in supporting and providing the ecosystem services people desire. Mangroves and seagrass beds interrupt freshwater discharge, are sinks for organic and inorganic materials as well as pollutants, and can generate an environment with clear, nutrient poor water that promotes the growth of coral reefs (Ogden, 1988; Szmant, 1997). Coral reefs in turn serve as physical buffers for oceanic currents and waves, creating overtime, a suitable environment for seagrass beds and mangroves. In addition to these physical interactions there are several biological and biogeochemical interactions between these interconnected ecosystems. Ogden (1988) refers to this large biome as a complex mosaic of mangroves, seagrass beds, and coral reefs interacting in a dynamic fashion, all influenced by terrestrial as well as open ocean activities.

Coral Reefs

The Florida Keys' coral reef tract is a bank-barrier system with seaward-facing, shallow-water spur-and-groove formations that are connected by a linear transitional reef from Miami to west of the Marquesas Keys. Over 6,000 patch reefs occur in nearshore and offshore environments. There are four main types of coral habitat in Florida Keys: hard bottom, patch reef, shallow offshore reef, and deep offshore reef. The hard bottom area is dominated by soft corals, such as sea fans, with a sandy substrate. A patch reef is a tall mound of coral dominated by massive corals, such as brain coral, and a higher diversity of organisms is found here. Shallow offshore reefs are found in zones of high-energy water. These are usually the barrier reefs and are inhabited by branching corals, such as staghorn and elkhorn corals. The deep offshore reefs are dominated by the massive corals and bottom-dwelling organisms.

Climate related stressors affecting coral reefs include temperature changes, changes in the frequency and severity of storms, sea level rise, and changes in water quality and salinity. Ocean water chemistry is also impacted by increasing atmospheric carbon dioxide levels, which can inhibit calcification, the deposition of the calcium carbonate minerals that are the structural building materials of coral reefs (Keller et al., 2009; Lirman et al., 2014). The major climate change factor that is increasingly important for coral reefs is rising ocean temperatures, which has been implicated in chronic stress and disease epidemics, as well as in the occurrence of mass coral bleaching episodes (Buddemeier et al., 2004). “Bleaching” refers to the loss of symbiotic algae by the coral host. Most of the pigments in the usually colorful corals depend on the presence of these algal cells. The living tissue of coral animals without algae is translucent, so the white calcium carbonate skeleton shows through, producing a bleached appearance. Massive corals that are slow-growing and thick-tissued tend to be less sensitive and commonly recover from all but the most extreme bleaching episodes. Thus, bleaching selectively removes certain species from reefs and can lead to major changes in the geographic distribution of coral species and reef community structures (Hughes et al., 2003).

Over the past 30 years, reefs have experienced fluctuations in coral cover and site-specific species diversity and an increase in coral diseases and bleaching. For example, in the years between 1983 and 2000, the total area of live elkhorn coral (*Acropora palmate*) and staghorn coral (*Acropora cervicornis*) at Looe Key reef is estimated to have declined by 93% and 98%, respectively (Miller et al., 2002). In 2015, coral monitoring results indicated high threats of mass bleaching from mid-August through late September. The prevalence of bleaching and paling in each zone was determined and broken into three categories: mild (0-20%), moderate (21-50%) and severe (>50%). Severe bleaching and paling, which is defined as >50% of all hard corals over 4cm surveyed showing signs of bleaching or paling, occurred in the fore-reef and offshore zones of the Middle and Lower Keys, and in all zones of the Upper Keys and Dry Tortugas sub-regions (Figure 7). Moderate bleaching (21-50%) occurred in the Middle and Lower Keys.

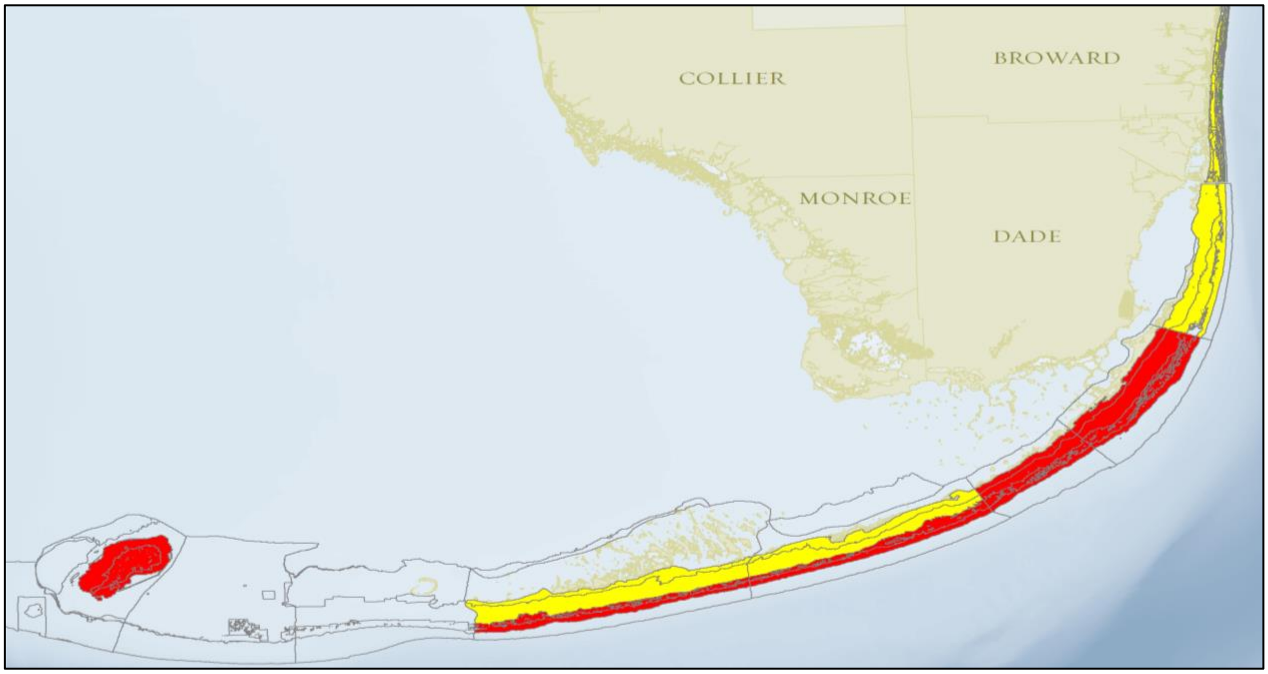


Figure 7. Distribution and prevalence of coral bleaching in the Florida Keys; Green = mild bleaching (0-20%), Yellow = moderate bleaching (21-50%), Red = severe bleaching (>50%) (Disturbance Response Monitoring, 2015).

Seagrasses

The ecosystem also includes one of the world's largest seagrass beds, which are among the richest, most productive, and most important submerged coastal habitats. Seagrasses, also known as submerged aquatic vegetation (SAV), provide food and habitat for commercially and recreationally important species of fish and invertebrates, and are an integral component of tropical coastal environments. Seagrass flats are also popular destinations for fishing and boating. These are highly productive areas that support a variety of commercial and recreational fish species by providing habitat for feeding grounds, nurseries, and refuges from predators. Seagrasses also protect shallow, unconsolidated sediments from erosion and help to maintain water clarity. An estimated 2.7 million acres of seagrass flats grow along Florida's extensive coastline, bays and lagoons (Dawes et al., 2004). Turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*) are common species growing in the Florida Keys. Shoal grass is found in the shallowest waters, and tolerates exposure and high salinities better than other seagrasses. Turtle grass typically grows from the low tide level to depths of approximately 30-40 feet on sand and rubble covered bottoms. Manatee grass is found at greater depths and usually grows in small patches. Both turtle and manatee grass tolerate water salinities of 20-36 ppt.

Turtle grass is the most dominant seagrass species and tolerates water conditions with relatively low nutrient levels, whereas manatee and shoal grasses are faster growing species that tolerate higher nutrient conditions (Dawes et al., 2004). Since turtle grass is sensitive to changes in nutrient levels, concentrations of nitrogen (N) and phosphorus (P) absorbed by turtle grass often indicate the nutrient availability in surrounding waters. When the ratio of N:P reaches 30:1, nutrient conditions are such that seagrass will be lost and gradually replaced by plants that are better adapted to the nutrient-rich conditions (Ferdie & Fourqurean, 2004). With very high levels of nutrients, macroalgae will be replaced by microalgae living in the water column. Sometimes, conditions can promote microalgae growth to become so dense that they block sunlight and promote the growth of epiphytes (sessile organisms) directly on the grass blades. Both situations can make it difficult for seagrasses to absorb sunlight needed for photosynthesis.

Significant changes in the dominant plants brought about by nutrient enrichment or eutrophication can lead to the loss of seagrass beds, which are critical nursery and feeding grounds for many invertebrates, fish, birds, reptiles and marine mammals, including many species that are important to the local fisheries. This can cause a shift in the seagrass-based food web or significantly alter an area's ecosystem and can negatively affect recreational and commercial fisheries. In 1987, Florida Bay experienced a significant seagrass die-off, followed by increased phytoplankton blooms and turbidity (Fourqurean & Robblee, 1999). These changes significantly impacted the bay's ecosystem, resulting in decreased lobster populations and sponge die-offs (Butler et al., 1995). The bay continues to experience episodic blooms and die-off events, and there remain significant concerns that this ecosystem is at risk without more effective management actions.

Mangroves

Mangroves cover the third important section of the Florida Keys ecosystem, with red mangrove trees fringing the 1,600 islands and 1,800 miles of shoreline within the Florida Keys National Marine Sanctuary (DOC, 1996). Mangroves provide habitat for juvenile fishes and invertebrates, stabilize sediments, and produce prop-root surfaces for attached organisms such as oysters, sponges, and algae. Mangroves also provide nursery habitat for numerous commercial and recreational fishery species and critical foraging habitat for adult fishes (Odum et al., 1982; Lewis, 2000; Faunce & Serafy, 2006). They provide foraging and nesting habitat for South Florida's ubiquitous fish-eating birds, as well as nesting and stopover habitat for resident and migratory passerine bird species (Odum et al., 1982). Herons, brown pelicans, and spoonbills all make their nests in upper branches of mangrove trees. Mangroves are also effective at sequestering carbon dioxide, nutrients, and reducing shoreline erosion from storm surges, currents, waves, and tides. These are all important ecosystem services that support human living and wellbeing (Moberg & Ronnback, 2003). However, local, regional, and global stressors, both natural and anthropogenic, may result in loss of this habitat in the Florida Keys.

Mangroves have distinct zones characterized by the species of mangrove that grows there. The zone where a species of mangrove exists depends on its tolerance for tidal flooding, soil salinity, and the availability of nutrients. There are three species of mangroves are found in the Florida Keys. The red mangrove (*Rhizophora mangle*) colonizes the seaward side, so it receives the greatest amount of tidal flooding. Further inland and at a slightly higher elevation, black mangroves (*Avicennia germinanas*) grow. The zone in which black mangroves are found is only shallowly flooded during high tides. White mangrove (*Laguncularia racemosa*) and buttonwood trees (*Conocarpus erectus*) face inland and dominate the highest parts of the mangroves. Tidal forces, climatic conditions, and soil type result in the mangrove species forming six different forest types: over wash, fringe, riverine, basin, hammock, and scrub forests (Lugo & Snedaker, 1974). The arrangement of the species within mangrove type determines the biota that occurs within the mangrove forests (Lugo & Snedaker, 1974).

The intricate root system of mangroves makes these forests attractive to fishes and other organisms seeking food and shelter from predators. Epiphytes and sessile invertebrates frequently grow on specialized root adaptations of mangroves (prop roots and pneumatophores) and these, plus the mangrove leaf litter, are the basis of mangrove food webs (Odum & Heald, 1975). Odum et al. (1982) reported 220 species of fish, 21 reptiles, 3 amphibians, 18 mammals, and 181 birds that utilize the mangroves of South Florida. The dense intertwining prop roots allow the mangroves to handle the daily rise and fall of tides, which means that most mangroves get flooded at least twice per day. The roots also slow the movement of tidal waters, causing sediments to settle out of the water and build up the muddy bottom.

Drivers and Pressures of Change

Drivers and pressures from the fluctuating population in the Florida Keys can have cascading impacts on the coastal environment. Florida's population in 2015 was more than 19 million, with most of the population residing in southeast Florida counties (U.S. Census, 2015). Furthermore, the number of seasonal residents and tourists in the Florida Keys exceeds the number of permanent residents (Leeworthy, Loomis, & Paterson, 2010). From 2003 to 2006, the increasing number of recreational boat registrations surpassed the population growth rate by three percent (Swett et al., 2009). In the year 2000 alone, it was estimated that the economic contribution from both natural and artificial reefs was $873.1 million for Monroe, Miami-Dade, Broward and Palm Beach counties combined (Johns et al., 2001). The reefs not only support various recreation and tourism activities, but they also protect coastlines from beach erosion caused by waves and moderate the impacts from storms (Bhat, 2003; Wells, Ravilious, & Corcoran, 2006). As population growth increases on the coast, conflicts between ocean health and ecosystem services are also likely to increase and become more challenging to balance the two. With increasing demands for space and resources, management will need to incorporate the diverse human and natural linkages of Florida's coral reef systems.

The greatest threat to the environment, natural resources, and economy of the Keys has been degradation of water quality, especially over the past couple decades, which has been a major concern for residents in the Keys (Kruczynski & McManus, 2002). Some of the reasons for the decline are believed to be: (1) the lack of fresh water entering Florida Bay; (2) nutrients from domestic wastewater via shallow-well injection, cess-pits, and septic tanks; (3) stormwater runoff containing heavy metals, fertilizers, insecticides, and other contaminants; (4) marinas and live-aboard vessels; (5) poor flushing of canals and embayments; (6) accumulation of dead seagrasses and algae along the shoreline; (7) sedimentation; (8) infrequency of hurricanes in recent decades; and (9) environmental changes associated with global climate change and rising sea-level. All of these factors are drivers and pressures tied to the state of the ecosystem and have indirect and direct effects on the quality of ecosystem services.

Eutrophication (an outcome of excess nutrients in the water, such as fertilizers) of nearshore waters is a documented problem. Septic tanks or cesspits have traditionally been used, however, nutrient removal in the Key's porous limestone causes groundwater seepage and carries wastewater into canals and inshore waters. Wastewater discharge can cause increased levels of nutrients leading to phytoplankton blooms that decrease water clarity and decay causing hypoxia in sediments and stratified canals (Lapointe et al., 1994). Nutrients also cause macro-algal overgrowth increasing competition among seagrasses and corals for space. This can affect the natural ecosystem functioning of the microbial loop, which cycles nutrients and carbon and is present in all aquatic ecosystems. Additionally, microbes could cause disease and illness in humans and marine organisms, such as fish, shellfish and corals. These effects are ultimately tied to the delivery of quality ecosystem services such as fishing, snorkeling, diving, human health, and shoreline protection.

Water quality issues are a particular concern in Florida Bay, which is located below the Everglades National Park, along the Florida Keys. In Florida Bay, reduced freshwater flow has increased plankton blooms, seagrass die-offs, and fish kills. Since Florida Bay and nearshore waters provide important nursery and juvenile habitat for a variety of reef species, the declines in these areas also affect the overall health and structure of offshore coral reefs. Therefore, regional strategies to address the quantity, quality, timing, and distribution of freshwater flows through the South Florida ecosystem into Florida Bay and estuaries are critical.

The effects of far-field drivers and pressures, such as global climate change and sea level rise further complicate management of coastal marine resources. Ecosystems will transition either by retreat and migration, adaptation, or elimination of functions and certain species. Shallow water habitats may transition to open water, forcing ecological changes in coastal wetlands and estuaries affecting nesting, spawning and feeding locations and behavior. Intrusion of saltwater into inland water bodies and the aquifer is negatively impacting freshwater resources, and these impacts will worsen or accelerate with further sea level rise. Inundation of shoreline will increase the extent and severity of beach erosion. Increased storm frequency and intensity, and water from storm surges will have worse implications on coastal communities in low-lying areas who are already vulnerable to flooding. Pollutants, debris, and hazardous materials released by flooding can contaminate land and coastal areas. Natural infrastructure is critical to the resilience of the Keys and residents because it provides many benefits related to storm protection, water and air purification, and other ecosystem services. Currently, the Florida Keys get nearly all of their drinking water from well fields in southern Miami-Dade County. However, the combination of South Florida's porous limestone geology, low elevation, and rising sea levels creates the potential to contaminate the drinking supply for residents of the Keys and other Florideans (Bloetscher et al., 2016; Sweet et al., 2014).

The complex set of drivers and pressures to the coral reef ecosystem may alter the many ways in which people benefit from the ecosystem services provided by the Florida Keys. In response, numerous resource management actions and regulations have been established. Most notable has been the designation of the Florida Keys National Marine Sanctuary.

Florida Keys National Marine Sanctuary

The National Marine Sanctuary Program has managed segments of the coral reef tract in the Florida Keys since 1975. The Key Largo National Marine Sanctuary was established in 1975 to protect

353 km^2 of coral reef habitat in the Upper Keys. In 1981, the Looe Key National Marine Sanctuary was established to protect the Looe Key Reef located in the Lower Keys. Because these two sanctuaries are located just 5-7 km offshore, the health of these coral reef resources has been affected by land-based sources of pollution and nutrients, with many threats coming from outside the boundaries of the sanctuaries. Throughout the 1980s, concerns persisted over deteriorating water quality, coral bleaching, loss of living coral cover, seagrass die-offs, declines in reef fish populations, and the spread of coral diseases throughout the region. There were also concerns over oil drilling and large vessel groundings. These issues were brought to the public spotlight after three separate vessel groundings occurred within three weeks in 1989, the same year of the Exxon Valdez incident. The combination of these concerns led U.S. Congress to enact the Florida Keys National Marine Sanctuary and Protection Act (PL 101-605) in 1990, prohibiting drilling and exploration for oil and minerals in Keys waters and by excluding large vessels (>50 m in length) from these waters.

The Act established the Florida Keys National Marine Sanctuary to provide long-term management of 2,900 square nautical miles of surrounding waters (Figure 8). Section 304 of the National Marine Sanctuaries Act (NMSA), 16 U.S.C. 1431 *et seq*., authorizes the Secretary of Commerce to issue regulations as are necessary and reasonable to implement the designation, including "managing and protecting the conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological or aesthetic resources and qualities of a national marine sanctuary". The NMSA directs the National Oceanic and Atmospheric Administration (NOAA) to administer the Sanctuary utilizing comprehensive resource management strategies to manage for multiple ecological and social benefits, increase public understanding of the unique marine areas, and to facilitate use of those areas. Thus, the dual mandate of both protection and use is evident in the NMSA and provides managers with guidance for creating a balanced management plan.

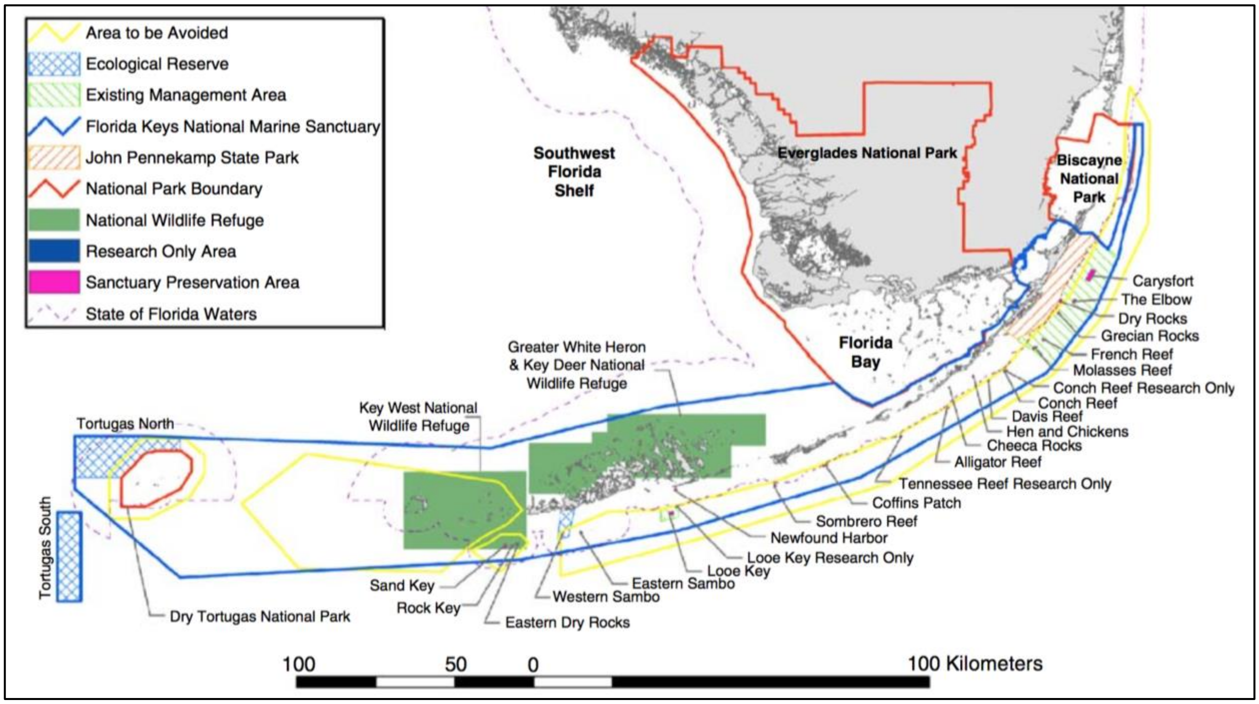


Figure 8. Map of the Florida Keys National Marine Sanctuary (solid blue line) boundaries and zones, State of Florida waters (dashed blue line), adjacent parks and refuges.

In response to water quality issues, the Sanctuary initiated the Water Quality Protection Program (WQPP) dedicated to protecting and improving water quality, coral reefs, seagrasses, fisheries and recreational opportunities within the sanctuary. A subsequent amendment to the Act in 1992 acknowledged the critical role of clean, clear water in maintaining marine resources within the sanctuary by directing the Administrator of the U.S. Environmental Protection Agency (EPA), the Governor of the State of Florida (Florida Department of Environmental Protection (FDEP)) and the Secretary of Commerce (National Oceanic and Atmospheric Administration, NOAA) to create a WQPP for the Sanctuary. The purpose of the WQPP is to identify and implement priority corrective actions to address point and nonpoint sources of pollution to maintain the chemical, physical, and biological integrity of the Sanctuary. The program is also to include the restoration and maintenance of a balanced, indigenous population of corals, shellfish, fish and wildlife, and recreational activities in and on the water.

Marine Zoning and Regulations

As mandated by the Act, a comprehensive management plan for the Sanctuary was developed throughout a six-year planning process and implemented in 1997. The plan provided a comprehensive analysis of the threats to the environment in the Keys and proposed more than 90 specific strategies to address those threats. Responsibilities were detailed for 18 federal and state agencies and departments, as well as for local governments and nongovernmental organizations. A number of different management response actions have been initiated, including reducing or eliminating waste discharge to marine waters from boaters; improving storm water and wastewater management strategies; implementing a research and monitoring program; restoring damages caused by vessel groundings; protecting maritime heritage resources; installing mooring buoys and enforce regulations on visitor use of resources; and install channel markers to improve navigation and reduce groundings.

The Sanctuary management plan created special areas of varying sizes and purposes and prohibited extractive activities within them. These areas were designated as types of marine zones in order to reduce pressures in heavily used areas, protect critical habitats and species, and reduce user conflicts (Figure 8). Three of the zones (Sanctuary Preservation Areas, Ecological Reserves, and Special-use areas) are fully protected no-take areas, where all consumptive activities (e.g., lobstering, fishing, spearfishing, shell collecting) are prohibited. These no-take zones combine to protect 6% of sanctuary waters and encompass 65% of the spur and groove shallow coral reef habitat by extending beyond them and into the Florida Straits (Figure 8). The marine zone types within the Sanctuary are as follows.

Existing Management Areas (EMAs) are areas within the sanctuary that were established by a federal agency prior to 1997 when sanctuary zoning regulations went into effect. Sanctuary regulations supplement the existing authorities to facilitate comprehensive protection of resources. There are 21 Existing Management Areas in the Sanctuary. Fifteen are administered by the Florida Department of Environmental Protection, four by the U.S. Fish and Wildlife Service (FWS), and two by FKNMS (Key Largo and Looe Key National Marine Sanctuaries).

Special-use (Research-only) Areas are set aside areas for scientific research, restoration, and monitoring. They can be used for specific uses such as long-term research and monitoring, or to confine or restrict activities. The sanctuary's four Special-Use Research Only Areas are located between Key West and Key Largo (Conch Reef, Tennessee Reef, Looe Key patch reef, and Eastern Sambo), and a permit is required to enter these areas.

Ecological Reserves (ERs), which include the Western Sambo ER and the Tortugas ER, encompass a total area of 160 square nautical miles. The ERs are the largest of the sanctuary zones and were established to protect and enhance natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of fish and other marine life (NOAA, 2007). These areas limit consumptive activities, while continuing to allow activities that are considered as compatible with resource protection.

Sanctuary Preservation Areas (SPAs) include 18 SPAs covering approximately 6.5 square nautical miles. SPAs were designated to protect shallow reefs and biologically important areas that help sustain critical marine species and habitats. Regulations for this zone type are designed to limit consumptive activities and to separate users engaged in different kinds of activities. Diving, snorkeling, and boating are allowed inside these zones, whereas some SPAs allow limited bait-fishing by permit only.

Wildlife Management Areas (WMAs) were established to minimize disturbance to especially sensitive or endangered wildlife and their habitats (NOAA, 2007). These zones typically include bird nesting, resting or feeding areas, turtle-nesting beaches, and other sensitive habitats. Regulations governing access were designed to protect endangered and threatened species and their habitats, while providing opportunities for public use. Access restrictions include no-access buffers, no-motor zones, idle speed only/no wake zones, and closed zones. Some restrictions may apply to certain times of the year, while others apply year-round. There are 27 WMAs, 20 of which are under the management of the FWS as units of the Florida Keys National Wildlife Refuges Complex. Two of these refuges, Key West and Great White Heron National Wildlife Refuges encompass more than 400,000 acres of marine waters. While the FWS has full federal authority to regulate public access and activities on all refuge-owned islands above the mean high tide line, the waters and submerged lands below the mean high tide line seaward are owned by the State of Florida. In 1992, FWS entered into a management agreement with Florida that authorized the application of federal regulations within state waters and submerged lands to minimize wildlife disturbance and habitat damage from non-wildlife-dependent recreational activities, consistent with the laws and policies of the National Wildlife Refuge System.

Areas to Be Avoided (ATBA) prohibit the operation of a tank vessel greater than 50 meters in registered length, with a few exceptions (e.g., national defense, law enforcement, responses to emergencies). Some ATBA boundaries buffer those of the sanctuary. Though not specifically identified in the management plan, the *General-use Area* is the remaining area of the sanctuary in which general sanctuary regulations apply. Regulations that apply throughout the entire area of the sanctuary, both in highly protected areas and general use areas, have a focus on habitat protection, reducing threats to water quality, and minimizing human impact to resources (Table 2).

Other federal efforts have also been designed specifically to protect coral reefs. In 1998, the year of a mass bleaching event, President Clinton issued the "Coral Reef Protection" Executive Order 13089. The order affirmatively required all federal agencies to identify actions that could affect U.S. coral reefs and to ensure, subject to certain exceptions, that their actions would not degrade those ecosystems. The order also created the U.S. Coral Reef Task Force (CRTF) to research the causes of, and solutions for, coral reef degradation; to reduce and mitigate coral reef degradation from pollution, overfishing, and other causes; and to implement strategies to promote conservation and sustainable use of coral reefs internationally (Executive Order No. 13089, 1998). The CRTF was further supported by the Coral Reef Conservation Act of 2000 (16 U.S.C. §§ 6401-6409). In the same year, the CRTF released a National Action Plan calling for 20% of all U.S. coral reefs to be designated as no-take ecological reserves by 2010 (CRTF, 2000). A no-take zone bans all consumptive uses, including fishing and mineral extraction (Sanchirico, 2000). Multiple-use areas would be designated in an attempt to balance human uses with resource conservation goals. The plan also calls for a broader understanding of coral reef ecosystems, including the human dimensions to ensure that management measures reflect the social, economic, political, and cultural environment.

Table 2. Prohibited activities in the Florida Keys National Marine Sanctuary.

1	Moving, removing, taking, injuring, touching, breaking, cutting or possessing coral or live rock.
2	Removing, injuring, or possessing coral or live rock.
3	Discharging or depositing treated or untreated sewage from marine sanitation devices, trash, and other materials.
4	Dredging, drilling, prop dredging or otherwise altering the seabed, or placing or abandoning any structure on the seabed.
5	Operating a vessel in such a manner as to strike or otherwise injure coral, seagrass, or other immobile organisms attached to the seabed, or cause prop scarring.
6	Having a vessel anchored on living coral in water less than 40 feet deep when the bottom can be seen. Anchoring on hard bottom is allowed.
7	Except in officially marked channels, operating a vessel at more than 4 knots/no wake within 100 yards of residential shorelines, stationary vessels, or navigational aids marking reefs.
8	Operating a vessel at more than 4 knots/no wake within 100 yards of a “divers down” flag.
9	Diving or snorkeling without a dive flag.
10	Operating a vessel in such a manner, which endangers life, limb, marine resources, or property.
11	Releasing exotic species.
12	Damaging or removing markers, mooring buoys, scientific equipment, boundary buoys, and trap buoys.
13	Moving, removing, injuring, or possessing historical resources.
14	Taking or possessing protected wildlife.
15	Using or possessing explosives or electrical charges.
16	Harvesting, possessing or landing any marine life species except as allowed by the Florida Fish and Wildlife Conservation Commission Rule (68B-42 F.A.C.)

Public Response

Development of collaborative management and forging intergovernmental relationships has been difficult because different levels of government, stakeholder groups, and scientists must communicate with each other to manage the waters surrounding the Florida Keys as a common-pool resource. Regulatory decisions are controversial, and conflicts are bound to arise. As Ostrom (1990, p.14) argues, “Getting institutions right is a difficult, time-consuming, conflict-evoking process”. The public hearing process exposed the extremely contentious nature of the FKNMS, especially the Zoning Action Plan (Suman et al., 1999; National Research Council, 1997).

Florida Keys residents have expressed concern for uncrowded conditions, water visibility, the amount of living coral on the reefs, and opportunities to view or catch many different kinds of fish (Leeworthy, Wiley, and Hospital, 2004). However, these concerns are mixed among different stakeholder groups. Many of Monroe County's citizens opposed the Sanctuary because they feared that the federal government would regulate local interests (Suman, Shivlani, & Milon, 1999). On the one hand, opponents including commercial fishermen objected to the initial establishment of the sanctuary zones and reserves. Commercial fishermen reported that the majority of their fishing activities took place within the jurisdiction of the sanctuary and that limited, or no access would result in increased costs of fishing and reduced landings (Milon et al., 1997). On the other hand, proponents of the sanctuary zones and reserves claimed that by restricting fishermen activities, the sanctuary would enhance non-consumptive, recreational benefits through improved coral reef quality and fish abundance, and reduced congestion.

A study by Suman, Shivlani, and Milon (1999) investigated the attitudes of environmental groups, commercial fishermen, and dive operators toward the designation of a no-take reserve in the Florida Keys. The study found that members of environmental groups were the strongest supporters of no-take marine reserves and the designation process although they tended to be the least participatory in the designation process. Commercial fishermen were much less supportive of the reserves and reported feeling alienated from the reserve designation process, indicating that they were intentionally excluded from the process. Of the three groups, dive operators participated the most in the designation process, but did show some concern that reserve regulations could limit their activities in the future. All groups demonstrated less support for establishment of reserves in the exact locations proposed in the Draft Management Plan than they did for establishment of reserves "somewhere in the Florida Keys" illustrating the NIMBY (Not-In-My-Back-Yard) effect with respect to the siting of designated protected area zones. People may generally support marine conservation efforts, but support may dissipate when those efforts interfere with their desired activities and needs.

In accordance with the National Marine Sanctuaries Act (16 U.S.C. 1431 *et seq*; 16 U.S.C. 470), the FKNMS began a marine zoning and regulatory review process in 2012. The review process included a scoping process, accepting public comments on future directions of the sanctuary. An examination of the public comments submitted to the FKNMS (NOAA-NOS-2012-0061) shows a diversity of views, values, beliefs, attitudes, and range in levels of integrative complexity regarding the marine zoning and regulatory review. For example, a relatively simple view was expressed by the following comment:

> "Most people will agree that whether it comes from the federal government, the state, the sanctuary, the U.S. Coast Guard, Florida Fish and Wildlife, county or city, we are being regulated to death and our economies are suffering because of it. They are closing areas for no reason, always telling people what they can't do."

In this comment, the individual perceives only one process at work in terms of regulation. There is no sign of either conceptual differentiation or integration, rather the imposition of an "us versus them" category structure. The individual also claims that most people would agree with the comment, implicitly denying that there are aspects that were not considered. On the other end of the spectrum, the public comments expressed more complex views by acknowledging multiple factors and scales:

> "The most fundamental aspects of our National Marine Sanctuary are not working and sanctuary regulations allow significant impacts to take place: fish stocks have declined dramatically, coral reefs are dead and dying, and water quality has declined (once clear waters are now green), the fish have gotten smaller, live corals are increasingly rare, and by all measures, the environmental quality of the Keys continues to decline. The extreme nature of environmental impacts, such as global warming, is expected to persist for decades. Rules enacted today could be obsolete in just a matter of a few years. Sanctuary managers need to respond with innovative management ideas and build in flexibility."

In this comment, the individual perceives multiple aspects to be involved in regulatory decisions and makes connections between the factors. The need for flexibility is recognized and future outcomes are considered. Both differentiation and integration are present, demonstrating a more complex statement than the previous. Overall, many issues were raised in the comments including concerns over inconsistent regulations among government agencies, access to "correct" information, access to resources, user conflicts, distrust in science and lack of justification for zones. These concerns relate to the perceived fairness of the sanctuary process in developing zoning regulations, engagement in the public participation process, the purpose of "no take" zones, and support for the siting of the zones.

Regulatory Review

The Sanctuary is required to review its management plan every five years in order to monitor and evaluate the progress of the national mission to protect national resources. Review of the original management plan began in 2001 and a revised management plan was published in 2007. The revised plan was divided into five management areas including science, education, outreach and stewardship, enforcement and resource protection, resource threat reduction, and administration, community relations, and policy coordination. Within each management area, action plans were drafted that outline strategies and activities to accomplish goals. The revised plan also outlined accomplishments achieved over the period of the Sanctuary's first inception and management activities. Accomplishments included the institution of the WQPP, designation of the Sanctuary's state waters as a No-Discharge Zone, and implementation of mooring buoys and channel markers throughout the Sanctuary. The WQPP has contributed data to Monroe County that assisted in the development of the Sanitary Wastewater Master Plan. The No-Discharge Zone has been effective in reducing wastewater effluent from vessels. Installation of mooring buoys and channel markers have been a joint project between the County and the Sanctuary, which has decreased damage to seagrass and coral reef communities

NOAA is currently undertaking a comprehensive review of the management plan, zoning plan and regulations for Florida Keys National Marine Sanctuary. A number of priorities that are being considered include coral reef restoration, ecosystem protection, artificial habitats, study areas and boundary modifications, water quality, fishery management coordination, law enforcement, user conflicts, boating licensing and education, permit procedures, user fees and alternative funding mechanisms. Management alternatives are being developed and will be released in a Draft Environmental Impact Statement that details the actions that would be taken under each alternative along with a description of its social, economic, and environmental impacts.

6. RESEARCH METHODOLOGY

Population of Interest

The population of interest focuses on state-licensed recreational saltwater anglers, who are permanent residents of Florida. Saltwater anglers are an important marine resource stakeholder group due to their numbers, political influence, economic inputs, and potential impact on the marine environment. This population consists of individuals who are likely to be in tune with issues regarding the use and protection of coastal marine resources, since state-licensed recreational saltwater anglers have a history of contentious relationships with government agencies in terms of resource management and the regulation of marine activities in Florida. Also, the Florida Keys National Marine Sanctuary is expected to release a Marine Zoning and Regulatory Review and Draft Environmental Impact Statement to the public for comments in 2018. Given the timing of such events, the state-licensed recreational saltwater anglers are an interesting population to apply this research framework to.

Sampling

Since this study is primarily interested in theory development and testing, obtaining a representative sample of Florida-licensed recreational saltwater anglers is not a primary concern. Rather, obtaining a sample of sufficient size is most important and necessary in order to conduct a meaningful analysis of integrative complexity sub-groups, and to build upon and test the relevant theories and hypotheses. While the results have important implications for coastal resources management, this research is primarily focused on testing more general coastal resource related cognitions. Therefore, for the purposes of theory testing and development, the sample used in the analyses is neither assumed to be representative nor are the data obtained assumed to be generalizable beyond theoretical application and the population of Florida-licensed recreational saltwater anglers.

To obtain a list of state-licensed recreational saltwater anglers who live in Florida and make use of the state's coastal-marine resources, a database of public records was requested from the Florida Fish and Wildlife Commission. The provided database included a list of names, corresponding contact information, gender and age of Florida state recreational saltwater fishing license holders who purchased a license between January 1, 2016 and February 1, 2017. The list of records was filtered according to five requirements. First, the individuals must have provided an email address, so that a link to an online survey could be emailed to the individuals. Second, individuals must have a primary residence within a zip code of Florida, due to the context and relevance of the questionnaire. Thus, the relevant study locations include all four regions of the State of Florida (Figure 9) and cities as far south as Key West, Florida (Figure 10). These four regions (Northwest, Northeast, Southwest and Southeast) of Florida align with the geographical scope of the Florida Coastal Management Program.

Third, individuals must be a minimum of 18 years of age, as required by the Institutional Review Board (IRB). Those under the age of 18 were excluded. Fourth, only one person per household (mailing address) was included in the sample. If there was more than one individual associated with the same mailing address, then the first person that appeared in the list was chosen to be included in the sample population. Finally, any repeated contacts in the database were deleted to prevent excess contacts with an individual. Repeated contacts would occur if a person purchased more than one type of fishing license or purchased a license more than once during the time frame specified above. Following these requirements resulted in a total of 345,762 individuals (Table 3 and Table 4).

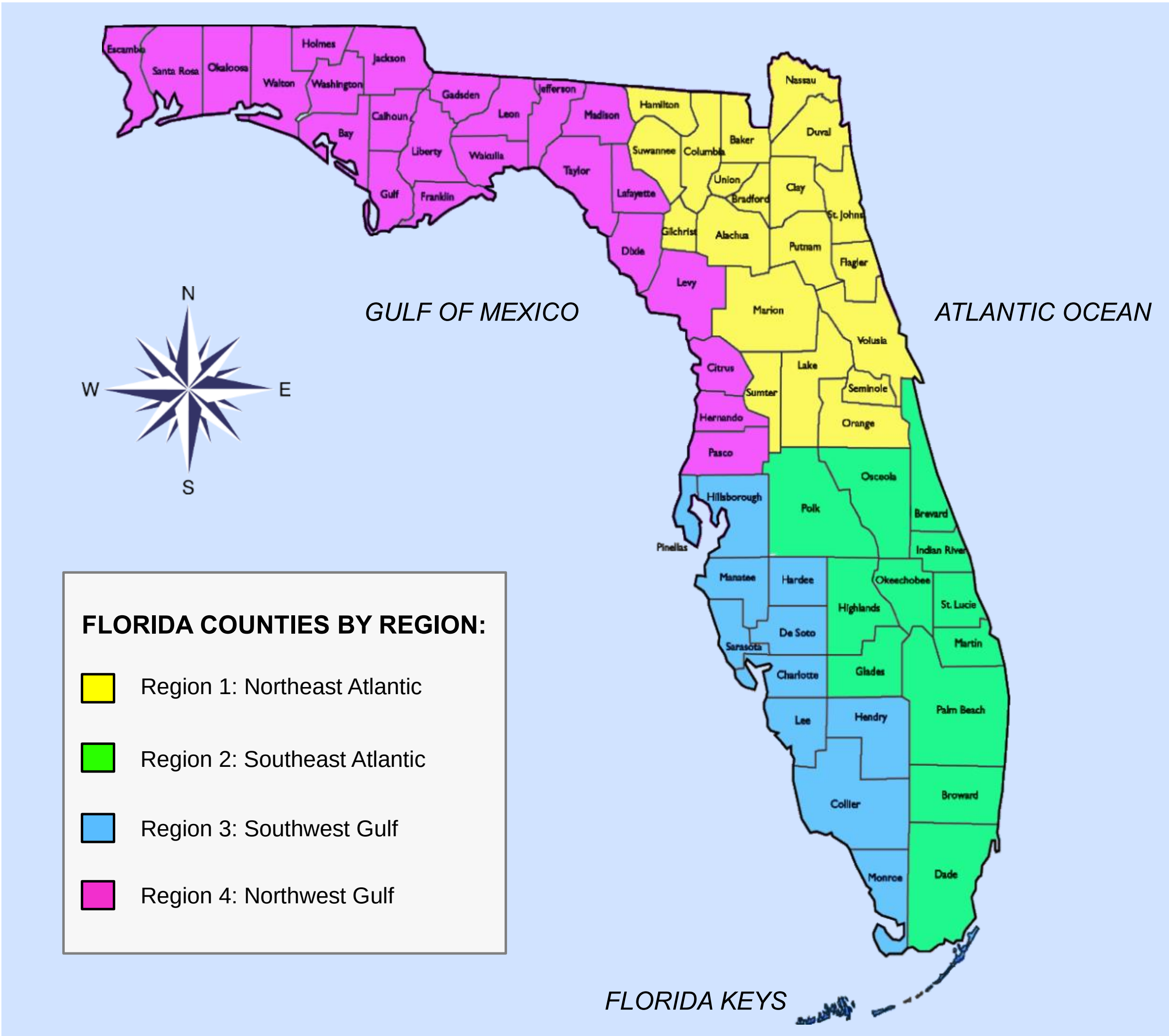


Figure 9. Map of Florida counties by region.

Table 3. Distribution of sample frame across four regions in Florida.

Region	N	%	Total	%
(1) Northeast Atlantic	77,590	22.4	77,590	22.5
(2) Southeast Atlantic..	111,361	32.2	188,951	54.6
(3) Southwest Gulf	103,817	30.0	292,768	84.6
(4) Northwest Gulf...	52,994	15.3	345,762	100.0

Figure 10. Map of the Florida Keys.

Table 4. Zip codes, cities, and populations in the Florida Keys, Monroe County.

Zip Code	City	Population [a]	Study Population [b]
33037	Key Largo	11,612	2,063
33070	Tavernier	5,344	1,185
33036	Islamorada	3,035	926
33001	Long Key	315	95
33050	Marathon	8,922	1,328
33051	Key Colony Beach	796	160
33040	Key West	32,891	3,798
33042	Summerland Key	5,829	1,269
33043	Big Pine Key	4,313	670
	Total (N)	*73,057*	*11,494*

[a] 2010 Population Census, [b] Study population based on residents with saltwater fishing licenses obtained between January 1, 2016 – February 1, 2017

Sample Size

An adequate sample size is important for meaningful analyses of subgroup data and for statistical power. When there are too few subjects, it might be difficult to detect statistically significant effects, thus providing inconclusive inferences. On the other hand, if there are too many subjects, even trivially small effects could be detected. Statistical power is the probability that a statistical significance test will lead to the correct rejection of the null hypothesis for a specified value of an alternative hypothesis (Cohen, 1988). In other words, it is the probability of detecting an effect or a change in a variable in the sample when that effect or change actually occurs in the population (High, 2000). Kirk (1982) suggested 0.80 as the minimum acceptable statistical power to use for hypothesis testing. While there is a total of 345,762 email addresses, it is unlikely that all of the email addresses will be valid, and it is likely that other persons will otherwise not receive the invitation and be unable to participate. Those individuals will be excluded from the effective sample, which includes only the individuals who could have returned a completed survey. Assuming a 20% response rate, an estimated 69,152 usable surveys may be obtained. This would be a far more than large enough sample size to provide the necessary power for a variety of inferential statistical tests to be conducted.

Data Collection

To collect the relevant information from Florida-licensed recreational saltwater anglers, data will be collected using an online (website-based) survey instrument. While postal mail surveys have been the standard mode for collecting social science data, online surveys are becoming more practical to use considering advances in modern technology and widespread uses of the Internet. Online surveys also have the advantages of reaching large populations, timeliness, reduced costs, higher flexibility, and more possibilities for design (Orr, 2005). Studies have compared the response rates of mail versus online surveys and have provided mixed results on whether one mode is more successful than the other (Fisher & Herrick, 2012; Guterbock et al., 2000). Still, particular methods can be used to increase response rates to an online survey and can generate similar or possibly better results than what might be obtained from a postal mail survey (Guterbock et al., 2000; Hoonakker & Carayon, 2013).

The survey used for this study will be implemented following techniques of the Dillman Method (Dillman, 1978). This method uses personalization and repeated contacts to increase the likelihood that an individual will complete and return the survey. Personalization is a way to increase successful email contacts and response rates (Dillman, 2000; Heerwegh, 2005). This approach seeks to make sure that potential respondents feel that the research project is legitimate and that they are important to the success of the project. To maximize response rates for the survey, multiple emails will be sent to individuals in multiple rounds according to a specific schedule. Research has found that a powerful determinant of response rates is the number of attempts made to contact a sample unit (Dillman, et al., 1974; Heberlein & Baumgartner, 1978; Goyder, 1987; Mehta & Sivadas, 1995; Smith, 1997). The more attempts made to reach people, the greater the chances of them responding. This is especially important for online surveys because emails may be more easily lost or ignored than mail contacts (Hoonakker & Carayon, 2009). Thus, for an online survey to be successful, it is important that multiple contacts be made.

Beginning in February of 2017, all individuals in the sample will be sent an email inviting them to participate in an online survey. When they receive the email, the “From” field will show an official university email address, informing the respondent that it is an important message from a reputable sender. The initial email contains a cover letter requesting their participation and ensuring their confidentiality, instructions and a link to the survey hosted by the Qualtrics website. The survey links are individualized website addresses that can only be accessed from the corresponding email address. This is done to help ensure that the survey is completed by the desired respondent, and to prevent the respondent from submitting responses more than once.

Efforts at personalization are designed to make the survey distinct from “junk mail”, which typically goes into the trash unopened. Unlike emails sent via listservs or mass email lists, personalized e-mails sent directly to an individual show the recipient that he or she is important and valued, and not just an item on a list. This information is immediately visible when a person opens an email message. In impersonalized emails, the names/email addresses of multiple recipients are either visible or marked as a blind-carbon-copy feature. The blind-carbon-copy feature conceals the names/email addresses of other recipients in that the "To:" line reads "To: Undisclosed Recipients" when an email is received (Schaefer & Dillman, 1998). An additional benefit to personalized email messages is that it helps to ensure an individual's confidentiality because the other recipients' contact information are not visible. Recipients can also immediately discern a generic "Dear Resident" salutation versus their name as a salutation in a personal email. Each email contact refers to the potential respondent's first name rather than using a generic greeting and concludes with an electronic signature of the researcher. The researcher's contact information is also included in the email in the event the recipient has questions or concerns about the survey or project.

The survey will be distributed in multiple rounds to maximize response rates. One week after the initial email, a follow-up email is sent to all recipients. The follow-up serves as a thank you if they have already completed and submitted the online survey or as a reminder that they should complete and submit the survey. For those who have not yet responded or completed the survey, the emails will also contain the survey link. Three weeks after the initial mailing, recipients who have not yet submitted their survey responses are sent a second email. The second email is identical to the first, except the language is slightly altered to further emphasize the importance of their participation. Five weeks after the initial mailing, the remaining non-respondents are sent a third email that further emphasizes the importance of their participation.

Each survey participant will be randomly assigned a unique number that serves as the respondent ID number to keep track of response rates while maintaining respondent confidentiality. When survey responses are submitted, the respondent's identification number will be recorded with the survey completion date and further email contact with the individual will be ended. The identification number will be entered with the responses to the survey in a separate data file. Following data collection, all names and contact information of respondents (and those who were sent a survey but did not respond) will be permanently deleted.

It is possible that not all of the email addresses provided in the fishing license database are valid. The initial email attempts should immediately identify whether members of the sample have valid addresses. Accordingly, if an insufficient sample size of respondents is anticipated, alternative methods can be implemented with traditional mail. In this situation, individuals will be sent a letter to the mailing address provided in the license database. The letter will be designed to match the design and language used in the email version. The letter will explain to mail recipients that the survey must be accessed online and will include an individualized website address to the survey. Follow-up reminders will be mailed according to a schedule similar to the email version.

Survey Design

Online Survey

The online survey instrument will be developed using the Qualtrics website interface. The questions presented in the survey are designed and formatted according to the Dillman Total Design Method (1978). This method incorporates a meticulous process in the survey's design and has proven effective in producing a satisfactory response rate. During the questionnaire development and survey implementation process, every visible aspect of the survey instrument will be subjected to three design considerations: making the questionnaire appear easy and less time-consuming to complete; making it interesting to fill out by including relevant questions; and increasing trust by using official headers and sponsorship (Dillman, 1978). The questionnaire design is also formatted to accommodate a range of electronic devices (i.e., smartphone, iPad, computer tablet), various operating systems and browsers.

All individuals in the sample are sent an initial email and website link, which takes the respondent to a webpage displaying an introductory screen containing the questionnaire's title, researcher's contact information, and graphical illustration relevant to the study. Respondents proceed to subsequent pages by clicking on the "next" button. The ordering of questions is presented in a way to assure that interesting questions related to the topic come first and progressively become more in-depth.

Each page of the online survey is designed to contain proportionally spaced text and graphics to make pages appear smaller and easier to complete. The settings of the online survey enable respondents to preview each page of the online survey, and the survey may be completed at their own convenience. Respondents may change their answers to any survey question. Responses to each question are automatically saved and a respondent's progress is displayed in the lower right corner of each screen throughout the survey. A progress indicator is used so that respondents know how far they have progressed in the survey and how much is left to complete. When respondents' progress is unknown, it is possible that surveys are abandoned close to the end, when respondents lose motivation (Jeavons, 1998; Couper, Traugott, & Lamias, 2001). To submit final responses, the survey includes two instructional pages at the end to help ensure that participants complete the full extent of the survey. Respondents are also given the opportunity to provide additional comments and are thanked for participating in the research project.

Pre-testing

The initial draft of the survey used for this study was pre-tested using two random samples of 250 individuals selected from the overall sample of residents. Pre-testing a survey instrument is an important step towards identifying and eliminating potential problems respondents may encounter when filing out a questionnaire. Several factors to consider are the effectiveness of the overall survey, and the reliability and validity of the survey questions. To be reliable, the respondents must answer a survey question in the same way each time. Comparing the answers that a respondent gives in one pretest with answers in another pretest is one way to assess reliability (Weisberg et al., 1996). A survey question's validity is determined by how well it measures the concept(s) it is intended to measure. Both convergent validity and divergent validity can be determined by first comparing answers to another question measuring the same concept, then by measuring this answer to the participant's response to a question that asks for the exact opposite answer. Pre-testing also provides information about response rates and possible wording problems that may be associated with specific question formats and response options.

Measurement of Integrative Complexity

Several measures of integrative complexity will be used to determine which format works best in capturing an individual's complexity of thought. Specifically, this research incorporates three different measurement approaches, including the use of differentiation and integration scales, vignettes, and a four-item index. The scales and vignettes are designed to be consistent with the traditional method of measuring differentiation and integration for enhanced construct validity, and the four-item index is designed based on the cognitive flexibility construct. These measures were developed throughout multiple rounds of pre-testing by East Carolina University undergraduate students. The intent was to refine the integrative complexity measures and to identify potential respondent problems, such as misunderstanding questions or being unable to answer questions. Questions used to measure integrative complexity were presented in a survey instrument and distributed to students in the classroom setting. The survey took about five minutes to complete and included a section asking students for written comments regarding the clarity of instructions, content, and questions. Responses to each draft were analyzed according to distribution of integrative complexity scores and the index was tested for reliability using Cronbach's (1951) coefficient alpha. This procedure, which tests for internal consistency, was used along with correlation analyses to determine which variables, if any, to drop in the final measure.

Differentiation and Integration Scales

Integrative complexity will be measured in the context of resource use versus preservation tradeoffs. Respondents will be provided with a brief description of the management dilemma, and then asked to think about their position on the issue. Specifically, they will be instructed to *"Think carefully about the issue in terms of use versus protection. If you were given the responsibility to decide whether use or protection should take priority, which would you choose? Use, protection, or a balance of the two?"* Following the description, there will be several sections covering the two integrative complexity dimensions of differentiation and integration.

Differentiation. In the differentiation section, respondents are provided with a list of 21 different subjects related to components of the DPSIR model. These subjects included ecosystem services and resource use (i.e., recreational fishing, local economy, tourism, seafood, local jobs, growth in local population, etc.), the state of the ecosystem and resource protection (i.e., water quality/pollution, protection of endangered species, fish abundance, diversity of fish species, coral reef health/disease, restoration of degraded seagrasses, ecosystem health, invasive species), and drivers and pressures (i.e., overfishing, boat anchoring/mooring, propeller scars, access to fishing locations, days in fishing season, sea level rise). An equal number of subjects representing each of the three categories are provided in the list and organized in a random order. Respondents are first instructed to choose from this list the subjects they actually considered relevant in their thinking about their position on the issue. To choose the subjects they considered, respondents will click on a radio button displayed next to the subjects. If they considered other subjects not on the list, they have the option of typing those subjects in a text box. The list of subjects will be dummy coded as 0 = subjects not chosen and 1 = subjects was chosen, yielding a range of 0 to 21 possible factors chosen.

Respondents are then instructed to indicate the extent to which each of those subjects they chose was considered in their thinking about the priority of use versus protection. This helps to validate whether an individual actually considered the subjects while thinking about the issue. The amount of consideration is measured on a 7-point scale (1 = no consideration, 4 = some consideration, 7 = a lot of consideration). If a factor is given no consideration to little consideration (scores 1 to 3), then it will not be included in the respondent's list of differentiated factors.

The number of different subjects an individual considers relevant when thinking about an issue measures their level of differentiation. Levels of differentiation will be determined after examining the distribution of data responses. The range in the number of subjects which respondents may consider is 1 – 21 factors. If all 21 subjects are actually considered and there is a sufficient distribution across those subjects, then four levels of differentiation will be created: zero differentiation (level 0), low differentiation (level 1), moderate differentiation (level 2), and high differentiation (level 3). If this range is smaller, there may be three or two levels of differentiation. Nonetheless, the distribution will be segmented into differentiation levels ranging from low to high. For example, with 21 subjects, the distribution could be split into four levels: if no subjects are considered then differentiation is zero or level 0; if 1 – 6 subjects are considered then differentiation is low or level 1; if 7 – 14 subjects are considered then differentiation is moderate or level 2; and if 15 – 21 subjects are considered then differentiation is high or level 3.

Integration. Integration describes how, or if, the respondent recognizes connections and interrelationships between the different sides to the issue. Traditionally, coders subjectively infer the level of integration from the respondent's writing. In this study, integration is measured by asking respondents to indicate the manner in which they thought about the subjects they considered. For this question, respondents were told that we were interested in the way they thought about those subjects; were they separate or connected? Respondents were instructed to choose from four statements the one statement that best describes their thinking. The following statements reflect four levels of integration, where statement (a) is zero integration or level 0, (b) is low integration or level 1, (c) is moderate integration or level 2, and (d) is high integration or level 3.

a. I thought about the subjects as being separate and unconnected matters.
b. I thought about the subjects as being mostly separate matters; perhaps some might be connected to each other.
c. I thought about the subjects as being somewhat separate matters; there are some connections between them. I considered how as one subject changes, other subjects change at the same time.
d. I thought about the subjects as all being connected to each other. They have complex links between them, and I considered how the subjects interact with each other as a whole.

Integrative Complexity Scores. An overall integrative complexity score is determined according to the differentiation and integration scores. An individual must first demonstrate an adequate amount of differentiation in order to have integration. Integrative complexity levels are calculated by cross-tabulating each level of differentiation with each level of integration (Table 5). For instance, if there is zero differentiation then *no integrative complexity* (level 0) exists regardless of the level of integration indicated by respondents. If differentiation is level 1 (low), there are just a few factors that are possible to integrate and *low integrative complexity* (level 1) is present. Thus, low integrative complexity exists with low differentiation and any level of integration. Low integrative complexity can also occur with moderate to high (level 2 – 3) differentiation and zero integration. If there is *moderate differentiation* (level 2) and low to moderate (level 1 – 2) integration, then moderate integrative complexity (level 2) is evident. Moderate integrative complexity is also indicated by high differentiation (level 3) and low integration (level 1). If there is moderate differentiation (level 2) and high integration (level 3), then *high integrative complexity* (level 3) exists. High integrative complexity is also evident by high differentiation (level 3) and moderate to high (level 2 – 3) integration.

Table 5. Scoring combinations of differentiation levels and integration levels used to determine level of integrative complexity.

Levels of Integrative Complexity	Levels of Differentiation	Levels of Integration
Level 0: None	0	0
	0	1
	0	2
	0	3
Level 1: Low	1	0
	1	1
	1	2
	1	3
	2	0
	3	0
Level 2: Moderate	3	1
	2	1
	2	2
Level 3: High	2	3
	3	2
	3	3

Self-classification Vignettes

The second approach used to examine integrative complexity will ask respondents to classify themselves by choosing one of four descriptions (vignettes). The advantage of using vignettes is that the narrative form of measurement provides more condition-qualified, local contingency, and specific characterizations of persons in contexts (Mischel, 1990). Thus, it is important that the vignettes reflect real life circumstances as best as possible (Hughes & Huby, 2004). The four vignettes reflect four levels of integrative complexity based on varying conditions of differentiation and integration (Table 6).

Table 6. Levels of integrative complexity and varying conditions of differentiation and integration.

	Differentiation	Integration
Level 1	*No Differentiation* Unidimensional, no potential of alternatives	*No Integration* All or none, “black and white” view
Level 2	*Low Differentiation* At least two dimensions, potential of alternatives	*Low Integration* Categorical, independent, might be relations
Level 3	*Moderate Differentiation* Several different dimensions and alternatives	*Moderate Integration* Some relations, mutual influence, tradeoffs
Level 4	*High Differentiation* Multiple dimensions and alternatives	*High Integration* System of interactions, contingencies, complex tradeoffs

The integrative complexity levels and conditions are based on the scores outlined in the Baker-Brown et al. (1992) coding manual. Four different vignettes were written to reflect the four levels of integrative complexity based on corresponding levels of differentiation and integration (Table 7). Respondents are asked to read each of the four descriptions and then choose the one statement that best describes their thinking in terms of their position on the issue of use versus protection of coastal resources.

Table 7. Self-classification (vignettes) measure of integrative complexity, ranging from low (1) complexity to high (4) complexity.

1	The issue of recreational use versus protection is **rather simple**; it's either **one or the other**. There were **one or two subjects** that were relevant, and I gave the issue **no further thought**.
2	The issue of recreational use versus marine resource protection **may not be that simple**, because **both** should be considered. There were **a few different subjects** that were relevant, and I thought about how different subjects **might be connected**.
3	The issue of recreational use versus marine resource protection is not simple, because there is more to consider. There were a number of different subjects that were relevant, and I thought about how some subjects affect other subjects.
4	The issue of recreational use versus marine resource protection is **quite complex**, because there is **a lot more to consider**. There were **many different subjects** that were relevant, and I thought about how the different subjects are **integrated** and affect each other as a whole.

Four-Item Index

In the final measure of integrative complexity, an index will be created based on characteristics typical of integratively complex thinkers (Tetlock et al., 1993; Tetlock, Peterson, & Lerner, 1996; Gruenfeld & Kim, 1998; Suedfeld, 2010). Four dimensions of level of integrative complexity are measured to comprise an additive index: openness to change, active listening, perspective taking, and information seeking. The index is designed to segment respondents into four unique integrative complexity subgroups based on four questions, each of which correspond to one of the four integrative complexity dimensions (Table 8).

Table 8. Integrative complexity index based on four cognitive flexibility items, ranging from low (1) complexity to high (4) complexity.

[INFORMATION SEEKING] When it comes to information about new regulations regarding recreational fishing and marine resource protection in Florida,

1. I do not seek or pay attention to information about coastal marine issues in Florida.
2. If I happen to come across information on coastal marine issues in Florida, I may pay some attention to it.
3. When I come across information on coastal marine issues in Florida, I usually pay attention to see what I can learn from it.
4. Information on coastal marine issues in Florida draws my attention. I often seek information on coastal marine issues, so that I can learn more about it.

[OPEN TO CHANGE] Assume that managers are currently reviewing the zones and regulations that would affect recreational fishing use and the protection of marine resources in Florida. If new regulations were proposed that significantly change the extent of recreational fishing and marine resource protection in Florida, what would your first thought most likely be?

1. What we have been doing so far is okay with me. I'm not interested in changing the current regulations.
2. I'm not sure I want to change current regulations, but I would be willing to hear what is proposed. I might be open to change.
3. New ways to address these problems could be useful, because our current approaches do not always work well. I would probably be open to change.
4. We must always find new ways to address these problems. Our current approaches don't always work well, and I am always open to change.

[ACTIVE LISTENING] Imagine you are having a conversation about the proposed regulations for recreational fishing and marine resource protection in Florida. If others made a comment that you strongly disagree with, how would you respond?

1. Don't listen to their reasoning, and politely excuse myself from the conversation.
2. Listen politely to some of their reasoning but not closely, and I would not engage in further conversation on the topic.
3. Listen carefully to their reasoning and ask questions if there's something I don't understand.
4. Actively listen to their reasoning and encourage them to elaborate on their views. I would try to have an open discussion that integrates all of our views for a more complete understanding.

[PERSPECTIVE TAKING] If someone suggested that you reconsider your position on the proposed regulations for recreational fishing and marine resource protection in Florida, which of the following statements best describe you?

1. I would continue to focus on my own perspective, rather than try to understand others.
2. I might be willing to consider different perspectives on the issue, but I doubt anything will come of them.
3. I would think about how other perspectives might be better or worse.
4. I would think carefully about the issue from others' perspectives and try to understand their reasoning.

Each of the four questions (items in the index) has four response options. Responses to each item in the index are ordered from low integrative complexity (response = 1) to very high integrative complexity (response = 4). To determine the overall integrative complexity level, the responses to all four items are added to determine a cumulative score ranging from 4 (lowest integrative complexity) to 16 (highest integrative complexity. The respondents will then be segmented into four groups (ranging from low to very high integrative complexity) based on the cumulative score as follows: cumulative scores of 4 to 6 indicate low integrative complexity (level 1); cumulative scores of 7 to 10 indicate moderate integrative complexity (level 2); cumulative scores of 11 to 13 indicate high integrative complexity (level 3); and cumulative scores of 14 to 16 indicate very high integrative complexity (level 4). Particular interest is in the extent to which the measures meet criteria for validity and theoretical generativity. The overall index measuring level of integrative complexity will be investigated for reliability during the data analysis.

Measurement of Dependent Variables

The dependent variables of interest include value orientations, attitudes, and acceptability of tradeoff alternatives. The development of specific question items for those variables is discussed below. In addition to concept specific questions, the survey will include demographic parameters (age, gender, education) to provide a description of the respondent population.

Value Orientations

An individual’s value orientation toward resource management will be constructed from six variables designed to measure an anthropocentric (resource use) orientation and six variables designed to measure an ecocentric (resource protection) orientation (Table 9). The variables are an extension of the variables used in studies on value orientations toward wildlife and natural resource management (Fulton et al., 1996; Vaske & Donnelly, 1999; Needham, 2010), and are measured on 7-point bi-polar scales ranging from 1 = strongly disagree to 4 = neutral to 7 = strongly agree.

Table 9. Measures of value orientations.

Anthropocentric

A. The primary value of the Florida ecosystem is to provide for people.
B. Florida ecosystems should primarily be managed for the benefits of people.
C. Human use of Florida ecosystems is more important than protecting fish species that live there.
D. Florida ecosystems are resilient enough to cope with the impacts of human activities.
E. Humans have a right to change the natural world to suit their needs.
F. There should be fewer regulations restricting human activities in the Florida ecosystem.

Ecocentric

G. Florida ecosystems are valuable in their own right, regardless of human interests.
H. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people.
I. Human activities in coral reef areas should not be allowed if it damages these areas.
J. Florida ecosystems are very sensitive to human activities and easily damaged.
K. People have a duty to protect fish and other parts of nature in Florida.
L. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today.

Measures of value orientation extremity are based on the amount by which an individual deviates from the midpoint of a scale. One method of measuring this amount of deviation involves a folding technique introduced by Suchman (1950). The folding process is done by collapsing the 7-point scale into a 1 to 4 measure where 7 and 1 (extreme scores) become a score of 4, 6 and 2 become a score of 3, 5 and 3 become a score of 2, and 4 (neutral) becomes a 1. This process results in a direction-neutral extremity scale.

The twelve value orientation items will be combined into an additive index to create a single measure of value orientation. This overall value orientation measure will be used in the moderation analysis with integrative complexity to predict attitudes. The value orientation index will be examined for reliability during data analysis to determine if all twelve items will be included in the ecocentric-anthropocentric continuum. Upon results of the reliability tests, the composite scale will reflect a value orientation continuum ranging from 1 = ecocentric, to 4 = pluralist, to 7 = anthropocentric. The ecocentric value orientation scores will be reverse-coded so that higher numbers reflect an ecocentric value score. The ecocentric scale will still reflect a low to high ecocentric orientation, but the scores will be reversed to 7-1. With all twelve items included in the index, the sum of the anthropocentric scores (1-7) and ecocentric scores (7-1) will yield an overall value orientation score ranging from 12 = ecocentric (high ecocentric + low anthropocentric), to 48 = pluralistic (neutral ecocentric + neutral anthropocentric), to 84 = anthropocentric (low ecocentric + high anthropocentric). An individual's overall value orientation will be created from subgroups of the continuum: anthropocentric (scores 12 – 35), pluralistic (scores 36 – 59), and ecocentric (scores 60 – 84).

Attitudes

Attitude Certainty. Respondents are first asked to indicate their general management preference on a 7-point scale ranging from 1 = "highest priority should be given to protecting natural environmental conditions even if there are negative social consequences" to 4 = "both environmental and social factors should be given equal priority" to 7 = "highest priority should be given to social considerations even if there are negative environmental consequences". The protection-use priority scale provided a general measure of an individual's preferences regarding tradeoffs between use and protection benefits and is similar to the environmental-economic priority scale used in previous studies (e.g., Shindler et al., 1993; Smith et al., 1997).

Attitude certainty measures the degree to which an individual is confident in his or her attitude toward an object. People are generally motivated to hold "correct" attitudes, yet, people are more confident in the correctness of some attitudes than others (Festinger, 1954; Petty & Cacioppo, 1986). Furthermore, people vary in the extent of their confidence that their attitudes towards any given object accurately represent their overall orientations toward it. Respondents are asked to rate the certainty with which they hold the attitude expressed. Measurement is based on a 7-point scale ranging from 1 = not at all certain to 7 = extremely certain.

Attitude Direction. A series of attitude statements were developed to focus on issues pertaining to recreational fishing and the protection of marine resources in Florida. Four statements referred to management actions that enhance protection of fish species or marine ecosystems, and four statements referred to management actions that increase use of fishery resources or recreational fishing opportunities (Table 10). Attitude "direction" is based on whether respondents support or oppose a management action oriented towards protection or use. Responses to each of the eight attitude statements were scored on a 7-point bi-polar scale of 1 = strongly oppose, to 4 = neither support nor oppose, to 7 = strongly support.

Table 10. Attitude statements for protection and use management actions.

<u>Protection-oriented Management Actions</u>

A. Shorter recreational fishing seasons with enhanced protection of the fish species you most prefer to catch.
B. Higher recreational bag limit for the fish species you most prefer to catch.
C. Expansion of marine protected areas in Florida where recreational fishing is prohibited.
D. Increase in the maximum size limit for the fish species you most prefer to catch.

<u>Use-oriented Management Actions</u>

E. Longer recreational fishing seasons with less protection of the fish species you most prefer to catch.
F. Lower recreational bag limit for the fish species you most prefer to catch.
G. Open more areas in Florida where recreational fishing is allowed.
H. Decrease in the maximum size limit for the fish species you most prefer to catch.

Attitude Extremity. Measures of attitude extremity have generally assessed the amount by which an individual deviates from the midpoint of an attitude scale (e.g., Downing, Judd, & Brauer, 1992; Van der Pligt, Ester, & Van der Lindern, 1983). One method of measuring this attitude deviation involves a folding technique introduced by Suchman (1950) and used by Bright (1998) in a study on attitudes toward natural resource management issues. The folding process is done by collapsing the 7-point scale into a 1 to 4 measure where 7 and 1 (extreme scores) become a score of 4, 6 and 2 become a score of 3, 5 and 3 become a score of 2, and 4 (neutral) becomes a 1. This process results in a direction-neutral extremity scale.

Acceptability of Tradeoffs

This study presents respondents with a series of scenarios in which they can make implicit tradeoffs in their decisions about the acceptability of resource management options. Prior to the scenarios, respondents are told that there are potential management alternatives that could be established for the coastal-marine region of Florida. Individuals are asked to respond on a 7-point scale to the acceptability of each alternative (scenario), ranging from 1 = highly unacceptable to 4 = neutral to 7 = highly acceptable. By observing how people change their evaluations in response to changes in the levels of the attributes present in the scenarios, it is possible to determine which attributes are most or least acceptable. The scenarios used in this research were developed based on two guidelines. First the situations are presented in rather simple terms, providing only a limited amount of detail. Describing scenarios in this manner requires subjects to rely on their own attitudes, beliefs and values as the primary bases for their responses (Axelrod, 1994). Second, the scenarios represent situations that to some extent model actual situations that people may, in fact, encounter.

When deciding which variables, dimensions and levels to use in this approach, researchers (e.g., Sauer et al., 2011; Ausperg & Hinz, 2015) recommend limiting the number of factors to no more than approximately seven (plus or minus two) factors. This recommendation is also suggested by research showing that people can store approximately seven pieces of information in their short-term memory at one time (Miller, 1994). Appropriately, this study will include only four factors. In terms of the number of levels within each factor, “balanced” numbers of levels (symmetric) across all factors can result in more efficient responses and statistical analyses (Kirk, 1982; Wittkin, Krishnamurti, & Nutter, 1982). In order to estimate more complex nonlinear relationships between the factors and the dependent variable, at least three or four levels are necessary per factor (Fox, 2008). A greater number of levels can also construct more realistic scenarios to which respondents can relate. Ideally the chosen levels should represent realistic states of nature, both in the current situation and in any possible future situations. For this study, a three-level design is proposed to facilitate investigation of possible curvature or a quadratic relationship between the response and each of the factors. By including levels both below and above the current situation, the values of both increases and decreases can be estimated.

The design used in this study includes important factors and levels within each factor that are based on an examination of the Florida Keys National Marine Sanctuary (FKNMS) 2007 Management Plan, public comments, and 2016 management plan review goals. The FKNMS reviewers are considering the creation of new Sanctuary Preservation Areas (SPAs) or Ecological Reserves (ERs) and expansion of existing SPAs to protect fish spawning aggregations and coral habitats. Such decisions would change recreational fishing opportunities in relevant areas and the degree of coral reef impacts. Accordingly, the following four factors are included: amount of marine protected area (factor A), protection of fish populations (factor B), access to fishing locations (factor C), and length of fishing season (factor C). Each of the four factors will vary according to three levels (decrease, no change, increase).

The scenarios will represent various combinations of the four factors and levels (Table 11). Each of the four factors has three levels, resulting in a total of 81 (3^4) unique objects (scenarios) in the full factorial design. Clearly, however, presenting such a large number of scenarios to respondents is excessive, impractical, and burdensome. There are a number of different strategies that may be adopted to reduce the number of choice sets given to respondents. One approach frequently used is a fractional factorial experimental design (Green, 1974). In this case, an experimental design refers to the plan for performing an experiment, particularly the experimental factors and levels to be used, as well as their combinations. More specifically, the experimental design characterizes the selection of experiments or scenarios to be used in the study. In a fractional factorial design, the treatments consist of combinations of two or more factors each at two or more levels. The combinations are such that each level of every factor occurs together with each level of every other factor, resulting in a balanced design. The number of treatments is the product of the number of levels of all factors.

Table 11. Factors, factor levels and codes used in the scenarios.

Factor	Levels *	Code
Factor A: Protected Area		
Managers propose to [*] the amount of protected area currently set aside for marine habitat protection and scientific research.	Reduce	0
	Make no changes to	1
	Expand	2
Factor B: Fish Population		
Managers propose to [*] the amount of protection afforded to fish populations.	Reduce	0
	Make no changes to	1
	Enhance	2
Factor C: Fishing Access		
Fishermen will have [*] access to locations where they can fish.	Reduced access	0
	The same amount of access	1
	Increased access	2
Factor D: Length of Fishing Season		
Fishermen will have [*] days in the season to fish for their most preferred species.	Less	0
	The same as the current number of	1
	More	2

In the process of selecting the fraction of the full factorial, the properties of the full factorial should be maintained. This involves reducing the number of scenarios needed to estimate the desired effects while maintaining orthogonality of the full factorial. Orthogonality implies every attribute is uncorrelated with each other (Wonnacott & Wonnacott, 1990). A number of treatment combinations may be randomly selected without replacement, but this is likely to produce statistically inefficient or sub-optimal designs. Some statistical information in the complete factorial universe is inevitably lost (Louviere, Hensher, & Swait, 2000), and the experimental design is less capable of deriving a model that correctly identifies all the possible relationships and probabilities that exist (Bennett & Adamowicz, 2001). As the number of factors increases, the likelihood for higher-order effects also increases and these higher-order effects should be included in the design (Louviere, Hensher, & Swait, 2000). Therefore, each fraction involves factorial needs assumptions about the non-significance of higher-order effects (Louviere, Hensher, & Swait, 2000).

In order to derive a more efficient fractional factorial design, the following must be pre-determined: the main effects and selected interaction effects to be tested, degrees of freedom required for model estimation, number of treatment combinations required (design degrees of freedom), and orthogonality (zero correlations) between attributes. Two-way interactions between levels of one factor with levels of another factor are assumed to be negligible, unless a significant interaction is believed to exist. In this study, two-way interactions are expected to occur between factors of resource use and protection because the two types of factors are co-dependent. Higher-order (three-way and four-way) interactions are assumed to be negligible because they are difficult to interpret and usually insignificant (Wu & Hamada, 2009). As suggested by Dawes and Corrigan (1974), main effects typically account for 70 to 90% of the explained variance, two-way interactions typically account for 5 to 15%, and higher-order interactions account for the remaining explained variance (Louviere et al., 2008).

In this study, a 27-run design is employed, a one-third fraction (3^{4-1}) of the 3^4 design. The design is expressed using the notation 3^{k-p}, where k is the number of factors and p is the size of the fraction of the full factorial used. Formally, p is the number of generators used to assign which effects and interactions are confounded. In this 3^{4-1} fractional factorial design, A, B, C, and D are used to represent the four main factors. The design plan is constructed so as to have no main effects aliased (confounded) with other main effects or aliased with two-factor interactions, and to have as few two-factor interactions as possible aliased with other two-factor interactions. Two effects are aliased or confounded when they cannot be estimated independently of each other. In this design, two-factor interactions that are only aliased with higher order interactions are termed measurable. In order to confound with the higher order items, four degrees of freedom from the two-order interactions are divided into $(3^n - 1)/2$ sets of 2 degrees of freedom, where n is equal to $k - p$ (Kempthorne, 1952). Two degrees of freedom are used to estimate the interaction, and the other two are for confounding with higher order interactions. For example, the interaction of AB with four degrees of freedom can be split into AB and AB^2 with two degrees of freedom each. Splitting the interactions into two parts will make the parts of the interactions have the same number of degrees of freedom as the main factors, and thus, all the main factors and interactions are orthogonal to each other. Splitting interactions has no obvious experimental meaning, and it is just for confounding purposes. The two parts of the interactions are the same in order to estimate the interaction between the two factors (Mclean et al., 1984).

The design follows the techniques provided by Box, Hunter, and Hunter (2005), Cochran and Cox (1957), Kempthorne (1952), and Xu (2005). A complete 3^4 factorial design has 81 treatment combinations, but this number can be reduced to 27 using the fundamental identity (also called the defining relation) of $I = ABCD^2 = A^2B^2C^2D$. The fundamental identity is first used to generate the complete defining relationship presenting the confounding pattern for the design. It is then used to choose the appropriate subset of the treatments from the complete design and determine the way in which the various main factors and interactions are confounded with one another (Mclean et al., 1984). Under modulus 3 conditions, three sets of treatment combinations are given by setting the defining relation equal to 0, 1, and 2 (mod 3). Of the three sets of relations, $ABCD^2 = 1$ (mod 3) was randomly selected as the one-third fraction design. Thus, modulo 3 of the sum of the factor levels across the four factors is equal to zero. In this design, the capital letters A, B, C, and D, which represent each of the four factors, are also used to represent the various main effects and interactions associated with the respective factors. For each main effect or part of a two-order interaction, the quantities aliased or confounded with it are obtained by multiplying the effect by both the fundamental identity and its square. Thus, the effects have three aliases and each factor or part of a two-order interaction is confounded with two other interactions. For example, in the case of main factor A, the equation $A = AB^2C^2D = BCD^2$ indicates that the main factor A is confounded with at least three-factor interactions. Similarly, $B = AB^2CD^2 = ACD^2$, $C = ABC^2D^2 = ABD^2$, and $D = ABCD = ABC$. Thus, the design is of resolution IV, in which all the linear and quadratic main effects for four factors are measurable because their aliases are higher order interactions. Following Wu and Hamada (2009), a two-factor interaction is estimable if it is not aliased with any main effects and is considered clear if it is not aliased with any other two-factor interactions. Among the two-factor interactions, AB^2, AC^2, AD, BC^2, BD, and CD are not aliased with any two-factor interactions and can therefore be estimated.

The design also incorporates a blocking technique to further reduce the number of treatment combinations. Considering the experimental capacity and time, the 27 runs in this study are divided into three blocks, each of size 9 (Table 12). In particular, the 3^{4-1} design is arranged into three blocks using the block generator, block = *AB*, following Wu and Hamada (2009) and Connor and Zelen (1959). The block generator arranges the treatment combinations into the design matrix by confounding additional interaction components and their aliases with the blocks using $x_1 + x_2 = 0,1,2 \pmod 3$. This is the most optimal blocking scheme because it allows for the maximum number of clear effects (Cheng & Wu, 2002; Xu, 2006; Xu & Lau, 2006). Also, using *AB* as the blocking generator enables confounding of the block effect with treatment effect *AB*, which is already confounded with interaction components CD^2 and ABC^2D. Thus, *AB* is an appropriate effect to sacrifice for block effects. With this blocking arrangement the main effects and two-factor interactions are not confounded with the block effects, and therefore, they can be estimated efficiently as a resolution IV design. Each block of nine scenarios is given to a different respondent, the result of which is that three different subsamples are required to complete the full design. Nine is the minimum number of scenarios to be evaluated by a survey respondent, as suggested by the following (Hair et al., 2010): Minimum number of scenarios = (Total number of levels across all factors – Number of factors + 1).

The resulting design matrix represents the treatment combinations that will be used in the questionnaire scenarios (Appendix B). In the rows of the design presented in Table 12, the factorial treatment combinations are designated by $x_1x_2x_3x_4$ (x = 0, 1, 2), where x_1 is the level of factor *A*, x_2 is the level of factor *B*, x_3 is the level of factor *C*, and x_4 is the level of factor *D*. For example, in Table 9, Run 2, the treatment combination 1212 indicates *A* at level 1, *B* at level 2, *C* at level 1, and *D* at level 2. The 27 treatments selected for the one-third fraction satisfy simultaneously the equation, $x_1 + x_2 + x_3 + 2x_4 = 0 \pmod 3$, which also represents $I = ABCD^2$. Using the rules of reduction modulo 3 in the equation, each component of the treatment combination is divided by three and the remainder substituted. Each of the three blocks consists of nine different treatment combinations which correspond to *AB* = 0 (Block 1), *AB* = 1 (Block 2), and *AB* = 2 (Block 3). Accordingly, three separate questionnaires will be developed for each block of nine scenarios and will be randomly distributed to individuals in the sample frame. The treatments within the blocks will also be randomized to further reduce the influence of unknown variables.

Table 12. Design for a 3^{4-1} factorial (one-third replicate) in three blocks.

Block 1		Block 2		Block 3	
Runs	A B C D	Runs	A B C D	Runs	A B C D
1	0 0 0 1	10	0 1 0 0	19	0 2 0 2
2	0 0 1 0	11	0 1 1 2	20	0 2 1 1
3	0 0 2 2	12	0 1 2 1	21	0 2 2 0
4	1 2 0 1	13	1 0 0 0	22	1 1 0 2
5	1 2 1 0	14	1 0 1 2	23	1 1 1 1
6	1 2 2 2	15	1 0 2 1	24	1 1 2 0
7	2 1 0 1	16	2 2 0 0	25	2 0 0 2
8	2 1 1 0	17	2 2 1 2	26	2 0 1 1
9	2 1 2 2	18	2 2 2 1	27	2 0 2 0

Factors = A, B, C, D

Codes: 0 = level 1, 1 = level 2, 2= level 3

Data Analysis

Only completed surveys will be included in the effective sample for data analysis. The effective sample is based on the response rate, which is calculated as the number of completed surveys received divided by the total number of surveys sent to individuals in the sample (adjusted for non-deliverables and mortalities). An advantage of using online survey software is that the Qualtrics program records the status of each individual's progress in completing the survey. Qualtrics also indicates whether individuals actually receive and open an email, or if an email address is invalid, ignored, or not opened for some other unknown reason.

Index Reliability

The indices measured in this study will be investigated for reliability in several ways (Babbie, 2010). First, the frequency distributions will be calculated for each of the items used for constructing the index in order to observe the distribution of responses. The percent of occurrences in each item will provide some indication of internal validity of the index because it measures how well one item predicts response to another item (Babbie, 2010; Salz, Loomis, & Finn, 2001). Respondents are expected to be relatively consistent in their responses to each of the four items in the index. For instance, a response of "1" on the first item should be followed by a response of "1" on the other three items. Second, the bivariate relationships among all potential pairs of index items will be examined to determine the direction and magnitude of each pair-wise relationship by generating correlation coefficients (Babbie, 2010). In this analysis, middle-range correlations (e.g., between 0.30 and 0.70) are desirable, as very low correlations indicate that one or more of the four items may not be appropriate for inclusion in the index and extremely high correlations indicate that one or more of the items are redundant and should be eliminated (Babbie, 2010). Finally, indices will be tested for index item reliability using Cronbach's coefficient alpha (Cronbach, 1951). Cronbach's alpha is commonly used to estimate internal consistency, a measure of how closely related a set of items are as a set. It has been applied by a range of disciplines to measure the extent to which individual item responses correlate with each other (Cortina 1993). Alpha is measured on a scale of 0 to 1 and estimates the proportion of variance that is systematic or consistent in a set of responses (Vaske, 2008). The general formula for computing Cronbach's alpha is:

$$\alpha = \frac{N}{N-1}\left(\frac{\sigma_X^2 - \sum_{i=1}^{N}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

where N = the number of items in the scale, σ_X^2 = the variance observed total test scores, $\sigma_{Y_i}^2$ = the variance of component i for person Y.

It is important to acknowledge that Cronbach's alpha is not a one-dimensional measure, even though it is often used to describe items in this way (Cronbach and Shavelson, 2004). A group of items can result in a high alpha and still be multidimensional in nature. This is often the case when separate clusters of items show high levels of intercorrelation with each other. On the other hand, a set of items can yield a low resultant alpha and be unidimensional if there is high random error within the system (Gigerenzer, 2004; Vaske, 2008). Another important consideration is that the items on a scale are assumed to be positively correlated with each other due to the fact that they are measuring the same construct. This may mean that items that have alternate directionality due to survey technique and reduced response bias may need to be recoded before Cronbach's alpha is calculated (Cronbach, 1951). The use of this statistic will provide the basis for the inclusion or exclusion of specific items in an aggregated integrative complexity metric.

Hypothesis Testing

The common level of significance typically used to support a statistically significant finding is 0.05 or less. This level is appropriate for testing in critical experiments within certain areas of science, such as medicine, pathology, or issues pertaining to "life or death". In such cases the consequence of making a Type I error can be severe. For other areas in research, adherence to the "typical" 0.05 level may not be as important. On a practical level, achieving the 0.05 level can be more difficult within the complex and diverse nature of social sciences. A lower significance level of 0.10 is also meaningful in providing strong support for evidence. Choosing the appropriate level of significance is especially important when accepting or rejecting hypotheses.

Throughout this study, hypotheses will be tested using an alpha level of 0.10. This level is chosen to reduce the possibilities of making Type I errors, as suggested by Gregoire and Driver (1987). A Type I error occurs when a null hypothesis was rejected but should have been accepted because significant differences do not actually exist. A Type II error occurs when a null hypothesis was accepted but should have been rejected because significant differences actually do exist. Using a 0.10 alpha level means that there is a 10% chance of reporting significant differences when they actually do not exist.

Hypotheses 1 and 2. A one-way analysis of variance (ANOVA) will be used to test *Ho1: There is no significant difference in the direction of value orientations according to level of integrative complexity*, and *Ho2: There is no significant difference in the extremity of value orientations according to level of integrative complexity*. Mean scores of value orientation are calculated for each integrative complexity level and then analyzed for significant statistical differences. If there are significant differences between value orientations according to integrative complexity level as expected, post-hoc analyses will be performed. On variables where the overall finding is significant, Tukey's post-hoc tests will be performed to assess pairwise differences between each level of integrative complexity.

Hypotheses 3 and 4. The next set of hypotheses pertain to attitude certainty. The first portion will test, *Ho3: There is no significant relationship between attitude certainty and priority towards the use versus protection of coastal* resources, using a Pearson correlation. The correlation between attitude certainty and priority will be analyzed according to the magnitude, direction, and statistical significance of the relationship. If there is a positive and moderate correlation between attitude certainty and priority as expected, then the two variables provide overall measures of attitude strength.

The second portion tests *Ho4: There is no significant difference in attitude certainty toward the use versus protection of coastal resources according to level of integrative complexity*. Mean scores of attitude certainty are calculated for each integrative complexity level and then analyzed for statistically significant differences using the one-way analysis of variance (ANOVA). If there are significant differences in attitude certainty according to integrative complexity level as expected, post-hoc analyses will be performed. On variables where the overall finding is significant, Tukey's post-hoc tests will assess pairwise differences between each level of integrative complexity.

Hypotheses 5 and 6. The third set of hypotheses test, *Ho5: There is no significant difference in the direction of attitudes according to level of integrative complexity*, and *Ho6: There is no significant difference in the extremity of attitudes according to level of integrative complexity.* Mean scores of attitude direction and attitude extremity are calculated for each integrative complexity level and then analyzed for statistically significant differences using the one-way analysis of variance (ANOVA). If there are significant differences in attitude direction and attitude extremity according to integrative complexity level as expected, post-hoc analyses will be performed. On variables where the overall finding is significant, Tukey's post-hoc tests will assess pairwise differences between each level of integrative complexity.

Hypotheses 7 and 8. The next set of hypotheses test whether integrative complexity influences or is related to the impact of value orientation's effect on attitudes toward coastal management actions. A moderating effect occurs when the predictor-criterion relationship changes as a function of an external factor (Baron & Kenny, 1986). Accordingly, a moderation analysis is appropriate in determining the effect of integrative complexity on the relationship between value orientations and attitude strength. Carroll and Bright (2009) suggest that significant moderation means the strength of the relationship between value orientations and attitudes toward coastal resource management priorities is different for respondents with high integrative complexity compared to those with low integrative complexity. In the moderation analysis, attitude toward coastal management priorities is regressed on value orientation and each level of integrative complexity (Cohen et al., 2003; Vaske, 2008). The first regression tests *Ho7: There is no significant relationship between value orientation and attitude toward coastal resources management options.* The second regression tests *Ho8: Integrative complexity has no significant effect on the relationship between value orientation and attitude towards coastal resources management options.*

The second regression adds an interaction term for value orientation and integrative complexity to the regression equation, as follows:

$$Y = \alpha + \beta_1 X + \beta_2 Z + \beta_3 XZ + \varepsilon$$

In this equation, the interaction effect (*XZ*) between value orientation (*X*) and integrative complexity (*Z*) measures the moderation effect. Baron and Kenny (1986) observe that if, in the final regression, the betas for the main effects of the independent variables change and the statistical interaction is significant, moderation occurred. This would indicate that integrative complexity is a moderator. If there is no statistically significant relationship on the dependent variable from the interaction between the moderator and independent variable, moderation is not supported. In other words, depending on the level of integrative complexity the relationship between value orientation and attitude changes in strength.

Hypotheses 9 to 13. The null hypothesis states, *Ho9: There is no significant difference in acceptability of management tradeoffs according to level of integrative complexity*. Overall acceptability of each scenario will be tested according to integrative complexity level (sub-group) using a one-way analysis of variance (ANOVA). If there are significant differences in attitude direction and attitude extremity according to integrative complexity level as expected, post-hoc analyses will be performed. On variables where the overall finding is significant, Tukey's post-hoc tests will assess pairwise differences between each level of integrative complexity. It is expected that individuals with higher integrative complexity consider balanced levels of resource use and protection to be more acceptable management alternatives, whereas individuals with lower integrative complexity consider unbalanced levels of resource use and protection to be more acceptable management alternatives. The nature of these tradeoffs (acceptability of tradeoffs between levels of use and protection) will be tested in hypotheses 10-13 using the following analyses.

The 3^{4-1} fractional factorial design used to measure acceptability of management alternatives will be tested for the main effects of four factors and their interactions in 27 observations, which are organized in three blocks of nine observations each. The main effects of two factors reflecting resource use (access to recreational fishing areas; length of recreational fishing season) will be tested according to *Ho10: Factors of resource use have no significant effect on the acceptability of management alternatives.* The main effects of factors reflecting resource protection (protected area; protection of fish populations) will be tested according to *Ho11: Factors of resource protection have no significant effect on the acceptability of management alternatives.* The factor interactions will be tested in *Ho12: There is no significant interaction between use and protection factors on the acceptability of management alternatives* and *Ho13: There is no significant interaction between factors and integrative complexity on the acceptability of management alternatives.*

A simple analysis starts by making a main effects plot and interaction plots to see what location and dispersion effects might be important, followed by a formal analysis of variance and half-normal plots. The 3^{4-1} design has 26 degrees of freedom that may be used to compute the sums of squares for the 13 sets of main effects and components of interactions (and their aliases). The two degrees of freedom in each group can be decomposed further into a linear effect and a quadratic effect with the contrast vectors $A_l = 1/\sqrt{2}\,(-1, 0, 1)$ and $A_q = 1/\sqrt{6}\,(1, -2, 1)$, respectively, where the values in the vectors are associated with the $\ln s^2$ values at the levels (0,1,2) for the group. Because the linear and quadratic effects are standardized and orthogonal to each other, these 26 effect estimates can be plotted on the half-normal probability scale for an initial analysis. The design is also analyzed by fitting a second-order model with the addition of the block effects:

$$Y = \beta_0 + \sum_{i=1}^{4} \beta_i x_i + \sum_{i=1}^{4} \beta_{ii} x_i^2 + \sum_{i<j}^{4} \beta_{ij} x_i x_j + \gamma_1 block1 + \gamma_2 block2 + \varepsilon,$$

where β_0 represents the intercept, β_i represents the linear effect of x_i, β_{ii} represents the quadratic effect of x_i, and β_{ij} represents the bilinear (i.e., linear-by-linear) interaction between x_i and x_j. The variables, *block*1 and *block*2, are indicators of blocks 1 and 2, respectively, with block 0 as a reference, and ε is the error term.

The fractional factorial design produces hierarchical or multilevel data because both respondents and scenarios are sampled (Auspurg & Hinz, 2015; Dülmer, 2007; Hox, Kreft, & Hermkens, 1991; Rossi

& Nock, 1982). Thus, there are variables of the respondent level and of the scenario level, producing a hierarchical structure by design (Snijders & Bosker, 2012). This type of design is used to account for the influence of respondent level variables along with the responses to the scenarios in one model (Dülmer, 2007; Rossi & Anderson, 1982; Shooter & Galloway, 2010). In this case, the respondent level refers to an individual's level of integrative complexity. The overall aim of the data analysis is to detect systematic correlation structures between the independent and dependent variables. Hierarchical linear modeling (HLM), also known as multilevel linear modeling, random coefficient model or a type of mixed-linear model, estimates the average effects of both scenario and respondent characteristics (Hoffman & Rovine, 2007; Hox, Kreft, & Hermkens, 1991; Raudenbush & Bryk, 2002). Adding interactions between respondent characteristics and factors are also informative for determining agreement among respondents by indicating whether judgments by some types of respondents are more sensitive to particular factors. Thus, the effects of the respondents' variables and cross-level interactions indicate subgroup differences among the respondents (Ausburg & Hinz, 2015). HLM is flexible in that not only random intercepts but also random slopes can be easily modeled. In addition, dealing with missing and unbalanced data is facilitated in HLM (Atzmüller & Steiner, 2010).

HLM poses two regression equations; one modeling the scenario effects within respondents and one modeling respondent effects between respondents. The output from the multilevel regression models is typically split into two parts: the fixed part, consisting of estimations of regression coefficients, their standard errors, *t*-values and probability values, and the random part, comprising the decomposition of the unexplained variance into variance components for each level. Random intercept models assume that the threshold of evaluation differs randomly in regard to respondents. In these random intercept models, a variance component measuring the unexplained variance in the intercept across units is specified for each of the higher levels of the design. When the random slope models are employed, it is also possible to specify variance components for the regression slopes of predictors introduced at lower levels of the model (Schoemann, Rhemtulla, & Little, 2014; Snijders & Bosker, 2012). The equation for a two-level model with intercepts and slopes that differ across level-2 units is:

$$y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + e_{ij}$$
$$\beta_{0j} = \gamma_{00} + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + u_{1j}$$

where y_{ij} is a score for level 1 unit *i* nested within level 2 unit *j*, β_{0j} is the intercept or mean acceptability score for each *i* person's acceptability rating within each of the *j* integrative complexity levels or subgroups, and e_{ij} is the respondent-level error within each subgroup.

To obtain an empirical impression of the variance decomposition, the intraclass correlation coefficient (ρ) is a ratio of the variance among level-2 units (τ_{00}) to the total variance of the outcome (Y_{ij}). The total variance of the outcome is the sum of the variance among level-2 units and the estimated residual variance. The value of the coefficient represents the proportion of variance in Y_{ij} attributed to the respondent level. In other words, this coefficient states how much of the variance of the outcome is a reflection of different respondents evaluating the scenarios. The value of the intraclass correlation coefficient ranges from zero to one. A very small value for ρ implies that the within-group variance is much greater than the between-group variance, and a ρ of zero shows that there is no correlation of responses within a group. The higher the intraclass correlation coefficient, the stronger the bias in the estimation of standard errors.

7. RESULTS

Survey Response Rates

A total of 345,762 emails containing a link to the online survey were initially sent out to Florida licensed recreational saltwater anglers. Of this initial sample, 7.8% of the surveys were non-deliverable due to invalid email addresses (Table 13). Since it was not possible for these individuals to receive the survey and participate in the study, the non-deliverables were excluded from the original sample. Thus, the effective sample size was 318,892 individuals.

Table 13. Florida recreational saltwater anglers' response rate to online survey.

	Florida Keys		Florida State		Total	
	n	*%*	*n*	*%*	*N*	*%*
Initial Sample	12,689		333,073		345,762	
Non-deliverables	963	7.6	25,907	7.8	26,870	7.8
Effective Sample	11,726		307,166		318,892	
Opted Out of Survey	516	4.4	8,573	2.8	9,089	2.9
Non-returned Surveys	10,754	91.7	292,572	95.2	303,326	95.1
Returned Surveys	456	3.9	6,021	2.0	6,477	2.0

In the emails, recipients who did not want to participate in the survey could “opt out” by clicking on a link in the email. The Qualtrics system indicated that approximately 2.9% of the recipients opted out of taking the survey for unknown reasons. There were a large proportion (95.1%) of non-returned surveys. A non-response bias test was not performed because this study did not seek to obtain a representative sample, but possible explanations for non-response may be that emails were left unopened, skipped, or ignored. Non-response may have occurred in large part to unforeseen circumstances and catastrophic events. The fall of 2017 was also an extremely active hurricane season, during which

Hurricane Irma had disastrous impacts to the entire state of Florida and the Florida Keys. These events prevented many of Florida's residents from receiving or participating in the survey. In total, 6,477 usable surveys were completed and submitted, yielding an overall response rate of 2.0%. This is an unusually low survey response rate. Although the total number of usable returned surveys was less than expected, this is still a large sample size and is sufficient for the purposes of this study.

Profile of Florida Licensed Recreational Saltwater Anglers

Demographics

Demographic statistics of the respondent population showed that the recreational anglers surveyed were predominately male (85.4%), and an average age of 50.3 years old. The respondents ranged between the ages of 18 and 87 years of age, with about 25% less than 41 years of the age. In general, the respondents were well-educated with 34.6% having a bachelor's degree and 24.8% having an advanced degree (professional, masters or doctorate). Only 1.6% reported that they never finished high school.

The recreational anglers reported that they had been permanent residents of Florida for an average of 12.6 years. About 10% reported that they were new residents of Florida (1 year or less), whereas more than half (52.0%) of the respondents had been residents for 10 or more years. Approximately 60.6% of respondents were residents of the southern regions of Florida, and 39.4% were residents of the northern regions of Florida (Table 14). Half of all the respondents lived near the Atlantic coast, whereas the other half lived near the Gulf of Mexico. When compared, the geographic distribution of survey respondents closely reflected the geographic distribution of the population of licensed recreational saltwater anglers in Florida. In the actual population, approximately 62.2% of licensed anglers lived in the southern regions and 37.7% lived in the northern regions of Florida.

Table 14. Distribution comparison of survey respondents and population of licensed recreational saltwater anglers by region of Florida.

	Respondents				Population of Licensed Anglers			
Region of Florida	*N*	*%*	*Total*	*%*	*N*	*%*	*Total*	*%*
(1) Northeast Atlantic	1,476	22.8	1,476	22.8	77,590	22.4	77,590	22.5
(2) Southeast Atlantic	1,762	27.2	3,238	50.0	111,361	32.2	188,951	54.6
(3) Southwest Gulf	2,165	33.4	5,403	83.4	103,817	30.0	292,768	84.6
(4) Northwest Gulf	1,074	16.6	6,477	100.0	52,994	15.3	345,762	100.0

Fishing Activity

Recreational saltwater anglers surveyed indicated that they had been saltwater fishing in Florida for an average of 28 years. The respondents also indicated the approximate number of days spent fishing in five different modes during the past 12 months (Table 15). Surveyed anglers spent an average of 25.3 days saltwater fishing from their own private boat during the previous 12-month period. The fewest number of days was spent saltwater fishing from a party boat (M = 0.95).

Table 15. Recreational anglers' saltwater fishing avidity in the past 12 months according to mode.

Fishing Mode	Days Fished (*M*)	*n*
From your own privately-owned boat	25.29	5,420
From shore (beach, bridge, dock, pier)	17.51	4,905
From someone else's privately-owned boat	9.46	4,871
From a charter boat	2.79	4,007
From a party boat	0.95	3,439

Anglers were asked to rank their top three most preferred species to catch when saltwater fishing in Florida. Red drum (also known as red fish or reds) was the most preferred species to catch among recreational saltwater anglers (18.1%), followed by snappers, snook, dolphinfish, groupers, and spotted seatrout (Table 16). Less than fifteen-percent of anglers indicated they did not have a top-three preferred species to catch.

Anglers were also asked to rank the top three species they actually targeted while saltwater fishing in Florida. Similar to anglers' preferences, red drum was the primary species anglers most commonly (19.5%) targeted while saltwater fishing (Table 17). The second most targeted species were snappers (16.1%), followed by spotted seatrout (11.1%). Although snook was a top-three preferred species to catch, snook was not a commonly targeted species.

Table 16. Species recreational anglers most preferred to catch when saltwater fishing in Florida.

	Ranked Preferences (%)			
Species	1st (%)	2nd (%)	3rd (%)	Total %
Red Drum (Redfish, Reds)	1,160 (18.1)	1,011 (16.0)	605 (9.9)	44.0
Snappers	908 (14.2)	1,017 (16.1)	888 (14.5)	44.8
Snook	879 (13.7)	676 (10.7)	481 (7.9)	32.3
Dolphinfish (Mahi-Mahi)	837 (13.1)	463 (7.3)	333 (5.4)	25.8
Groupers	819 (12.8)	765 (12.1)	614 (10.0)	34.9
Spotted Seatrout	443 (6.9)	600 (9.5)	680 (11.1)	27.5
Tarpon	192 (3.0)	155 (2.5)	248 (4.1)	9.6
Flounder	101 (1.6)	176 (2.8)	300 (4.9)	9.3
Cobia	85 (1.3)	106 (1.7)	189 (3.1)	6.1
Wahoo	84 (1.3)	195 (3.1)	127 (2.1)	6.5
Tuna	82 (1.3)	150 (2.4)	152 (2.5)	6.2
King Mackeral (Kingfish)	52 (0.8)	113 (1.8)	241 (3.9)	6.5
Other	573 (8.9)	635 (10.1)	778 (12.7)	31.7
No Preference	200 (3.1)	240 (3.8)	487 (7.9)	14.8
Total	6,415 (100.0)	6,302 (100.0)	6,123 (100.0)	

Table 17. Species recreational anglers actually target while saltwater fishing in Florida.

	Most Targeted Species (%)			
Species	1st (%)	2nd (%)	3rd (%)	Total %
Red Drum (Redfish, Reds)	1,251 (19.5)	938 (15.3)	538 (9.1)	43.9
Snappers	1,043 (16.3)	990 (16.1)	756 (12.8)	45.2
Dolphinfish (Mahi-Mahi)	831 (12.9)	343 (5.6)	332 (5.6)	24.1
Spotted Seatrout	731 (11.4)	777 (12.7)	642 (10.9)	35.0
Snook	696 (10.9)	558 (9.1)	545 (9.2)	29.2
Groupers	626 (9.8)	645 (10.5)	576 (9.8)	30.1
Kingfish	114 (1.8)	183 (3.0)	247 (4.2)	9.0
Tarpon	109 (1.7)	112 (1.8)	210 (3.6)	7.1
Flounder	89 (1.4)	179 (2.9)	290 (4.9)	9.2
Wahoo	35 (0.5)	118 (1.9)	103 (1.8)	4.2
Tuna	29 (0.4)	125 (2.0)	113 (1.9)	4.3
Cobia	42 (0.7)	54 (0.9)	148 (2.5)	4.1
Sheepshead	55 (0.9)	97 (1.6)	148 (2.5)	5.0
Other	567 (8.8)	954 (15.5)	1,089 (18.5)	42.8
No specific target species	191 (3.0)	78 (1.3)	156 (2.7)	7.0
Total	6,409 (100.0)	6,142 (100.0)	5,893 (100.0)	

Integrative Complexity

The first research objective was to examine integrative complexity of thought regarding management priorities for the use versus protection of coastal resources. To accomplish this objective, several measures of integrative complexity were examined to determine which approach worked best in capturing an individual's complexity of thought. The three different measurement approaches included the differentiation and integration scales, a four-item index, and self-classification vignettes.

Differentiation and Integration

Differentiation, the first dimension of integrative complexity, is a measure of the scope of an individual's thinking process. A high level of differentiation is indicated by a high number of subjects considered in a person's thoughts. In the survey, respondents were provided a list of 21 subjects, and asked to choose the subjects they did not consider while thinking about the issue of use versus protection. For the subjects that anglers considered, on a 7-point scale, the subjects were given some consideration (mean score = 3.33) to a lot (mean score = 5.55) of consideration (Table 18). Overall, the average differentiation was 16 subjects, with a mode and median of 18 different subjects considered by 13.8% of respondents (Figure 11). Eight (0.1%) respondents did not choose any of the subjects and therefore demonstrated zero differentiation. An overwhelming proportion (95%) of respondents indicated that they considered more than ten subjects in their thinking. Of the 21 subjects considered, nearly all of the respondents (90%) considered the following six subjects in their thinking: abundance of fish, fisheries health, future condition of marine resources, ecosystem health, recreation, and catch limits (Table 18). The least considered subjects were boat anchoring/mooring and invasive species, as indicated by 62% of the respondents.

Three levels of differentiation were created by segmenting the frequency distribution as follows: if 1-7 subjects were considered then differentiation was low or level 1; if 8-14 subjects were considered then differentiation was moderate or level 2; and if 15-21 subjects were considered then differentiation was high or level 3. This resulted in 116 (1.8%) individuals demonstrating low or level 1 differentiation, 1,182 (18.2%) individuals demonstrating moderate or level 2 differentiation, and 5,171 (79.9%) individuals demonstrating high or level 3 differentiation.

Table 18. Subjects that were considered in respondents thinking about the priority of use versus protection.

	Considered			Not Considered	
Subjects	Degree [1]	*n*	%	*n*	%
Abundance of fish	5.41	5,937	91.7	540	8.3
Fisheries health	5.55	5,916	91.3	561	8.7
Future condition of marine resources	5.55	5,916	91.3	561	8.7
Ecosystem health	5.35	5,886	90.9	59	19.1
Recreation	4.92	5,874	90.7	603	9.3
Catch limits	4.81	5,863	90.5	614	9.50
Overfishing	4.88	5,567	86.0	910	14.0
Endangered species protection	4.87	5,562	85.9	915	14.1
Water quality/pollution	5.30	5,321	82.2	1,156	17.8
Ecological diversity	4.36	5,317	82.1	1,160	17.9
Access to fishing locations	4.22	5,207	80.4	1,270	19.6
Days in fishing season	4.10	5,101	78.8	1,376	21.2
Local Economy	4.20	5,073	78.3	1,404	21.7
Coral health	4.69	5,057	78.1	1,420	21.9
Seagrasses	4.55	4,892	75.5	1,585	24.5
Propeller scarring	3.97	4,828	74.5	1,649	25.5
Tourism	3.92	4,736	73.1	1,741	26.9
Growth in local population	3.94	4,609	71.1	1,868	28.8
Local Jobs	3.97	4,550	70.2	1,927	29.8
Boat anchoring/mooring	3.33	3,995	61.7	2,482	38.3
Invasive species	4.33	3,985	61.5	2,492	38.5

[1] Mean degree of consideration measured on 7-point scale of 1=Almost no consideration, 2=Slight consideration, 3=Some consideration, 4=Moderate consideration, 5=A lot of consideration, 6=Strong consideration, 7=Primary consideration.

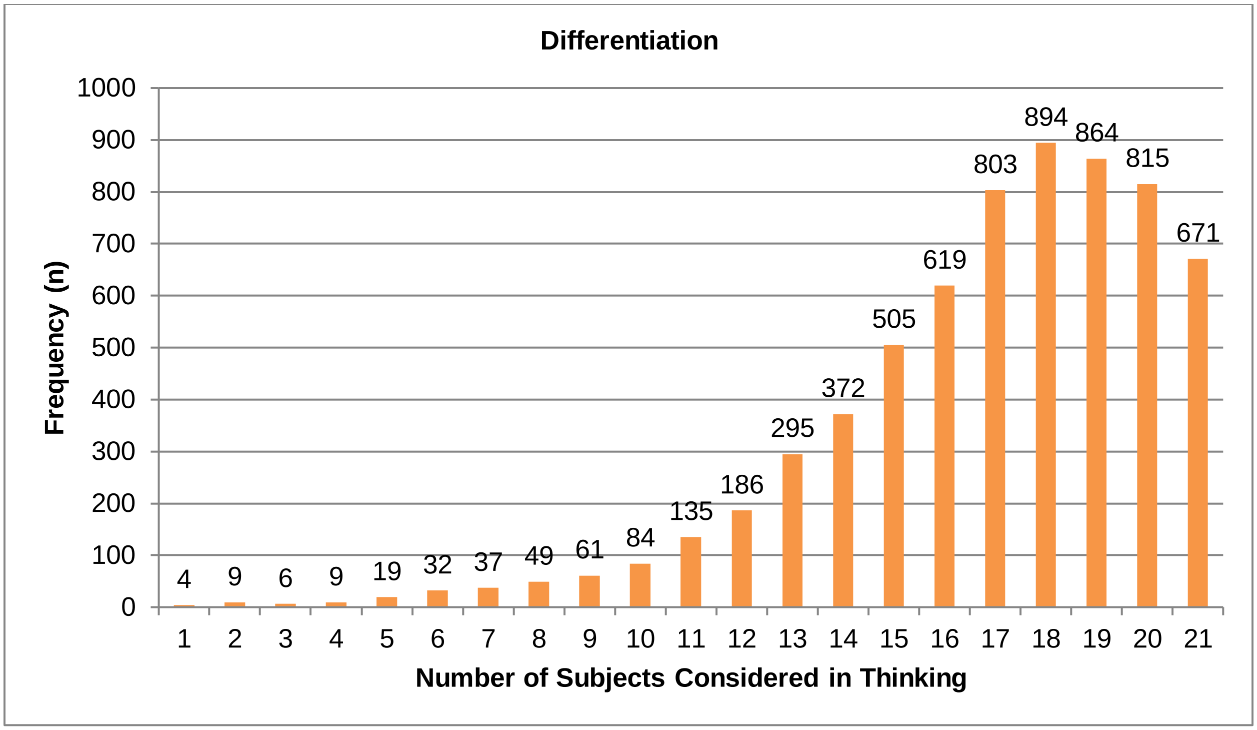


Figure 11. Differentiation of subjects considered while thinking about use versus protection.

Integration, the second dimension of integrative complexity, was measured by four response statements corresponding to four levels of integration. In the survey, respondents were asked about the manner in which they thought about the subjects they considered while thinking about the priority of use versus protection and were instructed to choose the one statement that best described their thinking (Table 19). Overall, the respondents indicated moderate to high levels of integration (M = 3.54).

Three levels of integrative complexity were constructed from combinations of differentiation levels and integration levels, as specified in the methodology section and in Table 20. The results of this process yielded an abnormal distribution across the three levels of integrative complexity (Figure 12). With an overwhelming proportion in the high level of integrative complexity and an inadequate proportion in the low level of integrative complexity, the use of this integrative complexity measure in data analysis and hypothesis testing would be ineffective. Therefore, this approach was dismissed as a valid measure of integrative complexity in this study.

Table 19. Distribution of responses according to four levels of integration (1=low, 4=high).

Integration	*N*	*%*	*Total*	*%*
(1) I thought about the subjects as being separate and unconnected matters	140	2.2	140	2.2
(2) I thought about the subjects as being mostly separate matters; perhaps some might be connected to each other	492	7.7	632	9.9
(3) I thought about the subjects as being somewhat separate matters; there are some connections between them. I considered how as one subject changes, other subjects change at the same time	1,499	23.5	2,131	33.5
(4) I thought about the subjects as all being connected to each other. They have complex links between them, and I considered how the subjects interact with each other as a whole	4,239	66.5	6,370	100.0

Table 20. Integrative complexity levels based on combinations of differentiation levels and integration levels.

	N	*%*	*Total*	*%*
Low Integrative Complexity				
Differentiation (1), Integration (1)	6	2.4	6	2.4
Differentiation (1), Integration (2)	6	2.4	12	4.8
Differentiation (1), Integration (3)	27	10.8	39	15.6
Differentiation (1), Integration (4)	76	30.5	115	46.1
Differentiation (2), Integration (1)	27	10.8	142	56.9
Differentiation (3), Integration (1)	107	43.1	249	100.0
Moderate Integrative Complexity				
Differentiation (2), Integration (2)	109	13.1	109	13.1
Differentiation (2), Integration (3)	349	41.8	458	54.9
Differentiation (3), Integration (2)	377	45.1	835	100.0
High Integrative Complexity				
Differentiation (2), Integration (4)	683	12.9	683	12.9
Differentiation (3), Integration (3)	1,122	21.3	1,805	34.2
Differentiation (3), Integration (4)	3,475	65.8	5,280	100.0

(1) = Level 1, (2) = Level 2, (3) = Level 3, (4) = Level 4

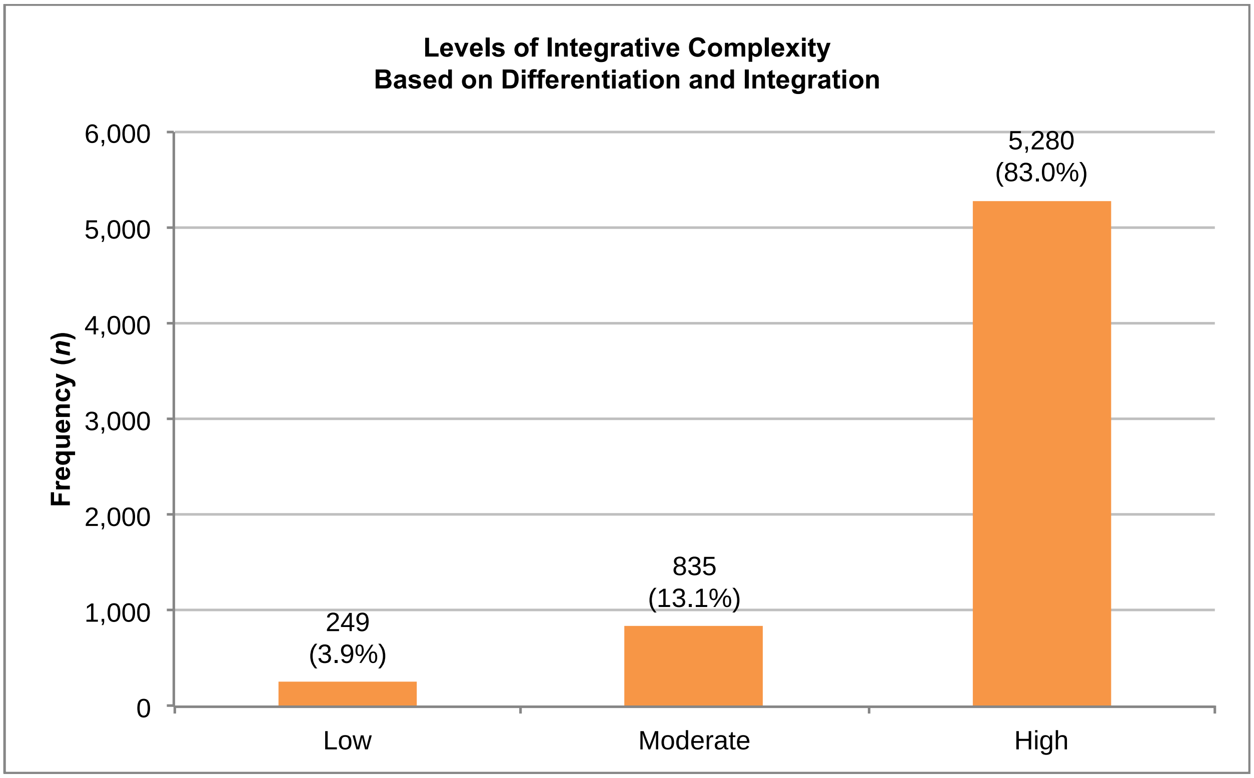


Figure 12. Frequency distribution according to three levels of integrative complexity based on differentiation and integration.

Four-Item Index

The second approach created a four-item index of integrative complexity. The integrative complexity index was created by first summing the scores for the four indicator items, 1) *open to change*, 2) *information seeking*, 3) *active listening*, and 4) *perspective taking*, with the sums ranging from a minimum of 4 to a maximum of 16 (Table 21). Respondents were categorized into four levels of integrative complexity, following an a priori method used by Salz et al. (2001). This process segmented the cumulative scores into brackets as equal in size as possible (level 1 had a range of 4 in its scores, whereas levels 2, 3, and 4 had a range of 3). Respondents in the "very low" level of integrative complexity had cumulative scores of 4 through 7. The second level, or "low" integrative complexity, consisted of cumulative scores of 8 through 10; the third level, or "moderate" integrative complexity, consisted of respondents scoring 11 to 13; and the fourth level, or “high” integrative complexity consisted of respondents scoring 14 to 16.

Table 21. Distribution of respondents according to cumulative index scores for integrative complexity.

Cumulative Index Score	*N*	%	*Total*	%
(4)	7	0.1	7	0.1
(5)	3	0.1	10	0.2
(6)	7	0.1	17	0.3
(7)	17	0.3	34	0.5
(8)	61	1.0	95	1.5
(9)	152	2.4	247	3.9
(10)	358	5.6	605	9.5
(11)	795	12.5	1,400	22.0
(12)	1,217	19.1	2,617	41.0
(13)	1,298	20.4	3,915	61.4
(14)	1,117	17.5	5,032	78.9
(15)	834	13.1	5,866	92.0
(16)	511	8.0	6,377	100.0

This process resulted in a distribution with only 0.5% of the respondents scoring into the “very low” (level 1) integrative complexity level and 9.0% in the “low” (level 2) integrative complexity level (Figure 13). “Moderate” (level 3) integrative complexity anglers accounted for 52.0% and “high” (level 4) integrative complexity anglers accounted for 38.6% of all respondents. Even with these first two levels combined, the sample size of respondents in the lowest integrative complexity level would be too small to use in statistical analyses.

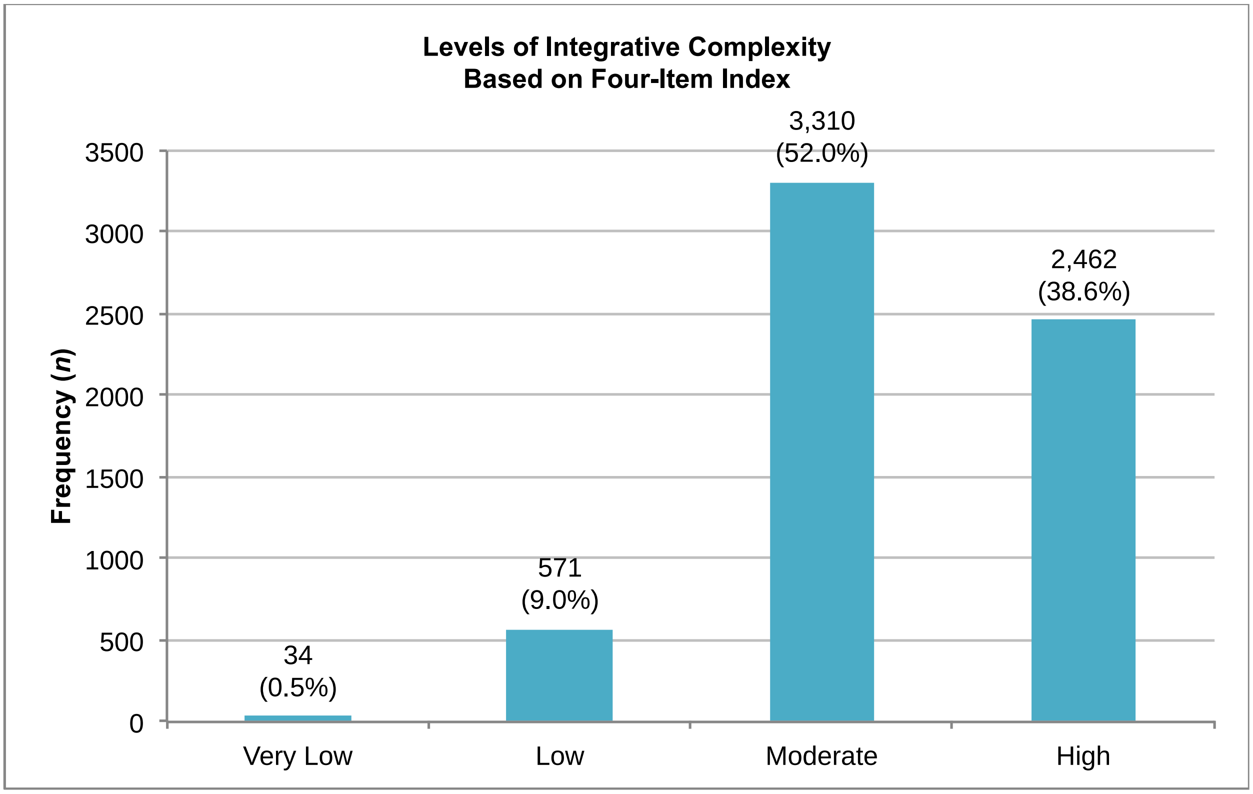


Figure 13. Frequency distribution according to three levels of integrative complexity based on four-item index.

As previously described in the data analysis (Chapter 6), several steps were taken to test the validity of the index and demonstrate whether it successfully measured what it is intended to measure. First, frequency distributions were calculated for each of the four index items (Figure 14). On a four-point scale of "1" (very low integrative complexity) to "4" (high integrative complexity), the modal response to the *open to change* and *active listening* items was "4". The modal response was "3" for the *information seeking* and *perspective taking* items. The proportion of responses in the lowest integrative complexity level was 1.4% or less for *information seeking*, *active listening*, and *perspective taking*, and greater for *open to change* (5.8%). A similar distribution pattern occurred across responses in the moderate integrative complexity level but at larger proportions.

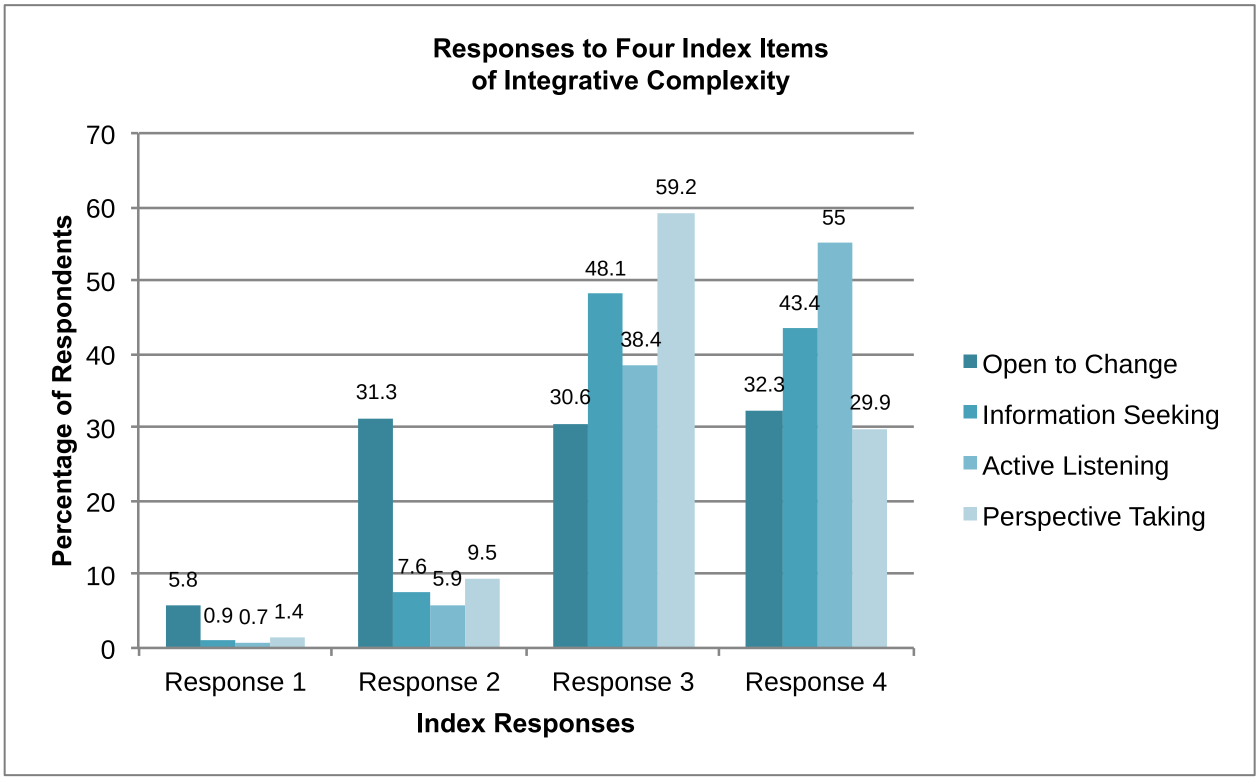


Figure 14. Distribution of responses to four index items of integrative complexity.

Bivariate relationships among the items considered for inclusion in the index were examined to determine the degree to which the items were related (Babbie, 1995). Correlation coefficients for the six pair-wise comparisons ranged from 0.16 to 0.37 and were all statistically significant at the 0.01 level (Table 22). This range suggested that no two items were so similar as to warrant exclusion from the index to avoid redundancy. While significant positive relationships were found for all pair-wise comparisons, all correlations were lower than the minimum of 0.40 and half were of low magnitude (less than 0.20). This suggests that each item, particularly *open to change*, measured a somewhat different aspect of integrative complexity, or something else. The relationship between *active listening* and *perspective taking* had a correlation of 0.37. The magnitude of this relationship was somewhat stronger than the other pair-wise correlations but did not suggest that the two items were so similar as to warrant exclusion from the index to avoid redundancy.

Table 22. Bivariate relationships among integrative complexity index items.

Index Item Pair	Correlation Coefficient *	% of Responses Differing by More Than One
Open to Change ~ Information Seeking	0.18	17.2
Open to Change ~ Active Listening	0.17	21.1
Open to Change ~ Perspective Taking	0.22	13.6
Information Seeking ~ Active Listening	0.29	4.5
Information Seeking ~ Perspective Taking	0.16	6.4
Active Listening ~ Perspective Taking	0.37	4.2

* Correlation is significant at the 0.01 level (2-tailed).

In addition to the bivariate correlation analysis, the percent of occurrences when two variables differ from each other by more than one was examined. This analysis is one gauge of the internal validity of an index, because it is a measure of how well one item predicts response to another item (Salz, Loomis, & Finn, 2001). In other words, if a respondent scored "1" on one of the index items, that respondent would be expected to score "1" on the other three index items. However, if that respondent scored a "3" or "4" on any of the other index items, that score would differ by more than one. Item analysis of the integrative complexity index demonstrated inconsistent responses across the four index items. For the three pair-wise comparisons including the item *open to change*, 13.6 – 21.1% of the responses differed from each other by more than one (Table 22). Pair-wise comparisons not involving the item *open to change* differed by more than one for 4.2 – 6.4% of respondents. This analysis suggested that the index did not achieve a sufficient degree of internal validity.

Index item reliability was tested using Cronbach's coefficient alpha (Cronbach, 1951). The reliability of the four-item index was measured with an internal consistency of α = 0.525. This result was lower than desired, with 0.600 being the recommended minimum level (Tarrant et al., 1997). Also reported are values for alpha when a particular item was deleted to determine the sensitivity of alpha to the deletion of individual items (Table 23). Alpha values when a particular item was deleted were 0.529 for *open to change*, 0.474 for *information seeking*, 0.401 for *active listening*, and 0.420 for *perspective taking*. These results showed that by excluding *open to change*, the index would improve slightly, as indicated by the higher alpha value. By excluding any of the latter three items, the index reliability would become worse. These results provided evidence to suggest that the *open to change* item adds nothing to the index, and only the latter three items could be used when constructing the final integrative complexity index.

Table 23. Reliability and correlation analyses of integrative complexity index.

Index Item	*M* [1]	Item Total Correlation	α if Item Deleted
Open to Change	2.90	0.266	0.529
Information Seeking	3.34	0.289	0.474
Active Listening	3.48	0.385	0.401
Perspective Taking	3.18	0.359	0.420

Cronbach's alpha with all items included = 0.525

[1] Mean scores measured on a four-point scale ranging from 1=low to 4=high.

The results of the reliability and internal validity measures raise some concerns about using the index as the integrative complexity measure for subsequent analyses and suggest that the integrative complexity index requires further improvement. The index was tested in the subsequent analyses, but the results did not suggest that the measure was externally valid. Thus, insufficient evidence supported the use of the four-item index in subsequent hypothesis testing.

Self-Classification Vignettes

The final approach to measuring integrative complexity was based on a set of four vignettes describing four levels of integrative complexity. Each of the four vignettes was carefully constructed to describe characteristics of four varying levels of differentiation and integration, ranging from low (score =1) to high (score = 4). Survey respondents were asked to choose the one vignette they felt best described how they thought about the issue of use versus protection overall. The frequency distribution across the four levels yielded a small proportion (2.6%) for vignette 1, as compared to the other three vignette levels (Table 24).

Table 24. Response distribution for vignettes classifying four levels of integrative complexity.

Vignettes	*n*	*%*	*Total*	*%*
(1) The issue of use versus protection is rather simple; it's either one or the other. There were one or two subjects that were relevant, and I gave the issue no further thought	165	2.6	165	2.6
(2) The issue of use versus marine resource protection may not be that simple, because both should be considered. There were a few different subjects that were relevant, and I thought about how different subjects might be connected	988	15.5	1,153	18.1
(3) The issue of use versus marine resource protection is not simple, because there is more to consider. There were a number of different subjects that were relevant, and I thought about how some subjects affect other subjects	2,358	36.9	3,511	55.0
(4) The issue of use versus marine resource protection is quite complex, because there is a lot more to consider. There were many different subjects that were relevant, and I thought about how the different subjects are integrated and affect each other as a whole	2,875	45.0	6,386	100.0

To achieve a more balanced sample size, respondents in level 1 and level 2 were combined to form level 1 (low integrative complexity), level 3 became level 2 (moderate integrative complexity), and level 4 became level 3 (high integrative complexity). This process yielded a distribution with 18.1% in the low integrative complexity level, 36.9% in the moderate integrative complexity level, and 45.0% in the high integrative complexity level (Figure 15). Of the three integrative complexity measures developed in this study, the self-classification vignettes performed the best in segmenting respondents into meaningful sub-groups of integrative complexity. Therefore, the integrative complexity levels resulting from the vignettes were used in subsequent hypothesis testing.

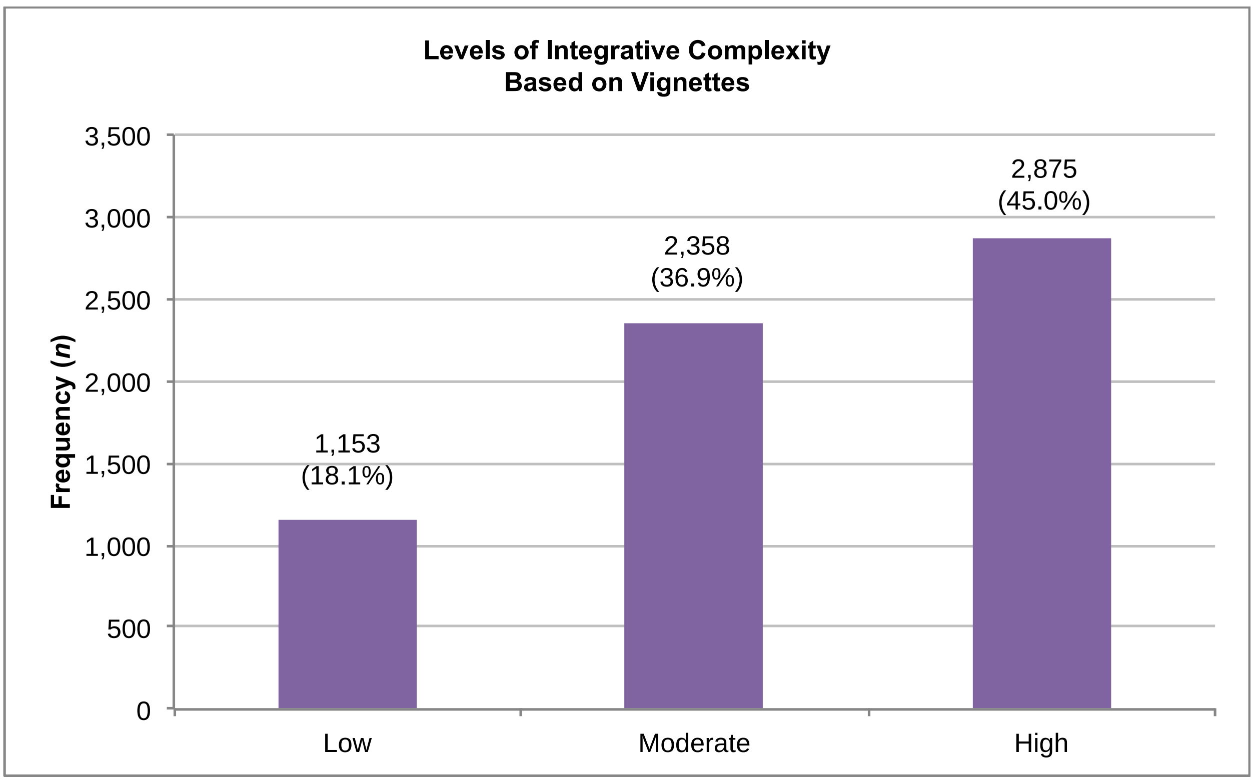


Figure 15. Frequency distribution according to three levels of integrative complexity based on self-classification vignettes.

Hypothesis Testing

Value Orientations

The second research objective was to determine if value orientations differed according to level of integrative complexity. Three types of value orientations toward resource management (ecocentric, pluralistic, and anthropocentric) were constructed from six statements measuring an anthropocentric orientation and six statements measuring an ecocentric orientation. To determine overall value orientation, ecocentric and anthropocentric items were aggregated to construct a single ecocentric-anthropocentric scale. The scores of each of the ecocentric statements were reverse-coded to reflect a comparable continuum ranging from ecocentric (score = 1), to pluralist (score = 4), to anthropocentric (score = 7). This overall score was used in the moderation analysis (Objective 4).

Scores to each of the twelve value orientation statements were added into a cumulative index with scores ranging from 12 to 84. Initially, the composite scores were segmented into three groups of value orientations using an a priori approach (Table 25). This approach segmented the cumulative scores into three subgroups with a range of 24 or 25. The ecocentric value orientation consisted of cumulative scores ranging from 12 to 36, the pluralistic value orientation consisted of scores 37 to 60, and the anthropocentric value orientation consisted of scores 61 to 84. However, this segmentation approach resulted in a skewed distribution with only 2.1% of respondents in the anthropocentric value orientation group. This unbalanced distribution was unsuitable for hypothesis testing. Alternatively, the index scores were segmented into proportional subgroups, each consisting of approximately one-third of all respondents (Table 25). The ecocentric value orientation consisted of cumulative scores ranging from 12 to 26 (33.6%), the pluralistic value orientation consisted of scores 27 to 38 (33.8%), and the anthropocentric value orientation consisted of scores 39 to 84 (32.6%).

Table 25. Distribution of subgroups (*N* = 6,262) created from cumulative value orientation index scores using a priori and weighting methods of segmentation.

Cumulative Index Scores [a]	a priori Segmentation *n*	%	Cumulative Index Scores [a]	Weighted Segmentation *n*	%
11 – 23	2,062	32.9	11 – 18	1,171	18.7
24 – 36	2,463	39.3	19 – 25	1,281	20.5
37 – 51	1,486	23.7	26 – 32	1,309	20.9
52 – 64	219	3.5	33 – 39	1,204	19.2
65 – 77	32	0.5	40 – 77	1,297	20.7

[a] Cumulative index scores based on eleven value orientation items measured on a scale of 1 to 7.

The value orientation index was examined for internal consistency and reliability. Bivariate relationships among the twelve items considered for inclusion in the index were examined to determine the degree to which the items were related (Table 26). Correlation coefficients for the 66 pairwise comparisons ranged from 0.10 to 0.54 and were all statistically significant ($p = 0.000$). The magnitudes of these correlations were in the low to moderate range, suggesting that no two items were so similar to warrant exclusion from the index to avoid redundancy. The lowest correlation coefficients (0.10 to 0.16) all involved item I, which was the value orientation statement, “Human activities in Florida ecosystems should not be allowed if they damage these natural areas.” The highest correlation (0.54) was between J (“We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today.”) and K (“Management should focus on doing what is best for the Florida ecosystem instead of what is best for people.”).

The bivariate relationships were then examined for the percent of occurrences when two variables differed from each other by more than one amount (Table 27). For each of the twelve items, possible responses ranged from “1” (strongly disagree) to “7” (strongly agree). The six ecocentric value orientation statements were reverse-coded to reflect a comparable ecocentric—anthropocentric continuum. For all pairwise comparisons, less than half of all respondents had responses for any two items that differed by more than one (Table 27). For item E ("Florida ecosystems should primarily be managed for the benefits of people.") and item L ("People have a duty to protect fish and other parts of nature in Florida."), 51.7% of all respondents had responses differing by more than one amount. This item pair displayed the highest percentage of responses differing by one. The pairwise comparison of item L and item C ("Human use of Florida ecosystems is more important than protecting fish species that live there.") displayed the lowest percentage (19.1%) of responses differing by more than one amount, which indicated that responses for these two items displayed the highest inter-item consistency.

Index item reliability was tested using Cronbach's coefficient alpha (Table 28). The reliability of the twelve-item index was measured with an internal consistency of $\alpha = 0.858$. This value is above the recommended minimum level of 0.600 and suggests that the twelve items are all measuring the same construct (Tarrant et al., 1997). The reliability of the index was further examined for when each item was deleted from the index. When item K was deleted from the index, the alpha value dropped to $\alpha = 0.838$, indicating that this item was important to include in the final index (Table 27). When item I was deleted from the index, the alpha value increased to $\alpha = 0.861$. This indicated that the reliability of the index would improve by deleting item I, and further supported the exclusion of item I from the final index. Thus, the final value orientation index was created based on eleven items (excluding item I).

Table 26. Bivariate correlations among twelve value orientation index items.

Index Item Pair	A	B	C	D	E	F	G	H	I	J	K
A. The primary value of the Florida ecosystem is to provide for people	1.00										
B. Florida ecosystems are resilient enough to cope with the impacts of human activities	0.44	1.00									
C. Human use of Florida ecosystems is more important than protecting fish species that live there	0.40	0.51	1.00								
D. Humans have a right to change the natural world to suit their needs	0.34	0.39	0.36	1.00							
E. Florida ecosystems should primarily be managed for the benefits of people	0.53	0.40	0.38	0.37	1.00						
F. There should be fewer regulations restricting human activities in the Florida ecosystem	0.36	0.48	0.42	0.40	0.42	1.00					
G. Florida ecosystems are valuable in their own right, regardless of human interests	0.25	0.28	0.28	0.25	0.23	0.27	1.00				
H. Florida ecosystems are very sensitive to human activities and easily damaged	0.26	0.43	0.32	0.31	0.28	0.39	0.35	1.00			
I. Human activities in Florida ecosystems should not be allowed if they damage these natural areas	0.10	0.16	0.13	0.21	0.16	0.23	0.34	0.30	1.00		
J. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today	0.29	0.39	0.34	0.33	0.31	0.44	0.38	0.52	0.32	1.00	
K. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people	0.36	0.38	0.34	0.38	0.42	0.44	0.38	0.45	0.35	0.54	1.00
L. People have a duty to protect fish and other parts of nature in Florida	0.22	0.31	0.35	0.30	0.25	0.32	0.33	0.35	0.24	0.41	0.38

Table 27. Percent of responses differing by more than one amount among pairwise comparisons of twelve value orientation index items.

Index Item Pair	A	B	C	D	E	F	G	H	I	J	K
A. The primary value of the Florida ecosystem is to provide for people	------										
B. Florida ecosystems are resilient enough to cope with the impacts of human activities	38.1	------									
C. Human use of Florida ecosystems is more important than protecting fish species that live there	42.0	21.4	------								
D. Humans have a right to change the natural world to suit their needs	42.0	30.5	27.7	------							
E. Florida ecosystems should primarily be managed for the benefits of people	31.0	41.2	45.0	42.5	------						
F. There should be fewer regulations restricting human activities in the Florida ecosystem	38.5	32.3	35.9	34.4	36.1	------					
G. Florida ecosystems are valuable in their own right, regardless of human interests	44.2	29.3	25.4	32.6	46.9	38.6	------				
H. Florida ecosystems are very sensitive to human activities and easily damaged	43.0	28.7	31.6	34.6	41.1	32.3	30.8	------			
I. Human activities in Florida ecosystems should not be allowed if they damage these natural areas	49.4	40.9	40.6	40.3	46.3	40.0	35.9	37.1	------		
J. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today	42.0	31.6	33.0	36.3	40.9	30.8	31.9	26.9	36.8	------	
K. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people	38.8	41.1	45.5	40.0	34.7	32.0	42.1	35.3	37.9	31.5	------
L. People have a duty to protect fish and other parts of nature in Florida	48.2	25.8	19.1	28.2	51.7	40.4	21.3	32.0	40.7	33.1	48.8

Table 28. Reliability and correlation analyses of value orientation index.

Index Item	*M* [1]	Item Total Correlation	α if Item Deleted
A. The primary value of the Florida ecosystem is to provide for people	3.38	0.508	0.849
B. Florida ecosystems are resilient enough to cope with the impacts of human activities	2.40	0.600	0.842
C. Human use of Florida ecosystems is more important than protecting fish species that live there	2.07	0.544	0.846
D. Humans have a right to change the natural world to suit their needs	2.53	0.518	0.847
E. Florida ecosystems should primarily be managed for the benefits of people	3.51	0.540	0.846
F. There should be fewer regulations restricting human activities in the Florida ecosystem	3.01	0.604	0.842
G. Florida ecosystems are valuable in their own right, regardless of human interests	2.26	0.473	0.850
H. Florida ecosystems are very sensitive to human activities and easily damaged	2.73	0.569	0.844
I. Human activities in Florida ecosystems should not be allowed if they damage these natural areas	3.21	0.352	0.861
J. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today	2.84	0.617	0.841
K. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people	3.42	0.646	0.838
L. People have a duty to protect fish and other parts of nature in Florida	1.78	0.487	0.850

Cronbach's alpha with all items included = 0.858

[1] Mean scores measured on a 7-point scale ranging from 1=strongly disagree to 7=strongly agree.

Value Orientation Direction

The null hypothesis, *(Ho1): there is no significant difference in the direction of value orientation according to level of integrative complexity*, was tested using a one-way analysis of variance. The means of all twelve anthropocentric and ecocentric value orientation items were significantly different (p = 0.000) between each level of integrative complexity (Table 29). Therefore, the null hypothesis (Ho1) was rejected.

The alternative hypothesis stated, *(Ha1): individuals with a pluralist value orientation will exhibit higher levels of integrative complexity than individuals with ecocentric or anthropocentric value orientations*. A Tukey's post hoc test made multiple comparisons of mean value orientation direction according to integrative complexity levels (Table 29). The means of the twelve anthropocentric and ecocentric value orientation items all demonstrated a linear pattern across levels of integrative complexity. The results of this analysis showed that overall, respondents tend to disagree with anthropocentric-oriented statements (mean scores of the 7-point Likert scales being below 4) and agree with ecocentric-oriented statements (mean scores of the 7-point Likert scales being above 4). However, respondents with high integrative complexity consistently demonstrated more ecocentric value orientations than respondents of lower integrative complexity that demonstrated more anthropocentric value orientations. The high integrative complexity respondents did not exhibit a pluralist value orientation as predicted by the alternative hypotheses. Rather, the results indicated that a clear direction in value orientation exists from low integrative complexity (anthropocentric direction) to high integrative complexity (ecocentric direction).

Table 29. Analysis of variance for means of anthropocentric and ecocentric value orientations according to three levels of integrative complexity.

	Integrative Complexity Level				
	Low	Moderate	High	*F*-Ratio	*p*-value
Anthropocentric					
A. The primary value of the Florida ecosystem is to provide for people	3.85	3.49	3.13	63.98	.000
B. Florida ecosystems are resilient enough to cope with the impacts of human activities	2.95	2.48	2.12	122.08	.000
C. Human use of Florida ecosystems is more important than protecting fish species that live there	2.48	2.14	1.86	87.31	.000
D. Humans have a right to change the natural world to suit their needs	2.85	2.57	2.37	34.42	.000
E. Florida ecosystems should primarily be managed for the benefits of people	3.91	3.63	3.29	52.09	.000
F. There should be fewer regulations restricting human activities in the Florida ecosystem	3.60	3.08	2.73	121.88	.000
Ecocentric					
G. Florida ecosystems are valuable in their own right, regardless of human interests	5.37	5.64	5.98	73.85	.000
H. Florida ecosystems are very sensitive to human activities and easily damaged	4.77	5.11	5.60	125.28	.000
I. Human activities in Florida ecosystems should not be allowed if they damage these natural areas	4.59	4.73	4.93	15.61	.000
J. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today	4.62	5.05	5.46	112.13	.000
K. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people	4.19	4.47	4.83	62.60	.000
L. People have a duty to protect fish and other parts of nature in Florida	5.90	6.12	6.44	100.58	.000

Mean value orientation direction scored as 1=Strongly Disagree, 2=Moderately Disagree, 3=Slightly Disagree, 4=Neutral, 5=Slightly Agree, 6=Moderately Agree, 7=Strongly Agree; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

Value Orientation Extremity

For each of the twelve value orientation statements, level of extremity was determined by converting the 7-point scale into a 4-point scale. Scores of 1 and 7 represented the most extreme values and were converted to a score of 4 (high extremity), scores 2 and 6 became a score of 3 (moderate extremity), scores 3 and 5 became a score of 2 (low extremity), and a score of 4 became a score of 1 (neutral). The null hypothesis, *(Ho2): there is no significant difference in the extremity of value orientation according to level of integrative complexity*, was tested using a one-way analysis of variance (Table 30). Statistically significant differences ($p = 0.000$) were found in value orientation extremity according to level of integrative complexity on all twelve value orientation statements, and therefore, the null hypothesis was rejected.

The alternative hypothesis stated, *(Ha2): individuals with less extreme value orientations exhibit higher levels of integrative complexity than individuals with more extreme value orientations*. A Tukey's post hoc test made multiple comparisons of mean value orientation extremity according to integrative complexity levels (Table 30). The means of the twelve anthropocentric and ecocentric value orientation items all demonstrated a consistent pattern of extremity across levels of integrative complexity, but not as predicted by the alternative hypothesis. Less extreme value orientations were observed among low integrative complexity levels, whereas extreme value orientations were observed among high integrative complexity levels.

Highest value extremity within each level of integrative complexity was observed in item L ("People have a duty to protect fish and other parts of nature in Florida."). High integrative complexity individuals expressed the lowest value extremity ($M = 2.65$) for item K ("Management should focus on doing what is best for the Florida ecosystem instead of what is best for people."). Low and moderate integrative complexity individuals expressed similar levels of value extremity for items A, E, F, D, and E.

Table 30. Analysis of variance of mean value orientation extremity scores according to integrative complexity level.

	Integrative Complexity Level				
	Low	Moderate	High	*F*-Ratio	*p*-value
Anthropocentric					
A. The primary value of the Florida ecosystem is to provide for people	2.59	2.63	2.85	44.44	.000
B. Florida ecosystems are resilient enough to cope with the impacts of human activities	2.77	2.92	3.22	118.09	.000
C. Human use of Florida ecosystems is more important than protecting fish species that live there	2.92	3.08	3.33	90.71	.000
D. Humans have a right to change the natural world to suit their needs	2.86	2.94	3.11	30.86	.000
E. Florida ecosystems should primarily be managed for the benefits of people	2.51	2.54	2.73	31.20	.000
F. There should be fewer regulations restricting human activities in the Florida ecosystem	2.44	2.47	2.77	66.51	.000
Ecocentric					
G. Florida ecosystems are valuable in their own right, regardless of human interests	2.85	3.03	3.31	116.45	.000
H. Florida ecosystems are very sensitive to human activities and easily damaged	2.60	2.71	3.03	109.56	.000
I. Human activities in Florida ecosystems should not be allowed if they damage these natural areas	2.66	2.77	2.96	48.65	.000
J. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today	2.64	2.67	2.93	62.65	.000
K. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people	2.48	2.45	2.65	27.98	.000
L. People have a duty to protect fish and other parts of nature in Florida	3.16	3.28	3.52	91.66	.000

Mean value orientation extremity scored as 1=Neutral, 2=Low Extremity, 3=Moderate Extremity, 4=High Extremity; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

Attitude Certainty

The respondents rated the overall simplicity—complexity of the issue of use versus protection on a 7-point Likert scale of extremely simple (1) to extremely complex (7). Overall, recreational anglers considered the issue of use versus protection as a "somewhat complex" (M = 5.27) issue (Table 31). Respondents were then asked to indicate whether use or protection should take priority, if it were up to them to decide (Table 32). Overall, the respondents gave slightly higher priority to protection (M = 4.36) on a 7-point Likert scale of highest priority to use (1), to equal priority to both (4), to highest priority to protection (7). Finally, respondents were asked how certain they were about the correctness of the priority they placed on the issue of use versus protection (Table 33). On a 7-point Likert scale of not at all certain (1) to completely certain (7), the respondents were moderately certain (M = 5.04) about their decision prioritizing use or protection.

The null hypothesis, *(Ho3): there is no significant relationship between attitude certainty and priority towards the use versus protection of coastal resources,* was tested using a Pearson correlation. Priority was converted into a four-point scale of 1 = balanced, 2= low priority, 3 = moderate priority, and 4 = extreme priority. Overall, respondents demonstrated low to moderate priority (M = 2.79). Among the respondents, there was a negative and somewhat low correlation between attitude certainty and priority towards the use versus protection of coastal resources, $r(n = 6{,}205) = -0.291$, $p = 0.000$. Therefore, the null hypothesis was rejected. These results did not support the alternative hypothesis, *(Ha3): there is a positive and moderate relationship between attitude certainty and priority towards the use versus protection of coastal resources*. Rather, as the amount of priority for use or protection increased, the amount of attitude certainty about this priority decreased. This finding was not consistent with previous attitude strength literature.

Table 31. Distribution of responses on the simplicity-complexity of managing for use versus protection.

Simplicity-Complexity	*n*	*%*	*Total*	*%*
(1) Extremely Simple	205	3.2	205	3.2
(2) Moderately Simple	458	7.1	663	10.3
(3) Slightly Simple	253	3.9	916	14.2
(4) Neutral	673	10.4	1,589	24.6
(5) Slightly Complex	1,210	18.8	2,799	43.4
(6) Moderately Complex	2,189	33.9	4,988	77.3
(7) Extremely Complex	1,461	22.7	6,449	100.0
Mean score = 5.27				

Table 32. Distribution of responses on the priority for use or protection.

Priority	*n*	*%*	*Total*	*%*
(1) Highest Priority to Use	385	6.0	385	6.0
(2) Much Higher Priority to Use	487	7.5	872	13.5
(3) Slightly Higher Priority to Use	650	10.1	1,522	23.6
(4) Equal Priority to Both	2,089	32.4	3,611	55.9
(5) Slightly Higher Priority to Protection	1,171	18.1	4,782	74.1
(6) Much Higher Priority to Protection	1,115	17.3	5,897	91.4
(7) Highest Priority to Protection	558	8.6	6,455	100.0
Mean score = 4.36				

Table 33. Distribution of responses on the certainty about the priority placed on use or protection.

Certainty	*n*	*%*	*Total*	*%*
(1) Not at all certain	185	2.9	185	2.9
(2) Slightly certain	207	3.2	392	6.1
(3) Somewhat certain	813	12.6	1,205	18.7
(4) Very certain	1,479	22.9	2,684	41.6
(5) Moderately certain	728	11.3	3,412	52.8
(6) Mostly certain	1,370	21.2	4,782	74.1
(7) Completely certain	1,675	25.5	6,457	100.0
Mean score = 5.04				

The fourth null hypothesis stated, *(Ho4) there is no significant difference in attitude certainty between levels of integrative complexity*. A one-way analysis of variance was used to test for differences in the means of attitude certainty according to levels of integrative complexity (Table 34). Statistically significant differences in attitude certainty were found according to level of integrative complexity (p = 0.000), and therefore, the null hypothesis was rejected.

The alternative hypothesis stated, *(Ha4): individuals with higher attitude certainty exhibit lower levels of integrative complexity than individuals with lower attitude certainty*. A Tukey's post hoc test made multiple comparisons of mean attitude certainty according to integrative complexity levels (Table 34). The means demonstrated a pattern opposite of what was predicted by the alternative hypothesis. Higher attitude certainty was exhibited by higher levels of integrative complexity, and lower attitude certainty was exhibited by lower levels of integrative complexity.

Table 34. Analysis of variance for mean attitude priority and mean attitude certainty across integrative complexity levels.

	Integrative Complexity Level				
	Low	Moderate	High	*F*-Ratio	*p*-value
Attitude Priority [a]	3.73	4.31	4.66	153.39	.000
Attitude Certainty [b]	4.80	4.88	5.28	53.71	.000

Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.
[a] 1=Highest priority to use, 2=Much higher priority to use, 3=Slightly higher priority to use, 4=Equal priority to both, 5=Slightly higher priority to protection, 6=Much higher priority to protection, 7=Highest priority to protection; [b] 1=Not at all certain, 2=Slightly certain, 3=Somewhat certain, 4=Very certain, 5=Moderately certain, 6=Mostly certain, 7=Completely certain

Attitude Direction

The null hypothesis, *(Ho5): there is no significant difference in attitude direction according to leves of integrative complexity*, was tested using a one-way analysis of variance. Statistically significant differences were found in attitude direction across levels of integrative complexity (p = 0.000), and therefore, the null hypothesis was rejected (Table 35).

The alternative hypothesis stated, *(Ha5): individuals with attitudes supporting coastal resource management options will exhibit higher levels of integrative complexity than individuals with attitudes opposing coastal resource management option*s. A Tukey's post hoc test made multiple comparisons of mean attitude direction across all three levels of integrative complexity (Table 35). Both low and moderate levels of integrative complexity expressed attitudes less supportive of an increase in the maximum size limit for the fish species they most prefer to catch (item D), as compared to the high level of integrative complexity. Both moderate and high levels of integrative complexity demonstrated attitudes opposing a decrease in the maximum size limit for the fish species they most prefer to catch (item H), whereas low integrative complexity individuals were more supportive of this management action.

For all eight statements, statistically significant differences in attitude direction occurred in a consistent linear pattern across integrative complexity levels. These results showed that individuals with low integrative complexity have attitudes opposing management actions which emphasized resource protection rather than recreational fishing or use of resources. Individuals with high integrative complexity demonstrated more supportive attitudes toward management actions emphasizing ecosystem protection rather than recreational fishing or use of resources. Overall, these findings suggest that attitude direction does vary according to integrative complexity level, and therefore, show mixed support for the alternative hypothesis.

Table 35. Analysis of variance of mean attitude scores for opposition or support toward management actions according to three levels of integrative complexity.

	Integrative Complexity Level				
Protection-oriented Management Actions	Low	Moderate	High	*F*-Ratio	*p*-value
A. Shorter recreational fishing seasons with enhanced protection of the fish species you most prefer to catch	2.82	3.17	3.71	99.59	.000
B. Lower recreational bag limit for the fish species you most prefer to catch	3.00	3.28	3.62	54.54	.000
C. Expansion of marine protected areas in Florida where recreational fishing is prohibited	2.96	3.26	3.68	62.64	.000
D. Increase in the maximum size limit for the fish species you most prefer to catch	3.59	3.68	3.80	6.48	.002
Use-oriented Management Actions					
E. Longer recreational fishing seasons with less protection of the fish species you most prefer to catch	3.79	3.34	2.83	130.96	.000
F. Higher recreational bag limit for the fish species you most prefer to catch	3.96	3.61	3.24	66.53	.000
G. Open more areas in Florida where recreational fishing is allowed	4.90	4.39	4.13	79.03	.000
H. Decrease in the maximum size limit for the fish species you most prefer to catch	3.21	3.03	2.99	7.40	.001

Mean attitude scores measured on a 7-point scale of 1=Strongly Oppose, 2=Moderately Oppose, 3=Somewhat Oppose, 4=Neutral, 5=Somewhat Support, 6=Moderately Support, 7=Strongly Support; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

Attitude Extremity

For each of the eight attitude statements, level of attitude extremity was determined by converting the 7-point scale into a 4-point scale. Scores of 1 and 7 represented the most extreme values and were converted to a score of 4 (high extremity), scores 2 and 6 became a score of 3 (moderate extremity), scores 3 and 5 became a score of 2 (low extremity), and a score of 4 became a score of 1 (neutral). The null hypothesis, *(Ho6): there is no significant difference in attitude extremity according to level of integrative complexity*, was tested using a one-way analysis of variance. Statistically significant differences were found in attitude extremity according to level of integrative complexity on all eight attitude statements, and therefore, the null hypothesis was rejected.

The alternative hypothesis stated, *(Ha6): individuals with higher levels of integrative complexity will exhibit more moderate attitudes toward coastal resource management alternatives than individuals with lower levels of integrative complexity who exhibit more extreme attitudes toward coastal resource management alternatives.* A Tukey's post hoc test made multiple comparisons of mean attitude extremity scores according to integrative complexity levels (Table 36). Support for the alternative hypothesis was fully evident in three attitude statements: attitudes toward management actions which expand marine protected areas closed to recreational fishing (item C), open more areas where fishing is allowed (item G), or increase the maximum size limit for the fish species most preferred to catch (item D).

Table 36. Analysis of variance of mean attitude extremity scores according to integrative complexity level.

	Integrative Complexity Level				
Protection-oriented Management Actions	Low	Moderate	High	*F*-Ratio	*p*-value
A. Shorter recreational fishing seasons with enhanced protection of the fish species you most prefer to catch	3.04	2.74	2.78	35.13	.000
B. Lower recreational bag limit for the fish species you most prefer to catch	2.74	2.55	2.53	15.79	.000
C. Expansion of marine protected areas in Florida where recreational fishing is prohibited	2.97	2.71	2.80	23.44	.000
D. Increase in the maximum size limit for the fish species you most prefer to catch	2.56	2.34	2.41	15.81	.000
Use-oriented Management Actions					
E. Longer recreational fishing seasons with less protection of the fish species you most prefer to catch	2.60	2.53	2.41	38.31	.000
F. Higher recreational bag limit for the fish species you most prefer to catch	2.61[a]	2.48[b]	2.64[a]	15.18	.000
G. Open more areas in Florida where recreational fishing is allowed	2.65	2.29	2.42	40.21	.000
H. Decrease in the maximum size limit for the fish species you most prefer to catch	2.55	2.50	2.59	4.25	.014

Mean attitude extremity scored as 1=Neutral, 2=Low Extremity, 3=Moderate Extremity, 4=High Extremity; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.
[a] Means are not significantly different; [b] Means are significantly different.

Three attitude statements partially supported the alternative hypothesis. Both moderate and high integrative complexity levels exhibited lower attitude extremity than low integrative complexity levels for management actions which shorten the recreational fishing season to enhance protection of preferred fish species (item A), lower bag limits for preferred fish species (item B) or lengthen the recreational fishing season to afford less protection of preferred fish species (item E).

There were two statements that demonstrated opposite patterns from what was expected, and therefore, did not support the alternative hypothesis. First, an inconsistent pattern in extremity was found in attitudes toward higher bag limits for preferred fish species (item F). Both low and high integrative complexity levels exhibited extreme attitudes toward an increase in bag limits, as compared to the moderate integrative complexity level, which exhibited lower attitude extremity. Second, an opposing pattern in extremity was found in attitudes toward a decrease in the maximum size limit for preferred fish species (item H). Lower integrative complexity levels exhibited less extreme attitudes than high integrative complexity, which exhibited high attitude extremity. In both of these cases, the results are mixed and are inconsistent with previous research. While the results for items F and H do not support the alternative hypothesis, the differences in attitude extremity scores between integrative complexity levels are extremely small.

Integrative Complexity as a Moderator

The fourth research objective examined integrative complexity as a moderator in the relationship between value orientation and attitudes toward coastal management actions. This analysis began by testing the null hypothesis, *(Ho7): there is no significant relationship between value orientation and attitude toward coastal resources management options*, and the alternative hypothesis, *(Ha7): anglers with ecocentric value orientations hold more favorable attitudes toward resource protection than do anglers with anthropocentric value orientations*. To determine moderation, the analysis also tested *(Ho8): integrative complexity has no significant effect on the relationship between value orientation and attitude towards coastal resources management options*. The alternative hypothesis predicted, *(Ha8): integrative complexity has a moderating effect on the direction and magnitude of the relationship between value orientation and attitude towards coastal resources management options*.

A moderation analysis was conducted to examine whether the causal relationship between value orientation and attitudes toward management actions changed as a function of integrative complexity, the moderator variable. This entailed conducting a separate moderation analysis for each of the eight attitude statements. Three regressions were conducted in each analysis, using the procedure developed by Baron and Kenny (1986). First, the attitude was regressed on value orientation. Next, attitude was regressed on the value orientation and integrative complexity. Third, attitude was regressed on the value orientation, integrative complexity, and the interaction of the two, measured as a multiplication of the value orientation and integrative complexity scores. A significant interaction between integrative complexity and value orientation suggests that integrative complexity moderates or affects the zero-order correlation of the relationship between value orientation and attitude (Baron & Kenny, 1986; Vaske, 2008). That is, the strength of the relationship between an individual's value orientation and their attitude toward a management action depends on their integrative complexity regarding that issue.

For all eight attitude statements, statistically significant relationships were found between value orientation and attitude, and the null hypothesis was rejected (Table 37). Each of these relationships also occurred in the direction as predicted, which supports the alternative hypothesis. Negative relationships between value orientation and attitude indicated that ecocentric value orientations were associated with attitudes more favorable toward resource protection (items A – D). Positive relationships between value orientation and attitude indicated that anthropocentric value orientations were associated with attitudes more favorable toward resource use (items E – H).

Table 37. Regression analysis for the moderating effects of Integrative Complexity (IC) on the relationship between value orientation and attitudes (A – H).

Independent Variables	*B* Coefficients			R^2	*F*-value
A. Shorter fishing season					
1) Value orientation	-0.60***			.179	1,330.01
2) Value orientation, IC	-0.57***	0.21***		.185	689.53
3) Value orientation, IC, Value orientation * IC	-0.53***	0.27***	-0.02	.186	459.86
B. Lower recreational bag limit					
Value orientation	-0.33***			.065	420.88
Value orientation, IC	-0.30***	0.17***		.069	222.43
Value orientation, IC, Value orientation * IC	-0.24***	0.27***	-0.03	.069	148.92
C. Expand marine protected area					
Value orientation	-0.54***			.142	1,008.65
Value orientation, IC	-0.52***	0.15***		.144	509.29
Value orientation, IC, Value orientation * IC	-0.40***	0.31***	-0.05**	.145	341.45
D. Increase maximum size limit					
Value orientation	-0.07***			.003	17.20
Value orientation, IC	-0.05***	0.09**		.004	12.07
Value orientation, IC, Value orientation * IC	-0.13**	-0.01	0.03	.004	8.75
E. Longer fishing season					
Value orientation	0.56***			.192	1,4445.00
Value orientation, IC	0.53***	-0.25***		.202	766.10
Value orientation, IC, Value orientation * IC	0.64***	-0.11	-0.05**	.203	512.70
F. Higher recreational bag limit					
Value orientation	0.37***			.077	507.91
Value orientation, IC	0.34***	-0.20***		.083	275.02
Value orientation, IC, Value orientation * IC	0.42***	-0.10	-0.03	.084	184.06
G. Open more recreational fishing areas					
Value orientation	0.48***			.146	1,036.20
Value orientation, IC	0.46***	-0.16***		.148	525.58
Value orientation, IC, Value orientation * IC	0.47***	-0.15**	-0.01	.148	350.35
H. Decrease maximum size limit					
Value orientation	0.11***			.009	57.31
Value orientation, IC	0.11***	-0.04		.010	30.10
Value orientation, IC, Value orientation * IC	0.15***	0.02	-0.02	.010	20.30

*** = significance at $p < .001$; ** = significance at $p < .050$; * = significance at $p < .100$

The alternative hypothesis (Ha6) predicting moderation was only supported by one of the eight attitude models. Moderation occurred in the interaction term predicting attitude toward management actions which expand marine protected areas in Florida and prohibit recreational fishing (item C). Integrative complexity had a statistically significant effect on both the direction and the strength of the relationship between value orientation and attitudes. The moderation analysis showed that the interaction between integrative complexity and value orientation was slightly negative and statistically significant ($B = -0.05$, $p < 0.05$), and provided evidence of integrative complexity moderating the relationship between value orientation and attitude towards expanding marine protected areas (Table 37). Thus, the effect of value orientation on attitude depended on integrative complexity level. However, this moderation component of the model explained only 0.1% of the variance in attitude towards expanding marine protected areas, as calculated from the difference in R^2 for the model that included the product (model 3, $R^2 = 0.145$) compared to the model that excludes it (model 2, $R^2 = 0.144$). Overall, this model showed that a more ecocentric value orientation ($B = -0.40$) and a higher integrative complexity level ($B = 0.31$) were associated with attitudes supporting management actions which expand marine protected areas in which recreational fishing is prohibited. Although there was a significant interaction, the effect of moderation was small.

Value orientation and integrative complexity explained the largest proportion of variance in attitudes toward “longer recreational fishing seasons with less protection of the fish species anglers most prefer to catch” (item E, $R^2 = 0.203$). Similar effects were found for attitudes toward “shorter recreational fishing seasons with enhanced protection of the fish species anglers most prefer to catch” (item A, $R^2 = 0.186$) However, the moderation effect was not statistically significant when included in the model for item A. Value orientation had a negative and significant effect ($B = -0.53$, $p < 0.001$) on attitude, which indicated that ecocentric value orientations had attitudes which supported a shorter fishing season/enhanced fish protection. Integrative complexity had a positive and significant effect ($B = 0.27$, $p < 0.001$), which indicated that higher integrative complexity anglers had attitudes which supported a shorter fishing season/enhanced fish protection.

Value orientation and integrative complexity explained the least amount of variance in attitudes toward either an "increase in the maximum size limit for the fish species anglers most prefer to catch" (item D, $R^2 = 0.004$), or a "decrease in the maximum size limit…" (item H, $R^2 = 0.010$). For item D, value orientation had a negative and significant effect on attitude ($B = -0.09$, $p < 0.05$), but integrative complexity and the interaction term did not have a statistically significant effect. Similar effects occurred for item H, except value orientation had a positive and significant effect on attitude ($B = 0.15$, $p < 0.001$). The magnitudes of these effects on item D and item H were minimal and close to zero, yielding weak models explaining attitudes toward either increasing or decreasing maximum size limits.

Acceptability of Tradeoffs

The fifth research objective examined the role of integrative complexity in shaping acceptability of management tradeoffs between the use of coastal resources and the protection of those same resources. Twenty-seven scenarios (factor combinations) were evaluated for acceptability on a 7-point scale of extremely unacceptable (1) to neutral (4) to extremely acceptable (7). The null hypothesis, *(Ho9): there is no difference in acceptability of management tradeoffs according to level of integrative complexity*, was tested using a one-way analysis of variance (Table 38). Overall, the null hypothesis was rejected in all but three of the 27 scenarios. There were no statistically significant differences in acceptability between integrative complexity levels for scenario 22 (A=1, B=1, C=0, D=2), scenario 23 (A=1, B=1, C=1, D=1), and scenario 24 (A=1, B=1, C=2, C=0). These three scenarios consisted of factors where no changes (level = 1) were made to that particular management action. All three levels of integrative complexity had somewhat acceptable to neutral views for management actions which maintain the current levels of protected area and protection of fish populations, while at the same time decrease the amount of access to fishing and extend the fishing season (scenario 22). Similar ratings of acceptability were reported across integrative complexity levels for management actions which maintain the current levels of protected area and protection of fish populations, while at the same time increase access to fishing and shorten the fishing season (scenario 24). These results suggest that anglers of all integrative complexity levels somewhat accept changes to either fishing access or the fishing season, as long as the current levels of protected area and fish protection remain the same. Scenario 23 presented no changes made to any of the four factors. Anglers expressed neutral acceptability for this scenario representing current conditions of resource use and protection.

The initial analysis suggested that individuals with high integrative complexity considered it least acceptable to reduce protection for increases in use (scenario 3), whereas, low integrative complexity individuals considered these conditions more acceptable. When the tradeoffs were reversed, high integrative complexity individuals considered it more acceptable to increase protection while reducing the amount of use (scenario 16), whereas, low integrative complexity individuals considered these conditions least acceptable. This suggests that high integrative complexity anglers find it more acceptable when there is no tradeoff in protection for use, and less acceptable to give up protection for use. Individuals with low integrative complexity demonstrated the opposite pattern.

Table 38. Analysis of variance for mean acceptability of tradeoff scenarios according to integrative complexity level.

Scenario	(Factor A) Amount of Protected Area	(Factor B) Protection of Fish Population	(Factor C) Access to Fishing	(Factor D) Length of Fishing Season	Integrative Complexity Level Low	Moderate	High	F-Ratio	p-value
1	Reduce	Reduce	Increase	No Change	3.86	3.62	3.16	29.58	.000
2	Reduce	Reduce	No Change	More Days...................	4.04	3.64	3.18	36.90	.000
3	Reduce	Reduce	Increase	More Days...................	3.97	3.49	2.93	51.83	.000
4	No Change	Enhance	Reduce	No Change	3.41	3.85	4.00	19.24	.000
5	No Change	Enhance	No Change	Fewer Days..................	3.67	3.96	4.24	18.57	.000
6	No Change	Enhance	Increase	Fewer Days..................	3.74	3.89	4.17	13.26	.000
7	Expand	No Change	Reduce	No Change	3.40	3.77	3.95	15.48	.000
8	Expand	No Change	No Change	Fewer Days..................	3.46	3.77	4.02	17.20	.000
9	Expand	No Change	Reduce	More Days...................	3.60	3.88	3.92	5.75	.003
10	Reduce	No Change	Increase	Fewer Days..................	3.22	3.38	3.17	4.59	.010
11	Reduce	No Change	No Change	More Days...................	4.36	3.94	3.61	29.43	.000
12	Reduce	No Change	Increase	No Change	4.10	3.85	3.53	17.63	.000
13	No Change	Reduce	Reduce	More Days...................	3.56	3.42	3.23	7.86	.000
14	No Change	Reduce	No Change	More Days...................	4.35	3.91	3.49	37.75	.000
15	No Change	Reduce	Increase	No Change	4.06	3.79	3.40	26.66	.000

1=Extremely unacceptable, 2=Moderately unacceptable, 3=Somewhat unacceptable, 4=Neutral, 5=Somewhat acceptable, 6=Moderately acceptable, 7=Extremely acceptable; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

Table 38 (continued). Analysis of variance for mean acceptability of tradeoff scenarios according to integrative complexity level.

Scenario	(Factor A) Amount of Protected Area	(Factor B) Protection of Fish Population	(Factor C) Access to Fishing	(Factor D) Length of Fishing Season	Integrative Complexity Level Low	Moderate	High	F-Ratio	p-value
16	Expand	Enhance	Reduce	Fewer Days	2.76	3.08	3.47	23.17	.000
17	Expand	Enhance	No Change	Fewer Days	3.44	3.78	4.14	23.27	.000
18	Expand	Enhance	Reduce	No Change	3.24	3.71	4.09	33.18	.000
19	Reduce	Enhance	No Change	Fewer Days	3.21	3.47	3.68	13.95	.000
20	Reduce	Enhance	Increase	No Change	4.31	4.17	4.01	5.82	.003
21	Reduce	Enhance	Increase	Fewer Days	3.58	3.51	3.69	3.09	.046
22	No Change	No Change	Reduce	More Days	3.66	3.65	3.55	1.25	.288
23	No Change	No Change	No Change	No Change	4.35	4.29	4.25	0.53	.587
24	No Change	No Change	Increase	Fewer Days	3.43	3.52	3.53	0.62	.536
25	Expand	Reduce	Reduce	More Days	3.24	3.54	3.42	5.40	.005
26	Expand	Reduce	No Change	More Days	3.97	4.14	3.79	10.20	.000
27	Expand	Reduce	Reduce	No Change	2.94	3.26	3.33	10.42	.000

1=Extremely unacceptable, 2=Moderately unacceptable, 3=Somewhat unacceptable, 4=Neutral, 5=Somewhat acceptable, 6=Moderately acceptable, 7=Extremely acceptable; Means underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

A hierarchical linear model (restricted maximum likelihood linear mixed-model) analysis was performed on acceptability from the fixed-effects of the four factors, interactions and integrative complexity levels. The estimated variance of the random components was 0.28 and statistically different from zero, $Z = 29.19$, $p = 0.000$. The ratio of this variance to the total variance, or the intraclass correlation coefficient was 0.28/ (0.28 + 2.29) = 0.11. This value suggests that 11% of the total variation in acceptability was due to inter-individual differences. Also, considering that the respondents were randomly assigned to one of three blocks, the low ICC indicated that the ratings were reliable, and blocking did not have an effect. This statistic also showed that the respondents evaluated each scenario differently and independent of one another.

The scenarios were further examined for the main effects of each factor and levels on acceptability of tradeoffs. The tests of fixed effects (Type III) showed that the effects of all four factors were statistically significant ($p = 0.000$) and that there was an overall mean difference in acceptability between each of the factor levels (Table 39). Therefore, the null hypotheses, *(Ho10): factors of resource use have no significant effect on the acceptability of management alternatives* and *(Ho11): factors of resource protection have no significant on the acceptability of management alternatives*, were rejected. The analysis suggested that, overall, recreational fishing access (factor C) was the most important factor in rating the acceptability of use versus protection scenarios ($F = 287.82$, $p = 0.000$), followed by protection of fish populations (factor B), length of the recreational fishing season (factor D), and protected area (factor A). Examination of the factor levels showed that a decrease (level 0) in protected area, protection of fish populations, or access to fishing resulted in a decrease in acceptability (Figure 16). No change (level 1) or an increase (level 2) in any of the four factors resulted in neutral ratings of acceptability.

Table 39. Type III tests of fixed effects for acceptability of tradeoffs.

Source	Numerator *df*	Denominator *df*	*F-ratio*	*p*-value
Intercept	1	6,814.92	134,861.95	.000
(A) Protected Area	2	51,392.98	93.25	.000
(B) Fish Population	2	51,392.98	133.87	.000
(C) Access to Fishing	2	41,742.38	287.82	.000
(D) Length of Fishing Season	2	41,742.38	186.83	.000
Integrative Complexity	2	6,362.70	3.32	.035
A * C	2	54,049.35	2.96	.051
A * D	4	51,188.28	12.59	.000
B * C	4	51,188.28	23.24	.000
B * D	2	54,049.35	3.68	.025
A * Integrative Complexity	4	50,928.77	16.49	.000
B * Integrative Complexity	4	50,928.77	16.24	.000
C * Integrative Complexity	4	50,928.51	15.53	.000
D * Integrative Complexity	4	50,928.51	24.23	.000

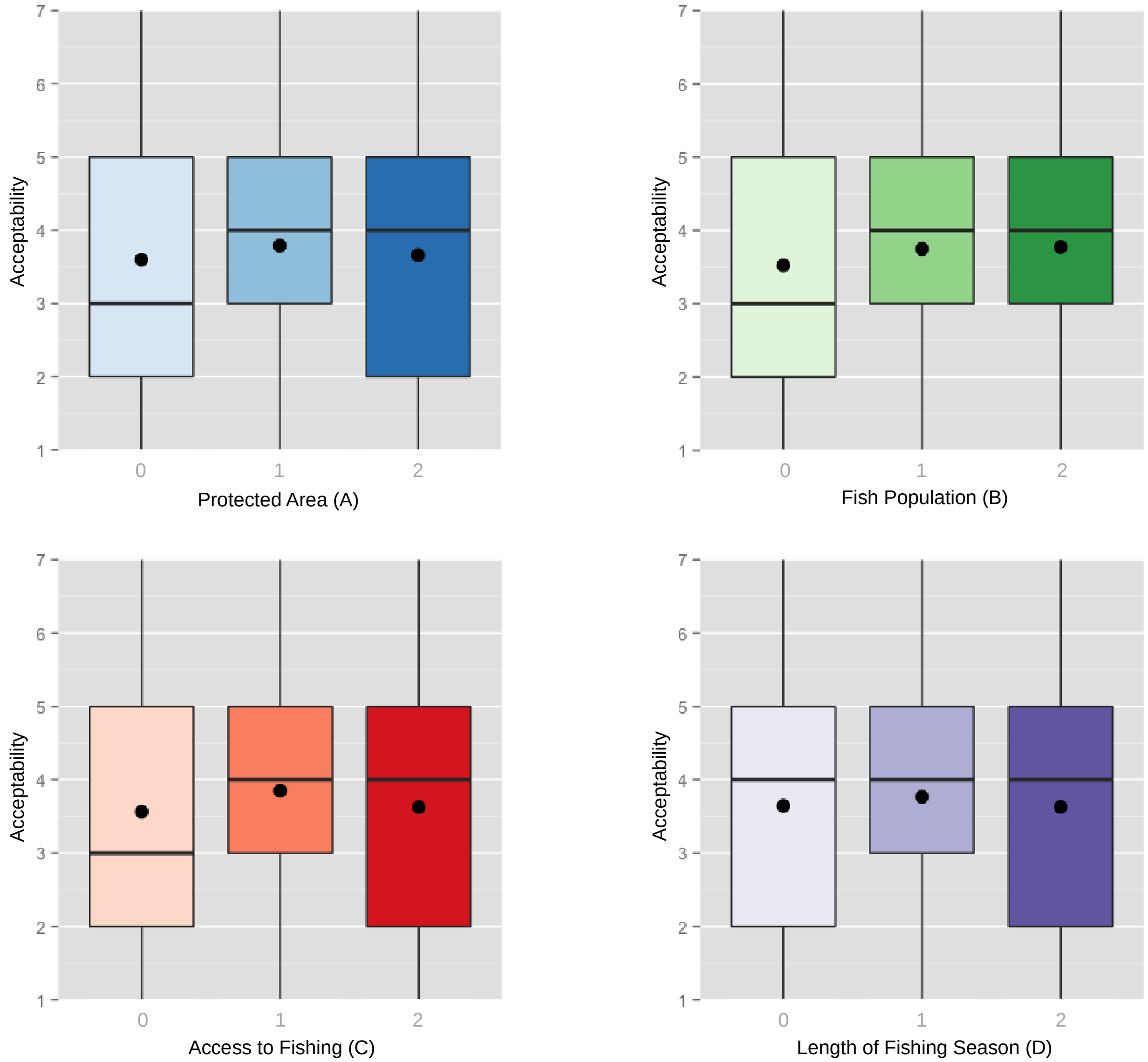


Figure 16. Main effects of use and protection factor levels on acceptability of tradeoffs; Levels 0=Decreasing, 1=No Change, 2=Increasing.

Approximately 55% more of the variance in acceptability was explained when integrative complexity was added to the model. A significant interaction effect between integrative complexity and each of the four factors indicated differences in acceptability between levels of integrative complexity (Figure 17). Therefore, the null hypothesis, *(Ho12): there is no significant interaction between factors and integrative complexity on the acceptability of management alternatives*, was rejected. Examination of the main effects of each factor on acceptability according to integrative complexity revealed which factors were most important to low, moderate, and high integrative complexity thinkers (Table 40 and Figure 18).

Factors of recreational fishing access (factor C) and the length of fishing season (factor D) were most important to respondents with low and moderate levels of integrative complexity. Lower acceptability occurred among these integrative complexity levels when there was a reduction in the amount of fishing access or the number of days in the fishing season, whereas high integrative complexity demonstrated higher acceptability for a reduction in these factors. When there was an increase in the amount of fishing access or the number of days in the fishing season, low and moderate integrative complexity levels rated these conditions with higher acceptability, whereas high integrative complexity demonstrated lower acceptability for an increase in these factors. These results further demonstrate how lower integrative complexity levels prioritize resource use over protection.

High integrative complexity, on the other hand, had more mixed results in the effects of factors on acceptability. Protection of fish populations (factor B) had the strongest effect, followed by recreational fishing access (factor C), marine protected area (factor A), and length of the fishing season (factor D). This suggested that higher integrative complexity levels considered both resource protection and use in the acceptability of management scenarios. High integrative complexity anglers rated an increase in protection of fish populations (factor B) or marine protected area (factor A) with higher acceptability than did low and moderate integrative complexity anglers who rated these conditions with lower acceptability. When there were no changes made to the amount of protection of either factor A or B, both low and moderate integrative complexity levels demonstrated somewhat higher acceptability than did high integrative complexity.

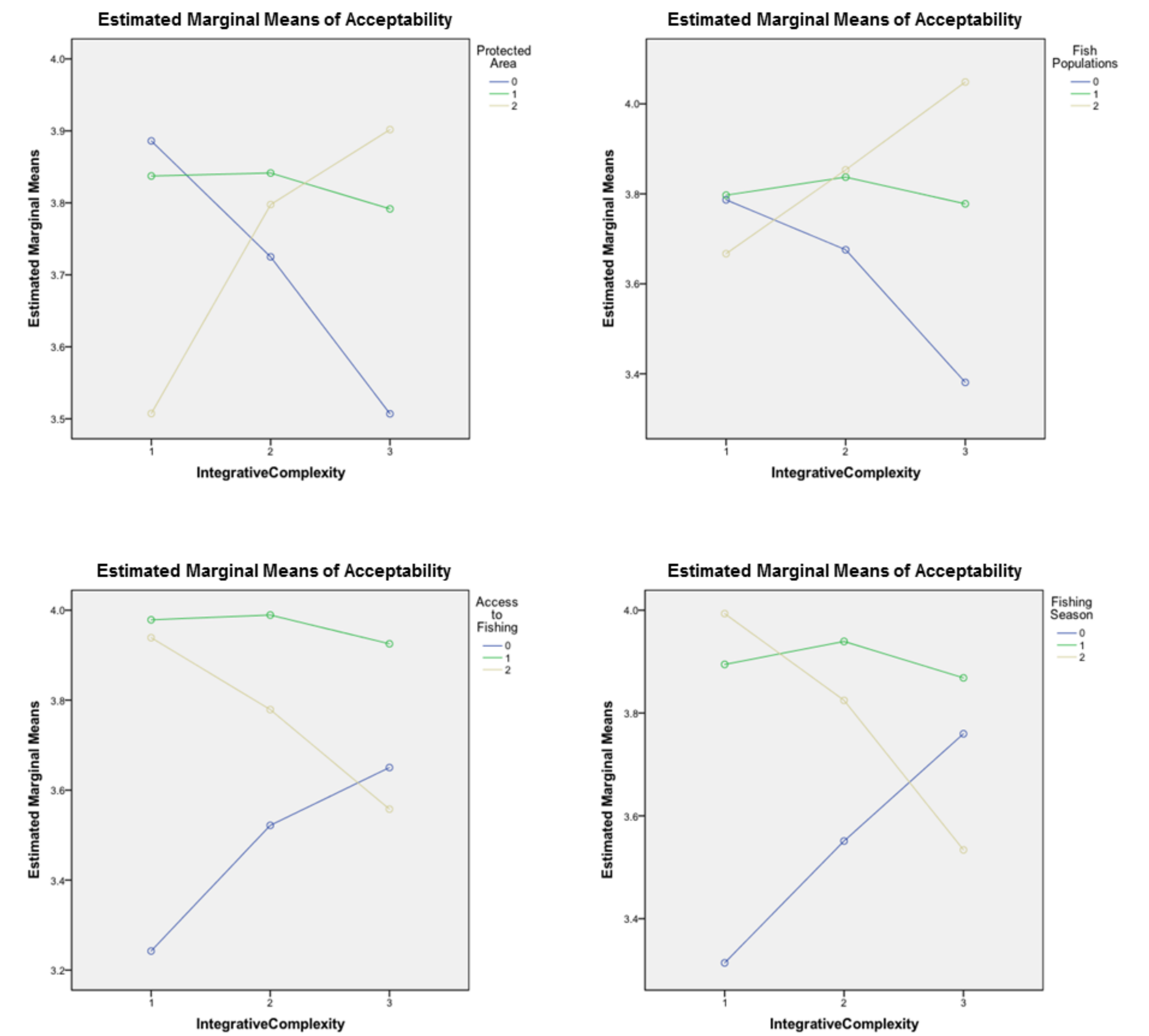


Figure 17. Estimated marginal means of acceptability by factors A (Protected Area), B (Fish Populations), C (Access to Fishing), and D (Fishing Season) across integrative complexity levels.

Table 40. Mean values of acceptability by factor levels and integrative complexity.

	Integrative Complexity Level				
	Low	Moderate	High	*F*-ratio	*p*-value
Protected Area (Factor A)					
Reduce (Level 0)	3.89	3.73	3.51	58.89	.000
No changes (Level 1)	3.84	3.85	3.79	1.83	.161
Expand (Level 2)	3.51	3.80	3.92	55.43	.000
Protection of Fish Population (Factor B)					
Reduce (Level 0)	3.79	3.68	3.38	80.14	.000
No Change (Level 1)	3.80	3.84	3.78	2.22	.109
Enhance (Level 2)	3.67	3.85	4.05	57.43	.000
Access to Fishing (Factor C)					
Reduce (Level 0)	3.25	3.52	3.65	53.15	.000
No Change (Level 1)	3.98	3.99	3.93	2.46	.085
Increase (Level 2)	3.93	3.78	3.55	53.90	.000
Length of Fishing Season (Factor D)					
Fewer days (Level 0)	3.32	3.56	3.77	67.52	.000
No Change (Level 1)	3.80	3.94	3.87	2.83	.059
More days (Level 2)	4.00	3.82	3.53	82.94	.000

Mean acceptability scored as 1=Extremely unacceptable, 2=Moderately unacceptable, 3=Somewhat unacceptable, 4=Neutral, 5=Somewhat acceptable, 6=Moderately acceptable, 7=Extremely acceptable; Mean scores underscored by same line are not significantly different at the 0.10 level according to a Tukey test.

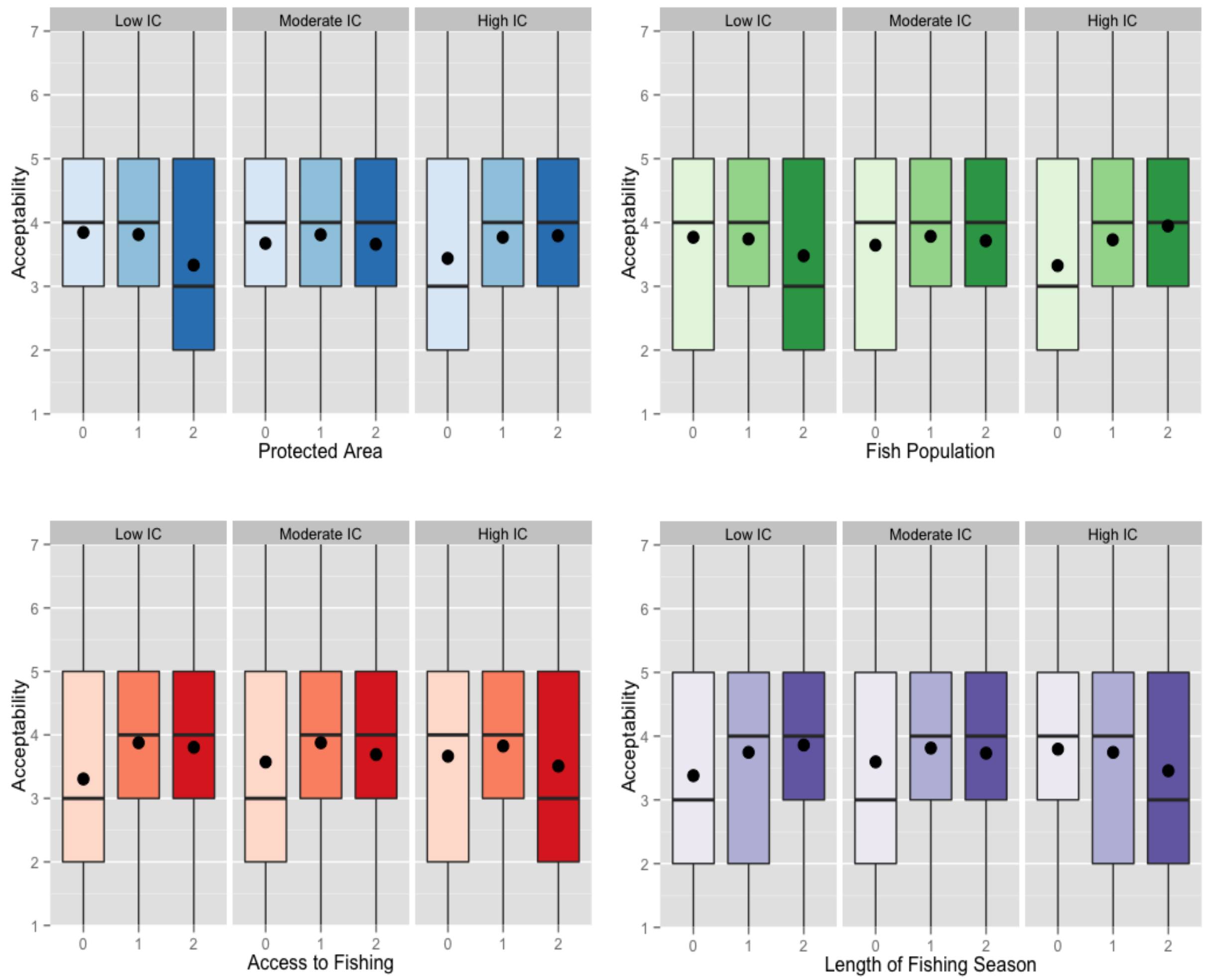


Figure 18. Main effects of protection (factors A and B) and use (factors C and D) on acceptability by integrative complexity levels.

There was a total of 24 tradeoffs between use and protection factors. A “tradeoff” occurred when there was a decrease or no change in the amount of protection (factor A or B), and no change or an increase in the amount of use (factor C or factor D). If both protection and use factors experienced the same level of change or no change, then no tradeoff was made. For these conditions (no changes), there were no significant differences in acceptability according to integrative complexity level. Significant differences were found between use and protection factors according to integrative complexity level for all but five tradeoffs (Table 41 and Table 42). Therefore, the null hypothesis, *(Ho13): there is no significant interaction between use and protection factors on the acceptability of management alternatives*, was rejected.

Table 41 shows the tradeoffs made in the amount of marine protected area (factor A) for changes in access to fishing locations (factor C) and length of the fishing season (factor D). As compared to low and moderate integrative complexity levels, higher integrative complexity levels considered it more acceptable to increase or make no changes to the amount of protected area, in exchange for a decrease or no changes in the amount of access to fishing locations. High integrative complexity anglers considered it less acceptable to decrease or make no changes to the amount of protected area, in exchange for no changes or an increase in access to fishing. Similar patterns were demonstrated in tradeoffs between protected area and the length of fishing season.

Table 42 shows the tradeoffs made in the amount of protection afforded to fish populations (factor B) for changes in access to fishing (factor C) and length of the fishing season (factor D). As compared to lower integrative complexity levels, higher integrative complexity anglers considered it more acceptable to increase or make no changes to protection of fish populations, in exchange for a decrease or no changes in the amount of access to fishing locations. High integrative complexity anglers considered it less acceptable to decrease or make no changes to protection of fish populations, in exchange for no changes or an increase in access to fishing. Similar patterns were demonstrated in tradeoffs between protection of fish populations and the length of fishing season. High integrative complexity demonstrated higher acceptability for no change or an increase in protection of fish populations, in exchange for fewer days in the fishing season. High integrative complexity considered it less acceptable when there was a decrease in protection of fish populations, but no change or more days in the fishing season.

The alternative hypothesis stated, *(Ha9): higher levels of integrative complexity are associated with higher acceptability of tradeoffs between resource use and protection, as compared to lower levels of integrative complexity being associated with lower acceptability of tradeoffs*. As demonstrated in Table 41 and Table 42, twelve out of the 24 tradeoffs supported the alternative hypothesis. These results showed that higher integrative complexity levels were associated with higher acceptability of tradeoffs only when levels of protection increased and levels of use (fishing) decreased or remained the same.

Table 41. Mean acceptability of protected area (factor A) and use (factors C and D) interactions by integrative complexity levels.

		Integrative Complexity Level				
		Low	Moderate	High	*F*-ratio	*p*-value
Protected Area (A)	Access to Fishing (C)					
(0) Reduce	(1) No Change	3.87	3.79	3.64	5.77	.003
	(2) Increase	3.89	3.67	3.38	66.19	.000
(1) No Change	(0) Reduce	3.28	3.59	3.64	8.47	.000
	(1) No Change *	4.14	4.09	4.02	2.30	.101
	(2) Increase	4.08	3.86	3.70	9.35	.000
(2) Enhance	(0) Reduce	3.14	3.49	3.66	61.54	.000
	(1) No Change	3.82	4.10	4.17	11.39	.000
Protected Area (A)	Fishing Season (D)					
(0) Reduce	(0) Fewer days *	3.34	3.48	3.55	5.41	.004
	(1) No Change	4.06	3.93	3.68	17.64	.000
	(2) More days	4.13	3.67	3.21	100.29	.000
(1) No Change	(0) Fewer days	3.35	3.69	3.92	18.88	.000
	(1) No Change *	3.96[a]	4.01	3.90[a]	1.91	.148
	(2) More days	4.13	3.76	3.50	24.31	.000
(2) Enhance	(0) Fewer days	3.10	3.45	3.77	52.11	.000
	(1) No Change	3.53	3.89	4.04	25.46	.000
	(2) More days *	3.77	4.01	3.88	6.89	.001

Mean acceptability scored as 1=Extremely unacceptable, 2=Moderately unacceptable, 3=Somewhat unacceptable, 4=Neutral, 5=Somewhat acceptable, 6=Moderately acceptable, 7=Extremely acceptable; Mean scores underscored by same line are not significantly different at the 0.10 level according to a Tukey test; [a] Means are not significantly different; [b] Means are significantly different; * No tradeoff.

Table 42. Mean acceptability of protection of fish population (factor B) and use (factors C and D) interactions by integrative complexity levels.

Fish Population (B)	Access to Fishing (C)	Low	Moderate	High	*F*-ratio	*p*-value
		Integrative Complexity Level				
(0) Reduce	(0) Reduce *	3.24 [a]	3.43 [b]	3.34 [a]	4.14	.016
	(1) No Change	4.00	3.88	3.53	29.40	.000
	(2) Increase	4.03	3.64	3.18	88.95	.000
(1) No Change	(0) Reduce	3.30	3.65	3.75	11.26	.000
	(1) No Change *	4.03	4.05	4.04	0.05	.955
	(2) Increase	3.92	3.70	3.44	14.95	.000
(2) Enhance	(0) Reduce	3.03	3.49	3.82	70.23	.000
	(1) No Change	3.75	4.03	4.21	20.92	.000
	(2) Increase *	4.03	3.99	4.06	0.97	.378
Fish Population (B)	Fishing Season (D)					
(0) Reduce	(1) No Change	3.68	3.68	3.42	11.06	.000
	(2) More days	3.91	3.69	3.33	90.78	.000
(1) No Change	(0) Fewer days	3.24	3.55	3.66	11.12	.000
	(1) No Change *	3.98	4.02	3.97	0.56	.569
	(2) More days	4.15	3.93	3.72	12.72	.000
(2) Enhance	(0) Fewer days	3.31	3.58	3.88	81.01	.000
	(1) No Change	3.95	4.15	4.23	7.38	.001

Mean acceptability scored as 1=Extremely unacceptable, 2=Moderately unacceptable, 3=Somewhat unacceptable, 4=Neutral, 5=Somewhat acceptable, 6=Moderately acceptable, 7=Extremely acceptable; Mean scores underscored by same line are not significantly different at the 0.10 level according to a Tukey test; [a] Means are not significantly different; [b] Means are significantly different; * No tradeoff.

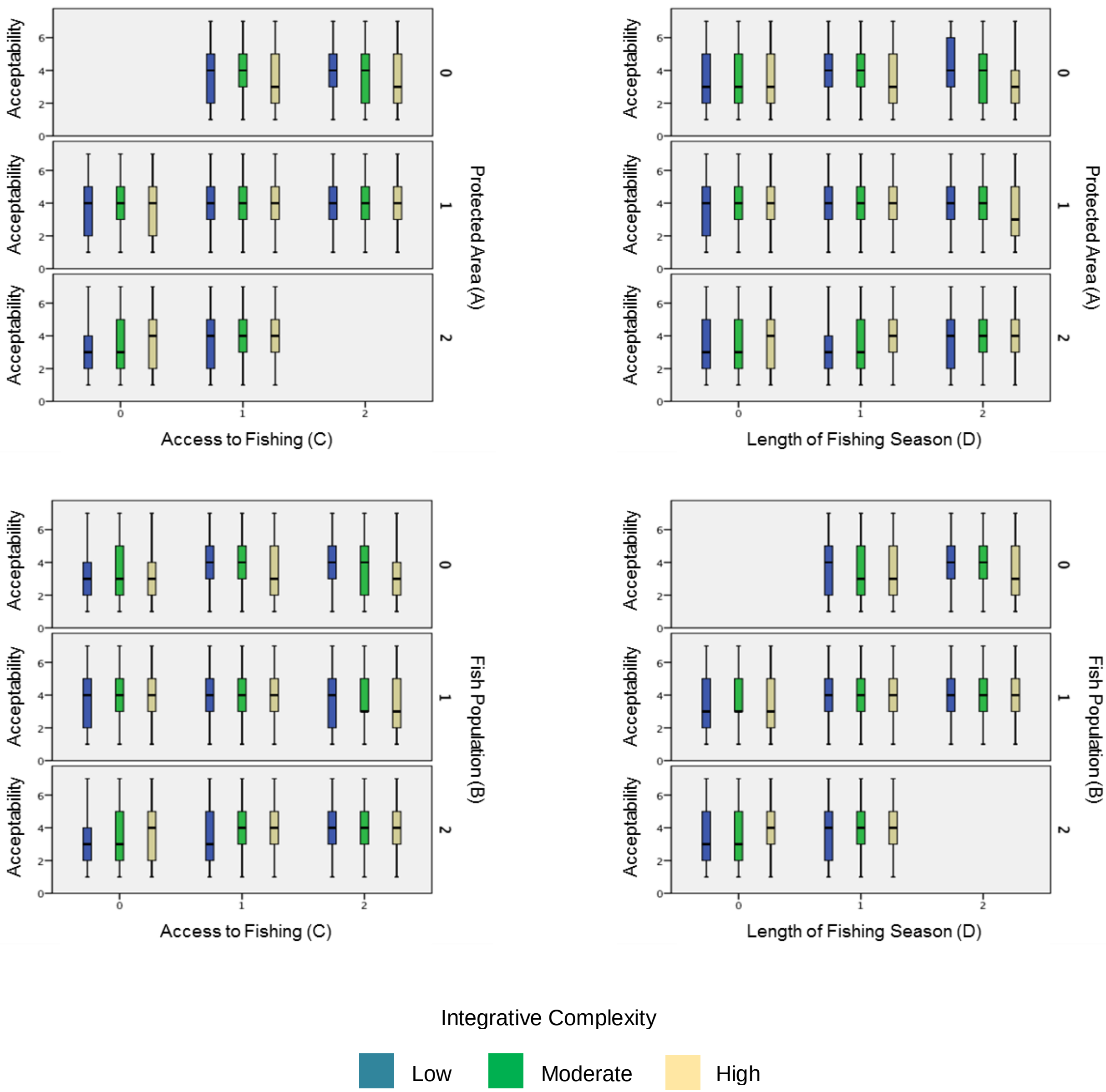


Figure 19. Interaction effects of use and protection factors on acceptability by integrative complexity levels.

8. DISCUSSION

The purpose of this dissertation was to examine how the complexity of thinking related to Florida recreational saltwater anglers' perceptions of coastal resource management priorities for resource use versus the protection of those same resources. This involved developing an alternative and functional method for measuring integrative complexity and applying it to coastal resource issues. Furthermore, this research examined the role of integrative complexity in anglers' value orientations, attitudes, and acceptability of tradeoffs between resource use and protection.

Integrative Complexity

Functionality of Measure

The first research objective examined integrative complexity of thought regarding management priorities for the use versus protection of coastal-marine resources. This involved the development of alternative measures that are quantitative and offer more control and predictability than the traditional qualitative methods (i.e., paragraph completion test or content analysis). To achieve this objective, three different measures of integrative complexity were developed based on 1) levels of differentiation and integration, 2) a four-item index, and 3) self-classification vignettes.

The first measurement approach followed the traditional conceptualization of integrative complexity based on the two dimensions of differentiation and integration (Tetlock, 1986; 1989). *Differentiation* was measured by the number of factors a respondent considered while thinking about the issue of resource use versus protection. This measure resulted in an overwhelming proportion (95%) of respondents indicating that they considered more than ten subjects (out of 21) in their thinking. With relatively few respondents demonstrating low levels of differentiation, this measure did not demonstrate validity or convincing results which truly reflect the respondents' level of differentiation.

It is possible that presenting a list of subjects may have assisted or led respondents in choosing subjects which they did not actually consider. Consequently, this could have produced a type of hindsight bias, which occurs when people believe or claim that they "knew it all along" (Roese & Vohs, 2012). It is also possible that this approach elicited socially desirable responses. A social desirability bias can occur in surveys asking "sensitive" questions. In this study, respondents may have been sensitive to questions about how they think. While the survey respondents were assured confidentiality, encouraged to answer honestly, and told that there were no right or wrong answers, there are people who have a core motive of self-enhancement (Fiske & Taylor, 1991), or attempt to appear favorably to others by presenting themselves in an overly positive way (Crowne & Marlowe, 1964). Participants may have felt that there were "correct" answers. Some researchers have suspected that survey participants may over claim knowledge, skills, and abilities (Musch, Ostapczuk, & Klaiber, 2012; Paulhus & Reid, 1991), but the prevalence of this social desirability bias remains uncertain (Krumpal, 2013).

While the differentiation measure produced a skewed distribution of respondents, the integration measure produced a more varied distribution of respondents across levels of integration. Since the distribution of respondents predominantly included moderate to high differentiation levels, the first approach did not permit the generation of low to high integrative complexity levels as operationalized. Thus, further attention to operationalizing the dimensions of differentiation and integration is still needed. Future studies may consider focusing development on the integration component, since differentiation is a requirement of integration (Baker-Brown et al., 1992; Schroder, Driver, & Streufert, 1967). Integration alone was not tested as an integrative complexity measure in this study, but future research could examine whether integration is a sufficient indicator of integrative complexity.

The second approach developed a four-item index of integrative complexity based on *open to change*, *information seeking*, *active listening*, and *perspective taking*. These four indicators were chosen based on the current understanding of integrative complexity and are typical characteristics of integratively complex thinkers noted in the literature (Tetlock et al., 1993; Gruenfeld & Kim, 1998; Suedfeld, 2010). These dimensions have also been described as indicators of cognitive flexibility (Gruenfeld et al., 1998; Nijstad et al., 2010). The results of the reliability analyses for the index suggest that some modifications are needed. In particular, low performance was observed when the *open to* *change* item was included in the index. With somewhat low Cronbach's alpha scores (below the recommended minimum $\alpha = 0.60$), the index is a potential measure of integrative complexity and improving the index should lead to stronger results. The statements representing the four dimensions could be better worded, or other combinations of characteristics may be better predictors of integrative complexity. Previous studies of integrative complexity, which have relied on qualitative methods (i.e., paragraph completion test and content analyses) to describe characteristics of simple to complex thinkers, have been debated over the reliability of the scoring methods and the ability to explain and predict thinking in a variety of situations (Conway et al., 2008; Suedfeld & Tetlock, 2014). Because research in cognitive/integrative complexity began with subjective scoring of text, and because much of it still uses that method, perhaps there are other dimensions which remain to be considered in the foundation of integrative complexity.

In the third approach, respondents self-classified into one of four integrative complexity levels by choosing the one vignette which best described their thinking process in terms of their position on the use versus protection of coastal resources. Each of the four vignettes were descriptions based on varying levels of differentiation and integration corresponding to a specific level of integrative complexity, ranging from low to high. The integrative complexity levels and conditions were based on the scores outlined by Baker-Brown et al. (1992). Of the three approaches, the vignettes performed the best in capturing multiple levels of integrative complexity. Using the three levels of integrative complexity created by the vignettes, the null hypothesis was rejected in all statistical analyses. This provided evidence of distinct subgroups of integrative complexity based on the vignettes. Thus, use of the vignettes is a promising approach to measuring integrative complexity levels. As compared to the other two approaches, vignettes may be a more straightforward measure of integrative complexity and impose less cognitive demand on respondents. Future research should continue to test the vignettes on reliability and validity, while adapting the content of the vignettes to reflect the context of the situation being studied. In using vignettes, researchers emphasize the importance of vignettes tapping into relatable, real life processes (Rossi & Anderson, 1982; Hughes & Huby, 2004).

Levels of Integrative Complexity among Respondents

The distribution of respondents falling into the low, moderate, and high integrative complexity levels are not consistent with most other integrative complexity studies. Tetlock (1986) suggested that people tend to use simple styles of reasoning and that it is not unusual for most of the integrative complexity scores to fall into the lower end of the scale. Similarly, in their research of plant and wildlife species protection, Bright and Barro (2000) found that approximately two-thirds of their sample had low integrative complexity scores. In this dissertation research, less than twenty-percent of the respondents had low integrative complexity, whereas most respondents had moderately high integrative complexity scores. This distribution of integrative complexity among Florida-licensed recreational saltwater anglers was similar to the integrative complexity levels found by Hawkins (2011). Approximately 26.3% of recreational anglers, commercial fishermen, and SCUBA divers in the Florida Keys demonstrated low integrative complexity regarding coral reef issues. Reasons for the larger proportion of moderate to high integrative complexity scores may be due to methodological issues, as discussed below.

First, it is possible that the integrative complexity subgroups (levels) in this study were actually “subgroups of a subgroup,” or the result of a moderately high integrative complexity group that was further segmented into low to high integrative complexity levels. In this case, the anglers who think with moderately high integrative complexity were the ones who chose to participate in the survey. Some researchers have suggested that survey respondents choose to participate because they are interested in the survey topic, participate in activities relevant to the topic, or have high levels of knowledge on the topic (Groves et al., 2006). Accordingly, the respondents to this study’s survey may have consisted of anglers who are more involved in recreational saltwater fishing in Florida. Researchers have also asserted that many decisions to participate in surveys are heuristic ones that are based on “peripheral” aspects of the options (Groves, Cialdini, & Couper, 1992). When receiving a survey invitation, respondents may not be motivated enough to invest much energy and time in participating. As a result, these respondents will decide to participate based on peripheral aspects (e.g., authority, reciprocation, scarcity, social validation, liking, etc.) of the options rather than all the information about options (Petty & Cacioppo, 1984, 1986). The peripheral type of respondent may also use simple or "low integrative complexity" thinking. Thus, the respondents in this study may not be representative of the population of Florida recreational saltwater anglers or the entire spectrum of integrative complexity levels. While this study did not aim for a representative sample, future research may consider the aforementioned aspects in tests for response/non-response bias.

A second explanation for why this distribution occurred may be because this study used a specific, targeted sample in responding to issues relevant to that population. State licensed recreational saltwater anglers who were permanent residents of Florida were more likely to be in tune with coastal management issues of use versus protection (in particular, recreational fishing issues), as compared to members of the general population. Although the survey respondents were not asked about the importance of coastal management issues, this group of anglers consisted of individuals who were more directly connected with the resource than members of the "general" public. Research has suggested that people involved in personally salient problems exhibit higher levels of integrative complexity (Suedfeld, 1992; Suedfeld et al., 1994). Therefore, it makes sense that most anglers surveyed think with moderately high integrative complexity and relatively fewer anglers think with low integrative complexity.

In other studies, lower integrative complexity levels might have been observed because respondents from a more general population were assessed on how they thought about issues which may or may not have been personally relevant or important. For instance, Bright and Barro's (2000) plant and wildlife species protection study was based on a sample of 115 residents of Illinois. The authors noted that low levels of integrative complexity may have been observed because a general population of respondents were asked about a topic specific to plant and wildlife species protection. They also observed that there were very few instances of held-values brought into a respondent's discussion about plant and wildlife species protection.

Integrative complexity may be better understood by exploring anglers' degree of recreation specialization. Bryan (1977) first proposed the concept, and defined recreation specialization as "a continuum of behavior from the general to the particular, reflected by equipment and skills used in the sport and activity setting preferences (p.175)". Through an inductive approach, Bryan classified trout anglers into four subgroups; occasional fishermen, generalists, technique specialists, and technique-setting specialists. An extensive amount of research followed, and the general notion of specialization was supported. However, Ditton, Loomis and Choi (1992) advanced specialization theory considerably by recognizing that Bryan's (1977) definition of specialization was circular, a tautology. Also, the method used to segment the population of recreationists into smaller subgroups was based on a single measure, such as frequency of participation. To give a theoretical foundation to specialization, Ditton et al. (1992) re-conceptualized and redefined recreation specialization as "a process by which recreation social worlds and sub-worlds segment and intersect into new recreation sub-worlds and the subsequent ordered arrangement of these sub-worlds and their members along a continuum" (p.33). Recreationists were segmented into sub-groups or sub-levels of recreation specialization based on individuals' orientation, experience, relationships and commitment to their activity.

Ditton et al. (1992) offered eight propositions of recreation specialization which may further the understanding of integrative complexity. First, recreation participants are likely to become more specialized in a given activity over time. As level of specialization in a recreation activity (i.e., fishing) increases, the following also increase: 2) value of side-bets, 3) centrality of that activity in a person's life, 4) acceptance and support for the rules, norms, and procedures associated with the activity, 5) importance of equipment and skillful use, 6) dependency on a specific resource, 7) use of mediated interaction, and 8) importance placed on non-activity-specific elements of the experience. With these propositions in mind, recreation specialization may help to better understand the Florida recreational saltwater anglers who participated in this study.

The recreational anglers surveyed in this study indicated that they had been saltwater fishing in Florida for an average of 28 years. This average was the same across all three levels of integrative complexity and implies a high degree of specialization and resource knowledge of Florida. In a study by Loomis et al. (2008), moderate to highly specialized recreational anglers in the Florida Keys had an average of 30-37 years fishing experience, whereas the least specialized anglers had an average of 21 years of experience. Although not tested here, the years of fishing experience by specialization level provide a gauge for this study's sample of recreational anglers. Considering the proportion of moderately high integrative complexity demonstrated in this study, it appears that this group of anglers could also be highly specialized recreational anglers.

The surveyed anglers also indicated that, on average, they spent the most number of days fishing in Florida from their own private boat. This implies that many of these anglers have a greater economic investment in recreational saltwater fishing and are potentially more specialized (proposition 5) than anglers who fish from other modes (Salz et al., 2001). In general, highly specialized anglers are likely to be more concerned, opinionated, and politically active regarding the management of marine fisheries resources compared with other recreational angler groups. The mode of fishing also provides an indication of how anglers could be affected by marine protected area boundaries. Anglers who fish from their private boat are more likely to be directly affected by marine protected areas than are shore anglers, due to their ability to access offshore fishing areas. They also have more autonomy over where they fish, as compared to angler in the for-hire mode who generally fish where the captain decides. This type of anglers is, therefore, more likely to feel that marine protected areas threaten their access to fish where they want than are shore, party boat or charter boat anglers.

Overall, this sample of Florida recreational saltwater anglers does not appear to represent the entire spectrum of integrative complexity levels but was successful in demonstrating that three distinct levels of integrative complexity exist. It also appears that these recreational anglers are highly specialized in their activity. Many aspects of the recreation specialization propositions parallel aspects of integrative complexity, and therefore, may help in understanding the mixed results found in this study and their implications.

Value Orientations

The second research objective examined whether value orientations differed according to level of integrative complexity. In this study, value orientations referred to patterns of multiple basic beliefs about general issues pertaining to the use of coastal resources (anthropocentric) or the protection of coastal resources (ecocentric). The direction and extremity of value orientations were tested according to level of integrative complexity.

Value Orientation (Direction)

The results revealed significant differences in value orientations across integrative complexity levels, and the rejection of the null hypothesis is consistent with previous studies (Bright et al., 2000; Czaja et al., 2016; Tetlock, 1984; Tetlock, 1989). However, the results did not support the alternative hypothesis that higher integrative complexity levels demonstrate a pluralist value orientation. As described by Tetlock's (1986) Value Pluralism Model, individuals with high integrative complexity were expected to have mixed values for resource use versus protection issues. But in the case of recreational saltwater anglers in Florida, individuals with high integrative complexity had ecocentric value orientations and individuals with lower integrative complexity had anthropocentric value orientations. This pattern was consistent across integrative complexity levels for all twelve value orientation statements. Thus, there was a clear value direction evident between low and high levels of integrative complexity.

While anglers with high integrative complexity did not exhibit a "pluralistic" value orientation as predicted, the ecocentric value orientation observed in this group makes some sense. As recreational saltwater anglers, these integratively complex thinkers clearly make use of fishery resources. Thus, to some degree, they already display some level of an anthropocentric value orientation. With this in mind, one interpretation of the results may be that high integrative complexity anglers recognize the value of resource protection, and therefore, think more broadly about fishery resources. At the other end of the spectrum, anglers who think with less integrative complexity are more oriented toward resource use (anthropocentric) than protection.

Value Orientation Extremity

The extremity of value orientation was also tested according to integrative complexity level. Results showed that high integrative complexity levels held more extreme value orientations than lower integrative complexity levels who held less extreme value orientations. Although the results did not support the alternative hypothesis predicting moderate value orientations among higher integrative complexity and extreme value orientations among lower integrative complexity, the patterns of extremity were consistent across integrative complexity levels.

The literature that examines the relationship between integrative complexity and value extremity is minimal and this dissertation provided an opportunity to explore that connection. According to the value pluralism model, advocates of extreme ideologies exhibit low levels of integrative complexity (Tetlock, 1983). Tetlock et al. (1985) found that more moderate British politicians exhibited higher levels of integrative complexity than did the Parliamentarians to their ideological left. Hawkins (2011) found significant differences in value extremity between integrative complexity levels but only for the biocentric value orientation. One explanation for the finding was that values tend to be more abstract concepts than attitudes (Eagly & Kulesa, 1997), hence their position relative to attitudes in the cognitive hierarchy model (Vaske & Donnelly, 1999). However, it appears that value extremity may be direction-oriented.

Attitudes

The third research objective examined whether attitudes toward use versus protection differed according to level of integrative complexity. Overall, the results pertaining to attitudes are mixed and contradict much of the integrative complexity literature. The results raise several unanswered research questions about the relationship between integrative complexity and attitude direction and extremity. Despite mixed findings, the results have interesting implications to future research.

Attitude Certainty

Attitude certainty is defined as the degree of certainty or confidence a person has in his or her judgments about an issue (Antil, 1983). Others have described it as a subjective sense of conviction in one's attitude or the sense that one's attitude is valid (Gross, Holtz, & Miller, 1995; Rucker, Tormala, Petty, & Briñol, 2014). This research provided an initial attempt to explore the concept of attitude certainty in relation to priority of use versus protection of resources. The results showed that as an individual's priority for use or protection increased, the amount of attitude certainty decreased. While this finding was not as predicted, the existing literature linking certainty to other attitude features (i.e., priority, extremity) offers mixed evidence.

This research also explored differences in attitude certainty according to integrative complexity level. The results found that individuals with high integrative complexity levels were more certain about the correctness of their position than those with low integrative complexity. This pattern is opposite to previous studies which suggest that higher attitude certainty is associated with lower integrative complexity. However, again, this finding is based on a single, general measure of attitude certainty and further development is needed to really understand the relationship between this concept and integrative complexity.

Future development of multiple measures of attitude certainty that are more specific to an issue may improve the quality and usefulness of attitude certainty regarding natural resource issues. Attitude measures with a high level of specificity in terms of target object, situation, and time provide a better indication of how people will react in those specific circumstances than do more general attitudes (Fishbein & Ajzen, 1975). Also, attitude certainty is likely not a monolithic construct, but rather it might consist of different dimensions. Further conceptualization of attitude "certainty" is needed. Other components of attitude structure, such as attitude importance, may offer additional insight into understanding attitude strength. Abelson (1988) emphasized the certainty that people have about important attitudes, and Krosnick (1990) defined attitude importance as “the degree to which a person is passionately concerned about and personally invested in an attitude” (p. 60). This may elicit more information about how a person thinks and why they may think with low versus high integrative complexity.

Attitude Direction

Significant differences were found in attitude direction between integrative complexity levels. These results were inconsistent with previous research which found no significant differences in the direction of one’s position based on integrative complexity (e.g., Bright & Barro, 2000; de Vries & Walker, 1987; Dillon, 1993; Tetlock, 1983). In the natural resource context, Bright and Barro (2000) found no differences in integratively complex thinking about plant and wildlife species protection between individuals with positive and negative attitudes. Their results were consistent with Dillon (1993) in a study of attitudes toward abortion, and de Vries and Walker (1987) in a study of attitudes toward nuclear weapons. Even Tetlock (1983), who originally proposed the rigidity-of-the-right hypothesis, suggested that the phenomenon might be due to minority/majority status of political parties rather than an inherent way of thinking about issues based on the direction of one’s position. While previous studies found no differences in attitude direction between integrative complexity levels, as previously discussed (section on levels of integrative complexity among respondents), the respondents in those studies were samples of the general public or college students who were asked to write about their views on topics that may or may not have been relevant to the respondents. Thus, it makes sense that no attitude direction was found among a less involved population in these studies, and that an attitude direction was found among Florida recreational anglers surveyed in this research. Several researchers have also noted that a disadvantage in the traditional scoring system (Brown et al., 1992) is that the same score can be assigned to statements that are equally complex, but they are not complex for the same reason (Conway et al., 2008, 2014). Thus, in order to more fully understand integrative complexity, it may be necessary to have finer-grained measurements of the different forms that complexity may take.

Attitude Extremity

In this dissertation, significant differences were found when attitude extremity was tested according to integrative complexity. It was hypothesized that those who indicate higher levels of integrative complexity would exhibit attitude moderacy, whereas, lower levels of integrative complexity would exhibit attitude extremity. This hypothesis was based on prior studies suggesting that attitude extremity is negatively related to integrative complexity (e.g., Linville, 1982; Tetlock et al., 1994; Tetlock et al., 1989). In natural resource-related research, previous studies found that individuals with the highest level of integratively complex thinking demonstrated moderate attitudes toward issues (Bright & Barro, 2000; Burtz & Bright, 2007; Linville, 1982). For example, Bright and Tarrant (2002) found that respondents who held moderate attitudes showed higher integrative complexity toward the Endangered Species Act than did those with extreme attitudes. Likewise, Bright and Manfredo (1992) found that moderate attitudes toward a variety of natural resource management issues were characterized by higher cognitive complexity than are extreme attitudes.

In this study, high integrative complexity anglers demonstrated less extreme attitudes in all but two out of eight attitude statements as expected. Anglers with high integrative complexity levels held moderate attitudes toward management actions which a) expand marine protected areas closed to recreational fishing, b) open more locations where fishing is allowed, or c) increase the maximum size limit for the fish species anglers most preferred to catch. Unexpectedly, anglers with high integrative complexity had highly extreme attitudes toward a decrease in the maximum size limit or a higher recreational bag limit for the fish species they most prefer to catch. This linkage between extreme attitudes and high integrative complexity is unclear and inconsistent with the previous natural resource/integrative complexity studies. However, there are a few studies outside the natural resource realm which suggested that attitude strength actually increases the complexity of one's thinking (Suedfeld, 2000; Van Heil & Mervielde, 2003).

The findings also provide evidence that low integrative complexity levels have more extreme attitudes. Anglers with low integrative complexity levels held highly extreme attitudes toward all management actions except for one. They had low attitude extremity towards a decrease in the maximum size limit for their most preferred fish species to catch. The findings of low integrative complexity having extreme attitudes make sense because a person who has a well-developed representation of an attitude object is probably less likely to engage in integratively complex thinking and more likely to think in rigid, black and white terms.

The overall connection between attitude direction and attitude extremity is interesting when interpreted as whole. Low integrative complexity anglers had attitudes supporting use-oriented management actions, and these attitudes were held with high extremity. High integrative complexity anglers had attitudes supporting protection-oriented management actions, and these attitudes were held with low to moderate extremity. Attitude moderacy or ambivalence may result when an individual understands the tenability of contradictory arguments for an issue, which is a characteristic of integratively complex thinking (Tetlock, 1983).

Integrative Complexity as a Moderator

The apparent connection between value orientations and attitudes in the cognitive hierarchy (Vaske & Donnelly, 1999) was reason to consider whether people's thought complexity, when thinking about an issue, impacted the relationship between value orientation and attitude. The fourth research objective examined whether the relationship between value orientations and attitudes toward coastal management actions were moderated by integrative complexity. The moderation analysis tested three regressions on attitudes according to 1) value orientations, 2) value orientations and integrative complexity, and 3) the interaction between value orientation and integrative complexity.

The relationships between value orientations and attitudes were all statistically significant and occurred in the direction as predicted. More ecocentric value orientations tended to have attitudes supporting protection-related management actions, whereas more anthropocentric value orientations tended to have attitudes supporting use-related management actions. These findings are also supported and predicted by the literature (Vaske & Donnelly, 1999; Fulton et al., 1996). The relationship between value orientations and attitudes provides evidence of structural consistency within the cognitive hierarchy. Structural consistency refers to the extent to which an attitude is evaluatively consistent with other attitudes (inter-attitudinal consistency), or with other cognitive constructs (i.e., value orientations) associated with the attitude object (Eagly & Chaiken, 1993). This suggests that attitudes are, in fact, rooted in the fundamental value one holds and driven, in part, by the orientation of those values.

The apparent connection between value orientations and attitudes in previous research was reason to consider whether thinking with integrative complexity impacted the relationship between value orientations and attitudes. Integrative complexity, however, did not serve as a significant moderator to the relationship between value orientations and attitudes. Moderation (significant interaction effect) occurred in the relationship between value orientation and attitudes toward expanding marine protected areas closed to recreational fishing. This suggested that value orientation statistically depended on integrative complexity in predicting this attitude, but the size of this effect was minimal. Separately, value orientation and integrative complexity both had significant effects in predicting attitudes for all but one attitude statements. Integrative complexity had no significant effect in predicting attitudes toward a decrease in the maximum size limit for the fish species they most prefer to catch. In this particular case, anglers' value orientation overrode integrative complexity in predicting attitudes. This result makes sense in consideration with the previous tests on attitudes, in which there were fewer statistical differences in attitude direction and extremity between integrative complexity levels. Thus, overall, there was no moderating effect of integrative complexity on the relationship between value orientations and attitudes. Attitudes toward management actions are directly driven by the individual effects of both value orientations and integrative complexity.

Acceptability of Tradeoffs

The fifth research objective examined the role of integrative complexity in shaping acceptance of management tradeoffs between use and protection of coastal resources. Overall, there were significant findings associated with acceptability of tradeoffs between resource use and protection, and integrative complexity clearly had a large influence in predicting acceptability. When the tradeoffs between use and protection were most obvious (reducing/increasing both protection factors, increasing/decreasing both use factors), it was clear that low and high integrative complexity anglers evaluated the competing objectives differently. These patterns observed in the types of tradeoffs considered acceptable were also reflected in the value orientations and attitude statements. Again, as discussed in the previous findings, these patterns support the structure of thinking within the cognitive hierarchy and further suggest connections to the recreation specialization literature.

The high integrative complexity anglers surveyed in this study were largely ecocentric-oriented and tended to support management actions prioritizing resource protection. This finding may be further explained by recreation specialization. According to recreation specialization, proposition six predicts that as specialization increases, dependency on a resource will increase. Highly specialized recreationists are likely to voice the strongest opinions (either in favor or opposition) in response to management actions. Thus, a highly specialized angler who thinks with high integrative complexity would consider adverse impacts to the resource to be of greater concern than would less specialized anglers with lower integrative complexity.

There are also limitations related to both the design and the hypothetical nature of the scenarios used to measure acceptability of tradeoffs between resource use and protection. Stated choice experiments or other types of conjoint designs could be used as an alternative approach to elicit the acceptability of tradeoffs (Gillis & Ditton, 2002; Lawson & Manning, 2002; Oh et al., 2005). Stated choice experiments are based on a methodology similar to the fractional factorial design that was used in this study. Rather than rating scenarios on a scale, the respondents are asked to make a series of discrete choices between scenarios. Choice experiments have been applied in the field of outdoor recreation research and management as a tool to help determine visitors' preferences and opinions on acceptable tradeoffs concerning issues related to recreation and management (Louviere & Timmermans, 1990; Lawson & Manning, 2002; Schroeder, Dwyer, Louviere, & Anderson, 1990).

Future Research

Continued research, from a theoretical perspective, could apply other components included within the cognitive hierarchy framework. The focus of this research was on value orientations and attitudes, but other cognitive constructs within the hierarchy, such as social norms or behavior intentions, may also be connected to integrative complexity. Exploring the role of these constructs could improve upon integrative complexity's predictive validity and expand our theoretical understanding of such relationships. For example, attitude extremity may further be related to the strength of behavior intentions or norms. Social norms are socially agreed upon rules of behavior or conditions given particular sets of circumstances and are shared by members of a group (Vaske & Whitaker, 2004). Norms can help to answer questions about standards for acceptable social, behavioral, or biophysical conditions. Individuals within the group tend to feel a sense of obligation based on those norms, and as one faces sanctions from other members of the group. Thus, the more extreme a person's attitude toward a situation, the more obligated or responsible the person may be to behave in ways that are consistent with the attitude. Since this study found that attitude extremity varies according to integrative complexity, similar patterns may also be expected to occur in norms. People may be more flexible or open to change when thinking about issues, unless they believe that it is their obligation to do so. Further research in norms and other cognitive hierarchy concepts would enhance our understanding of integrative complexity, as well as how people think about acceptable tradeoffs between resource use and protection.

Another potential area to explore is the relationship between integrative complexity and knowledge. In this study, the anglers surveyed were not representative of the entire population of Florida recreational saltwater anglers. These anglers were predominantly college-educated, and many had advanced degrees or specialized training. It is possible that subject knowledge may have an indirect role in integrative complexity. Knowledge may partially help to explain the mixed results found between attitude extremity and integrative complexity in this study. As previously discussed, some authors have treated knowledge as cognitive complexity, but the literature suggests that knowledge is more appropriately understood as a variable or sub-variable in integrative complexity. Bright and Wyche (1998) found that students who took coursework in environmental education developed more complex reasoning on the Endangered Species Act and related tradeoffs throughout their course than those who had not. But a high level of knowledge, in and of itself, is unlikely to be a sufficient condition for high integrative complexity. For instance, one function of knowledge is to help maintain strong attitudes (Wood, Rhodes, & Biek, 1995). Attitudes are typically considered strong when they are resistant to change and persistent over time. In the Bright and Barro (2000) study, the highest level of integrative complexity toward plant and wildlife species protection was found for individuals whose attitudes toward the issue were of low extremity and who had the highest levels of knowledge. Yet, individuals with high levels of knowledge combined with highly extreme attitudes demonstrated low integrative complexity. These individuals may have high knowledge about an issue, but do not access such knowledge when their attitudes are formed or may place importance on only those aspects of their knowledge consistent with their attitudes (Wood, Rhodes, & Biek, 1995). Future research could further examine the relationship between types of knowledge and attitudes, and how they influence integrative complexity.

Integrative complexity may also be connected to the ways with which an individual receives, uses, and elaborates on information. This study developed a four-item index based on constructs of cognitive flexibility and other research suggesting that higher integrative complexity is related to higher information seeking and elaboration. Mediated communication involves a process by which a message or communication is transmitted via some for or medium (Pavlik & McIntosh, 2004). The literature suggests that integratively complex thinkers will seek out more information from diverse sources to better understand an issue. Accordingly, we could expect that an individual who uses a variety of mediated communication outlets about an issue will gain a deeper, richer understanding of that issue and demonstrate higher levels of integrative complexity.

Previous research and theory suggests that people are more complex on issues that they have experience with (Ceci & Liker, 1986; Conway, Shaller, Tweed, & Hallett, 2001). Thus, the use of mediated communication across a range of integrative complexity levels may also be better understood through recreation specialization. For example, Loomis, Anderson, Hawkins, and Paterson (2008) used mediated communication findings to inform Florida Keys National Marine Sanctuary managers and other interested parties how much use SCUBA divers, snorkelers, and recreational anglers were making of various information outlets. The use of mediated interaction was reflected across levels of recreation specialization. More specialized anglers who are invested in activity are more likely to seek out information about recreational fishing from a variety of mediated sources such as Internet sites, magazines, or talking with other anglers. Highly specialized anglers have also shown a greater awareness of the negative impacts of recreational harvest and greater support for regulations, as compared to less specialized anglers. Mediated communication questions are important in coastal management, as they indicate specifically where managers may wish to focus communication, outreach, and education efforts and budgets when used on representative samples.

Management Implications

In addition to its overall contribution to social science theory, this research has important implications for coastal-marine resource management. This study provides resource managers with baseline social data that can be compared with future studies to analyze trends in anglers' integrative complexity, value orientations, attitudes, and acceptable tradeoffs. A measure of integrative complexity enhances our understanding about public perceptions of coastal resource issues, because it considers the interrelationships among diverse topics and constructs. Given the complex and often controversial nature of coastal resource management issues, it becomes important to acknowledge the extent to which people understand and think about the intricacy of these issues. While some caution is in order when discussing the implications of the study results to resource managers in Florida, this research has applied relevance. The results of developing, implementing, and testing the integrative complexity measure (vignettes) support its use by managers to segment constituents into integrative complexity levels. When care is taken to use it on a representative sample, it should assist in providing information about those constituents across a variety of human dimensions inquiries.

The conceptual model supports the ongoing management efforts involving diverse scientists, policy-makers, managers and citizens. Use of the integrative complexity measure is a relatively new research concept which has continued potential in social science and coastal resource management. This methodology potentially allows statewide inter-agency communication, education, and collaboration efforts to be tailored, at the appropriate level of detail and complexity, to specific audiences. With regards to this study, local, state and federal agencies of Florida have insight into the thinking processes of recreational saltwater anglers residing in all Florida counties. Thus, this information is valuable at a larger, state-wide level. The data could be further analyzed for differences at various scales and regions of Florida. Future efforts could apply this conceptual model to non-residents of Florida, commercial fishermen, or other types of coastal-marine resource users. This would enhance the understanding of integrative complexity and how thinking may differ across key stakeholder groups.

One important implication is the use of this research by management to gain an understanding of how the public views, interprets, and thinks about an issue and how proposed management actions will be received. This is essential, since policies which satisfy one value or objective often require sacrificing others (making tradeoffs). Stakeholders' attitudes about specific issues, such as fisheries or marine protected areas/sanctuaries, are often cited in public policy debates and can be instrumental in the decision-making process. Through modeling cognitions, this research provides managers with a better understanding of the underlying values that directly influence stakeholders' attitudes, the nature of those attitudes, and the degree of simplicity-complexity with which they think.

Another area of this study that should interest managers is the hypothetical management scenarios. Understanding how people think tradeoffs in use and protection should be balanced provides useful information for management decision-making, such as during the development of management plans, a regulatory review, or making day-to-day decisions that can have long-term effects on an ecosystem service. Insights from these scenarios are useful in selecting specific management alternatives that are considered acceptable to stakeholders, and in predicting their cognitive and behavioral reactions to management decisions, or potential for conflict.

Communication and Outreach. This research also has applications for developing communicative strategies aimed at changing people's attitudes towards marine resource stewardship. In this study, high integrative complexity anglers held attitudes supporting protection-oriented management actions. Low integrative complexity anglers are less supportive of such measures and may respond more negatively to restrictions on recreational fishing. The results suggest that low integrative complexity anglers may be wary of the establishment or expansion of a protected area.

Management agencies often seek to "educate the public," but to accomplish such a goal is not as simple as providing people with information. Research suggests that neither formal nor informal environmental education efforts are successful at improving low levels of public knowledge about the environment (Arcury & Johnson, 1987). But even if this was successful, additional knowledge may have little or no effect on attitudes towards environmental issues (Bright & Barro, 2000; Bright & Manfredo, 1996). This "information deficit model" of behavior change assumes that by providing people with information on an issue (e.g., litter or pollution) will lead to attitudes that support "responsible" activities (e.g., recycling) and behaviors will change (DeYoung, 2000; Weaver, 1991). Delivering new knowledge to people can enhance their awareness of environmental issues and of the environmental impacts of their behavior (Steg & Vlek, 2009). This is especially true for messages that are perceived as logical and relevant to the person, and that capture their attention (Scannell & Gifford, 2013). However, the relative success of such programs will vary according to a person's level of integrative complexity, or their ability and motivation to process the information received. As this dissertation showed, the tendency of individuals to think with integrative complexity further depends on their value orientations, attitudes, and likely other factors.

According to the expectancy-value model, attitudes can be changed either by changing one or more of their salient beliefs or by adding new salient beliefs relevant to the attitude object (Ajzen & Fishbein, 1980). Changes in attitudes can, in turn, trigger changes in people's behavioral intentions, which can ultimately lead to actual changes in behavior (Ajzen & Fishbein, 1980). For example, shifting anglers' attitudes in favor of resource protection might produce changes in the views of influential recreational fishing interest groups. Based on the results of this study, management efforts might focus on the anglers who think with low integrative complexity. This type of thinker held more extreme attitudes supporting resource use and opposing resource protection. Anglers who think with low integrative complexity are expected to be less open or flexible, less willing to listen to other concerns, and less willing to compromise on issues of management relevance. Since a sizeable proportion of anglers in this study exhibited moderately high integrative complexity, managers could work with these anglers to communicate various sides of coastal resource issues with low integrative complexity anglers. Talking with other fishermen or "word-of-mouth" are often the most important channels of information for anglers (Loomis et al., 2008).

Communication with the public involves information processing on their behalf, and this process varies with a person's level of integrative complexity. People have diverse views, needs, goals, or general conceptualizations concerning the meaning and implications of received information. By knowing the level of integrative complexity with which people think about issues, communication can be tailored to their particular cognitive structures and the proper content can be developed for more effective dialogue.

According to Clute (2000), there are implications for framing messages in appropriate contexts and levels of complexity. When an individual is exposed to information at a higher level of complexity than they typically function, they will often simplify the input and revert back to their preferred level of integrative complexity (Hunsberger et al., 1992). Recognizing that individuals with varying levels of integrative complexity process and think about information differently enables management to interact with audiences more appropriately. The application of integrative complexity in coastal resources management can aid in communication by first assessing at which levels of complexity individuals are functioning, and then by focusing on information dissemination at or near the appropriate level of detail and complexity to correspond to specific audiences who may or may not think in an integratively complex way about an issue.

Communication models, such as the Elaboration Likelihood Model (Petty & Cacioppo, 1986), are connected to integrative complexity and can provide further guidance in more effective communication and outreach. The Elaboration Likelihood Model suggests that people differ in how carefully and extensively they think about a message and the position or behavior it is advocating. Using either a "central route" (education) or a "peripheral route" to persuasion, various information sources may be used to influence attitudes of certain groups, or behavior. For audiences who think about an issue with low integrative complexity, communication attempts with a goal of persuasion toward a viewpoint, such as garnering support for management policies, emphasizing values underlying those policies may be most effective. A different communication approach, with a greater level of complexity, may be necessary when managers need to accurately and effectively provide information about the consequences of policy implementation (Gruenfeld et al., 1998).

Interdisciplinarity. Integrative complexity is also important on management's behalf, who must address the public's diversity. Removing the blindfolds and barriers to interdisciplinary collaboration will help to broaden the range of investigation, bringing with it new insights and innovative ways of seeing. This was acknowledged by Cortner and Moote (1999), who cautioned that while ecosystem-based management calls for adaptive and flexible management, "the values, theories, methodologies, and tools of the old paradigm have not yet been discarded" (p. 51). Yet, twenty years later, integratively complex thinking and an interdisciplinary approach to resource management are still needed across decision-makers, scientists, and institutions, as well as students. In addition to the various challenges, such as conflicting and complex legislative mandates and shifting public values, the next generation of leaders will have to deal with even more challenging issues in the future, such as the consequences of climate change. They must be able to engage with a wide variety of perspectives. They must be able to combine expertise in a discipline, to understand its rigor and depth, with the capacity to reach out to other disciplines and work in interdisciplinary teams. They need to be able to make the connections between the diverse domains of knowledge, which means integrating diverse disciplinary traditions.

9. CONCLUSION

In conclusion, this dissertation research found interesting results and some support for a connection between integrative complexity, value orientations, and attitudes toward coastal resource use and protection. While much of the results showed mixed support for the alternative hypotheses, there were consistent patterns in the direction of value orientations, attitudes and acceptability of tradeoffs across integrative complexity levels. Overall, high integrative complexity anglers demonstrated ecocentric value orientations, more support for protection-oriented management actions, and higher acceptability for tradeoffs involving an increase in resource protection. Low integrative complexity anglers demonstrated relatively more anthropocentric value orientations, more support for use-oriented management actions, and higher acceptability for tradeoffs involving an increase in resource use.

The results of this study question the sharp distinction between the content and structure of thought processes that has been drawn in the integrative complexity literature (e.g., Schroder et al., 1967; Streufert & Streufert, 1978; Suedfeld, 1983). Theorists have emphasized that integrative complexity is not "what" people think but "how" people think. However, this study shows that both content and structure are closely intertwined, and efforts to analyze structure in isolation from content can produce mixed, possibly misleading, conclusions. This research suggests that particular value orientations and attitudes might impact different forms of complexity differently.

The management dilemma of use versus protection is a complex issue, and like most complex issues, it does not lend itself to a simple or simplistic solution. Our society faces a wide range of serious and growing coastal resource issues, such as short- and long-term effects of climate change, sea level rise, natural hazards and storms, or the ongoing demand for use and access to natural resources, development, and energy production. These issues are multidimensional and complex. There is no single underlying reason behind each of these issues, and accordingly, there is no "one simple solution". Rather, there is a broad spectrum of factors, and to address these issues more efficiently requires integrative thinking to incorporate adaptive and innovative approaches to resource management, as well as in research itself. In order to take on this challenge, the "hedgehogs" must start thinking like "foxes".

10. REFERENCES

Abelson, R.P. (1988). Conviction. *American Psychologist*, 43, 267 – 275.

Abelson, R.P., and Levi, A. (1985). Decision making and decision theory. In: *The Handbook of Social Psychology*, Vol. 3. G. Lindsey and E. Aronson (Eds.). New York: Academic Press, Inc.

Agardy, T. (2000). Information needs for marine protected areas: Scientific and societal. *Bulletin of Marine Science*, 66(3), 875 – 888.

Ajzen, I. (2001) Nature and operations of attitudes. *Annual Review of Psychology*, 52, 27-58.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In: J. Kuhl and J. Beckmann, (Eds.), *Action control: From cognition to behavior* (pp. 11-39). Berlin: Springer.

Ajzen, I., and Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Antil, J.H. (1983). Uses of response certainty in attitude measurement. *Advances in Consumer Research*, 10, 409-415.

Arcury, T.A., and Johnson, T.P. (1987). Public environmental knowledge: A statewide survey. *The Journal of Environmental Education*, 18(4), 31 – 37.

Atkinson, J.W. (1957). Motivational determinants of risk-taking behavior. *Psychological Review*, 64, 359 – 372.

Atzmüller, C., and Steiner, P.M. (2010). Experimental vignette studies in survey research. *Methodology*, 6(3), 128 – 138.

Auspurg, K., and Hinz, T. (2015). *Factorial survey experiments*. Series: Quantitative Applications in the Social Sciences, No. 175. Thousand Oaks, CA: Sage Publications.

Austin, J., Carter, J., Klein, B., and Schang, S. (2004). *Judging NEPA: A hard look at judicial decision making under the National Environmental Policy Act.* Environmental Law Institute, Washington D.C.

Axelrod, L. (1994). Balancing personal needs with environmental preservation: Identifying the values that guide decisions in ecological dilemmas. *Journal of Social Issues*, 50(3), 85 – 104.

Babbie, E. (2010). *The Practice of Social Research* (12th ed.). Belmont, CA: Wadsworth Publishing Company.

Baker-Brown, G., Ballard, E., Bluck, S., De Vries, B, Suedfeld, P., and Tetlock, P. (1992). The Conceptual/Integrative Complexity Scoring Manual. In: *Motivation and Personality: Handbook of Thematic Content Analysis*. Charles P. Smith (Ed.). Cambridge University Press: New York, NY.

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., and Turner, R.K. (2002). Economic reasons for conserving wild nature. *Science*, 297, 950 – 953.

Barbier, E.B. (1989). *Economics, natural resources, scarcity and development: Conventional and alternative views*. Earthscan Publications: London.

Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C., and Silliman, B.R. (2011). The value of estuarine and coastal ecosystem services. *Ecological Monographs*, 81(2), 169 – 193.

Barbot, B., Besançon, M., and Lubart, T. (2011). Assessing creativity in the classroom. *The Open Education Journal*, 4(1), 58–66.

Baron, R.M., and Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.

Bassili, J.N. (1996). Meta-judgmental versus operative indexes of psychological attributes: The case of measures of attitude strength. *Journal of Personality and Social Psychology*, 71, 637-653.

Bateman, I.J., Mace, G.M., Fezzi, C., Atkinson, G., and Turner, K. (2011). Economic analysis for ecosystem services. *Environmental Resource Economics*, 48, 177 – 218.

Beisner, B.E., Haydon, D.T., and Cuddington, K. (2003). Alternative stable states in ecology. *Frontiers in Ecology and the Environment*, 1(7), 376 – 382.

Bell, S., and Morse, S. (1999). *Sustainability indicators: Measuring the immeasurable?* Second Edition. Earthscan: Sterling, VA.

Bennett, J., and Adamowicz, V. (2001) Some fundamentals of environmental choice modeling. In: J. Bennett and R. Blamey (Eds.), *The choice modeling approach to environmental valuation*. Massachusetts, Edward Elgar Publishing Limited.

Berlin, I. (1953). *The hedgehog and the fox: An essay on Tolstoy's view of history*. Simon & Schuster: New York.

Berk, R.A., and Fovell, R.G. (1999). Public perceptions of climate change: A 'willingness to pay' assessment. *Climatic Change*, 41, 413 – 446.

Bhat, M.G. (2003). Application of non-market valuation to the Florida Keys marine reserve management. *Environmental Management*, 67, 315-325.

Bieri, J. (1955). Cognitive complexity-simplicity and predictive behavior. *Journal of Abnormal and Social Psychology*, 51, 263-268.

Bieri, J. (1961). Complexity-simplicity as a personality variable in cognitive and preferential behavior. In D.W. Fiske and S.R. Maddi (Eds.) *Functions of varied experience*. Homewood, IL: Irwin.

Bieri, J. (1966). Cognitive complexity and personality development. In O.J. Harvey (Ed.) *Experience, structure, and adaptability*. New York: Springer.

Bloetscher, F., Polsky, C., Bolter, K., Mitsova, D., Garces, K. P., King, R., Carballo, I.C., and Hamilton, K. (2016). Assessing potential impacts of sea level rise on public health and vulnerable populations in southeast Florida and providing a framework to improve outcomes. *Sustainability,* 8(4), 315, 1 – 18.

Bobo, L., and Licari, F.C. (1989). Education and political tolerance testing the effect cognitive sophistication and target group affect. *Public Opinion Quarterly*, 53, 285-308.

Box, G.E.P., Hunter, J.S., and Hunter, W.G. (2005). *Statistics for experimenters: Design, innovation, and discovery* (2nd Edition). New York: Wiley.

Boxall, P.C., Adamowicz, W.L., Swait, J., Williams, J., and Louviere, J. (1996). A comparison of stated preference methods for environmental valuation. *Ecological Economics*,18, 243–253.

Brander, L.M., Van Beukering, P., and Cesar, H.S.J. (2007). The recreational value of coral reefs: A meta-analysis. *Ecological Economics*, 63(1), 209 – 218.

Brent, E., and Granberg, D. (1982). Subjective agreement and the presidential candidates of 1976 and 1980. *Journal of Personality and Social Psychology*, 42, 393 – 403.

Briggs, J.C. (2005). Coral reefs: Conserving the evolutionary sources. *Biological Conservation*, 126, 297 – 305.

Bright, A.D. (1998). Attitude-strength and support of recreation management strategies. *Journal of Leisure Research*, 29(4), 363 – 379.

Bright, A.D., and Barro, S.C. (2000). Integrative complexity and attitudes: A case study of plant and wildlife species protection. *Human Dimensions of Wildlife*, 5(4), 30-47.

Bright, A.D., and Burtz, R. (2006). Creating defensible space in the wildland-urban interface: The influence of values on perceptions and behavior. *Environmental Management*, 37(2), 170−185.

Bright, A.D., and Manfredo, M.J. (1996). A conceptual model of attitudes toward natural resource issues: A case study of wolf reintroduction. *Human Dimensions of Wildlife*, 1, 1 – 21.

Bright, A.D., and Manfredo, M.J. (1995). The quality of attitudinal information regarding natural resource issues: The role of attitude-strength, importance, and information. *Society and Natural Resources*, 8, 399 – 414.

Bright, A.D. and Tarrant, M.A. (2002). Effect of environment-based coursework on the nature of attitudes toward the Endangered Species Act. *The Journal of Environmental Education*, 33(4), 10-19.

Bright, A.D., and Wyche, S. (1998). The effect of enviromnentally-based coursework on perceptions of a natural resource issue. *Proceedings of the Seventh International Symposium on Society and Resource Management*, Columbia, MO. May 27-31, 1998.

Bright, A.D., Vaske, J.J., Kneeshaw, K., and Absher, J.D. (2003). Scale development of wildfire management basic beliefs. In P.J. Jakes (comp.), *Homeowners, communities, and wildfire: Science findings from the national fire plan*. GTR NC-231. St. Paul, MN: USDA Forest Service, North Central Research Station. pp. 18-25.

Brooks, J.J., Warren, R.J., Nelms, M.G., and Tarrant, M.A. (1999). Visitor attitudes toward and knowledge of restored bobcats on Cumberland Island National Seashore, Georgia. *Wildlife Society Bulletin*, 27(4), 1089–1097.

Brundidge, J., Reid, S.A., Choi, S., and Muddiman, A. (2014). The "Deliberative Digital Divide": Opinion leadership and integrative complexity in the U.S. Political Blogosphere. *Political Psychology*, 35(6), 741 – 755.

Bruskotter, J.T., and Fulton, D.C. (2008). Minnesota anglers' fisheries-related value orientations and their stewardship of fish resources. *Human Dimensions of Wildlife*, 13, 207 – 221.

Bryan, H. (1977). Leisure value systems and recreation specialization: The cased of trout fishermen. *Journal of Leisure Research*, 9, 174 – 187.

Buddemeier, R.W, Baker , A.C, Fautin, D.G, Jacobs, J.R. (2004). The adaptive hypothesis of bleaching. In: E. Rosenberg and Y. Loya (Eds.), *Coral health and disease*. Springer-Verlag: Berlin, Germany.

Burtz, R.T., and Bright, A.D. (2007). Integrative complexity and attitudes toward fire management in the wildland urban interface. *Journal of Park and Recreation Administration*, 25(4), 99 – 116.

Butler, M.J., Hunt, J.H., Herrnkind, W.F., Childress, M.J., Bertelsen, R., Sharp, W., Matthews, T., Field, J.M., and Marshall, H.G. (1995). Cascading disturbances in Florida bay, USA: Cyanobacteria blooms, sponge mortality, and implications for juvenile spiny lobsters *Panulirus argus*. *Marine Ecology Progress Series*, 129, 119-125.

Caddy, J.F. (1999). Fisheries management in the twenty-first century: Will new paradigms apply? *Reviews in Fish Biology and Fisheries*, 9, 1 – 43.

Cameron, L.D., Brown, P.M., and Chapman, J.G. (1998). Social value orientations and decisions to take proenvironmental action. *Journal of Applied Social Psychology*, 28(8), 675 – 697.

Campbell, A., Kapos, V., Scharlemann, J., Bubb, P., Chenery, A., Coad, L., Dickson, B., Doswald, N., Khan, M.S.I., Kershaw, F. , and Rashid, M. (2009) Review of the literature on the links between biodiversity and climate change: impacts, adaptation and mitigation. Secretariat of the Convention on Biological Diversity. Technical Series No.42, 124pp.

Carroll, J., and Bright, A. (2009). The integrative complexity of wildfire management scale: Are we there yet? *Human Ecology Forum: Essays, Commentaries and Applications*, 16(2), 211 – 221.

Carroll, J. and Bright, A. (2010). Integrative complexity of wildfire management: Development of a scale. *Journal of Applied Social Psychology*, 40(2): 344-359.

Ceci, S.J., and Liker, J.K. (1986). A day at the races: A study of IQ, expertise, and cognitive complexity. *Journal of Experimental Psychology: General*, 115, 255-266.

Chaffee, S.H. (1986). Mass media and interpersonal channels: Competitive, convergent, or complementary? In G. Gumpert and R. Cathcart (Eds.), Intermedia (3rd ed., pp. 62-80). New York, NY: Oxford University Press.

Chagaris, D., Mahmoudi, B., and Murphy, M. (2015). The 2015 stock assessment of red drum, Sciaenops ocellatus, in Florida, IHR2015-003. Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL.

Chasis, S. (1985). The Coastal Zone Management Act: A protective mandate. *Natural Resources Journal*, 25(1), 21 – 30.

Chan, K.M.A., Shaw, M.R., Cameron, D.R., Underwood, E.C., and Daily, G.C. (2006). Conservation planning for ecosystem services. *PLoS Biology*, 4(11), e379.

Cheng, S.W., and Wu, C.F.J. (2002). Choice of optimal blocking schemes in two-level and three-level fractional factorial designs. *Technometrics*, 44, 269 – 277.

Clute, K. (2000). A perspective from wildland communicators: Communicators Guide. The National Interagency Fire Center and the National Wildfire Coordinating Group.

Cochran, W.G., and Cox, G.M. (1957). *Experimental designs*, Second Edition. New York, NY: John Wiley and Sons, Inc.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Second Edition. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Cohen, J. (1992). Quantitative methods in psychology: A power primer. *Psychological Bulletin*, 112(1), 155-159.

Cohen, J., Cohen, P., West, S.G., and Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (Third ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Connor, W.S., and Zelen, M. (1959). *Fractional factorial experiment designs for factors at three levels*. National Bureau of Standards Applied Mathematics Series 54. U.S. Government Printing Office, Washington D.C.

Conway, L.G., III, Conway, K.R., Gornick, L.J., and Houck, S.C. (2014). Automated integrative complexity. *Political Psychology*, 35, 603–624.

Conway, L.G., III, Gornick, L.J., Burfeind, C., Mandella, P., Kuenzli, A., Houck, S.C., and Fullerton, D.T. (2012). Does complex or simple rhetoric win elections? An integrative complexity analysis of U.S. presidential campaigns. *Political Psychology*, 33(5), 599 – 618.

Conway, L.G., III, Thoemmes, F., Allison, A.M., Hands Towgood, K., Wagner, M.J., Davey, K., Salcido, A., Stovall, A.N., Dodds, D.P., Bongard, K., and Conway, K.R. (2008). Two ways to be complex and why they matter: Implications for attitude strength and lying. *Journal of Personality and Social Psychology*, 95, 1029–1044.

Conway, L.H., III, Schaller, M., Tweed, R.G., and Hallett, D. (2001). The complexity of thinking across cultures: Interactions between culture and situational context. *Social Cognition*, 19, 230-253.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78, 98-104.

Cortner, H., and Moote, M.A. (1999). *The politics of ecosystem management*. Washington D.C.: Island Press, pp. 179.

Costanza, R., and Farley, J. (2007). Ecological economics of coastal disasters: Introduction to the special Issue. *Ecological Economics*, 63(2-3), 249-253.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Naeem, S., Limburg, K., Paruelo, J., O'Neill, R.V., Raskin, R., Sutton, P., and van den Belt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature*, 387, 253–260.

Costanza, R., Farber, S.C., and Maxwell, J. (1989). Valuation and management of wetlands. *Ecological Economics*, 1, 335 – 361.

Crockett, W.H. (1965). Cognitive complexity and impression formation. In B. A. Maher (II Ed.). *Progress in experimental personality research.* New York: Academic Press, pp. 47 – 90.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16, 297-334.

Cronbach, L.J., and Shavelson, R.J. (2004). My current thoughts on coefficient alpha and successor procedures. *Educational and Psychological Measurement*, 64(3), 391 – 418

Crowne, D.P., and Marlowe, D. (1964). *The approval motive*. New York: John Wiley & Sons.

Czaja, M.R., Bright, A.D., and Cottrell, S.P. (2016). Integrative complexity, beliefs, and attitudes: Application to prescribed fire. *Forest Policy and Economics*, 62, 54 – 61.

Dahl, C. (1997). Integrated coastal resources management and community participation in a small island setting. *Ocean and Coastal Management*, 36, 23 – 45.

Daily, G.C., and Matson, P.A. (2008). Ecosystem services: From theory to implementation. *Proceedings of the National Academy of Sciences*, 105(28), 9455 – 9456.

Daily, G.C., Söderqvist, T., Aniyar, S., Arrow, K., Dasgupta, P., Ehrlich, P.R., Folke, C., Jansson, A., Jansson, B., Kautsky, N., Levin, S., Lubchenco, J., Mäler, K., Simpson, D., Starrett, D., Tilman, D., and Walker, B. (2000). The value of nature and the nature of value. *Science*, 289, 395–96.

Daily, G.C., Polasky, S., Goldstein, J., Kareiva, P.M., Mooney, H.A., Pejchar, L., Ricketts, T.H., Salzman, J., and Shallenberger, R. (2009). Ecosystem services in decision making: time to deliver. *Frontiers in Ecology and the Environment* , 7(1), 21 – 28.

Davidson, P., Wood, S., and Griffin, R. (2009). *Management: Core concepts and applications*. John Wiley and Sons, Australia.

Daw, T., Brown, K., Rosendio, S., and Pomeroy, R. (2011). Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being. *Environmental Conservation*, 38, 370-379.

Dawes, R.M., and Corrigan, B. (1974). Linear models in decision making. *Psychological Bulletin*, 81(2), 95 – 106.

Dawes, C.J., Phillips, R.C., and Morrison, G. (2004). Seagrass communities of the Gulf Coast of Florida: Status and ecology. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute and the Tampa Bay Estuary Program. St. Petersburg, FL. iv + 74 pp.

De Dreu, C.K.W., Baas, M., and Nijstad, B.A. (2008). Hedonic tone and activation level in the mood-creativity link: Toward a dual pathway to creativity model. *Journal of Personality and Social Psychology*, 94, 739–756.

De Groot, R.S., Brander, L., van der Ploeg, S., Costanza, R., Bernard, F., Braat, L., Christie, M., Crossman, N., Ghermandi, A., Hein, L., Hussain, S., Kumar, P., McVittie, A., Portela, R., Rodriguez, L.C., ten Brink, P., and van Beukering, P. (2012). Global estimates of the value of ecosystems and their services in monetary units. *Ecosystem Services*, 1, 50–61.

De Vries, B., and Walker, L.J. (1987). Conceptual/integrative complexity and attitudes toward capital punishment. *Personality and Social Psychology Bulletin*, 13(4), 448 – 457.

De Young, R. (2000). Expanding and evaluating motives for environmentally responsible behavior. *Journal of Social Issues*, 56, 509 – 526.

Delia, J.G., Clark, R.A., and Switzer, D.E. (1974). Cognitive complexity and impression formation in informal social interaction. *Speech Monographs*, 41(4), 299 – 308.

Dennis, D.F. (1998). Analyzing public inputs to multiple objective decisions on National Forests using conjoint analysis. *Forest Science*, 24(3), 421-429.

Deutsch, M. (1975). Equity, equality, and need: What determines which value will be used as the basis of distributive justice. *The Journal of Social Issues*, 31(3), 137 – 149.

Dietz, T., Rosa, E.A., and York, R. (2007). Driving the human ecological footprint. *Frontiers in Ecology and the Environment,* 5(1), 13-18.

Dillman, D.A. (1978). *Mail and telephone surveys: The total design method*. New York, NY: John Wiley & Sons.

Dillman, D.A. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York, NY: John Wiley & Sons.

Dillman, D.A., and Frey, J.H. (1974). Contribution of personalization to mail questionnaire response as an element of a previously tested method. *Journal of Applied Psychology*, 59, 297 – 301.

Dillon, M. (1993). Argumentative complexity of the abortion discourse. *Public Opinion Quarterly*, 57, 305-314.

Ditto, P.H., and Lopez, D.F. (1992). Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of Personality and Social Psychology*, 63(4), 568 – 584.

Ditton, R.B., Loomis, D.K., and Choi, S. (1992). Recreation specialization: Re-conceptualization from a social worlds perspective. *Journal of Leisure Research*, 24, 33 – 51.

DOC (Department of Commerce). (1996). Florida Keys National Marine Sanctuary: Final management plan/environmental impact statement, Vol. 1. Sanctuaries and Reserves Division, National Oceanic and Atmospheric Administration. 319 p.

Donahue, S., Acosta, A., Akins, L., Ault, J., Bohnsack, J., et al., (2008). The state of coral reef ecosystems of the Florida Keys. In: Waddell, J.E., Clarke, A.M. (Eds.), The State of Coral Reef Ecosystems of the US and Pacific Freely Associated States: 2008. NOAA Technical Memorandum NOS NCCOS 73. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD, pp. 161e188, pp. 569.

Dore, M.H.I., and Webb, D. (2003). Valuing biodiversity: reality or mirage? *Environmental Monitoring and Assessment*, 86, 91–104.

Douglas, N.L. (2000). Enemies of critical thinking: Lessons from social psychology research. *Reading Psychology,* 21, 129 – 144.

Downing, J.W., Judd, C.M., and Brauer, M. (1992). Effects of repeated expressions on attitude extremity. *Journal of Personality and Social Psychology,* 63(1), 17-29.

Driver, M.J., and Streufert, S. (1969). Integrative complexity: An approach to individuals and groups as information-processing systems. *Administrative Science Quarterly*, 14(2), 272-285.

Dülmer, H. (2007). Experimental plans in factorial surveys: Random or Quota Design?. *Sociological Methods and Research*, 35(3), 382-409.

Dunlap, R.E., and McCright, A.M. (2008). A widening gap: Republican and Democratic views on climate change. *Environment*, 50(5), 26 – 35.

Dunlap, R., and Van Liere, K.D. (1978). The "new environmental paradigm": A proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9, 10-19.

Dunlap, R., and Van Liere, K.D. (1984). Commitment to the dominant social paradigm and concern for environmental quality. *Social Science Quarterly*, 65, 1013 – 1028.

Dunlap, R., Van Liere, K.D., Mertig, A.G., and Jones, R.E. (2000). Measuring endorsement of the New Ecological Paradigm: A revised NEP scale. *Journal of Social Issues*, 56, 425-442.

Eagly A., and Chaiken, S. (1993). *The Psychology of Attitudes*. Fort Worth, TX: Harcourt Brace.

Eagly, A.H., and Kulesa,P. (1997). Attitudes, attitude structure, and resistance to change. In *Environment, ethics, and behavior: the psychology of environmental valuation and degradation*. Bazerton, M.H. Lexington Books.

Easterbrook, J.A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66(3), 183 – 201.

Eccles, J.S., and Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, 53, 109 – 132.

Ehrhardt, N.M., Puga, R., and Butler, M.J., IV. (2010). Large ecosystem dynamics and fishery management concepts: the Caribbean spiny lobster, *Panulirus argus*, fisheries. In: L. Fanning, R. Mahon, and P.McConney (Eds.), *Towards marine ecosystem-based management in the wider Caribbean*. (pp. 157–175). Amsterdam University Press, Amsterdam, the Netherlands.

Einhorn, H.J., and Hogarth, R.M. (1981). Behavioral decision theory: Processes of judgment and choice. *Annual Review of Psychology*, 32, 53–88.

Enck, J.W., and Brown, T.L. (2002). New Yorkers' attitudes toward restoring wolves to the Adirondack Park. *Wildlife Society Bulletin*, 30(1), 16–28.

Ettlie, J. E., Groves, K.S., Vance, C.M., and Hess, G.L. (2014). Cognitive style and innovation in organizations. *European Journal of Innovation Management*, 17(3), 311 – 326.

Farber, S.C., Costanza, R., and Wilson, M.A. (2002). Economic and ecological concepts for valuing ecosystem services. *Ecological Economics*, 41, 375 – 392.

Farber, S., Costanza, R., Childers, D. L., Erickson, J., Griss, K., Grove, M., Hopkinson, C.S., Kahn, J., Pincetl, S., Troy, A., Warren, P., and Wilson, M. (2006). Linking ecology and economics for ecosystem management. *Bioscience*, 56(2), 121-133.

Faunce, C.H., and Serafy, J.E. (2006). Mangroves as fish habitat: 50 years of field studies. *Marine Ecology Progress Series*, 318, 1–18.

Fazio, R.H. (1986). How do attitudes guide behavior? In: R.M. Sorrentino and E.T. Higgins (Eds.), *Handbook of motivation and cognition* (Vol. 1, pp. 204–243). New York: Guilford Press.

Feather, N.T. (1995). Values, valences, and choice: The influence of values on the perceived attractiveness and choice of alternatives. *Journal of Personality and Social Psychology*, 68(6), 1135 – 1151.

Feist, G.J. (1994). Personality and working style predictors of integrative complexity: A study of scientists' thinking about research and teaching. *Journal of Personality and Social Psychology*, 67(3), 474 – 484.

Ferdie, M., and Fourqurean, J.W. (2004). Differential responses of benthic primary producers to nitrogen and phosphorus enrichment in a carbonate coastal marine system. *Limnology and Oceanography*, 49(6), 2082-2094.

Festinger, L. (1964). *Conflict, decision, and dissonance (Vol. 3)*. Stanford University Press.

Feygina, I., Jost, J.T., Goldsmith, R.E. (2010). System justification, the denial of global warming, and the possibility of system-sanctioned change. *Personality and Social Psychology Bulletin*, 36, 326–338.

Fishbein, M., and Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Fisher, S.H., and Herrick, R. (2012). Old versus new: The comparative efficiency of mail and internet surveys of state legislators. *State Politics and Policy Quarterly*, 13(2), 147-163.

Fiske, S. (1992). Sociocultural aspects of establishing marine protected areas. *Ocean and Coastal Management*, 17(1), 25 – 46.

Fiske, S.T., and Taylor, S.E. (1991). *Social cognition* (2nd Edition). New York: McGraw-Hill.

Fletcher, K.M. and Wallace, R.K. (2001). Understanding fisheries management: A manual for understanding the federal fisheries management process, including analysis of the 1996 Sustainable Fisheries Act. 2nd edition. Mississippi-Alabama Sea Grant Consortium, Publication 00-005.

Florida Department of Environmental Protection. (2017). Accessed at https://floridadep.gov/fco/coastal-access-guide.

Fourqurean, J.W., and Robblee, M.B. (1999). Florida Bay—a history of recent ecological changes. *Estuaries*, 22, 345–357.

Fox, J. (2008). *Applied regression analysis and generalized linear models* (2nd Edition). Thousand Oaks, CA: Sage.

Frankhauser, S., Smith, J.B., and Tol, R.S.J. (1998). *Weathering climate change: Some simple rules to guide adaptation decisions*, Vol. D98/01. Amsterdam: Institute for Environmental Studies, Vrije Universiteit.

Fulton, D.C., Manfredo, M.J., and Lipscomb, J. (1996) Wildlife value orientations: A conceptual and measurement approach. *Human Dimensions of Wildlife*, 1(2), 24 – 47.

Gan, C., and Luzar, E.J. (1993). A conjoint analysis of waterfowl hunting in Louisiana. *Journal of Agricultural and Applied Economics*, 25(2), 36-45.

Gardner, R.W. (1953). Cognitive styles in categorizing behavior. *Journal of Personality*, 22, 214 – 233.

Garland, D.R. (1981). Training married couples in listening skills: Effects on behavior, perceptual accuracy, and marital adjustment. *Family Relations*, 30, 297–307.

Gärling, T. (1999). Value priorities, social value orientations and cooperation in social dilemmas. *British Journal of Social Psychology*, 38, 397 – 408.

Gärling, T., Gärling, A., Fujii, S., and Bergstad, C.J. (2003). Moderating effects of social value orientation on determinants of proenvironmental behavior intention. *Journal of Environmental Psychology*, 23, 1 – 9.

Gigerenzer, G. (2004). Mindless statistics. *Journal of Socio-Economics*, 33, 587 – 606.

Gigliotti, L.M. (1990). Environmental education: what went wrong? What can be done? *The Journal of Environmental Education*, 22(1): 9-12.

Glock, C.Y., Wuthnow, R., Piliavin, J.A., and Spencer, M. (1975). *Adolescent prejudice*. Harper & Row: New York.

Goldsmith, R.E. (1985). Adaption-Innovation and cognitive complexity. *The Journal of Psychology: Interdisciplinary and Applied*, 119(5), 461 – 467.

Goldstein, J.H., Daily, G.C., Friday, J.B., Matson, P.A., Naylor, R.L., and Vitousek, P. (2006). Business strategies for conservation on private lands: Koa forestry as a case study. *Proceedings of the National Academy of Sciences*, 103, 10140 – 10145.

Goyder, J. (1987). *The silent minority*. Boulder, CO: Westview Press.

Green, P.E. (1974). On the design of choice experiments involving multifactor alternatives. *Journal of Consumer Research*, 1(2), 61 – 68.

Gregoire, T., and Driver, B. (1987). Type II errors in leisure research. *Journal of Leisure Research*, 19(4), 261-272.

Gross, S.R., Holtz, R., and Miller, N. (1995). Attitude certainty. In R.E. Petty and J.A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 215-246). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Groves, R.M., Cialdini, R.B., and Couper, M.P. (1992). Understanding the decision to participate in a survey. *Public Opinion Quarterly*, 56(4), 475-495.

Groves, R.M., Couper, M.P., Presser, S., Singer, E., Tourangeau, R., Acosta, G.P., and Nelson, L. (2006). Experiments in producing nonresponse bias. *Public Opinion Quarterly*, 70(5), 720-736.

Gruenfeld, D.H. (1995). Status, ideology, and integrative complexity on the U.S. Supreme Court: Rethinking the politics of political decision making. *Journal of Personality and Social Psychology*, 68, 5-20.

Gruenfeld, D.H., and Preston, J. (2000). Upending the status quo: Cognitive complexity in Supreme Court justices who overturn legal precedent. *Personality and Social Psychology Bulletin*, 26(8), 1013–1022.

Gruenfeld, D.H., Thomas-Hunt, M.C., and Kim, P.H. (1998). Cognitive flexibility, communication strategy, and integrative complexity in groups: public versus private reactions to majority and minority status. *Journal of Experimental Social Psychology*, 34(2): 202-226.

Guilford, J.P. (1956). The structure of intellect. *Psychological Bulletin*, 53(4), 267 – 293.

Guterbock, T.M., Meekins, B.J., Weaver, A.C., and Fries, J.C. (2000). Web versus paper: A mode experiment in a survey of university computing. Paper presented at the Annual Meeting of the American Association for Public Opinion Research, August 2000, Portland, OR.

Guttieri, K., Wallace, M.D., and Suedfeld, P. (1995). The integrative complexity of American decision makers in the Cuban Missile Crisis. *The Journal of Conflict Resolution*, 39(4), 595 – 621.

Hair, J.F., Black, W.C., Babin, B.J., and Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Upper Saddle River, NJ: Prentice Hall.

Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3859), 1243 – 1248.

Harvey, O.J., Hunt, D.E., and Schroder, H.M. (1961). *Conceptual systems and personality organization*. New York: John Wiley & Sons, Inc.

Hawkins, C. (2011). *Finding blame for environmental outcomes: A cognitive style approach to understanding stakeholder attributions, attitudes, and values* (Doctoral dissertation). Retrieved from ProQuest Database. (Accession No. 910869588).

Heberlein, T.A., and Baumgartner, R. (1978). Factors affecting response rates to mailed questionnaires: A quantitative analysis of the published literature. *American Sociological Review*, 43, 447-62.

Heerwegh, D., Vanhove, T., Matthijs, K., and Loosveldt, G. (2005). The effect of personalization on response rates and data quality in web surveys. *International Journal of Social Research Methodology: Theory and Practice*, 8, 85 – 99.

Hicks, C.C., McClanahan, T.R., Cinner, J.E., and Hills, J.M. (2009). Trade-offs in values assigned to ecological goods and services associated with different coral reef management strategies. *Ecology and Society*, 14(10).

High, R. (2000). Important factors in designing statistical power analysis studies. *Computing News*, Summer issue, 14 – 15.

Himes, A. (2007). Performance indicators in MPA management: using questionnaires to analyze stakeholder preferences. *Ocean and Coastal Management*,50, 329–351.

Hirsch, P.D., Adams, W.M., Brosius, J.P., Zia, A., Bariola, N., and Dammert, J.L. (2011). Acknowledging conservation trade-offs and embracing complexity. *Conservation Biology*, 25(2), 259 – 264.

Hockey, G.R.J., and Hamilton, P.A. (1983). The cognitive patterning of stress states. In: G.R.J. Hockey (Ed.), *Stress and fatigue in human performance* (pp. 331 – 361). New York: Wiley and Sons, Inc.

Hoffman, L.H., and Rovine, M.J. (2007). Multilevel models for the experimental psychologist: Foundations and illustrative examples. *Behavior Research Methods*, 39(1), 101 – 117.

Hoffman, L.H., and Slater, M.D. (2007). Evaluating public discourse in newspaper opinion articles: Values-framing and integrative complexity in substance and health policy issues. *Journalism and Mass Communication Quarterly*, 84(1), 58 – 74.

Holland, D.S. (2000). A bioeconomic model of marine sanctuaries on Georges Bank. *Canadian Journal of Fisheries and Aquatic Science*, 57, 1307 – 1319.

Holling, C.S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4, 1 – 23.

Holling, C.S., and Meffe, G.K. (1996). Command and control and the pathology of natural resource management. *Conservation Biology*, 10, 328 – 337.

Hoonakker, P., and Carayon, P. (2009). Questionnaire survey nonresponse: A comparison of postal mail and internet surveys. *International Journal of Human-Computer Interaction*, 25(5), 348-373.

Houck, S.C., Conway, L.G., and Gornick, L.J. (2014). Automated integrative complexity: Current challenges and future directions. *Political Psychology*, 35(5), 647 – 659.

Hovland, C.I. (1959). Reconciling conflicting results derived from experimental and survey studies of attitude change. *American Psychologist*, 14(1), 8 – 17.

Howard, J.A., and Sheth, J.N. (1969). *The theory of buyer behavior*. New York: Wiley and Sons, Inc.

Hox, J.J., Kreft, I.G.G., and Hermkens, P.L.J. (1991). The analysis of factorial surveys. *Sociological Methods and Research*, 19(4), 493 – 510.

Hughes, R., and Huby, M. (2004). The construction and interpretation of vignettes in social research. *Social Work & Social Sciences Review*, 11(1), 36-51.

Hughes, T.P., Baird, A.H., Bellwood, D.R., Card, M., Connolly, S.R., Folke, C., Grosberg, R., Hoegh-Guldberg, O., Jackson, J.B.C., Kleypas, J., Lough, J.M., Marshall, P., Nyström, M., Palumbi, S.R., Pandolfi, J.M., Rosen, B., and Roughgarden, J. (2003). Climate change, human impacts, and the resilience of coral reefs. *Science*, 301, 929-933.

Hunsberger, B., Lea, J., Pancer, S.M., Pratt, M., and McKenzie, and M.W. (1992). Making life complicated: Prompting the use of integratively complex thinking in religious, social and moral domains. *Journal of Personality*, 60(1), 95-114.

Hyman, H.H., and Sheatsley, P.B. (1947). Some reasons why information campaigns fail. *Public Opinion Quarterly*, 11(3), 412 – 423.

Jacques, P.J., Dunlap, R.E., and Freeman, M. (2008). The organization of denial: Conservative think tanks and environmental scepticism. *Environmental Politics*, 17, 349-385.

Jamieson, G.S., and Levings, C.O. (2001). Marine protected areas in Canada – implications for both conservation and fisheries management. *Canadian Journal of Fisheries and Aquatic Science*, 58, 138 – 156.

Janis, I.L. (1989). *Crucial decisions: Leadership in policy making and crisis management*. New York: Free Press.

Janis, I.L., and Mann, L. (1979). *Decision making: A psychological analysis of conflict, choice, and commitment.* New York: The Free Press, a division of Macmillan Inc.

Jervis, R. (1976). *Perception and misperception in international politics*. Princeton University Press: Princeton, NJ.

Johns, G., Leeworthy, V.R., Bell, F.W., and Bonn, M.A. (2001). Socioeconomic Study of Reefs in Southwest Florida. Report prepared for Broward County, Palm Beach County, Miami-Dade County, Monroe County, Florida Fish and Wildlife and Conservation Commission: Hazen and Sawyer.

Johnson, C.J. (2013). Identifying ecological thresholds for regulating human activity: Effective conservation or wishful thinking? *Biological Conservation*, 168, 57 – 65.

Joireman, J.A., Lasane, T.P., Bennett, J., Richards, D., and Solaimani, S. (2001). Integrating social value orientation and the consideration of future consequences within the extended norm activation model of proenvironmental Behavior. *British Journal of Social Psychology*, 40, 133-155.

Joireman, J.A., Van Lange, P.A.M., Kuhlman, D.M., Van Vugt, M., and Shelley, G.P. (1997). An interdependence analysis of commuting decisions. *European Journal of Social Psychology*, 27, 441-463.

Judd, C.M., and Krosnick, J.A. (1989). The structural bases of consistency among political attitudes: Effects of political expertise and attitude importance. In A.R. Pratkanis, S.J. Breckler, and A.G. Greenwald (Eds.), *Attitude structure and function* (pp. 99-128). Hillsdale, NJ: Erlbaum.

Judd, C.M., and Lusk, C.M. (1984). Knowledge structures and evaluative judgments: Effects of structural variables on judgmental extremity. *Journal of Personality and Social Psychology*, 46(6), 1193 – 1207.

Kagan, J., Moss, H.A., and Sigel, I.E. (1963). Psychological significance of styles of conceptualization. *Monographs of the Society for Research in Child Development*, 28(2), 73-112.

Kaplan, K.J. (1972). On the ambivalence–indifference problem in attitude theory and measurement: A suggested modification of the semantic differential technique. *Psychological Bulletin*, 77, 361–372.

Kelble, C.R., Loomis, D.K., Lovelace, S., Nuttle, W.K., Ortner, P.B., Fletcher, P., Cook, G.S., Lorenz, J.J., and Boyer, J.N. (2013). The EBM-DPSER conceptual model: Integrating ecosystem services into the DPSIR framework. *PLoS ONE*, 8(8), e70766.

Keller, B.D., Gleason, D.F., McLeod, E., Woodley, C.M., Airame, S., Causey, B.D., Friedlander, A.M., and Steneck, R.S. (2009). Climate change, coral reef ecosystems, and management options for marine protected areas. *Environmental Management*, 44(6), 1069 – 1088.

Kelly, G.A. (1955). *The psychology of personal constructs*. Norton, New York.

Kempthorne, O. (1952). *The design and analysis of experiments*. New York, NY: John Wiley and Sons.

Kennedy, J.J., and Thomas, J.W. (1995). Managing natural resources as social value. In R.L. Knight and S.F. Bates (Eds.), *A New Century for Natural Resources Management.* Washington D.C.: Island Press.

Kim, K.H. (2006). Can we trust creativity tests? A review of the torrance tests of creative thinking (TTCT). *Creativity Research Journal*, 18(1), 3 – 14.

Kim, J.N., and Grunig, J.E. (2011). Problem solving and communicative action: A situational theory of problem solving. *Journal of Communication*, 61, 120–149.

Kirk, R.E. (1982). *Experimental design: Procedures for the behavioral sciences*. Monterey, CA: Brooks/Cole Pub. Co.

Kloo, D., Perner, J., Aichhorn M., Schmidhuber, N. (2010). Perspective taking and cognitive flexibility in the dimensional change card sorting (DCCS) task. *Cognitive Development*, 25, 208–217.

Koo, J., and Han, J. (2007). Integrative complexity in correspondence. *Journal of Pacific Rim Psychology*, 1(2), 60 – 69.

Koval, M.H., and Mertig, A.G. (2004). Attitudes of the Michigan public and wildlife agency personnel toward lethal wildlife management. *Wildlife Society Bulletin*, 32, 232–243.

Kramer, R.M., McClintock, C.G., and Messick, D. M. (1986). Social values and cooperative response to a simulated resource conservation crisis. *Journal of Personality*, 54, 576-592.

Kristiansen, C.M., and Matheson, K. (1990). Value conflict, value justification, and attitudes toward nuclear weapons. *The Journal of Social Psychology*, 130(5), 665 – 675.

Krosnick, J.A. (1988). Attitude importance and attitude change. *Journal of Experimental Social Psychology*, 24, 240 – 255.

Krosnick, J.A. (1990). Government policy and citizen passion: A study of issue publics in contemporary America. *Political Behavior*, 12, 59 – 92.

Krosnick, J.A., and Abelson, R.P. (1992). The case for measuring attitude strength in surveys. In J. Tanur (Ed.), *Questions about survey questions* (pp. 177-203). New York: Russell Sage.

Krosnick, J.A., and Alwin, D.F. (1987). An evaluation of a cognitive theory of response-order effects in survey measurement. *Public Opinion Quarterly*, 51(2), 201–219.

Krosnick, J.A., Boninger, D.S., Chuang, Y.C., Berent, M.K., and Carnot, C.G. (1993). Attitude strength: One construct or many related constructs? *Journal of Personality and Social Psychology*, 65, 1132-1151.

Kruczynski, W.L., and McManus, F. (2002). Water quality concerns in the Florida Keys: sources, effects, and solutions. In: J.W. Porter and K.G. Porter (Eds.), *The Everglades, Florida Bay, and coral reefs of the Florida Keys: An ecosystem sourcebook* (pp. 827-881). CRC Press, Boca Raton, FL.

Kruglanski, A.W. (1980). Lay epistemologic process and contents: Another look at attribution theory. *Psychological Review*, 16, 275 – 297.

Kruglanski, A.W. (1990). Motivations for judging and knowing: Implications for causal attribution. In: E.T. Higgins and R.M. Sorrentino (Eds.), *The handbook of motivation and cognition: Foundation of social behavior*. Vol. 2 (pp. 333 - 368). New York: Guilford.

Kruczynski, W.L., and McManus, F. (2002). Water quality concerns in the Florida Keys: sources, effects, and solutions. In Porter, J.W., and Porter, K.G. (Eds.), *The Everglades, Florida Bay, and coral reefs of the Florida Keys: an ecosystem sourcebook*. Boca Raton, FL: CRC Press, p. 827–881.

Kruglanski, A.W., and Webster, D.M. (1996). Motivated closing of the mind: Seizing and freezing. *Psychological Review*, 103, 263-283.

Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: A literature review. *Quality & Quantity*, 47(4), 57 – 69.

Kuhlthau, C. (2004). *Seeking meaning: a process approach to library and information services*. London: Libraries Unlimited.

Lachapelle, P.R., McCool, S.F., Patterson, M.E., (2003). Barriers to effective natural resource planning in a messy world. *Society and Natural Resources*, 16, 473 – 490.

Lapointe, B.E., Tomasko, D.A., and Matzie, W.R. (1994). Eutrophication and trophic state classification of seagrass communities in the Florida Keys. *Bulletin of Marine Science*, 54(3), 696–717.

Lawson, S., and Manning, R. (2003). Research to inform management of wilderness camping at Isle Royale National Park: Part II – prescriptive research. *Journal of Park and Recreation Administration*, 21(3), 43–56

Lee, M.E., and Miller, R. (2003). Managing elk in the wildland-urban interface: Attitudes of Flagstaff, Arizona. *Wildlife Society Bulletin*, 31(1), 185–191.

Lee, F., and Peterson, C. (1997). Content analysis of archival data. *Journal of Consulting and Clinical Psychology*, 65, 959-969.

Leeworthy, V.R., and Ehler, R. (2010). Linking the economy and the environment of Florida Keys/Key West: Economic contribution of recreating visitors to the Florida Keys/Key West 2007-08. Washington, DC: Office of National Marine Sanctuaries, National Ocean Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Leeworthy, V.R., and Morris, F.C. (2010). A socioeconomic analysis of the recreation activities of Monroe County residents in the Florida Keys/Key West 2008. Silver Spring, MD: Office of National Marine Sanctuaries, National Ocean Service, National Oceanic and Atmospheric Administration.

Leeworthy, V.R., Wiley, P.C., and Hospital, J. (2004). Importance-satisfaction ratings five-year comparison, SPA & ER use, and socioeconomic and ecological monitoring comparison of results 1995-96 to 2000-01. Silver Spring, MD: National Oceanic and Atmospheric Administration, National Ocean Service, Office of Management and Budget, Special Projects Division.

Leeworthy, V.R., Loomis, D.K., and Paterson, S.K. (2010). Linking the economy and environment of the Florida Keys/Key West: Visitor profiles—Florida Keys/Key West 2007-08. National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries (available at http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/full_visitor_08.pdf), 196 pp.

Leiserowitz, A.A. (2006). Climate change risk perception and policy preferences: the role of affect, imagery, and values. *Climate Change*, 77, 45–72.

Leiserowitz, A.A., Maibach, E.W., Roser-Renouf, C., and Hmielowski, J.D. (2011). *Politics and global warming: Democrats, Republicans, Independents, & the Tea Party*. New Haven, CT: Yale Project on Climate Change Communication.

Lertzman, K. (2009). The paradigm of management, management systems, and resource stewardship. *Journal of Ethnobiology*, 29, 339 – 358.

Lewis, R.R. (2000). Ecologically based goal setting in mangrove forest and tidal marsh restoration in Florida. *Ecological Engineering*, 15(3-4), 191-198.

Liebrand, W.B.G. (1984). The effects of social motives, communication, and group size on behavior in an N-person multi-stage mixed-motive-game. *European Journal of Social Psychology*, 14, 239–264.

Linder, C., and Marshall, D. (2003). Reflection and phenomenography: towards theoretical and Educational development possibilities. *Learning and Instruction*, 13, 271–284.

Linville, P.W. (1982). The complexity-extremity effect and age-based stereotyping. *Journal of Personality and Social Psychology*, 42(2), 193 – 211.

Lirman, D., Schopmeyer, S., Galvan, V., Drury, C., Baker, A.C., and Baums, I. (2014). Growth dynamics of the threatened Caribbean staghorn coral *Acropora cervicornis*: Influence of host genotype, symbiont identity, colony size, and environmental setting. *PLoS ONE*, 9(9), e107253.

Liu, Y. and Ginther, D. (2002). Cognitive styles and distant education. *Online Journal of Distance Learning Administration,* 5(2). http://www.westga.edu/~distance/liu23.html.

Loomis, D.K., and Paterson, S.K. (2014). The human dimensions of coastal ecosystem services: Managing for social values. *Ecological Indicators*, 44, 6 – 10.

Loomis, D.K., Anderson, L.E., Hawkins, C., and Paterson, S.K. (2008). Understanding coral reef use: Recreational fishing in the Florida Keys by residents and non-residents during 2006-2007. The Florida Reef Resilience Program, (p. 119).

Louviere, J.J., and Timmermans, H. (1990) Stated preference and choice models applied to recreation research. *Leisure Sciences*, 12, 9–32.

Louviere, J.J., Hensher, D.A., and Swait, J. (2000). *Stated choice methods: analysis and application*. Cambridge: Cambridge University Press.

Louviere, J.J., Islam, T., Wasi, N., Street, D., and Burgess, L. (2008). Designing discrete choice experiments: Do optimal designs come at a price? *Journal of Consumer Research*, 35(2), 360-375.

Lubchenco, J., and Sutley, N. (2010). Proposed U.S. policy for ocean, coast and great lakes stewardship. *Science*, 328, 1485 – 1486.

Luce, R.D., and Tukey, J.W. (1964). Simultaneous conjoint measurement: A new type of fundamental measurement. *Journal of Mathematical Psychology*, 1, 1 – 27.

Lugo, A.E., and Snedaker, S.C. (1974). The ecology of mangroves. *Annual Review of Ecology and Systematics*, 5, 39–64.

Machlis, G.E., and Force, J.E. (1988). Community stability and timber-dependent communities. *Rural Sociology*, 53(2), 220 – 234.

Maddux, W.W., Bivolaru, E., Hafenbrack, A.C., Tadmor, C.T., and Galinsky, A.D. (2014). Expanding opportunities by opening your mind: Multicultural engagement predicts job market success through longitudinal increases in integrative complexity. *Social Psychological and Personality Science*, 5(5), 608 – 615.

Maheswaran, D., and Chaiken, S. (1991). Promoting systematic processing in low-motivation settings: Effect of incongruent information on processing and judgment. *Journal of Personality and Social Psychology*, 61, 13-25.

Manfredo, M.J. (2008). *Who cares about wildlife? Social science concepts for exploring human-wildlife relationships and conservation issues*. New York, NY: Springer.

Manfredo, M.J., and Fulton, D.C. (1997). A comparison of wildlife values in Belize and Colorado. *Human Dimensions of Wildlife*, 2, 62- 63.

Marshall, N.A., Marshall, P.A., and Abdulla, A. (2009). Using social resilience and resource dependency to increase the effectiveness of a prospective Marine Protected Area (MPA) in Salum, Egypt. *Journal of Environmental Planning and Management*, 52(7), 901 – 918.

Martín-López, B., Iniesta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., García Del Amo, D., Gómez- Baggethum, E., Oteros-Rozas, E., Palacios-Agundez, I., Willaarts, B., González, J.A., Santos-Martín, F., Onaindia, M., Santiago- López, C., and Montes, C. (2012). Uncovering ecosystem service bundles through social preferences. *PLoS ONE*,7(6), e38970.

Mascia, M.B. (2004). Social dimensions of marine reserves. In C. Dahlgren and J. Sobel (Eds.) *Marine reserves: A guide to science, design, and use.* Island Press, Washington D.C.

Mascia, M.B., and Claus, C.A. (2009). A property rights approach to understanding human displacement from protected areas: the case of marine protected areas. *Conservation Biology*, 23, 16 – 23.

McCleery, R.A., Ditton, R.B., Sell, J., and Lopez, R.R. (2006). Understanding and improving attitudinal research in wildlife sciences. *Wildlife Society Bulletin*, 34, 537–541.

McClintock, C.G. (1972). Social motivation—a set of propositions. *Systems Research and Behavioral Science*, 17(5), 438-454.

McCright, A.M., and Dunlap, R.E. (2011). The politicization of climate change: Political polarization in the American public’s views of global warming. *Sociological Quarterly*, 52, 155-194.

McFarlane, B.L., and Boxall, P.C. (2000). Factors influencing forest values and attitudes of two stakeholder groups: The case of the Foothills Model Forest, Alberta, Canada. *Society and Natural Resources*, 13(7), 649 – 661.

McFarlane, B.L., and Boxall, P.C. (2003). The role of social psychological and social structural variables in environmental activism: An example of the forest sector. *Journal of Environmental Psychology*, 23(1), 79 – 87.

McGuire, W.J. (1974). Psychological motives and communication gratification. In J. G. Blumler & E. Katz (Eds.), *The uses of mass communications: Current perspectives on gratifications research* (pp. 167-198). Beverly Hills, CA: SAGE.

McLean, R.A., and Anderson, V.L. (1984). *Applied Factorial and Fractional Designs*. New York: Marcel Dekker.

McNaughton, D., Hamlin, D., McCarthy, J., Head-Reeves, D., and Schreiner, M. (2007). Learning to listen: Teaching an active listening strategy to pre-service education professionals. *Topics In Early Childhood Special Education*, 27(4), 223-231.

Mehta, R., and Sivadas, E. (1995). Comparing response rates and response content in mail vs. electronic mail surveys. *Journal of the Market Research Society*, 37(4), 429-439.

Messick, S. (1984). The nature of cognitive styles: Problems and promise in educational practice. *Educational Psychologist*, 19(2), 59-74.

Messick, S., and McClintock, C.G. (1968). Motivational bases of choice in experimental games. *Journal of Experimental Social Psychology*, 4, 1-25.

Millennium Ecosystem Assessment (MEA). (2005). *Ecosystems and human well-being synthesis*. Island Press, Washington D.C.

Miller, M.A., Mourque, A.S., and Bohnsack, J.A. (2002). An analysis of the loss of acroporid corals at Looe Key, Florida, USA: 1983–2000. *Coral Reefs*, 21, 179–182. *Communication*, 12, 7–49.

Milon, J.W., Suman, D.O., Shivlani, M., and Cochran, K.A. (1997). Commercial fishers' perceptions of marine reserves for the Florida Keys National Marine Sanctuary. Gainesville, FL: Florida Sea Grant Technical Paper-89.

Mitchel, R.C., and Carson, R.T. (1989). *Using surveys to value public goods: The contingent valuation method*. Resources for the Future: Washington D.C.

Moberg, F., and Folke, C. (1999). Ecological goods and services of coral reef ecosystems. *Ecological Economics*, 29, 215 – 233.

Moberg, F., and Ronnback, P. (2003). Ecosystem services of the tropical seascape: Interactions, substitutions and restoration. *Ocean and Coastal Management*, 46(1-2), 27-46.

Muller, R.G., Trotter, A.A., and Stevens, P.W. (2015). The 2015 stock assessment update of common snook, Centropomus undecimalis, IHR 2015-004. Fish and Wildlife Conservation Commission, St. Petersburg, FL.

Murphy, M.D., Chagaris, D., and Addis, D. (2011). An assessment of the status of spotted seatrout in Florida waters through 2009. Florida Fish and Wildlife Conservation Commission, St. Petersburg, FL.

Musch, J., Ostapczuk, M., and Klaiber, Y. (2012). Validating an inventory for the assessment of egoistic bias and moralistic bias as two separable components of social desirability. *Journal of Personality Assessment*, 94(6), 620 – 629.

Myszkowski, N., Storme, M., Davila, A., and Lubart, T. (2015). Managerial creative problem solving and the big five personality traits. *The Journal of Management Development*, 34(6), 674-684.

Myyry, L. (2002). Everyday value conflicts and integrative complexity of thought. *Scandinavian Journal of Psychology*, 43, 385 – 395.

Needham, M.D. (2010). Value orientations toward coral reefs in recreation and tourism settings: A conceptual and measurement approach. *Journal of Sustainable Tourism*, 18, 757–772.

Nel, J.G. (2001). The information seeking process: Is there a sixth sense? *Mousaion*, 19(2), 23-32.

Nemeth, C., and Rogers, J. (1996). Dissent and the search for information. *British Journal of Social Psychology*. *Special Issue: Minority Influences*, 35, 67-76.

Nemeth, C.J., and Wachtler, J. (1983). Creative problem solving as a result of majority vs. minority influence. *European Journal of Social Psychology*, 13, 45 – 55.

Nijstad, B.A., De Dreu, C.K.W., Rietzschel, E.F., and Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology*, 21, 34–77.

Nordlund, A.M., and Garvill, J. (2002). Value structures behind proenvironmental behavior. *Environment and Behavior*, 34, 740-756.

O'Connor, R.E., Bord, R.J., Yamal, B., and Wiefek, N. (2002). Who wants to reduce greenhouse gas emissions? *Social Science Quarterly*, 83(1), 1-17.

O'Connor, B.P., and Tindall, D.B. (1990). Attribution and behavior in a commons dilemma. *The Journal of Psychology*, 124(5), 485 – 494.

O'Malley, C.E. (1986). Helping users help themselves. In D.A. Norman and S.W. Draper (Eds.), *User centered system design: New perspectives in human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Odum, W.E., and Heald, E.J. (1975). Mangrove forests and aquatic productivity. In: A.D. Hasler (Ed.), *Coupling of land and water systems*, p. 129–136. Springer-Verlag.

Odum, W.E., McIvor, C.C., and Smith, T.J. (1982). *The ecology of the mangroves of south Florida: A community profile*. FWS/OBS-81/24. Washington, DC, United States Fish and Wildlife Service, Office of Biological Services.

OECD. (2003). OECD environmental indicators: Development and use. OECD, Paris.

Ogden, J.C. (1988). The influence of adjacent systems on the structure and function of coral reefs. Proceedings from the 6th International Coral Reef Symposium, Townsville, 1, 123 – 129.

Oh, C., and Ditton, R.B. (2006). Using recreation specialization to understand multi-attribute management preferences. *Leisure Sciences*, 28(4), 369 – 384.

Oh, C., Ditton, R.B., Gentner, B., and Riechers, R. (2009). A stated preference choice approach to understanding angler preferences for management options. *Human Dimensions of Wildlife*, 10(3), 173 – 186.

Olsson, P., Gunderson, L.H., Carpenter, S.R., Ryan, P., Lebel, L., Folke, C., Holling, C.S. (2004). Shooting the rapids: navigating transitions to adaptive governance of social–ecological systems. In: Workshop of Resilience Alliance, Nagambie, Australia.

Orr, S. K. (2005). New technology and research: An analysis of Internet survey methods in political science. *Political Science and Politics*, 38(2), 263-267.

Osgood, C., Suci, G., and Tannenbaum, P. (1957). *The measurement of meaning*. Urbana, IL: University of Illinois Press.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge, UK and New York, NY: Cambridge University Press.

Ostrom, E., Burger, J., Field, C.B., Norgaard, R.B., and D. Policansky. (1999). Revisiting the commons: Local lessons, global challenges. *Science*, 284, 278 – 282.

Palmer, D.I., and Kalin, R. (1991). Predictive validity of the dogmatic rejection scale. *Personality and Social Psychology Bulletin*, 17(2), 212 – 218.

Pancer, S.M., Pratt, M., Hunsberger, B., and Gallant, M. (2000). Thinking ahead: Complexity of expectations and the transition to parenthood. *Journal of Personality*, 68, 253–280.

Parker, S.K., and Axteil, C.M. (2001). Seeing another viewpoint: Antecedents and outcomes of employee perspective taking. *Academy of Management Journal*, 44, 1085-1100.

Parks, C.D. (1994). The predictive ability of social values in resource dilemmas and public goods games. *Journal of Personality and Social Psychology*, 20(4), 431-438.

Paukert, A., Stagner, B., and Hope, K. (2004). The assessment of active listening skills in helpline volunteers. *Stress, Trauma, and Crisis*, 7, 61–76.

Paulhus, D.L., and Reid, D.B. (1991). Enhancement and denial in socially desirable responding. *Journal of Personality and Social Psychology*, 60, 307–317

Pearce, D.W., and Turner, R.K. (1990). *Economics of natural resources and the environment*. The Johns Hopkins University Press.

Petty, R.E., and Cacioppo, J.T. (1984). The effects of involvement on response to argument quality and quantity: Central and peripheral routes to persuasion. *Journal of Personality and Social Psychology*, 46, 69-81.

Petty, R.E., and Cacioppo, J.T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. New York: Springer-Verlag.

Petty, R.E., Haugtvedt, C., and Smith, S.M. (1995). Elaboration as a determinant of attitude strength: Creating attitudes that are persistent, resistant, and predictive of behavior. In: R.E. Petty and J.A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 93-130). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Petty, R.E., and Krosnick, J.A. (Eds.). (1995). *Attitude strength: Antecedents and consequences*. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Pierce, J.C., Lovrich, N.P., Jr., Tsurutani, T., and Abe, T. (1989). *Public knowledge and environmental politics in Japan and the United States*. Boulder, CO: Westview Press.

Pomeroy, R.S., Mascia, B., and Pollnac, R. (2007). *Marine protected areas: The social dimension*. Fisheries and Agriculture Organization (FAO) Fisheries Department, Report and documentation of the Expert Workshop on Marine Protected Areas and Fisheries Management: Review of Issues and Considerations. FAO Fisheries Report. No. 825. Rome.

Porter, C.A., and Suedfeld, P. (1981). Integrative complexity in the correspondence of literary figures: Effects of personal and societal stress. *Journal of Personality and Social Psychology*, 40, 321-330.

Pratt, M.W., and Hunsberger, B. (1992). Reflections of religion: Aging, belief orthodoxy, and interpersonal conflict in the complexity of adult thinking about religious issues. *Journal for the Scientific Study of Religion*, 31, 514–521.

Pruitt, D.G., and Lewis, S.A. (1975). Development of integrative solutions in bilateral negotiation. *Journal of Personality and Social Psychology*, 31(4), 621 – 633.

Pyszczynski, T., and Greenberg, J. (1987). Toward an integration of cognitive and motivational perspectives on social inference: A biased hypothesis-testing model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 20, pp. 297–340). San Diego, CA: Academic Press.

Raden, D. (1983). Strength-related attitude dimensions. *Social Psychological Quarterly*, 48, 312 – 330.

Ranganathan, J., Raudsepp-Hearne, C., Lucas, N., Irwin, F., Zurek, M., Bennett, K., Ash, K., and West, P. (2008). *Ecosystem services: A guide for decision makers*. World Resources Institute, Washington D.C.

Raudenbush, S.W., and Bryk, A.S. (2002). *Hierarchical linear models. Applications and data analysis methods* (2nd ed.). London: Sage.

Robertson, T.S., Zielinski, J., and Ward, S. (1984). *Consumer Behavior*. Glenview, IL: Scott, Foresman.

Roese, N.J., and Vohs, K.D. (2012). Hindsight bias. *Perspectives on Psychological Science*, 7(5), 411 – 426.

Rogers, C.R. (1980). *A way of being*. Houghton Mifflin: Boston.

Rokeach, M. (1973). *The nature of human values*. New York: Free Press.

Rossi, P.H., and Anderson, A.B. (1982). The factorial survey approach: An introduction. In: P.H. Rossi and S.L. Nock (Eds.), *Measuring social judgments: The factorial survey approach* (pp. 15 – 67). Beverly Hills, CA: Sage.

Rossi, P.H., and Berk, R.A. (1997). *Just punishments: Federal guidelines and public views compared*. New York: Aldine De Gruyter.

Rossi, P.H., and Nock, S.L. (1982). *Measuring social judgments: The factorial survey approach*. Beverly Hills, CA: Sage Publications.

Rucker, D.D., Tormala, Z.L., Petty, R.E., and Briño, P. (2014). Consumer conviction and commitment: An appraisal-based framework for attitude certainty. *Journal of Consumer Psychology*, 24(1), 119-136.

Salz, R.J., Loomis, D.K., and Finn, K.L. (2001). Development and Validation of a Specialization Index and Testing of Specialization Theory. *Human Dimensions of Wildlife*, 6(4), 239–258.

Sample, J., and Warland, R.H. (1973). Attitudes and the prediction of behavior. *Social Forces*, 51, 292-304.

Sanchirico, J.N., and Mumby, P. (2009). Mapping ecosystem functions to the valuation of ecosystem services: Implications of species–habitat associations for coastal land-use decisions. *Theoretical Ecology*, 2(2), 67–77.

Sanchirico, J.N., Eagle, J., Palumbi, S., and Thompson, B.H. (2010). Comprehensive planning, dominant-use zones, and user rights: A new era in ocean governance. *Bulletin of Marine Science*, 86(2), 1–12.

Sanginga, P.C., Abenakyo, A., Kamugisha, R., Martin, A.M., and Muzira, R. (2010). Tracking outcomes of social capital and institutional innovations in natural resources management: Methodological issues and empirical evidence from participatory bylaw reform in Uganda. *Society and Natural Resources*, 23(8), 711–725.

Sauer, C., Auspurg, K., Hinz, T., and Liebig, S. (2011). The application of factorial surveys in general population samples: The effects of respondent age and education on response times and response consistency. *Survey Research Methods*, 5(3), 89-102.

Savolainen, R. (2012). Conceptualizing information need in context. *Information Research*, 17(4), 534.

Scannell, L., and Gifford, R. (2013). Personally relevant climate change: The role of place attachment and local versus global message framing in engagement. *Environment and Behavior*, 45, 60–85.

Schaefer, D.R., and Dillman, D.A. (1998). Development of a standard e-mail methodology: Results of an experiment. *The Public Opinion Quarterly*, 62(3), 378–397.

Schank, R.C., and Abelson, R. (1977). *Scripts, plans, goals, and understanding*. Hillsdale, NJ: Earlbaum Associates.

Scheffer, M., Carpenter, S., Foley, J.A., Folke, C., and Walker, B. (2001). Catastrophic shifts in ecosystems. *Nature*, 413, 591–596.

Scheffer, M., Hosper, S.H., Meijer, M.L., and Moss, B. (1993). Alternative equilibria in shallow lakes. *Trends in Ecology and Evolution*, 8(8), 275–279.

Scherer, D., and Attig, T. (1983). *Ethics and the environment*. Englewood Cliffs, NJ: Prentice Hall.

Schoemann, A.M., Rhemtulla, M., and Little, T.D. (2014). Multilevel and longitudinal modeling. In H.T. Reis & C.M. Judd (Eds.), *The Handbook of Research Methods in Personality and Social Psychology* (2nd ed.) Cambridge University Press.

Schroder, H., Driver, M., and Streufert, S. (1967). *Human information processing*. New York: Holt, Rinehart and Winston.

Schroeder, H.W., and Louviere, J. (1999). Stated choice models for predicting the impact of user fees at public recreation sites. *Journal of Leisure Research*, 31(3), 300–324.

Schroeder, H.W., Dwyer, J.F., Louviere, J.J., and Anderson, D.H. (1990). Monetary and nonmonetary trade-offs of urban forest site attributes in a logit model of recreation choice. In B.L. Driver and G.L. Peterson (eds.) *Forest Resource Value and Benefit Measurement: Some Cross-Cultural Perspectives* (General Technical Report RM-197, pp. 41–51). Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Schultz, P.W., and Zelezny, L. (2003). Reframing environmental messages to be congruent with American values. *Research in Human Ecology*, 10(2), 126 – 136.

Schwartz, S.H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in Experimental Social Psychology*, 25, 1-65.

Schwartz, S. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues*, 50, 19-45.

Scott, W.A., Osgood, D.W., and Peterson, C. (1979). *Cognitive Structure: Theory and Measurement of Individual Differences*. Washington D.C.: V.H. Winston and Sons.

Shafer, L.E. (1969). *The average camper who doesn't exist*. United States Northeastern Forest Experiment Station, Upper Darby, PA.

Shindler, B., List, P., and Steel, B.S. (1993). Managing federal forests: Public attitudes in Oregon and nationwide. *Journal of Forestry*, July, 36-42.

Shinn, E.A. (2008). Corals as bioindicators of climate change. *Environmental Bioindicators*, 3, 149 – 152.

Shooter, W., and Galloway, S. (2010). The use of factorial surveys in leisure research. *Journal of Leisure Research*, 42(4), 641 – 652.

Sligte, D.J., de Dreu, C.K.W., and Nijstad, B.A. (2011). Power, stability of power, and creativity. *Journal of Experimental Social Psychology*, 47(5), 891 – 897.

Smeets, E., and Weterings, R. (1999). *Environmental indicators: Typology and overview*. European Environment Agency: Copenhagen, Denmark.

Smith, J. (1997). Nonresponse bias in organizational surveys: Evidence from a survey of groups and organizations working for peace. *Nonprofit and Voluntary Sector Quarterly*, 26, 359-368.

Smith, F.P., Gorddard, R., House, A.P.N., McIntyre, S., and Prober, S.M. (2012). Biodiversity and agriculture: Production frontiers as a framework for exploring trade-offs and evaluating policy. *Environmental Science & Policy*, 23, 85 – 94.

Sniderman, P.M., Brody, R.A., and Tetlock, P.E. (1991). *Reasoning and Choice*. New York: Cambridge University Press.

Snijders, T.A.B., and Bosker, R.J. (2012). Multilevel analysis: An introduction to basic and advanced multilevel modeling (2nd Edition). Los Angeles, CA: Sage.

Southwick Associates, Inc. (2009). The Potential Economic and Conservation Impacts of Proposed Marine Recreational Fishing Closures in Southern California. Produced for the American Sportfishing Association, Washington D.C.

Stanovich, K.E., and West, R.F. (1997). Reasoning independently of prior belief and individual differences in actively open-minded thinking. *Journal of Educational Psychology*, 89, 342–57.

Stanovich, K.E., and West, R.F. (2007). Natural myside bias is independent of cognitive ability. *Thinking and Reasoning*, 13, 225 – 247.

Stark, W.A., Jr., (1968). A list of fish of Alligator Reef, Florida with comments on the nature of the Florida reef fish fauna. *Undersea Biology*, 1, 4-40.

Steel, B.S., List, P., and Shindler. B. (1994). Conflicting values about federal forests: A comparison of national and Oregon publics. *Society and Natural Resources*, 7, 137- 153.

Steg, L., and Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29, 309 – 317.

Stern, P.C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues,* 56(3), 407-424.

Stern, P.C., and Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, 50(3), 65 – 84.

Stern, P.C, Dietz, T., Abel, T., Guagnano, G.A., and Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6(2), 81-97.

Streufert, S. (1997). Complexity: An integration of theories. *Journal of Applied Social Psychology*, 27(23), 2068 – 2095.

Streufert, S., and Streufert, S.C. (1978). *Behavior in the complex environment*. Winston & Sons: Washington D.C.

Streufert, S., and Swezey, R.W. (1986). *Complexity, managers, and organizations*. Academic Press: New York.

Suchman, E.A. (1950). The intensity component in attitude and opinion research. In: S.A. Stoffer et al. (Eds.), *Measurement and prediction*. Princeton: Princeton University Press.

Suedfeld, P. (1985). American Psychological Association Presidential addresses: The relation of integrative complexity to historical, professional, and personal factors. *Journal of Personality and Social Psychology*, 49, 1643-1651.

Suedfeld,P. (1988). Authoritarian thinking, groupthink, and decision-making under stress: Are simple decisions always worse? *Society*, 25(5), 25-7.

Suedfeld, P. (1992). Cognitive managers and their critics. *Political Psychology*, 13, 435-453.

Suedfeld, P. (2000). Cognitive styles: Personality. In A. E. Kazdin (Ed.), *Encyclopedia of psychology* (Vol. 2, pp. 166 –169). Washington, DC: American Psychological Association.

Suedfeld, P. (2010). The cognitive processing of politics and politicians: Archival studies of conceptual and integrative complexity. *Journal of Personality*, 78(6), 1669 – 1702.

Suedfeld, P., and Bluck, S. (1993). Changes in integrative complexity accompanying significant life events: Historical evidence. *Journal of Personality and Social Psychology*, 64(1), 124 – 130.

Suedfeld, P., and Coren, S. (1992). Cognitive correlates of conceptual complexity. *Personality and Individual Differences*, 13(11), 1193 – 1199.

Suedfeld, P., and Granatstein, J.L. (1995). Leader complexity in personal and professional crises: Concurrent and retrospective information processing. *Political Psychology*, 16, 509-522.

Suedfeld, P., and Leighton, D.C. (2002). Early communications in the war against terrorism: An integrative complexity analysis. *Political Psychology*, 23, 585-599.

Suedfeld, P., and Piedrahita, L.E. (1984). Intimations of mortality: Integrative simplification as a precursor of death. *Journal of Personality and Social Psychology*, 47, 848-852.

Suedfeld, P., and Tetlock, P. (1977). Integrative complexity of communications in international crises. *Journal of Conflict Resolution*, 21(1), 169 – 184.

Suedfeld, P., Tetlock, P.E., and Ramirez, C. (1977). War, peace, and integrative complexity. *Journal of Conflict Resolution*, 21, 427-442.

Suedfeld, P., Bluck, S., and Ballard, E. J. (1994). The effects of emotional involvement and psychological distance in integrative complexity. *Journal of Applied Social Psychology*, 24, 443-452.

Suedfeld, P., Bluck, S., Loewen, L. & Elkins, D.J. (1994). Sociopolitical values and integrative complexity of members of student political groups. *Canadian Journal of Behavioral Science*, 26(1), 121 – 141.

Suedfeld, P., Tetlock, P., and Streufert, S. (1992). Conceptual/integrative complexity. In C. P. Smith (Ed.), *Handbook of thematic content analysis* (pp. 393-400). New York: Cambridge University Press.

Suedfeld, P., Cross, R.W., and Brcic, J. (2011). Two years of ups and downs: Barack Obama’s patterns of integrative complexity, motive imagery, and values. *Political Psychology*, 32(6), 1007 – 1033.

Suedfeld, P., Wallace, M.D., and Thachuk, K. (1993). Changes in integrative complexity among Middle East leaders during the Persian Gulf crisis. *Journal of Social Issues*, 49(3), 183-99.

Suman, D., Shivlani, M., and Milon, J.W. (1999). Perceptions and attitudes regarding marine reserves: A comparison of stakeholder groups in the Florida Keys National Marine Sanctuary. *Ocean and Coastal Management*, 42, 1019 – 1040.

Svarstad, H., Petersen, L.K., Rothman, D., Siepel, H., and Wätzold, F. (2008). Discursive biases of the environmental research framework DPSIR. *Land Use Policy*, 25, 116 – 125.

Sweet, W., Park, J., Marra, J., Zervas, C., and Gill, S. (2014). *Sea level rise and nuisance flood frequency changes around the United States*. Silver Spring, MD: National Ocean and Atmospheric Administration.

Swett, R.A., Sidman, C., Fik, T., and Sargent, B. (2009). Developing a spatially enabled inventory of recreational boats using vessel registration data. *Coastal Management*, 37(5), 405-420.

Szmant, A.M. (1997). Nutrient effects on coral reefs: A hypothesis on the importance of topographic and trophic complexity on nutrient dynamics. Proceedings from the 8th International Coral Reef Symposium, 2, 1527– 1532.

Tadmor, C.T., Tetlock, P.E., and Peng, K. (2009). Acculturation strategies and integrative complexity: The cognitive implications of biculturalism. *Journal of Cross-Cultural Psychology*, 40(1), 105 – 139.

Tallis, H., and Polasky, S. (2009). Mapping and valuing ecosystem services as an approach for conservation and natural-resource management. *Annals of the New York Academy of Sciences*, 1162(1), 265 – 283.

Tallis, H., and Polasky, S. (2011). Assessing multiple ecosystem services: an integrated tool for the real world. In: Kareiva, P., Tallis, H., Ricketts, T., Daily, G., Polasky, S. (Eds.), *Natural Capital: Theory and Practice of Mapping Ecosystem Services*. Oxford University Press: Oxford.

Tarrant, M.A., Bright, A.D., and Cordell, H.K. (1997). Attitudes toward wildlife species protection: Assessing moderating and mediating effects in the value-attitude relationship. *Human Dimensions of Wildlife*, 2(2), 1 – 20.

Tausczik, Y.R., and Pennebaker, J.W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology*, 29(1), 24–54.

Teel, T.L., Dayer, A.A., Manfredo, M.J., and Bright, A.D. (2005). *Regional results from the research project entitled "Wildlife Values in the West."* (Project Rep. No. 58). Project Report for the Western Association of Fish and Wildlife Agencies. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit.

Teel, T.L., and Manfredo, M.J. (2009). Understanding the diversity of public interests in wildlife conservation. *Conservation Biology*, 24(1), 128 – 139.

Tesser, A., and Leone, C. (1977). Cognitive schemas and thought as determinants of attitude change. *Journal of Experimental Social Psychology*, 13, 340 – 356.

Tetlock, P.E. (1979). Identifying victims of groupthink from public statements of decision makers. *Journal of Personality and Social Psychology*, 37(8), 1314 – 1324.

Tetlock, P.E. (1981). Pre- to post-election shifts in presidential rhetoric: Impression management or cognitive adjustment? *Journal of Personality and Social Psychology*, 41, 207-212.

Tetlock, P.E. (1983). Accountability and complexity of thought. *Journal of Personality and Social Psychology*, 45(1), 74 – 83.

Tetlock, P.E. (1984). Cognitive style and political belief systems in the British House of Commons. *Journal of Personality and Social Psychology*, 46(2), 365 – 375.

Tetlock, P.E., (1985). Integrative complexity of American and Soviet foreign policy rhetoric: A time-series analysis. *Journal of Personality and Social Psychology*, 49(6), 1565 – 1585.

Tetlock, P.E. (1986). A value pluralism model of ideological reasoning. *Journal of Personality and Social Psychology*, 50(4), 819-827.

Tetlock, P.E. (1988). Monitoring the integrative complexity of American and Soviet Policy rhetoric: What can be learned? *Journal of Social Issues*, 44(2), 101 – 131.

Tetlock, P.E. (1989). Structure and function in political belief systems. In A.G. Greenwald & A. Pratkanis (Eds.), *Attitude structure and function*. Hillsdale, NJ: Erlbaum.

Tetlock, P.E. (2009). *Expert political judgment: How good is it? How can we know?* Princeton University Press: Princeton, NJ.

Tetlock, P.E., and Kim, J. (1987). Accountability and judgment processes in a personality predication task. *Journal of Personality and Social Psychology*, 52(4), 700-709.

Tetlock, P.E., and Tyler, A. (1996). Winston Churchill's cognitive and rhetorical style: The debate over Nazi intentions and self-government for India. *Political Psychology*, 17, 149 – 170.

Tetlock, P.E., Armor, D., and Peterson, R.S. (1994). The slavery debate in antebellum America: Cognitive style, value conflict, and the limits of compromise. *Journal of Personality and Social Psychology*, 66, 115–126.

Tetlock, P.E., Hannum, K.A., and Micheletti, P.M. (1984). Stability and change in the complexity of senatorial debate: Testing the cognitive versus rhetorical style hypothesis. *Journal of Personality and Social Psychology*, 46(5), 979-990.

Tetlock, P.E., Peterson, R.S., and Lerner, J.S. (1996). Revising the value pluralism model: Incorporating social content and context postulates. In C. Seligman, J. Olson, and M. Zanna (Eds.), *Values: Eighth annual Ontario Symposium on Personality and Social Psychology* (pp. 25-51). Hillsdale, NJ: Lawrence Erlbaum.

Tetlock, P.E., Peterson, R.S., and Berry, J.M. (1993). Flattering and unflattering personality portraits of integratively simple and complex managers. *Journal of Personality and Social Psychology*, 64(3), 500 – 511.

Tetlock, P.E., Skitka, L., and Boettger, R. (1989). Social and cognitive strategies for coping with accountability: Conformity, complexity, and bolstering. *Journal of Personality and Social Psychology*, 57(4), 632-640.

Tetlock, P.E., Metz, S.E., Scott, S.E., and Suedfeld, P. (2014). Integrative complexity coding raises integratively complex issues. *Political Psychology*, 35(5), 625 – 634.

Thomassin, A., White, C.S., Stead, S.S., and David, G. (2010). Social acceptability of a marine protected area: The case of Reunion Island. *Ocean and Coastal Management*, 53, 169–179.

Thompson, M.M., Zanna, M.P., and Griffin, D.W. (1995). Let's not be indifferent about (attitudinal) ambivalence. In: R.E. Petty and J.A. Krosnick (Eds.), *Attitude strength*: *Antecedents and consequences* (pp. 361 – 386). Mahwah, NJ: Erlbaum.

Thøgersen, J., and Olander, F. (2002). Human values and the emergence of a sustainable consumption pattern: A panel study. *Journal of Economic Psychology*, 23, 605-630.

Thorndike, R.L., and Gallup, G.H. (1944). Verbal intelligence of the American adult. *Journal of General Psychology*, 30, 75 – 85.

Tognacci, L.N., Russell, H.W., Wideen, M.F., and Vernon, D.T.A. (1972). Environmental quality: How universal is public concern? *Environment and Behavior*, 4, 73 – 86.

Tormala, Z.L., and Petty, R.E. (2004). Source credibility and attitude certainty: A metacognitive analysis of resistance to persuasion. *Journal of Consumer Psychology*, 14, 427-442.

Tringali, M.D., Leber, K.M., Halstead, W.G., McMichael, R., O'Hop, J., Winner, B., Cody, R., Young, C., Neidig, C., Wolfe, H., Forstchen, A., Barbieri, L. (2008). Marine stock enhancement in Florida: a multidisciplinary, stakeholder-supported, accountability-based approach. *Reviews in Fisheries Science*, 16, 51–57.

Tuckman, B.W. (1965). Developmental sequence in small groups. *Psychological Bulletin*, 63(6), 384 – 399.

Tullet, A.D. (1997). Cognitive style: Not culture's consequence. European Psychologist, 2(3), 258-267.

Turner, K.R., Pearce, D., and Bateman, I. (1994). *Environmental Economics: an Elementary Introduction*. Hemel Hempstead: Harvester Wheatsheaf.

Tversky, A. (1972). Elimination by aspects: A theory of choice. *Psychological Review*, 79(4), 281 – 299.

Van Dyne, L., and Saavedra, R. (1996). A naturalistic minority influence experiment: Effects of divergent thinking, conflict and originality in work-groups. *British Journal of Social Psychology. Special Issue: Minority Influences*, 35, 151-167.

Van Lange, P.A.M., and Liebrand, W.B.G. (1989). On perceiving morality and potency: Social values and the effects of person perception in a give-some dilemma. *European Journal of Social Psychology,* 3, 209–225.

Van der Pligt, J., Ester, P., and Van der Lindern, J. (1983). Attitude extremity, consensus and diagnosticity. *European Journal of Social Psychology*, 13(4), 340-356.

Van Hiel, A., and Mervielde, I. (2003). The measurement of cognitive complexity and its relationship with political extremism. *Political Psychology*, 24(4), 781-801.

Van Vugt, M., Meertens, R.M., and Van Lange, P.A.M. (1995). Car or public transportation? The role of social orientations in a real-life social dilemma. *Journal of Applied Social Psychology*, 25, 258-278.

Van Vugt, M., Van Lange, P.A.M., and Meertens, R.M. (1996). Commuting by car or public transportation? A social dilemma analysis of travel mode judgments. *European Journal of Social Psychology*, 26, 373-395.

Vannoy, J.S. (1965). Generality of cognitive complexity-simplicity as a personality construct. *Journal of Personality and Social Psychology*, 2(3), 385-396.

Vaske, J.J. (2008). *Survey research and analysis: Applications in parks, recreation and human dimensions*. State College, PA: Venture Publishing.

Vaske, J.J., and Donnelly, M.P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources*, 12, 523-537.

Vaske, J.J., and Donnelly, M.P. (1997). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society and Natural Resources*, 12, 523 – 537.

Vaske, J.J., Donnelly, M.P., Williams, D.R., and Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about forest management. *Society and Natural Resources*, 14, 761–776.

Vaske, J.J., and Whittaker, D. (2004). Normative approaches to natural resources. *Society and Natural Resources: A Summary of Knowledge*. Jefferson, MO: Modern Litho.

Vaze, P., Dunn, H., and Price, R. (2006). *Quantifying and valuing Ecosystem Services*. Department of Environment, Food and Rural Affairs (DEFRA), UK.

Vince, R. (2002). Organizing reflection. *Management Learning*, 33(1), 63 – 78.

Walker, B., and Salt, D. (2006). Resilience thinking: Sustaining ecosystems and people in a changing World. Washington D.C.: Island Press.

Wallbaum, A. (1993). Integrative complexity, international crises, and cognitive management. In K. S. Knud (Ed.), *Conflict and Social Psychology* (pp. 34−44). Newbury Park: CA: Sage Publications.

Wan, E.W., and Rucker, D.D. (2013). Confidence and construal framing: When confidence increases versus decreases information processing. *Journal of Consumer Research*, 39(1), 977–992.

Weaver, D. (1991). Issue salience and public opinion: Are there consequences of agenda-setting? *International Journal of Public Opinion Research*, 3(1), 53 – 68.

Weinstein, M., Baird, R., Conover, D., Gross, M., Keulartz, J., Loomis, D., Naveh, Z., Peterson, S.B., Reed, D.J., Roe, E., Swanson, R.L., Swart, J.A.A., Teal, J.M., Turner, R.E., and van der Windt, H.J. (2007). Managing coastal resources in the 21st century. *Frontiers in Ecology and the Environment*, 5(1), 43 – 48.

Weisberg, H.F., Krosnick, J.A., and Bowen, B.D. (1996). *An introduction to survey research, polling, and data analysis* (3rd Ed.). Newbury Park, CA: Sage. 394 pp.

Wells, S., Ravilious, C., Corcoran, E. (2006). In the front line: Shoreline protection and other ecosystem services from mangroves and coral reefs. *United Nations Environmental Programme—World Conservation Monitoring Centre Biodiversity Series*, 24, UNEP/WCMC: Cambridge, UK.

Werner, H. (1957). The concept of development from a comparative and organismic point of view. In D.B. Harris (Ed.), *The concept of development*. Minneapolis: University of Minnesota Press.

Winter, G., Vogt, C., Fried, J.S. (2002). Fuel treatments at the wildland–urban interface: Common concerns in diverse regions. *Journal of Forestry*, 100(1), 15–21

Wittkin, D., Krishnamurti, L., and Nutter, J. (1982). Comparing derived importance weights across attributes. *Journal of Consumer Behavior*, 8, 113 – 123.

Wittmann, K., Vaske, J., Manfredo, M., and Zinn, H. (1998). Standards for lethal response to problem urban wildlife. *Human Dimensions of Wildlife*, 3, 29-48.

Wonnacott, T., and Wonnacott, R. (1990). *Introductory statistics*. New York, NY: Wiley and Sons.

Wong, E.M., Ormiston, M.E., and Tetlock, P.E. (2011). The effects of top management team integrative complexity and decentralized decision making on corporate social performance. *Academy of Management Journal*, 54(6), 1207 – 1228.

Wood, W. (1982). The retrieval of attitude-relevant information from memory: Effects on susceptibility to persuasion and on intrinsic motivation. *Journal of Personality and Social Psychology*, 42, 798-810.

Wood, W., Rhodes, N., and Biek, M. (1995). Working knowledge and attitude strength: An information-processing analysis. In R.E. Petty & J.A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Wood, B., and Vedlitz, A. (2007). Issue definition, information processing, and the politics of global warming. *American Journal of Political Science*, 51, 552 - 568.

Wu, C.F.J., and Hamada, M.S. (2009). *Experiments: Planning, Analysis, and Optimization* (2nd ed.). New York, NY: John Wiley

Xu, H. (2005). A catalogue of three-level regular fractional factorial designs. *Metrika*, 62, 259 – 281.

Xu. H. (2006). Blocked regular fractional factorial designs with minimum aberration. *The Annals of Statistics*, 34(5), 2534 – 2553.

Xu, H., and Lau, S. (2006). Minimum aberration blocking schemes for two- and three-level fractional factorial designs. *Journal of Statistical Planning and Inference*, 136, 4088 – 4118.

Yoskowitz, D., Carollo, C, Beseres-Pollack, J., Welder, K., Santos, C., and Francis, J. (2012). Assessment of changing ecosystem services provided by marsh habitat in the Galveston Bay region. Harte Research Institute, Corpus Christi, TX.

Young, M.D., and Hermann, M.G. (2014). Integrative complexity has its benefits. *Political Psychology*, 35, 635–645.

Zeigarnik, B. (1927). On finished and unfinished tasks. *Psychologische Forschung*, 9, 1 – 85.

Zimmerman, I.L., and Woo-Sam, J.M. (1973). *Clinical interpretation of the Wechsler Adult Intelligence Scale*. New York: Grune and Stratton.

Zinn, H.C, Manfredo, M.J., Vaske, J., and Wittman, K. (1998). Using normative beliefs to determine the acceptability of wildlife management actions. *Society and Natural Resources*, 11, 649 – 662.

APPENDIX A. IRB APPROVAL

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **www.ecu.edu/irb**

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: Mary Allen
CC:
David Loomis
Date: 1/31/2017
Re: UMCIRB 16-002365
Integrative Complexity of Coastal Resources Management: Examining Tradeoffs between Ecosystem Protection and Resource Use

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 1/30/2017 to 1/29/2018. The research study is eligible for review under expedited category #7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Allen_Dissertation_Proposal	Study Protocol or Grant Application
Consent Letter for Expedited Survey Research	Consent Forms
Survey	Surveys and Questionnaires

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

APPENDIX B. ACCEPTABILITY SCENARIOS IN THREE BLOCKS

Block 1

Scenario	Factor A: Protected Area	Factor B: Fish Population	Factor C: Access to Fishing	Factor D: Fishing Season
1	0 – Reduce	0 – Reduce	0 – Reduce	1 – No change
2	0 – Reduce	0 – Reduce	1 – No change	0 – Reduce
3	0 – Reduce	0 – Reduce	2 – Increase	2 – Increase
4	1 – No change	2 – Increase	0 – Reduce	1 – No change
5	1 – No change	2 – Increase	1 – No change	0 – Reduce
6	1 – No change	2 – Increase	2 – Increase	2 – Increase
7	2 – Increase	1 – No change	0 – Reduce	1 – No change
8	2 – Increase	1 – No change	1 – No change	0 – Reduce
9	2 – Increase	1 – No change	2 – Increase	2 – Increase

Block 2

Scenario	Factor A: Protected Area	Factor B: Fish Population	Factor C: Access to Fishing	Factor D: Fishing Season
10	0 – Reduce	1 – No change	0 – Reduce	0 – Reduce
11	0 – Reduce	1 – No change	1 – No change	2 – Increase
12	0 – Reduce	1 – No change	2 – Increase	1 – No change
13	1 – No change	0 – Reduce	0 – Reduce	0 – Reduce
14	1 – No change	0 – Reduce	1 – No change	2 – Increase
15	1 – No change	0 – Reduce	2 – Increase	1 – No change
16	2 – Increase	2 – Increase	0 – Reduce	0 – Reduce
17	2 – Increase	2 – Increase	1 – No change	2 – Increase
18	2 – Increase	2 – Increase	2 – Increase	1 – No change

Block 3

Scenario	Factor A: Protected Area	Factor B: Fish Population	Factor C: Access to Fishing	Factor D: Fishing Season
19	0 – Reduce	2 – Increase	0 – Reduce	2 – Increase
20	0 – Reduce	2 – Increase	1 – No change	1 – No change
21	0 – Reduce	2 – Increase	2 – Increase	0 – Reduce
22	1 – No change	1 – No change	0 – Reduce	2 – Increase
23	1 – No change	1 – No change	1 – No change	1 – No change
24	1 – No change	1 – No change	2 – Increase	0 – Reduce
25	2 – Increase	0 – Reduce	0 – Reduce	2 – Increase
26	2 – Increase	0 – Reduce	1 – No change	1 – No change
27	2 – Increase	0 – Reduce	2 – Increase	0 – Reduce

APPENDIX C. SURVEY INSTRUMENT

Florida Recreational Saltwater Fishing Questionnaire

Human Dimensions Research Unit
Institute for Coastal Science and Policy
East Carolina University
Greenville, NC 27858-4353

>>

In the following questions, please tell us about your recreational saltwater fishing activity and experience in Florida.

1. How many years have you been saltwater fishing in Florida?

0 Years

2. Consider all of the time you spend saltwater fishing in Florida. In the past 12 months, approximately how many days did you go fishing in Florida from:

	Days
a. Your privately owned boat	
b. Someone else's privately owned boat	
c. Charter boat	
d. Party boat	
e. Shore (beach, bridge, dock, pier)	

3. What species of fish do you most prefer to fish for in Florida?

Most Preferred

Second Most Preferred

Third Most Preferred

4. What species of fish do you actually fish for in Florida?

Most Fished For

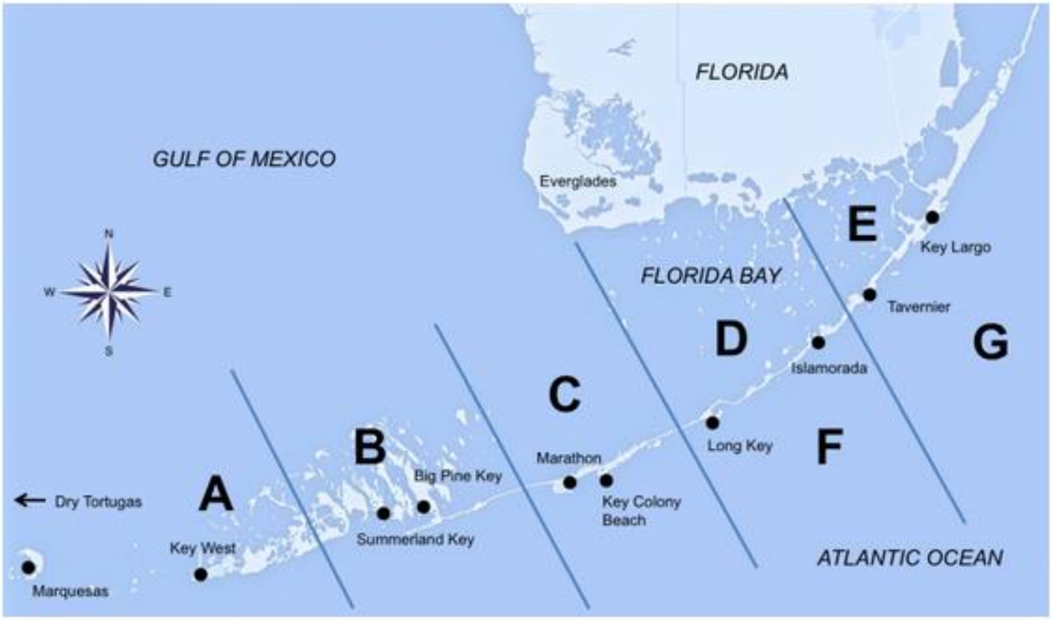
Second Most Fished For

Third Most Fished For

>>

5. In the <u>past 12 months</u>, approximately how many days did you go fishing in each of the following zones (A - G) designated on the map below?

	Days
a. Zone A	
b. Zone B	
c. Zone C	
d. Zone D	
e. Zone E	
f. Zone F	
g. Zone G	



>>

In many natural resource management decisions, there is an inherent conflict between resource use and resource protection.

For example, people <u>use</u> the marine environment for various benefits, such as recreation and tourism. At the same time, people also value the <u>protection</u> of marine resources (non-use), such as fish and marine habitats.

The <u>issue</u> is that managers must determine the amount of emphasis placed on the use of marine resources and protection of those same resources.

---

6. In your opinion, how <u>simple</u> or <u>complex</u> is the issue of managing for marine resource use versus protection in Florida?

Extremely Simple 1	Moderately Simple 2	Slightly Simple 3	Neutral 4	Slightly Complex 5	Moderately Complex 6	Extremely Complex 7

---

7. If it were <u>up to you</u> to decide whether marine resource use or protection should take *<u>priority</u>* in Florida, which would you choose?

Highest Priority to Use 1	Much Higher Priority to Use 2	Slightly Higher Priority to Use 3	Equal Priority to Both 4	Slightly Higher Priority to Protection 5	Much Higher Priority to Protection 6	Highest Priority to Protection 7

---

8. How <u>certain</u> are you about the correctness of the priority you place on the issue of marine resource use versus protection?

Not at all Certain 1	Slightly Certain 2	Somewhat Certain 3	Very Certain 4	Moderately Certain 5	Mostly Certain 6	Completely Certain 7

>>

9. In your decision regarding the priority of use versus protection, which of the following subjects (if any) *did not* come straight to your mind? Please choose only the subject(s) that you *did not consider* while making your decision about the priority of use versus protection. There are no right or wrong answers.

Recreation	Local jobs	Abundance of fish
Tourism	Overfishing	Access to fishing locations
Invasive species	Water quality/pollution	Growth in local population
Local economy	Ecosystem health	Coral health
Fisheries health	Days in fishing season	Endangered species protection
Boat anchoring/mooring	Sea grasses	Propeller scarring
Ecological diversity	Catch limits	Future condition of marine resources

>>

10. **Based on the previous question, the following subject(s) appear to be relevant to your priority for use versus protection. While considering these subjects, you may have given greater thought to some subjects, and less thought to others. To what extent did you consider each subject in your thinking about the priority of use versus protection?**

	Almost no consideration 1	Slight consideration 2	Some consideration 3	Moderate consideration 4	A lot of consideration 5	Strong consideration 6	Primary consideration 7
Recreation	○	○	○	○	○	○	○
Tourism	○	○	○	○	○	○	○
Invasive species	○	○	○	○	○	○	○
Local economy	○	○	○	○	○	○	○
Fisheries health	○	○	○	○	○	○	○
Boat anchoring/mooring	○	○	○	○	○	○	○
Ecological diversity	○	○	○	○	○	○	○
Local jobs	○	○	○	○	○	○	○
Overfishing	○	○	○	○	○	○	○
Water quality/pollution	○	○	○	○	○	○	○
Ecosystem health	○	○	○	○	○	○	○
Days in fishing season	○	○	○	○	○	○	○
Sea grasses	○	○	○	○	○	○	○
Catch limits	○	○	○	○	○	○	○
Abundance of fish	○	○	○	○	○	○	○
Access to fishing locations	○	○	○	○	○	○	○
Growth in local population	○	○	○	○	○	○	○
Coral health	○	○	○	○	○	○	○
Endangered species protection	○	○	○	○	○	○	○
Propeller scarring	○	○	○	○	○	○	○
Future condition of marine resources	○	○	○	○	○	○	○

11. While you were thinking about the priority of use versus protection, in what manner did you think about the factors you considered? For this question, we are interested in the way you thought about those subjects; were they separate or connected? Please choose the one statement that best describes your thinking.

1 I thought about the subjects as being separate and unconnected matters.

2 I thought about the subjects as being mostly separate matters; perhaps some might be connected to each other.

3 I thought about the subjects as being somewhat separate matters; there are some connections between them. I considered how as one subject changes, other subjects change at the same time.

4 I thought about the subjects as all being connected to each other. They have complex links between them, and I considered how the subjects interact with each other as a whole.

12. Please read the following four statements carefully, and then choose the one statement that best describes how you thought about the issue of use versus protection.

1 The issue of recreational use versus marine resource protection is **rather simple**; it's either **one or the other**. There were **one or two subjects** that were relevant, and I gave the issue **no further thought**.

2 The issue of recreational use versus marine resource protection **may not be that simple**, because **both** should be considered. There were **a few different subjects** that were relevant, and I thought about how different subjects **might be connected**.

3 The issue of recreational use versus marine resource protection is **not simple**, because there is **more to consider**. There were **a number of different subjects** that were relevant, and I thought about how some subjects **affect** other subjects.

4 The issue of recreational use versus marine resource protection is **quite complex**, because there is **a lot more to consider**. There were **many different subjects** that were relevant, and I thought about how the different subjects are **integrated** and affect each other as a whole.

>>

We are interested in how you would respond to various management actions regarding recreational fishing and marine resource protection that could be proposed in Florida.

13. Please indicate the extent to which you <u>support or oppose</u> the following management actions in Florida.

	Strongly Oppose 1	Moderately Oppose 2	Somewhat Oppose 3	Neutral 4	Somewhat Support 5	Moderately Support 6	Strongly Support 7
a. Shorter recreational fishing seasons with enhanced protection of the fish species you most prefer to catch	○	○	○	○	○	○	○
b. Higher recreational bag limit for the fish species you most prefer to catch	○	○	○	○	○	○	○
c. Expansion of marine protected areas in Florida where recreational fishing is prohibited	○	○	○	○	○	○	○
d. Increase in the maximum size limit for the fish species you most prefer to catch	○	○	○	○	○	○	○
e. Longer recreational fishing seasons with less protection of the fish species you most prefer to catch	○	○	○	○	○	○	○
f. Lower recreational bag limit for the fish species you most prefer to catch	○	○	○	○	○	○	○
g. Open more areas in Florida where recreational fishing is allowed	○	○	○	○	○	○	○
h. Decrease in the maximum size limit for the fish species you most prefer to catch	○	○	○	○	○	○	○

>>

14. Assume that managers are currently reviewing the zones and regulations that would affect recreational fishing use and the protection of marine resources in Florida. If new regulations were proposed that significantly change the extent of recreational fishing and marine resource protection in Florida, what would your first thought most likely be?

1 What we have been doing so far is okay with me. I'm not interested in changing the current regulations.

2 I'm not sure I want to change current regulations, but I would be willing to hear what is proposed. I might be open to change.

3 New ways to address marine resource problems could be useful, because our current approaches do not always work well. I would probably be open to change.

4 We must always find new ways to address marine resource problems, because our current approaches don't always work well. I am always open to change.

15. When it comes to information about new regulations regarding recreational fishing and marine resource protection in Florida,

1 I do not seek or pay attention to information about regulations for recreational fishing and marine resource protection in Florida.

2 If I happen to come across pertinent information about regulations for recreational fishing and marine resource protection in Florida, then I may pay some attention to it.

3 When I come across information about regulations for recreational fishing and marine resource protection in Florida, I usually pay attention to see what I can learn from it.

4 Information about regulations for recreational fishing and marine resource protection in Florida draws my attention. I often seek information on marine issues, so that I can learn more about it.

16. Imagine you are having a conversation about the proposed regulations for recreational fishing and marine resource protection in Florida. If others made a comment that you strongly disagree with, how would you respond?

1 Don't listen to their reasoning, and politely excuse myself from the conversation.

2 Listen politely to some of their reasoning but not closely, and I would not engage in further conversation on the topic.

3 Listen carefully to their reasoning, and ask questions if there's something I don't understand.

4 Actively listen to their reasoning, and encourage them to elaborate on their views. I would engage in an open discussion that integrates all of our views for a more complete understanding.

17. If someone suggested that you <u>reconsider your position</u> on the proposed regulations for recreational fishing and marine resource protection in Florida, which of the following statements best describes you?

1 I would continue to focus on my own viewpoint of the issue, rather than try to understand others.

2 I might be willing to consider another person's viewpoint of the issue, but I doubt anything will come of it.

3 I would consider another person's viewpoint of the issue, and think about how their perspective might be better or worse.

4 I would incorporate another person's viewpoint of the issue into my thinking, and try to understand their reasoning before coming to a conclusion.

>>

In this section, we are interested in your beliefs regarding the role of humans in the natural environment, the rights of people to access and use natural resources, and the rights of nature.

18. Please indicate the extent to which you agree or disagree with each of the following statements.

	Strongly Disagree 1	Moderately Disagree 2	Slightly Disagree 3	Neutral 4	Slightly Agree 5	Moderately Agree 6	Strongly Agree 7
a. The primary value of the Florida ecosystem is to provide for people.	○	○	○	○	○	○	○
b. Florida ecosystems are resilient enough to cope with the impacts of human activities.	○	○	○	○	○	○	○
c. Human use of Florida ecosystems is more important than protecting fish species that live there.	○	○	○	○	○	○	○
d. Human activities in Florida ecosystems should not be allowed if they damage these natural areas.	○	○	○	○	○	○	○
e. Florida ecosystems are valuable in their own right, regardless of human interests.	○	○	○	○	○	○	○
f. Florida ecosystems should primarily be managed for the benefits of people.	○	○	○	○	○	○	○
g. Florida ecosystems are very sensitive to human activities and easily damaged.	○	○	○	○	○	○	○

e. Florida ecosystems are valuable in their own right, regardless of human interests.

f. Florida ecosystems should primarily be managed for the benefits of people.

g. Florida ecosystems are very sensitive to human activities and easily damaged.

h. We have to protect Florida ecosystems for future generations, even if it means reducing our standard of living today.

i. There should be fewer regulations restricting human activities in the Florida ecosystem.

j. Management should focus on doing what is best for the Florida ecosystem instead of what is best for people.

k. Humans have a right to change the natural world to suit their needs.

l. People have a duty to protect fish and other parts of nature in Florida.

>>

Natural resource management decisions in Florida involve <u>tradeoffs</u> between the amount of recreational use in marine ecosystems, and the amount of protection given to those natural areas.

For example, managers may decide to <u>enhance</u> the protection of marine resources. At the same time, this would also result in <u>decreased</u> recreational fishing opportunities.

On the other hand, managers could <u>reduce</u> protection of marine resources. At the same time, this would result in an <u>increase</u> in recreational fishing opportunities.

Part of this research aims to understand how you think about <u>tradeoffs</u> between different levels of use versus protection of marine resources in Florida, and which tradeoffs you consider acceptable.

---

19. You will be presented with nine (9) different management scenarios that were randomly selected from a total of 27 possible scenarios. Each scenario describes four (4) conditions that could happen in a management decision. These 4 conditions, which differ depending on the scenario, include:

1	AMOUNT OF PROTECTED AREA	**Reduce**, **make no changes** to, or **expand** the amount of protected area currently set aside for marine habitat protection and scientific research.
2	FISH POPULATIONS	**Reduce, make no changes** to, or **enhance** the amount of protection afforded to fish populations.
3	FISHING ACCESS	Fishermen will have **reduced**, the **same** amount of, or **increased** access to locations where they can fish.
4	LENGTH OF FISHING SEASON	**Less**, the **same** as the current number of, or **more** days in the season to fish for their targeted species.

Please read each scenario carefully. Each scenario presents different sets of tradeoffs based on the 4 conditions above. Then evaluate how <u>acceptable</u> or <u>unacceptable</u> each scenario is to you, based on the 4 conditions.

>>

Managers in Florida propose to:

- **Reduce** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Enhance** the amount of protection afforded to fish populations

Fishermen will have:

- **Increased** access through more locations where they can fish
- **Less** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable	Moderately Unacceptable	Somewhat Unacceptable	Neutral	Somewhat Acceptable	Moderately Acceptable	Extremely Acceptable
1	2	3	4	5	6	7

>>

Managers in Florida propose to:

- **Expand** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Reduce** the amount of protection afforded to fish populations

Fishermen will have:

- **Decreased** access through fewer locations where they can fish
- The **same** as the current number of days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable	Moderately Unacceptable	Somewhat Unacceptable	Neutral	Somewhat Acceptable	Moderately Acceptable	Extremely Acceptable
1	2	3	4	5	6	7

>>

Managers in Florida propose to:

- **Reduce** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Enhance** the amount of protection afforded to fish populations

Fishermen will have:

- The **same** amount of access through the current locations where they can fish
- **Less** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Make no changes** to the amount of protected area currently set aside for marine habitat protection and scientific research
- **Make no changes** to the amount of protection afforded to fish populations

Fishermen will have:

- The **same** amount of access through the current locations where they can fish
- The **same** as the current number of days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Expand** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Reduce** the amount of protection afforded to fish populations

Fishermen will have:

- The **same** amount of access through the current locations where they can fish
- **More** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Make no changes** to the amount of protected area currently set aside for marine habitat protection and scientific research
- **Make no changes** to the amount of protection afforded to fish populations

Fishermen will have:

- **Reduced** access through fewer locations where they can fish
- **More** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Make no changes** to the amount of protected area currently set aside for marine habitat protection and scientific research
- **Make no changes** to the amount of protection afforded to fish populations

Fishermen will have:

- **Increased** access through more locations where they can fish
- **Less** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Reduce** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Enhance** the amount of protection afforded to fish populations

Fishermen will have:

- **Increased** access through more locations where they can fish
- The **same** as the current number of days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

Managers in Florida propose to:

- **Expand** the amount of protected area currently set aside for marine habitat protection and scientific research
- **Reduce** the amount of protection afforded to fish populations

Fishermen will have:

- **Reduced** access through fewer locations where they can fish
- **More** days in the season to fish for their targeted species

Considering the 4 conditions described above, how acceptable or unacceptable do you think this scenario is?

Extremely Unacceptable 1	Moderately Unacceptable 2	Somewhat Unacceptable 3	Neutral 4	Somewhat Acceptable 5	Moderately Acceptable 6	Extremely Acceptable 7

>>

The following questions will help us to improve our understanding of anglers.
The information you provide will remain strictly <u>confidential</u>.
Your name will <u>never</u> be associated with your answers.

20. To what extent do you <u>make use</u> of the following sources for current information about recreational fishing in Florida?

	No Use 1	Almost No Use 2	A Little Use 3	Some Use 4	A Lot of Use 5
a. Fishing magazines					
b. Government agency publications					
c. Newspapers					
d. Bait & tackle shops/companies					
e. Fishing club/organization meetings					
f. Television					
g. Talking with other fishermen					
h. Internet sites/social media					
i. Conservation organization publications					
j. Radio					

21. Are you?

1 Male

2 Female

22. What is your age?

0 Years

23. What is the zip code of your primary home residence?

0 Zip Code

24. How many years have you been living at your primary home residence?

0 Years

25. What is the highest level of education you have completed?

1 12th Grade or less

2 High school graduate or GED

3 Associate or technical school degree or college coursework

4 Bachelor degree (example: BA or BS)

5 Advanced, professional, or doctoral degree

Is there anything else you would like to share with us? Please feel free to provide additional comments on marine resource management issues in Florida.

As we continue to develop these survey questions, we appreciate any feedback, comments, or suggestions that you may have. (For instance, did the questions make sense? Was the survey too long? etc.)

SUBMIT

Your contribution to this research is greatly appreciated.
Thank you for your time and help!

Please direct all inquiries to:

Mary Allen
Human Dimensions Research Unit
Institiute for Coastal Science and Policy
East Carolina University
Greenville, NC 27858-4353
Email: HD@ecu.edu

APPENDIX D. ADDITIONAL RESULTS

Table 1. Percentages of responses to integrative complexity index items with differences of more than one amount.

	Open to Change			
	1	2	3	4
Information Seeking				
1	24 (6.5)	14 (0.7)	12 (0.6)	9 (0.4)
2	43 (11.7)	199 (10.0)	151 (7.7)	92 (4.5)
3	144 (39.0)	1,103 (55.2)	1,030 (52.6)	799 (38.7)
4	158 (42.8)	683 (34.2)	765 (39.1)	1,167 (56.5)
Active Listening				
1	15 (4.0)	11 (0.6)	9 (0.5)	12 (0.6)
2	38 (10.2)	164 (8.2)	110 (5.6)	63 (3.1)
3	134 (36.1)	873 (43.7)	876 (44.8)	573 (27.7)
4	184 (49.6)	948 (47.5)	961 (49.1)	1,417 (68.6)
Perspective Taking				
1	34 (9.2)	25 (1.3)	12 (0.6)	17 (0.8)
2	82 (22.1)	232 (11.6)	158 (8.1)	138 (6.7)
3	186 (50.1)	1,294 (64.8)	1,307 (66.6)	998 (48.3)
4	69 (18.6)	447 (22.4)	484 (24.7)	913 (44.2)
	Information Seeking			
	1	2	3	4
Active Listening				
1	11 (18.6)	4 (0.8)	17 (0.6)	15 (0.5)
2	9 (15.3)	81 (16.7)	207 (6.7)	77 (2.8)
3	24 (40.7)	260 (53.6)	1,414 (46.0)	756 (27.2)
4	15 (25.4)	140 (28.9)	1,436 (46.7)	1,930 (69.5)
Perspective Taking				
1	8 (13.3)	18 (3.7)	31 (1.0)	31 (1.1)
2	11 (18.3)	77 (15.8)	309 (10.0)	211 (7.6)
3	26 (43.4)	298 (61.3)	1,990 (64.6)	1,479 (53.2)
4	15 (25.0)	93 (19.1)	750 (24.4)	1,060 (38.1)

Blue boxes = responses differed by more than one amount.

Table 1 (continued). Percentages of responses to integrative complexity index items with differences of more than one amount.

	Active Listening			
	1	2	3	4
Perspective Taking				
1	18 (38.3)	19 (5.1)	23 (0.9)	28 (0.8)
2	14 (29.8)	153 (40.8)	259 (10.5)	182 (5.2)
3	11 (23.4)	183 (48.8)	1,786 (72.7)	1,814 (51.5)
4	4 (8.5)	20 (5.3)	390 (15.9)	1,500 (42.6)

Blue boxes = responses differed by more than one amount.

Table 2. Analysis of variance for acceptability of four factors of use and protection.

	Sum of Squares	*df*	*Mean Square*	*F-Value*	*p-value*	*partial eta²*
Corrected Model	4,482.08	20	224.10	85.50	.000	.029
Intercept	728,074.20	1	728,074.20	277,768.74	.000	.827
A (PROTECTED AREA)	608.06	2	304.03	115.99	.000	.004
B (FISH POPULATION)	955.45	2	477.73	182.26	.000	.006
C (ACCESS)	1,390.86	2	695.43	265.32	.000	.009
D (SEASON)	903.98	2	451.99	172.44	.000	.006
A * C	14.27	2	7.14	2.72	.066	.000
A * D	122.89	4	30.72	11.72	.000	.001
B * C	240.94	4	60.24	22.98	.000	.002
B * D	18.42	2	9.21	3.51	.030	.000
Error	151,819.77	57,921	2.62			
Total	941,796.00	57,942				
Corrected Total	156,301.847	57,941				

ACCEPTABILITY = A + B + C + D + AC + AD + BC + BD, R^2 **= .029**

Table 3. Analysis of variance for acceptability of four factors of use and protection, and their interactions with integrative complexity.

	Sum of Squares	*df*	*Mean Square*	*F-Ratio*	*p-value*	*partial eta*^{2}
Corrected Model	6,887.06	38	181.24	70.42	.000	.045
Intercept	627,259.477	1	627,259.48	243,713.52	.000	.810
A (PROTECTED AREA)	451.81	2	225.90	87.77	.000	.003
B (FISH POPULATION)	708.71	2	354.36	137.68	.000	.005
C (ACCESS)	1,377.35	2	688.67	267.58	.000	.009
D (SEASON)	946.22	2	473.11	183.82	.000	.006
INT_COMPLEXITY	31.65	2	15.83	6.15	.002	.000
A * C	13.40	2	6.69	2.60	.074	.000
A * D	120.08	4	30.02	11.66	.000	.001
B * C	225.89	2	56.47	21.94	.000	.002
B * D	18.02	2	9.01	3.50	.030	.000
A * COMPLEXITY	151.38	4	37.84	14.70	.000	.001
B* COMPLEXITY	146.52	4	36.63	14.23	.000	.001
C * COMPLEXITY	143.43	4	35.86	13.93	.000	.001
D * COMPLEXITY	222.87	4	55.72	21.65	.000	.002
Error	147,476.30	57,300	2.57			
Total	932,362.00	57,339				
Corrected Total	154,363.36	57,338				

ACCEPTABILITY = A + B + C + D + AC + AD + BC + BD + A(COMPLEXITY) + B(COMPLEXITY) + C(COMPLEXITY) + D(COMPLEXITY), $\boldsymbol{R^2}$ **= .045**