EVALUATING FLORIDA'S COASTAL PROTECTED AREAS:

A MODEL FOR COASTAL MANAGEMENT PLAN EVALUATION

A Dissertation

by

SARAH PRAEGER BERNHARDT

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

December 2010

Major Subject: Urban and Regional Planning

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Approved by:

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ABSTRACT

Evaluating Florida's Coastal Protected Areas: A Model for Coastal Management Plan Evaluation. (December 2010)

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Chair of Advisory Committee: Dr. Samuel D. Brody

This research presents the first coastal and marine protected areas specific quantitative management plan evaluation protocol. This critical research gap in the coastal and marine protected area (CMPA) research literature was addressed by creating a protocol for evaluating CMPA plan quality utilizing a combination of marine protected area (MPA) and land use planning techniques for the first time, then applying it to a sample of CMPAs providing both descriptive results of CMPA plan quality and analysis of factors that might influence plan quality. A sample of CMPAs (n=40) under the jurisdiction of Florida's Coastal and Aquatic Managed Areas (CAMA) was evaluated for plan quality using 96 indicators scored as 0, 1, or 2 and then divided into five plan components: factual basis, goals and objectives, policies, tools and strategies, inter-governmental coordination and cooperation, and implementation and monitoring.

Total CMPA plan quality averaged 29.40 out of a possible 50.00. CMPA plan quality ranged from 20.00 to 47.00 with a standard deviation of 7.07. Regression analysis examined the effects of CMPA context, participation, environmental threats and socioeconomic factors on CMPA plan quality. The age of CMPA plans was found to be a significant indicator of CMPA plan quality. Other significant indicators of plan quality included threatened biodiversity, participation, and percent of adjacent developed or agricultural land.

DEDICATION

For James and Henry

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NOMENCLATURE

AP	Aquatic Preserve
CAMA	Coastal and Aquatic Managed Areas
C-CAP	NOAA Coastal Change Analysis Program
CMPA	Coastal and Marine Protected Area
IUCN	International Union for the Conservation of Nature and Natural Resources
FKNMS	Florida Keys National Marine Sanctuary
GIS	Geographic Information System
MMA	Marine Managed Area
MPA	Marine Protected Area
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NOAA	National Oceanic Atmospheric Administration
NMS	National Marine Sanctuary
NMSP	National Marine Sanctuary Program
US	United States of America

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CHAPTER I

INTRODUCTION

1.1 Background

Over half of the United States population lives within the coastal zone, and with this concentrated population comes a myriad of users, threats and subsequent use conflicts (Klee, 1999). Population pressure in the coastal zone brings increasing demands upon the coastal environment from alteration of watersheds in the coastal region, increasing fishing pressure, and other extractive activities that stress biodiversity in the marine and coastal environments. Increasing use of the coastal zone generates conflicts and disputes over coastal and marine resources.

As the coastlines of the world become more populated, there is a need to protect the open spaces and natural resources of the coast. Protected coastal and marine managed areas are important tools for maintaining the vitality of coastal life. Coastal protected areas are vital to the United States as they help maintain the fishing economy, help buffer against natural hazards such as flooding and hurricanes, and provide a buffer for the environment when there are potential outcomes that we cannot imagine.

This dissertation follows the style of *Journal of the American Planning Association*.

Written management plans exist for most legally designated areas, including cities, states, and protected areas. These documents in their ideal form create a blueprint for the management of the resource for which they were written. In protected areas, they provide goals, objectives, regulations, policies and background information to ensure the sustainable management of discrete areas.

There is a rich body of planning literature focusing on the evaluation of written plans which can be adapted to evaluating the quality and effectiveness of coastal and marine protected area (CMPA) plans. The planning literature suggests that a good plan is more likely to lead to strong land management practices. In addition, strong plan-making processes that include public participation and community involvement are more likely to be focused on environmental regulation (Norton, 2005c). The evaluation of protected area plans can be used to determine the potential success of coastal and marine protected areas (CMPAs).

Although some work has been done to address the quality of plans and plan implementation in coastal communities participating in the North Carolina Coastal Administration Management Act (Norton, 2005a, 2005b, 2005c), there remains a need to address plan quality of coastal and marine protected areas in general. Past research on CMPA plans is primarily based on single case studies and qualitative assessments. To date, little or no work has been done to systematically evaluate a sample of CMPAs against a quantitative model and explain the variation among these CMPAs with respect to their plan quality. This research addresses this gap by building on existing literatures on marine protected areas (MPAs) and plan quality to: a) construct a measurable model of what makes for a high quality CMPA management plan; b) evaluate this model against a sample of CMPAs in coastal Florida to assess their strengths and weaknesses; and c) explain the variation in plan quality using multiple regression analysis.

1.2 Research questions

This research project addresses the question of what makes a coastal or marine protected area successful or effective. While it may be possible to look at a single site and determine if it is successful in protecting one particular value or resource, it is much more difficult to look at a large number of sites and determine if the protected areas are meeting their goals. This research is done from a planning perspective, looking at the question of plan quality and applying this concept to the case of protected areas in general and coastal and marine protected areas in particular. The written plan for a protected area is the blueprint which determines the potential success of the area. A successful protected area is one which uses effective management to protect its environmental resources and includes the use of a high quality management plan. A written plan, if used to its fullest potential, is the daily guidebook for resource managers, educators and research staff of the CMPA. The plan specifically outlines the overall vision of the CMPA while attending to the goals and objectives that determine the day-to-day agenda of the staff. When a successful and well written plan is used as a reference manual on a regular basis, a CMPA is more likely to meets its goals and objectives and strive toward its vision.

The plan has the power to determine the outcome of a protected area. A plan containing specific highly relevant components has the potential to influence the success of the protected area. If a plan that meets certain criteria is considered a high quality plan and the plans can be quantitatively measured in terms of a quality score, then it is possible to measure variability among coastal protected area plans.

1.3 Research questions and objectives

The primary focus of this research is to identify the components that make up a high quality, effective coastal and marine protected area management plan. Subsequently what comprises CMPA plan quality was defined by looking at examples of high quality plans, and then an informed protocol was created for evaluating the quality of existing CMPA management plans. Thus, the primary research questions and subsequent research objectives for this research are as follows: *Research Question 1*: What makes for a high quality coastal and marine protected area plan? *Objective 1.1*: Define coastal and marine protected area plan quality. *Objective 1.2*: Create a coastal and marine protected area plan evaluation protocol.

The secondary focus of this research was to test the protocol for measuring CMPA plan quality by determining if the protocol could detect variability between management plans. A sample of CMPA management plans would need to be selected which could test the protocol's ability to measure differences in plan quality. The sample of CMPA management plans could be evaluated using the CMPA plan quality protocol to determine if there is variability in the quality of the management plans. The research question and subsequent objectives for this secondary portion of the research are as follows: *Research Question 2*: Is there variation among coastal and marine protected area plan quality? *Objective 2.1*: Select coastal and marine protected areas which can be evaluated in terms of their management plan quality by applying the coastal protected area plan evaluation protocol. *Objective 2.2*: Evaluate a sample of coastal and marine protected area plans.

Once a sample of CMPA plans that exhibited variation was obtained, the next step was to ascertain if there were any characteristics of the CMPAs, their surroundings or resources that influenced the quality of the CMPA plans. Based on the CMPA and planning literature, the researcher focused on a series of contextual, participation, socioeconomic and environmental factors. Those factors became the independent variables for testing a number of hypotheses regarding what influences CMPA plan quality. Finally the objective was to take what was learned from the results of the research and apply them in a way that would provide policy makers and CMPA managers with insight on how to improve future CMPA plan quality. The final set of research questions and objectives are as follows: *Research Question 3*: What factors contribute to the variation in coastal and marine protected area plan quality? *Objective 3.1*: Measure various independent variables to predict the variation in coastal and marine protected area plan quality. *Objective 3.2*: Provide insight to the coastal and marine protected area research and management community in terms of management planning as defined by plan quality.

The results of the proposed research provide a quantitative way to look at coastal and marine protected area management through the specific lens of the management plans. The findings will provide baseline data for the CMPA literature in the field of plan quality analysis, and will hopefully guide thoughtful reflection on how CMPA managers and agencies write and evaluate their management plans.

1.4 Dissertation structure

This dissertation includes eight chapters which are summarized as follows:

Chapter I begins with an introduction into the subject of CMPAs, planning and plan quality evaluation. The background is followed by an introduction to the three research questions and subsequent objectives that guided the progress of my research.

Chapter II is the literature review. The literature review begins with background on coastal and marine protected areas management, introducing the framework of international and U.S. CMPA management. The second section of the literature summarizes main trends in CMPA management, including interest in evaluating the success of CMPAs. The third section is a history of general plan quality and plan evaluation followed by a focus on CMPA plan quality and plan evaluation. The five components of plan evaluation are presented.

Chapter III begins with the research rationales, followed by the conceptual model. The dependent variable, CMPA plan quality, is discussed, followed by the ten independent variables which are divided into four groups. The hypotheses of the research are presented for each of the ten independent variables.

Chapter IV includes a description of (provides) the methods used in the research. The sample selection is followed by the sample population and sample frame. Data collection and measurement techniques are provided in detail for the dependent variable of CMPA plan quality and all independent variables. A summary table is provided detailing each variable and the related data sources and scales used. Data analysis techniques are outlined, including specific statistical analyses followed by a discussion of the threats to validity that were encountered in this research and what was done to address those threats.

Chapter V includes a presentation of the results of analysis of the dependent variable, CMPA plan quality. Results include a summary of the CMPA plans and the CMPAs in general, followed by detailed results of the CMPA plan quality analysis. Descriptive statistics are presented for mean CMPA plan quality and mean plan component scores, followed by descriptive plan quality scores for each CMPA. Two figures are presented summarizing total and plan component scores for each of the 40 CMPAs. Mean plan component indicator scores are presented for each of the five plan components and their 96 indicators. Inter-item correlation and scale reliability test results are presented. Finally, descriptive statistics summarizing the CMPAs in general and the variables included in the conceptual model specifically are provided.

Chapter VI includes a description of the influence that the independent variables have on CMPA plan quality. Correlation analysis results are presented for the dependent variable and all independent variables. Regression analysis results are presented for the CMPA contextual, participation, environmental threats and socioeconomic block models followed by the full model results.

Chapter VII provides the discussion of the results of the CMPA plan quality analyses and statistical analyses of the research followed by an examination and presentation of policy recommendations of the study.

Chapter VIII, the conclusion, provides a final research summary. Limitations of the research are addressed followed by a discussion of potential future research projects that stem from or could enhance the results from this dissertation.

CHAPTER II

LITERATURE REVIEW

2.1 Coastal and marine protected areas management

Humans have interacted with and manipulated the world's coastal lands and resources for thousands of years, culminating in the industrial revolution's assumption that coastal and other natural resources were a limitless commodity to be harnessed for economic gain (Kay & Alder, 1999). During the late 19th century the view of land based resources shifted towards acknowledgement that they were finite, and could potentially be destroyed or managed (Kay & Alder, 1999). It was only in the early to mid 20th century that the current form of preservation or protection of coastal or marine areas arrived, with influence from the wide proliferation of land use planning tools and techniques (Kay & Alder, 1999). The CMPA community began to embrace land based planning techniques in the late 1960s (Kay & Alder, 1999) culminating with the passage of the U.S. Coastal Zone Management Act of 1972.

The United States National Park system is among the oldest national park systems in the world, beginning with Yellowstone National Park, the first national park established here in 1872. There were approximately 105,000 protected areas world wide as of 2004 covering 19,647,326 km^2 of the world's surface (Chape, 2004). One of the oldest recorded marine protected areas in the United States, and the first wildlife refuge, is Pelican Island National Wildlife Refuge in Florida established in 1903 as a bird refuge. As of 2004 there were 4,526 MPAs in the world (Wells & Day, 2004). CMPAs exist in all marine environments, from Antarctica to the Caribbean to the Baltic, in every major water body of the world, including many freshwater areas, such as the Great Lakes. CMPAs are established to protect a single species, such as the Hawaiian Islands Humpback Whale National Marine Sanctuary, or to protect entire ecosystems such as in the Great Barrier Reef Marine Park in Australia. CMPAs protect coral reefs, estuaries, seagrasses, individual species, intertidal zones, offshore fisheries, historical fishing areas, archaeologically significant areas, deep water corals, underwater seamounts, and almost any type of marine habitat imaginable. CMPAs are designated by state, federal and local governments, the United Nations, Tribal Nations, and non-governmental organizations such as The Nature Conservancy and the International Union for the Conservation of Nature and Natural Resources (IUCN).

There is a dizzying array of national and international designations of criteria for measuring MPA goals and designating their preservation status. Two standards of the field are those goals set forth by the National Research Council and the IUCN protected area management categories. The National Research Council divides MPA goals into 7 categories (National Research Council & Committee on the Evaluation Design and Monitoring of Marine Reserves and Protected Areas in the United States, 2001) (see Table 2.1). The MPA goals of protecting biodiversity and habitats, collecting scientific information, protecting cultural resources, and enhancing recreation opportunities are the most traditional ways to view the protection of natural resources. It has only been in the past decade that we have begun to include a focus on the creation of protected areas for sustainable environmental benefits (such as water and air quality).

Table 2.1. National Research Council MPA goals.

Goal category	Specific goals
1. Conservation of biodiversity and habitat	A. Protect depleted, threatened, rare, or endangered species or populations b. Preserve or restore the viability of representative habitats and ecosystems
2. Fishery management	A. Control exploitation rates b. Protect critical stages of the species' life history c. Reduce secondary fishing impacts d. Ensure against possible failures of conventional regulatory systems e. Conserve life-history traits and genetic diversity
3. Scientific knowledge	A. Provide a source of baseline data
4. Educational opportunities	
5. Enhancement of recreational activities and tourism	
6. Sustainable environmental benefits	
7. Protection of cultural heritage	

There are 6 categories of protected area management designated by the IUCN (International Union for Conservation of Nature, 1994) (see Table 2.2). The diversity of protected areas includes a wide array of definitions. The IUCN has established specific objectives and levels of protected area management which have provided a base line for preservation around the world (Table 2.2). An example of a National Park Category II designated site would be Everglades National Park. The northern portion of J.N. "Ding" Darling National Wildlife Area on Sanibel Island in Florida is designated as a Wilderness Area and would fall under IUCN Category Ib.

Protected areas are defined as

"*an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated*

> *cultural resources, and managed through legal or other effective means*" (Hockings, Stolton, & Dudley, 2000).

But with any definition that applies to such a diverse group, there is need to insert the following clause:

> "*Although all protected areas meet the general purposes contained in this definition, in practice the precise purposes for which protected areas are managed differ greatly*" (International Union for Conservation of Nature, 1994).

Alternatively the IUCN defined MPAs in 1992 as

> "*Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment*" (Kelleher & Kenchington, 1992).

A dichotomy of definitions exist dividing multiple-use MPAs into those that are based on sustainable use principles (e.g. United States National Marine Sanctuaries) and those that prevent all or certain extractive uses (no-take reserves). These do not need to be mutually exclusive as MPAs can include "the full configuration of protected areas in coastal areas and oceans" (Agardy et al. 2003, p. 357).

Table 2.2. IUCN Protected Area Management Categories (International Union for Conservation of Nature, 1994).

Category	**Description (Based on management objective)**	**Definition**
CATEGORY I	*IUCN protected area*	An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means
CATEGORY Ia	*Strict Nature Reserve*: protected area managed mainly for science	Area of land and/or sea possessing some outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.
CATEGORY Ib	*Wilderness Area*: protected area managed mainly for wilderness protection	Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.
CATEGORY II	*National Park*: protected area managed mainly for ecosystem protection and recreation	Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.
CATEGORY III	*Natural Monument*: protected area managed mainly for conservation of specific natural features	Area containing one or more, specific natural or natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.
CATEGORY IV	*Habitat/Species Management Area*: protected area managed mainly for conservation through management intervention	Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.
CATEGORY V	*Protected Landscape/Seascape*: protected area managed mainly for landscape/seascape conservation and recreation	Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.
CATEGORY VI	*Managed Resource Protected Area*: protected area managed mainly for the sustainable use of natural ecosystems	Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

Note: http://www.unep-wcmc.org/protected_areas/categories/index.html. Accessed 09/07/2010.

In the United States a marine protected area (MPA) is defined by the 2000 US Executive Order 13158 as:

> *"…any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.*"

The US MPA Center has compiled a database of marine managed areas (MMA) in the US, which numbered 1,500 as of 2006. An MMA is defined as a site meeting the following definitions of the terms used in the US Executive Order 13158 defining MPAs (International Union for Conservation of Nature, 1994; U.S. Marine Protected Areas Center, 2006):

- *area: have legally defined boundaries*
- *marine: be an area of ocean or coastal waters or the Great Lakes*
- *reserved: be established by or currently subject to site-specific regulation*
- *lasting: provide year-to-year protection for a minimum of two consecutive years*
- *protection: have existing regulations that afford increased protection specifically to natural and/or cultural resources and qualities within the site*.

The US MPA Center contends that MPAs are a specific subset of the MMA category within the United States. Over 85% of the US MMAs were established since the 1970s designation of federal and state environmental management and protection laws (U.S. Marine Protected Areas Center, 2006). Worldwide, there have been similar trends in creating MPAs, and subsequently there has been a call for evaluations of the success and effectiveness of these MPAs. Are MPAs cost effective? Are MPAs achieving the goals and objectives that they set out to achieve? These questions are being asked as government leaders are increasingly seeking to better manage critical coastal and marine areas.

It is within this framework that CMPA management plan quality in the United States will be examined in this study.

2.2 Main trends in CMPA management

There is a growing worldwide phenomenon to better manage critical marine resources. One of the main areas of interest is that of assessing management effectiveness. In response to the increasing pressure on our oceans, coastal and marine protected areas (CMPAs) are being formed with great abandon around the world with all types of goals, objectives, and scopes. Unfortunately this boom in protected areas establishment has not included much analysis of the effectiveness of the protected areas, especially in terms of their management and socio-economic impacts. Most CMPAs conduct some sort of biological monitoring, but there is a lack of quantitative studies evaluating the effectiveness of their planning and management capacity and outcomes.

A survey by Alder (1996) of 65 countries in the "tropics" suggested that only 23% (excluding Australia) of MPAs had implemented their plans suggesting a prevalence of "paper parks." In addition, the same survey of tropical MPAs found that more emphasis was placed upon ecological factors instead of social or economic factors during plan formation (Alder, 1996). Although the focus of this research is on the quality of plans themselves, it is interesting to note that in at least one study it was found that the CMPA plans were not being implemented. Were the plans' qualities low or were there other factors at play?

There have been recent movements worldwide to develop mechanisms for evaluating protected area management effectiveness, beginning with the IUCN management effectiveness framework (Hockings et al., 2000). There are several measurement manuals for managers to evaluate the effectiveness of their protected area or MPA (Hockings, et al., 2000; Mesoamerican Barrier Reef Systems Project, 2003; Pomeroy, Parks, & Watson, 2004). More specifically, MPA management effectiveness monitoring is being done by MPA managers site by site at the local level, such as proposed in the manual developed by the IUNC Programme on Protected Areas, NOAA and WWF: *"How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness"* (Pomeroy, et al., 2004).

Several case studies and surveys have begun to evaluate MPA effectiveness (Appeldoorn & Lindeman, 2003; Berger, Harborne, Dacles, Solandt, & Ledesma, 2005; Dahl-Tacconi, 2005; Kritzer, 2004; Mas, 2005; Mascia, 1999). In one study with a focus on watershed effects, Jameson et al. (2002) asked whether or not MPAs can be effective when they are managed without effort to control upstream influences and when management applies a checklist approach. Another study in South Africa looked at management objectives and other selection factors in a number of MPAs as a way to measure effectiveness (Hockey & Branch, 1997).

The CMPA community has not focused on plan quality or plan effectiveness with the exception of several specific case studies. In a comparative case study of MPAs in Mexico, Australia and the Lesser Antilles, Agardy (1993) provides in-depth analysis of the quality of coastal planning in terms of zoning, public involvement and multiple use planning techniques which have traditionally been used on land without focusing on plans directly. In a more recent case study, Agardy (2004) addresses specific deficiencies in actual strategies for planning, an overemphasis on monitoring and mapping, and a lack of engagement of non-governmental stakeholders in its construction of the U.S. Coral Reef Task Force's National Action Plan to Conserve Coral Reefs. Agardy (2004) suggests that the plan should have provided guidance on how to "set up applied experiments that would tell us which threats are most critical to tackle" as opposed to the details they provided on how to monitor the existing conditions of coral reefs (p. 39).

2.3 Plan quality and plan evaluation

2.3.1 The history of plan quality and plan evaluation

Early research in plan evaluation focused on evaluating plans in terms of the cost-benefit of the plans' intended outcomes and the actual price to achieve those goals (Hill, 1968; Hill & Tzamir, 1972). The legislation of state planning mandates in states such as Florida, California and coastal North Carolina led to a revisiting of the evaluation of plans. Berke and French's (1994) evaluation of plans in terms of state planning mandates appears to be the basis of subsequent plan quality studies and is the seminal piece in establishing the use of core plan components. The core plan components devised by Berke and French were expanded upon by Kaiser and others (1995) to include: the fact component, "an analysis of relevant conditions"; the values component which sets goals and priorities; and the policies component for "formulating principles of planning and action" (p. 257).

The plan evaluation components were expanded upon in an evaluation of state mandated plans in southern Florida by Brody (2003c, 2003d, 2003e, 2003f) who added implementation and collaboration and inter-organizational coordination. Brody applied the core plan components when evaluating the quality of local comprehensive plans in terms factual basis, goals and objectives, collaboration or inter-organizational coordination, policies and strategies, and implementation. Brody's (2003c, 2003d, 2003e, 2003f) research measured ecosystem planning by measuring local comprehensive plans' quality, the local plan's ability to manage ecological systems in terms of biodiversity, the influence of resource-based industries on the planning process, and the influence of public participation in the planning process. Berke, Crawford, et al. (1999) offered an eight plan component evaluation for plans in New Zealand which focused on criteria for intergovernmental implementation: clarity of purpose, interpretation of the mandate, integration with other plans and policy instruments, organization and presentation, identification of issues, quality of fact base, internal consistency of plans, and monitoring.

Most recently the core plan components have been revisited, focusing on internal versus external plan quality criteria resulting in a similar but slightly more general eight components (Berke & Godschalk, 2009; Berke, Godschalk, Kaiser, & Rodriguez, 2006). The internal plan quality criteria are: issues and vision statement, fact base, goal and policy framework, and plan proposals; while the external plan quality criteria are: encourage opportunities to use plan, creation of clear views and understanding of plans, accounting for interdependent actions in plan scope, and participation of actors (Berke, Godschalk, et al., 2006). This division of the criteria into internal and external criteria offers a potential tool with which to evaluate how well the plan is going to engage the user, offering an interesting and previously unexamined window into the potential for public access, standing and influence (Senecah, 2004).

Plan quality studies have addressed specific aspects of plans in terms of state planning mandates (Berke & French, 1994; Dalton & Burby, 1994), cooperative planning mandates (Berke, et al., 1999; Berke, Dixon, & Ericksen, 1997), natural hazards (Brody, 2003a; Burby & Dalton, 1994), sustainability (Berke & Conroy, 2000), ecosystem management (Brody, 2003e; Brody, Carrasco, & Highfield, 2003), stakeholder participation (Brody, 2003f; Burby, 2003), sprawl reduction (Brody, Carrasco, & Highfield, 2006), biodiversity (Brody, 2003c), industry participation in environmental planning (Brody, 2003d) and strategic environmental assessments (Tang, 2008; Tang, Bright, & Brody, 2009; Tang & Brody, 2009) (See Table 2.3).

Table 2.3. Review of plan quality and plan evaluation literature.

Plan quality evaluation: specialty	**Authors**
• Sustainability	(Berke & Conroy, 2000)
• Natural hazards	(Brody, 2003a; Burby & Dalton, 1994)
• Stakeholder participation	(Brody, 2003f; Burby, 2003)
• Industry participation in ecosystem management	(Brody, 2003d)
• Sprawl reduction	(Brody, Carrasco, et al., 2006)
• Plan evaluation	(Baer, 1997; Berke & Godschalk, 2009)
• Biodiversity	(Brody, 2003c)
• State planning mandates	(Berke & French, 1994; Dalton & Burby, 1994; Norton, 2005a, 2005b, 2005c)
• Coastal zone management within state planning mandates	(Norton, 2005a, 2005b, 2005c)
• Cooperative planning mandates	(Berke, et al., 1999; Berke, et al., 1997)
• Strategic environmental assessment	(Tang, 2008; Tang, et al., 2009; Tang & Brody, 2009)
Plan effectiveness	
• Ecosystem management	(Brody, 2003e; Brody, Carrasco, et al., 2003)
• State growth management & stakeholder participation	(Brody, Godschalk, & Burby, 2003)
• Plan implementation	(Brody & Highfield, 2005a; Laurian et al., 2004; Norton, 2005a, 2005b, 2005c) (Berke et al., 2006)

Plan effectiveness studies have addressed ecosystem management (Brody, 2003e; Brody, Carrasco, et al., 2003), state growth management and stakeholder participation (Brody, Godschalk, et al., 2003), and plan implementation (Brody & Highfield, 2005a; Laurian, et al., 2004).

Baer (1997) offers a comprehensive review of plan evaluation. The contents of a plan reflect "the plan's initial conceptualization" (Baer, 1997, p. 330). Plan evaluation

> "*...criteria reflect a concern about plan adequacy and competence similar to that shown in state mandates for plans. State mandates are exhaustively... "rational" in their detailed requirements for technical competence*" (Baer, 1997, p. 330).

Baer (1997) warns that evaluation criteria are useful for responding to state planning mandates, "so long as planners do not become totally enamored with technique and expertise" (p. 330).

Research evaluating plan implementation is a relatively new addition to the environmental planning field (Berke, Backhurst, et al., 2006; Brody & Highfield, 2005a; Laurian, et al., 2004). Norton (2005a, 2005b, 2005c) has addressed the quality of plans and plan implementation of coastal communities participating in the North Carolina Coastal Administration Management Act. The current paucity of research evaluating plan implementation may be due to the lack of agreement regarding appropriate time frames for evaluating the success of plans and general techniques for evaluating plan effectiveness, and the lack of long-term data sets to use in research studies (Brody & Highfield, 2005b). Laurian, Day, et al. (2004) present a "conformance-based plan implementation evaluation (PIE) methodology" which used core plan components which included: internal plan consistency, fact base, clarity of issues, "provisions for monitoring," and planning capacity which resulted in simple scores for evaluating "implementation shortcomings" (p. 478-479). This research study measures the quality of CMPA management planning documents, not the quality or extent of the implementation of those planning documents.

2.3.2 Coastal and marine protected area plan quality and plan evaluation

A CMPA plan evaluation matrix incorporates the knowledge of what makes up a successful protected area in terms of design, site selection, and all levels of management. All MPAs are unique in terms of their "environmental characteristics, societal needs, and management frameworks” and “no model exists that is appropriate in all circumstances” (Agardy, 1997, p. 199). The following design, site selection, and management principles have been applied to the proposed CMPA plan quality evaluation protocol (Appendix A). The components either adapt land based planning criteria to CMPA management plan considerations or purely stem from marine and coastal specific needs.

2.4 Marine protected area plan components

Coastal and marine protected area plans can be evaluated by building upon the already rich local plan quality research from the planning literature. The CMPA plan can be enhanced with local plan criteria for ecosystem management established by Brody (2003c, 2003d, 2003e, 2003f), and then further specified to include the issues specific to a marine or coastal environment. A CMPA plan evaluation protocol has been created by the researcher that contains all of the necessary components for a successful written management plan (see Appendices A and B).

2.4.1 Factual basis

The process of selecting potential areas or zones for marine protection involves data collection, data analysis and data synthesis (Salm & Price, 1995). Maps are commonly used in CMPA planning to identify critical habitats (core zones), neighboring habitats (protected area boundaries), and linked habitats (buffer zones) (Salm, Clark, & International Union for Conservation of Nature and Natural Resources, 1984). Decision support systems such as geographic information systems (GIS) can be helpful for compiling data which may be shared through an on-line data base which may be updated and accessed by the public, stakeholders and partners taking part in plan development and management (Sexton, 1998).

The factual basis component of a written plan is an inventory of what the CMPA management currently knows about their protected area. It includes species lists, habitat types, biophysical information, threats, socio-economic data, and governance information. Other common information in the factual basis includes geology, climate, boundaries, uses, historical background, and cultural resources. This information can be presented in written or graphical format and is the foundation upon which the goals and objectives of the CMPA are built.

2.4.2 Goals and objectives

The goals and objectives component of a CMPA management plan should provide specific, measurable goals and objectives for the CMPA. Each goal should have corresponding objectives, which in turn will direct corresponding policies for the CMPA. Goals for CMPA plans may be scientific, economic, cultural and/or ethical (Jones, 1994). The goals and objectives should stem from the mission and value statements of the CMPA, which ideally set out a vision of what the CMPA will be like in both the near and distant future. Goals are generally somewhat broad and forward thinking, requiring several objectives to be accomplished before the goal is achieved. Objectives should be straightforward, measurable, and achievable within a clear and concise timeframe.

The two most common goals for MPA establishment are conservation of biodiversity and enhancement of ecotourism for reserves considered wilderness areas, and resource management areas used to create the export of a sustainable supply of resources for human consumption, such as in cases of declining fisheries (Halpern & Warner, 2003). Ideally each MPA must start with clearly defined objectives created with stakeholder input (Agardy, 1997). Evaluating vulnerability allows site selection to take into consideration current and potential threats to an ecosystem (Gubbay, 1995) but more importantly, monitoring and evaluation methods should be in line with objectives, and should be monitored for effectiveness by a stakeholder or independent group which may also regularly evaluate whether or not the MPA's full value is being realized (Agardy, 1997). Additional important goals of MPAs include education, research, effective management of resources, fisheries management, sustainable environmental benefits, and protection of cultural heritage. Each goal may be complemented by additional objectives, criteria or parameters for measuring, and relative importance as a policy instrument.

2.4.3 Policies, tools, and strategies

The policies, tools and strategies component of a CMPA plan should stem directly from the goals and objectives. These are the regulatory tools, incentive based tools, and spatial design tools that will aid the CMPA in achieving the goals and objectives. This is where the CMPA utilizes strategies specific to a coastal environment, zoning, buffer areas, resource use restrictions, limited access, user fees, educational programs, and other techniques to achieve stated goals and objectives.

The regulatory tools criteria included in the Policies, Tools and Regulations component of the protocol (Appendix A) reinforce Dramstad, Olson, and Forman's

(1996) ideas that plans should avoid habitat fragmentation, encourage wildlife corridors, and provide structural and regulatory measures to avoid future fragmentation and erosion of habitats. MPA effectiveness has been criticized using a “three screen doors” analogy suggesting that atmospheric, terrestrial, and oceanic sources of inputs need to be managed in a successful MPA (Jameson, et al., 2002).

One important tool in CMPA design is the use of zones. Zoning is a useful regulatory and spatial design tool. Zoning should be designed “to maximize protection for ecologically critical areas, while allowing sustainable use in less sensitive, vulnerable or important areas” while boundaries should reflect ecological boundaries and should be flexible to change if new information becomes available (Agardy, 1997, p. 199). Zoning uses CMPAs as building blocks for representative networks of CMPAs or for bringing attention to larger scale environmental problems, (Agardy, 1997, pp. 199-200). The scale of the CMPA should determine the scale of habitat classification and mapping in order to create a “representative” system (Stevens, 2002). An overarching system of coastal and marine protected areas can create “a management umbrella over a fragmented system to help coordinate and strengthen diverse, but related, efforts” (Salm, et al., 1984) (see Appendix B, PTS_16). Agardy (1994) argues that multiple use MPAs must “utilize a system of multiple core areas" in order to be effective.

Zoning in MPAs has been tested in a variety of cases, including the Great Barrier Reef and Belize (Laffoley, 1995). Experience has shown that straight lined boundaries, on-site surface markers, and color coded maps can be effective mechanisms to increase zone compliance (Laffoley, 1995) (see Appendix B, PTS_17).

The use of zoning to designate multiple uses in protected areas can reduce perceived and potential conflicts among users. Ecological principles guide the creation of zones utilizing core areas, buffer zones, and outer boundaries of the protected area (Agardy, 1997). The ability of a multiple use zoning plan to “accommodate anticipated growth in coastal and marine tourism while maintaining environmental quality and avoiding conflicts with other economic sectors” has been demonstrated by the Great Barrier Reef Marine Park (GBRMP) (Agardy, 1997, p. 67). Coastal and marine protected areas can provide place-based protection within a locally managed geographic framework while helping managers “buffer against unforeseen management mistakes” and “provide a framework for testing management measures so that conservation and management can be undertaken in efficacious ways” (Agardy, 1997, p. 69).

2.4.4 Inter-organizational coordination and cooperation

The inter-organizational coordination and cooperation component of the CMPA plan identifies the need for a protected area to be aware that threats and issues span across geographic, time, political and ecological boundaries. Protected area jurisdictions that coordinate with neighboring municipalities, state, local or federal resource or regulatory agencies also have the potential to be more successful, as they are able to streamline their efforts, building relationships and sharing resources with other organizations. Successful CMPAs should outline intergovernmental agreements and other similar arrangements in their management plans. It stands to reason that regulations are less frequently broken in areas where there is a local sense of involvement.

The utilization of site selection criteria ensures that objective measures are used when determining suitable areas for protection (Gubbay, 1995). Criteria must be clearly defined, selected and agreed upon by stakeholders to ensure that the sites are transparent in their selection (Agardy, 1997). The participatory design process is one where stakeholders are actively involved and allows for selection of criteria that all groups will support (National Research Council & Committee on the Evaluation Design and Monitoring of Marine Reserves and Protected Areas in the United States, 2001). It is common for site selection criteria to be grouped under the value categories of social, economic, scientific (or ecological), planning and management values (which may be argued to include feasibility, pragmatic and regional values) (Gilman, 1997; Gubbay, 1995; National Research Council & Committee on the Evaluation Design and Monitoring of Marine Reserves and Protected Areas in the United States, 2001). Ranking of criteria should be completed by a stakeholder committee to ensure that criteria meet the goals and objectives of the CMPA (Gilman, 1997). In the process of selecting sites for zoning in new CMPAs, it may be appropriate for a guided ranking of the criteria, led by the regulatory agencies that will influence the enforcement of any protections, but including involvement from the stakeholder representatives in the committee. Finally, the criteria should be paired with a directed look at identifying compatible and incompatible uses of selected sites and potential user conflicts in the MPA (Salm, et al., 1984).

2.4.5 Implementation and monitoring

A written management plan is nothing more than a piece of paper until actions are taken to implement the plan and monitor the results. This is where the implementation and monitoring components of a CMPA plan are essential. Monitoring objectives must be quantifiable and responsibility for monitoring and implementation should be clearly designated in the plan (see Appendix B, IM_10 to IM_14). A plan cannot be successfully implemented without adequate designation of resources, identification of the organization's capacity, sanctions for violations of policy, administrative authority and other designations of education, outreach and research efforts (see Appendix B, IM_2 to IM_8).

CMPAs should be designed for feasibility and with mechanisms for self-financing from the beginning and should be used to "raise awareness, educate, and empower" throughout the life of a CMPA (Agardy, 1997, pp. 199-200). There are critical linkages between the land and sea via estuaries and the land-sea interface that will require coordinated multi agency participation and the involvement of local communities in the development and management processes to ensure compliance and enforcement of any new protected area system (Agardy, 1997; Batisse, 1990). It is important to emphasize the fact that the ocean is one large system of which each CMPA is just a part. CMPAs need to integrate themselves into "the context of a larger ocean governance system" while ocean and governance systems need to consider existing CMPAs (Ehler, 2003, p. 339). This component of plans is designed to measure inclusion in the management plan of mechanisms for implementing the plan and monitoring the success of programs, not the actual implementation of the plan.

CHAPTER III

CONCEPTUAL FRAMEWORK AND RESEARCH HYPOTHESES

3.1 Research rationales

Since 75% of US MMAs are established by state or territorial jurisdiction, I focused my research on this predominant form of protected areas. Examining state protected areas provided a level of continuity between plans. As of October 2006, Florida had 384 state established MMAs, the highest number of all states in the US. California had the second highest number of state established MMAs with 117. This research provides a pilot test of a plan evaluation protocol which can be used to evaluate the management plans of CMPAs throughout the United States and other parts of the world.

3.2 Conceptual model

The dependent variable in the model is CMPA total plan quality. The independent variables include those pertaining to the socioeconomics of the populated areas adjacent to the CMPA, variables specific to each CMPA and its management plan's context. There are five types of independent variables: contextual, CMPA capacity, participation, environmental threats and socioeconomic. The variables are summarized in the research model (Figure 3.1).

3.3 Dependent variable: plan quality

The plan quality literature has received increased attention in the past decade (Berke & French, 1994; Berke, Roenigk, Kaiser, & Burby, 1996; Brody, 2003a; Brody

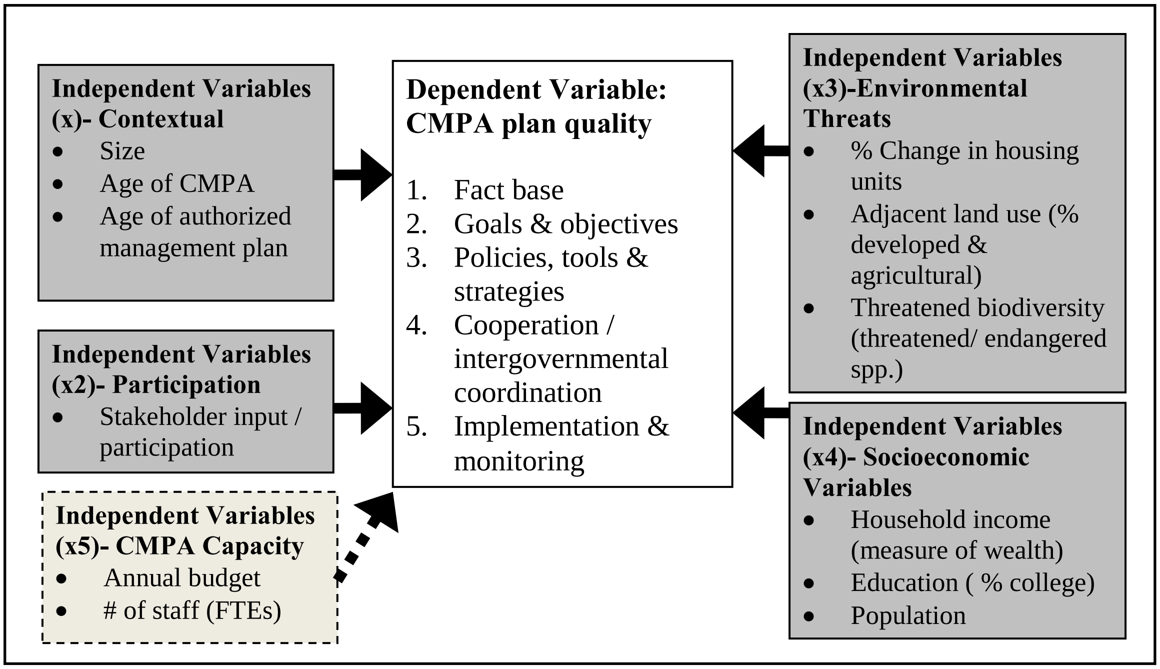

Figure 3.1. Research model for evaluation of CMPA plan quality as a measure of management success.

& Highfield, 2005a; Burby, 2003). Building upon this rich literature, the researcher has augmented the traditional planning literature with CMPA concerns to create a model of a successful or high quality CMPA plan. The systematic, quantitative evaluation of CMPA plans to determine success has not been previously addressed. There is a need to address the quality of CMPA plans in general, and more specifically, in Florida, the state with the highest number of state run marine managed areas (MMAs) within the United States.

Each plan was evaluated in terms of five components which together measure CMPA plan quality: fact basis; goals and objectives; policies, tools and strategies; intergovernmental coordination and cooperation; implementation and monitoring. Each of these components is described in the following methods section, then each component is presented with its specific indicators (see Appendix A and Appendix B).

3.4 Independent variables

There are four types of independent variables in this research study: CMPA plan contextual, participation, environmental threats, and socioeconomic.

3.4.1 CMPA plan contextual independent variables

The general context of a CMPA can be a strong indicator of CMPA management plan quality. The size and age of a CMPA can be important indicators along with the year that the current CMPA management plan was authorized. Larger protected areas will have higher quality management plans due to a perceived need for more management in larger areas.

Hypothesis 1: CMPA plan quality will increase as a function of unit increase in the size of the CMPA.

Older CMPAs have had more time to develop strong management plans, to learn from management errors and mistakes.

Hypothesis 2: CMPA plan quality will increase as a function of unit increase in the age of the CMPA.

Newer CMPA management plans will be of a higher quality because they take into account lessons learned in CMPA management over the past 30 plus years as CMPAs are more commonly used as management tools.

Hypothesis 3: CMPA plan quality will decrease as a function of unit increase in the number years since the current CMPA management plan was authorized (i.e., CMPA plan quality will increase as the age of a management plan decreases).

3.4.2 Public participation independent variable

Stakeholders should be involved in the visioning process of the management plan, decision making, and in continued monitoring and evaluation of the plan (Brody, Godschalk, et al., 2003). Much of the literature suggests that it is best to begin stakeholder participation as near to the beginning of the planning process as possible. While some of the research suggests that the timing is not that important (Brody, Godschalk, et al., 2003), it seems wise to engage stakeholders early in the process in order to ensure their ownership and future adherence to plan rules and regulations (Wondolleck & Yaffee, 2000). Stakeholders and the public are more likely to understand the decision-making process and take ownership of the new plans and regulations if they were involved in their development (Wondolleck & Yaffee, 2000). When creating a management plan for CMPAs there are five steps, the second and fourth of which are public consultation prior to the drafting of the management plan and public participation in the review of the draft management plan (Kenchington & Kelleher, 1995). Coastal and marine protected areas are more likely to be successful and experience user compliance of regulations when there has been quality public participation throughout the management planning process (Dalton, 2005). It is hypothesized that higher quality public participation, in the form of stakeholder groups, easily accessible information, and web and print material accessibility will result in higher CMPA plan quality scores.

Hypothesis 4: CMPA plan quality will increase as a function of unit increase in public participation.

3.4.3 Environmental threat independent variables

3.4.3.1 Change in housing units

When CMPAs are located adjacent to areas with higher rates of population growth the planners and stakeholders involved in the creation of management planning documents are more likely to be aware of decreasing coastal and marine environmental resources resulting in a greater interest in maintaining those resources. It is hypothesized that CMPAs adjacent to areas of rapid or recent population growth as measured with percent change in housing units will have higher quality CMPA plans.

Hypothesis 5: CMPA plan quality will increase as percent change in housing unit increases.

3.4.3.2 Adjacent land uses

CMPAs are located adjacent to a variety of adjacent land uses including agricultural, industrial, commercial or residential development. It is suggested, that as the number of different types of land uses increases, so will pressure on the CMPA and subsequently, the perceived need for stronger protection measures, which would lead to stronger CMPA plan quality (Brody, 2003b)

Hypothesis 6: CMPA plan quality will increase as a function of a unit increase in the total area of adjacent agricultural and developed land use.

3.4.3.3 Threatened biodiversity

Previous research has found that while biodiversity does not have a statistical influence on plan quality, the presence of disturbed biodiversity does influence plan quality (Brody, 2003b). Consequently, threatened biodiversity, as a measure of disturbed biodiversity, is being used in this research as a variable of CMPA plan quality. Threatened biodiversity is being measured as the sum of all threatened, endangered and species of special concern, as identified in the management plans. It is being theorized that if there is a perceived sense of threat due to a larger number of listed threatened (or endangered or special concern) species, there is more likely to be a stronger effort to create a higher quality management plan to protect the biodiversity in a protected area.

Hypothesis 7: CMPA plan quality will increase as the number of threatened and endangered species increases.

3.4.4 Socioeconomic independent variables

3.4.4.1 Household income as a measure of wealth

There is a hypothesis in the sociology and psychology fields known as the affluence hypothesis that suggests that more affluent populations or individuals are more likely to embrace environmentalism due to the fact that their basic needs such as food, water and shelter have been met. Numerous studies have attempted to test the affluence hypothesis some with uncertain results (Scott & Willits, 1994; Van Liere & Dunlap, 1980), some with positive results (Diekmann & Franzen, 1999; Franzen, 2003; Gelissen, 2007), while several studies have suggested that perhaps there is a more complicated connection between wealth and environmentalism. These other studies suggest that there is a u-shaped relationship between wealth and environmentalism, very poor and very wealthy countries and populations are more likely to embrace environmentalism while countries with middle range gross domestic profits are more likely to be focused on development concerns and shy away from environmentalism (Duroy, 2008; Xiao & McCright, 2007).

In planning research it has been found that wealthy populations are more likely to have more resources to invest in ensuring that coastal and marine areas are maintained at a high level of environmental quality (Berke, et al., 1996; Brody, Highfield, & Carrasco, 2004; Burby, May, & Center for American Places, 1997) while median home value has been found to have a positive correlation with plan quality (Berke, et al., 1999) suggesting that higher quality plans may occur in wealthier regions. Plan quality is influenced by wealthy, environmentally-minded people because they have the time and interest to participate in the planning process than less wealthy populations. Wealthy communities are more likely to financially support local CMPAs in terms of donations, gifts, and other means of support for individuals and local organizations. Wealthy communities have more volunteer organizations supporting CMPAs, which leads to enhanced planning processes. This accumulated interest and wealth are hypothesized to result in CMPA plans of higher quality than those CMPAs that are not adjacent to wealthy populations.

Hypothesis 8: CMPA plan quality will increase by a unit increase in average household income in adjacent communities.

3.4.4.2 Education

Populations with higher education levels tend to have greater interest in environmental issues. Highly educated populations are more likely to get involved in management planning and public participation processes. CMPAs located in or adjacent to counties with higher educational levels will result in CMPA plans of higher quality. Previous research has shown a positive relationship between education and ecosystem plan quality (Tang and Brody 2009).

Hypothesis 9: CMPA plan quality will increase with a unit increase in percent of population with a college degree in adjacent communities.

3.4.4.3 Population

Coastal and marine protected areas planners whose CMPAs are located adjacent to large populations are more likely to be aware of decreasing coastal and marine environmental resources resulting in a greater interest in maintaining those resources. Large population centers are frequently home to centers for research, academia, and government agencies which manage natural resources, thus planning efforts have a larger range of expertise to draw upon. On the other hand, large population centers are often faced with widespread environmental impact problems due to impervious surfaces, runoff, air pollution, and decreased natural ecosystems among other problems. Previous research focusing on ecosystem plan quality has found significant correlations between population and plan quality (Brody, 2003c; Tang & Brody, 2009). It is hypothesized that CMPAs adjacent to areas of large population will have higher quality CMPA plans due to their proximity to a greater variety of constituents, resources and threats.

Hypothesis 10: A unit increase in population in adjacent communities will significantly increase CMPA plan quality.

3.4.5 CMPA capacity

The capacity of the CMPA to successfully implement the creation and review of the management plan may be directly tied to the CMPA's annual budget and the number of full time staff (FTEs) assigned to the CMPA. CMPAs with larger annual budgets can afford the resources and staff members to create high quality planning documents and pay for the research and mapping necessary for a strong factual basis of the management plan. CMPAs with larger numbers of full time staff are more likely to create high quality planning documents because there are more people available to dedicate to the job of plan creation. In statistical analyses the number of FTEs and budget are highly correlated thus were combined to create a single scale of CMPA capacity (see Methods). In 1991 the Aquatic Preserves managing agency was the Florida Department of Natural Resources and had the "goal of on-site management of all aquatic preserves by 1991, as expressed in the Agency Functional Plan" (Department of Natural Resources, Division of State Lands, & Bureau of Submerged Lands and Preserves, 1991, p. 69). This statement by the managing agency suggest that the Aquatic Preserves management team saw a need for increased staff and funding in order to move these protected areas from "paper parks" to successful management areas.

Hypothesis 11: CMPA plan quality will increase as a function of unit increase in CMPA capacity (an additive scale of budget and FTEs) for each CMPA.

CHAPTER IV

METHODS

4.1 Sample selection

Within the United States, NOAA has created an inventory of CMPAs, referred to as marine managed areas (MMAs), which identifies 1,511 MMAs divided into 1,825 zones within the United States and its territorial waters. Among the inventoried states, Florida has 450 NOAA classified MMAs divided into 549 zones, the largest number for any state in the United States, followed by California with 141, Texas with 86 and Hawaii with 71 MMAs (www3.mpa.gov/exploreinv/AdvancedSearch.aspx, accessed 12/4/07). Florida is the focus of this research due to the fact that it has the largest number of MMAs or CMPAs in the United States. Within Florida, the Department of Environmental Protection's (DEP) Office of Coastal and Aquatic Managed Areas manages the largest number of CMPAs, managing the state's 41 Aquatic Preserves, three National Estuarine Research Reserves (NERR), one National Marine Sanctuary (NMS), and the Coral Reef Conservation Program. The Aquatic Preserves program offers the largest single type of CMPA within the state, providing a consistent management format for plan evaluation. One final incentive to the focus on Florida is that all of the Aquatic Preserve, NERR and NMS management plans are publicly available in PDF format via the internet. Additionally, CAMA Aquatic Preserves are evenly distributed throughout the state's coastal waters, providing an excellent representation of a coastal protected area network.

4.2 Sample population

The survey population for the research is all coastal or marine protected areas in Florida as defined by Florida's Coastal Zone Management Act authorized legislation (Table 4.1).

Table 4.1. List of all CMPAs managed by the Florida Department of Environmental (DEP) Protection Coastal and Aquatic Managed Areas (CAMA) with management plans.

Florida Coastal and Marine Protected Areas	
Aquatic Preserves**	
1. Alligator Harbor	19. Lemon Bay
2. Apalachicola Bay	20. Lignumvitae Key
3. Banana River	21. Loxahatchee River - Lake Worth Creek
4. Big Bend Seagrasses	22. Matlacha Pass
5. Biscayne Bay - Card Sound	23. Mosquito Lagoon
6. Boca Ciega Bay	24. Nassau River - St. Johns River Marshes
7. Cape Haze	25. North Fork, St. Lucie *
8. Cape Romano - Ten Thousand Islands	26. Pellicer Creek
9. Cockroach Bay	27. Pine Island Sound
10. Coupon Bight	28. Pinellas County
11. Estero Bay	29. Rocky Bayou
12. Fort Clinch State Park	30. Rookery Bay
13. Fort Pickens	31. St. Andrews
14. Gasparilla Sound - Charlotte Harbor	32. St. Joseph Bay
15. Guana River Marsh	33. St. Martins Marsh
16. Indian River - Malabar to Vero Beach	34. Terra Ceia
17. Indian River - Vero Beach to Ft. Pierce	35. Tomoka Marsh
18. Jensen Beach to Jupiter Inlet	36. Yellow River Marsh
Florida National Estuarine Research Reserves	
1. Apalachicola National Estuarine Research Reserve	
2. Guana Tolomato Matanzas National Estuarine Research Reserve	
3. Rookery Bay National Estuarine Research Reserve	
National Marine Sanctuary Program	
1. Florida Keys National Marine Sanctuary	

*Inland, but contains part of a brackish estuary.
**There are 41 APs, but Lake Jackson, Oklawaha River, and Wekiva River Rainbow Springs APs were excluded from the study because they are located completely inland and contain no coastal areas.

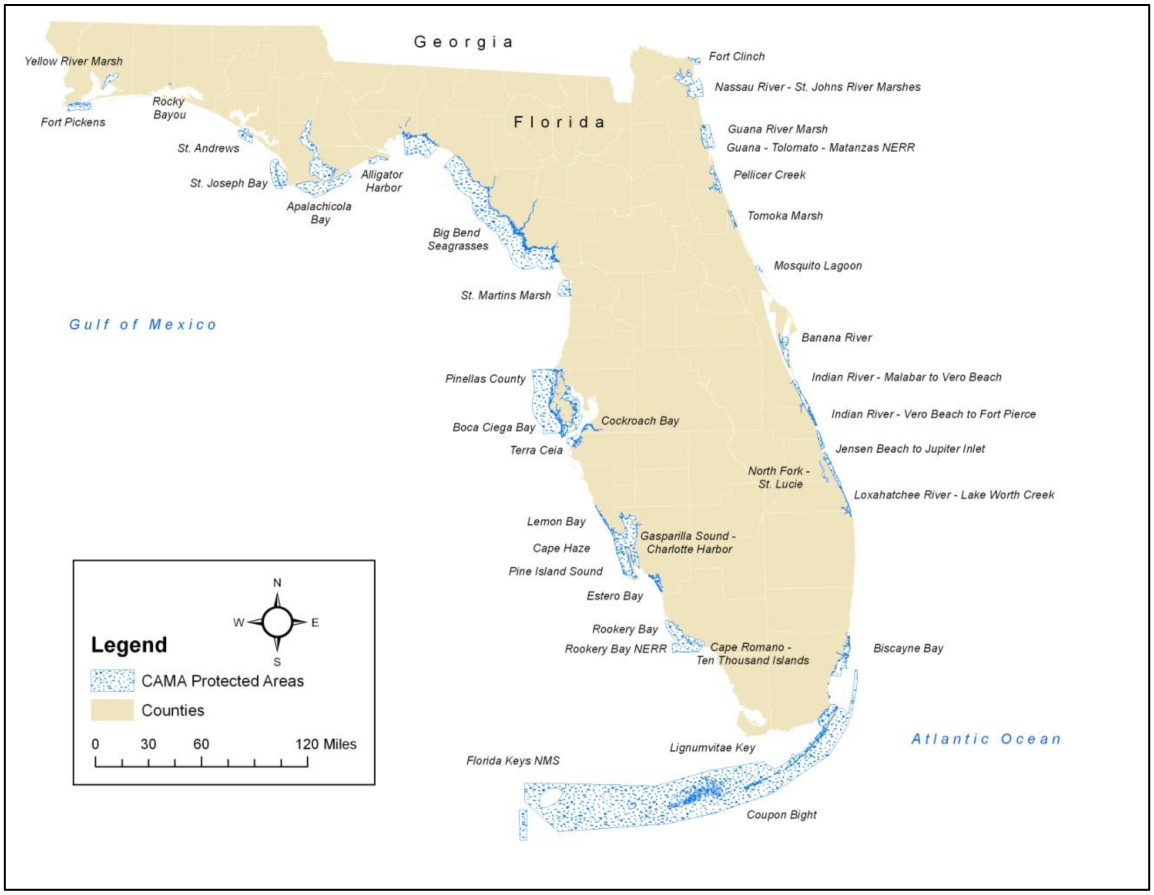

Figure 4.1. Map of Florida’s Coastal and Aquatic Managed Areas (CAMA).

4.3 Sample frame

The sample frame was made up of all those CMPAs in Florida which have a written plan completed and publicly available. Further, these protected areas must be located adjacent to or within state jurisdiction (i.e., protected areas outside state waters will not be included in order to limit the sites studied to areas with immediate human population pressures) and must be located directly on or adjacent to the coastline, or be completely marine. To further limit this sample, only protected areas currently within the jurisdiction of the Coastal and Aquatic Managed Areas branch of the Florida Department of Environmental Protection (Table 4.1) were included in the sample. By selecting CMPAs under one single regulatory authority, there was a control for variability in plan quality that might occur due to differing policies between agencies. Within this group of protected areas, a sample was derived of all CAMA managed protected areas within the Aquatic Preserves, National Marine Sanctuaries and National Estuarine Research Reserves authorizations (n = 40) (Table 4.1 and Figure 4.1). Plans evaluated were the most recent authorized plan for the jurisdiction being studied. One exception was the Guana River Marsh Aquatic Preserve, which has a stand-alone plan from 1985 and more recently was included in the GTMNERR management plan along with Pellicer Creek AP. In the case of Guana River Marsh AP, the plan from 1985 will be used, and the plan coding information from the GTMNERR management plan will apply only to GTMNERR and Pellicer Creek AP.

4.4 Data collection

Analysis of written protected area plans was done by the author. Plans were accessed via the internet and downloaded in portable document format (PDF) or requested directly from the area in paper format. United States Census data was utilized to obtain secondary data at the county level. Telephone and email correspondence were used to acquire data regarding budgets and staff. Plans were evaluated in a non-systematic order. The order in which plans were evaluated was tested and determined to be not significant in the outcome of the final plan scores.

4.5 Dependent variable measurement: coastal plan quality

The management plan evaluation protocol was developed to be specific to CMPA plans although not specific to CAMA plans in particular. The plan evaluation components and their indicators represent the most important characteristics for a CMPA as defined by the author, and influenced by a number of experts in the field of CMPAs and protected areas (PAs) in general (Agardy, 1997; Hockings, et al., 2000; Hockings, Stolton, Leverington, Dudley, & Courrau, 2006; Staub & Hatziolos, 2003).

Each plan was evaluated in terms of five components, which together will measure CMPA plan quality: fact basis; goals and objectives; policies, tools and strategies; intergovernmental coordination and cooperation; implementation and monitoring. Each of these components is explained in the following sections, then each component is presented with its specific indicators (see Table 4.2, Appendixes A and B).

Each plan component was measured using a series of indicators, which together direct the measurement of each plan component. In general, the plan coding process involved recording a score for each indictor in a spreadsheet. In order to obtain a score for each indicator the entirety of the plan was considered, not just certain sections of the plan. Notes were made recording page numbers and other information pertaining to each indicator as it was given a score. The following sections describe how each plan component was scored. The written plans were coded via document analysis. Each of the plan components indicators were measured using an ordinal scale (0-2) where 2 = Identified, detailed, relevant, clear; 1 = Identified, vague; and 0 = Not identified, none (Berke, Godschalk, et al., 2006; Brody, 2003e).

Table 4.2. Plan quality components and their indicators.

Components of CMPA plan quality	**Plan quality evaluation protocol**
Factual Basis	20 indicators
Goals and Objectives	32 indicators
Policies, Tools and Strategies	20 indicators
Inter-organizational Coordination and Cooperation	10 indicators
Implementation and Monitoring	14 indicators
Total Plan Quality	96 total indicators

The dependent variable, plan quality, was measured following techniques established by Berke et al. (1999; 1997; 1996) and modified by Brody (2003e). Each of the following steps was completed for each individual plan included in the sample. *First*, the indicators that make up each plan component were measured via document analysis, resulting in a score of 0, 1, or 2 for each indicator. The coding categories were defined specifically for each indicator, and generally categorized as 0 = not identified, none; 1 = identified, but vague; 2 = identified, detailed, relevant, and clear. *Second*, the indicators that compose each component were summed to create a cumulative score for each component. These scores vary depending upon the number of indicators that comprise a component. *Third*, dividing the total component score by the maximum score possible from the total number of indicators used to comprise that component provided a fractional score, with a range from 0 to 1. *Fourth*, a standardized score for each component was calculated by multiplying the fractional scores by 10, providing a range for each plan component from 0 to 10. The final step was to sum all of the plan component scores together creating a total plan quality score, with a possible range between 0 and 50 (based on 5 main plan components) (see Table 4.3). This technique places equal emphasis on each plan component regardless of the number of indicators used to measure the component.

For each of the 96 indicators used to calculate total plan quality, breadth and quality scores were calculated. In addition, breadth and quality scores were calculated for the three indicators used to measure the participation independent variable. Indicator breadth scores were calculated by dividing the number of plans that address a targeted indicator by the total number of plans in the study, yielding a score between 0 and 1.0. Indicator quality scores were calculated by dividing the total sum of scores of all plans that addressed a targeted indicator by the number of plans that addressed the indicator, then dividing the result by two, to get a score between 0 and 1.0. In the case of the participation indicators, which had a maximum possible sore of 1.0, quality scores did not require dividing by two to get the final score between 0 and 1.0.

Descriptive statistics are reported for each plan component and its indicators, including means, standard deviations, total number sampled, ranges, and the Standard Error of Measurement utilizing the Cronbach alpha reliability coefficient (Cronbach, 1951) (see Chapter V). It is expected that as the Cronbach alpha levels increase, precision increases.

Table 4.3. Summary of research variables, data types and data sources.

Variable Name	**Variable Operation**	**Data Source**	**Scale**
Plan Quality			
Overall plan quality	Summation of all possible indicators	Written management plans	0 to 50
Plan quality subcomponents	Five components, each a sum of indicators within the	Written management plans	0 to 10
Plan quality indicators	Individually scored, as 0, 1, or 2	Written management plans	0, 1, or 2
Contextual			
Size	Total area of CMPA including terrestrial, marine and aquatic resources	Agency reported; FL GIS	Continuous (acres)
Management authority	Federal, state, or local management authority	Plan	Nominal
Age of CMPA	Number of years since CMPA was authorized (calculated from 2010)	Plan	Continuous
Age of current CMPA plan	Number of years since most recent plan update was published (calculated from 2010)	Plan	Continuous
Environmental threats			
Percent change in housing units	Percent change in housing units for the two decades prior to year current plan was updated. Calculated as a function of the county adjacent to the CMPA. For CMPAs with boundaries adjacent to more than one county, the value will be the mean of the sum of the adjacent counties.	US Census 1970, 1980, 1990, & 2000.	Continuous (0-100)

Table 4.3. Continued.

Variable Name	Variable Operation	Data Source	Scale
Percent of developed and agricultural adjacent land uses	Measures the percent of adjacent land to the CMPA that is categorized as developed or agricultural land uses as measured from the NOAA C-CAP dataset utilizing a buffer of 1 mile. (Total calculated as a % of total adjacent land or % of adjacent land excluding submerged lands and open water).	Plan; C-CAP data (NOAA Coastal Services Center, 2009)	Continuous
Threatened biodiversity	Total number of species listed in the management plan as threatened or endangered or species of special concern. This variable was collected after the management plans were scored for plan quality. Species lists reported as published by FDA and USFWS	Reported in plan	Continuous
CMPA Capacity	CAMA allocates money to regions, without specifying percentage of time allocated to each CMPA within the region. For this research capacity variables were divided equally between the total number of CMPAs represented by a region's budget or FTA allocation. Measured for the most recently available fiscal year (FY 2010 July 1, 2009 - June 30, 2010 for CAMA, FY 2009 October 1, 2008 to September 30, 2009 for FKNMS).		
Number of staff (Full Time Equivalents or FTEs)	Measured as the total number of full time employees (in terms of a 40 hour work week) dedicated to the CMPA (this number can include state, federal or contract staff, and be a continuous measure). E.g. 3.25 would indicate that the CMPA has the equivalent of three and a quarter full time staff persons dedicated to the site.	Reported by CMPA staff	Continuous
Salaries	Measured as the total agency (Federal, state, or combined) spending on staff salaries specific to a CMPA for the current year in terms of dollars per year for the most recently available fiscal year.	Florida CAMA and FKNMS budget summaries	Continuous ($/year)
Operating Funds	Measured as the total agency (Federal, state, or combined) spending on operating funds specific to a CMPA for the current year in terms of dollars per year for the most recently available fiscal year.	Florida CAMA and FKNMS budget summaries	Continuous ($/year)
Annual Budget	Measured as the total agency (Federal, state, or combined) spending specific to a CMPA for the current year in terms of dollars per year for the most recently available fiscal year (sum of salaries and operating funds).	Florida CAMA and FKNMS budget summaries	Continuous ($/year)

Table 4.3. Continued.

Variable Name	Variable Operation	Data Source	Scale
Participation			
Participation and stakeholder input	Score based on amount of public involvement in plan creation. This data is collected as part of the plan evaluation protocol, but is not included in the analysis as part of the dependent variable. It is an independent variable only.	Management plan, Plan appendices	This is an additive score (0, 1, 2, or 3)
Socioeconomic	Calculated as a function of the county adjacent to the CMPA. For CMPAs with boundaries adjacent to more than one county, the value will be the mean of the sum of the adjacent counties. All socioeconomic variables will be from the US Census prior to the year the plan was updated.	2000 US Census unless otherwise noted	
Population	Population will be calculated using the census prior to the year the current plan was updated. Calculated as a function of the county adjacent to the CMPA. For CMPAs with boundaries adjacent to more than one county, the value will be the mean of the sum of the adjacent counties.	US Census 1980, 1990, & 2000.	Continuous
Income (wealth)	Measured as the average annual income of households within a county. Dollar amounts for 1969 and 1979 are adjusted to reflect 1989 values (United States Department of Labor & Bureau of Labor Statistics, 2009). 1989 and 1999 values were not adjusted.	(U.S. Census Bureau, 2009; United States Department of Labor & Bureau of Labor Statistics, 2009)	Continuous ($/ household/ year)
Education	*Education* variable will be measured as percent of the population who are college educated. This will be measured as achievement of a Bachelor's Degree as defined for the 1990 and 2000 Census (for 1980 Census this will be the sum of individuals who attended college for 4 or 5 years).	US Census	Continuous (% college educated)

Notes: Variable measurements adapted from a number of sources (Brody et al., 2006; Hockings, et al., 2000; Hockings, et al., 2006; Staub & Hatziolos, 2003). Additional data sources included Florida Department of Environmental Protection Geographic Information Systems (DEPGIS) and http://www.geoplan.ufl.edu/ GEOPLAN data clearing house.

4.5.1 Factual basis

The factual basis component measures how each protected area measures and identifies the existing resources in their jurisdiction in terms of biophysical, socio-cultural, and economic resources. In addition to the inventory of factual information, the public accessibility of the factual information is evaluated in terms of how easily the factual information can be read, processed, and utilized by the general public and the staff of the protected area. Each indicator within the factual basis component was given a score of 0, 1, or 2. A score of “0” represents that the indicator was not identified, present, or recognized in the plan. A score of “1” represents that the indicator was present in the plan, but the indicator was not presented with detail or was superficially mentioned. A score of “2” was given for an indicator that was present in detail and was thoroughly explained in the plan.

For example, the indicator which measured if commercially important species were identified with baseline scientific data had full variation resulting in plans with 0, 1 and 2 scores. The Florida Keys NMS plan received a 2 score for the identification of commercially important species due to its inclusion of text and figures describing lobster fishery data in the plan and in a referenced Environmental Impact Statement (United States Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, & National Marine Sanctuary Program, 2007). The North Fork St. Lucie River Aquatic Preserve Management Plan received a score of one for identification of commercially important species due to a mention of four example species that could be considered commercially important, but provided no details about the commercially important species (Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, & North Fork St. Lucie River Aquatic Preserve, 2009). The final example is of Rocky Bayou State Park Aquatic Preserve’s management plan which received a score of zero for identification of commercially important species (Martin, Department of Natural Resources, Division of State Lands, Bureau of Submerged Lands and Preserves, & Northwest Florida Aquatic Preserve Field Office, 1991). The Rocky Bayou State Park AP plan had no mention of commercially important species of any type in the plan.

4.5.2 Goals and objectives

The goals and objectives component measures how a CMPA measures its guiding statement, goals, and objectives. In a plan, the guiding statements direct the goals and objectives which in turn direct the policies, tools and strategies. These indicators were given a score of “0” if the specific indicator was not mentioned or described in the plan. A score of “1” was given for indicators that identify a specific goal or objective, but did not provide details, or the goals or objectives were not measurable or were not specific to a time frame. A score of “2” was given for goal and objective indicators which were measurable, provided a clear time frame for accomplishment, and were clearly and concisely written in straightforward language. The indicator for the guiding statement needed to include mention of one or all of the following: vision statement, mission statement or values for the CMPA in precise and clear language as described in the protocol (see Appendix A) in order to receive a score of “2”. No mention of guiding statements was scored as “0”, while vague, imprecise or mentions of only one of the three guiding statements were scored as “1”.

For example, the indicator measuring the objective to implement a management effectiveness monitoring program (Appendix B, GO_26) of the Jensen Beach to Jupiter

Inlet management plan was scored as a 2 because this goal was mentioned specifically in the plan in a chapter entitled "Resource and Progress Monitoring Program" and outlined specific tasks that should be monitored, and provided a specific time frame in which the monitoring should take place (every three years) in order for "the management plan to be effectively implemented" (Department of Natural Resources, Division of State Lands, & Bureau of Submerged Lands and Preserves, 1990, p. 80). The management plan for Boca Ciega Bay and Pinellas County Aquatic Preserves was scored as a zero for the indicator measuring the objective to implement a management effectiveness monitoring program because there was no mention at any level of any intention for this type of action to take place in the written plan (Pinellas County Department of Engineering & Department of Environmental Management, 1987). The management plan for the Charlotte Harbor Aquatic Preserves (Cape Haze, Gasparilla Sound – Charlotte Harbor, Matlacha Pass and Pine Island Sound APs) was given score of one for the indicator measuring the objective to implement a management effectiveness monitoring program because, although there was a mention that "staff will annually develop an implementation status report that will contain a summary of identified management needs and suggested measures to be take in meeting these needs", it was not specific enough in providing details of the monitoring efforts (Department of Natural Resources, Bureau of Environmental Land Management, & Division of Recreation and Parks, 1983a, p. 111).

4.5.3 Policies, tools and strategies

The policies, tools and strategies of a CMPA plan should stem directly from the goals and objectives. These are the regulatory tools, incentive based tools, and spatial design tools that will aid the CMPA in achieving the goals and objectives. Each indicator within the policies, tools and strategies component was given a score of 0, 1, or 2. A score of "0" represents that the indicator was not identified, present, or recognized in the plan. A score of "1" says that the indicator was present in the plan, but the indicator was not considered with detail or was superficially mentioned. A score of "2" was given for an indicator that was considered in detail and was thoroughly explained in the plan.

For example, the regulatory tool represented by the indicator "zoning is specified (if appropriate) and utilizes a system of multiple core areas or conservation zones" was scored as a "2" in Apalachicola Bay AP because the AP was divided into individual management areas with their own allowable uses and specific rule criteria. The management areas included 12 different classifications representing over 30 sites (Department of Natural Resources, Bureau of Submerged Lands and Preserves, & Division of State Lands, 1992). Alligator Harbor AP's management plan was scored as a "1." Alligator Harbor AP's plan was divided into two specified zones: an Approved Shellfish Harvesting Area as designated by the Florida Department of Natural Resources and an Unclassified area. In addition, the waters of the AP were given the Class II (shellfish propagation or harvesting) surface water classification by the Florida Department of Environmental Regulation in addition to the Outstanding Florida Waters designation bestowed upon all Florida APs (Department of Natural Resources, Bureau of

Historic and Environmental Land Management, National Oceanic and Atmospheric Administration, & Office of Ocean and Coastal Resource Management, 1986). A CMPA in the sample would receive a score of “0” if there was no variation within the boundaries of the CMPA with regards to zoning, and the ecology, geography or use of the site indicated that zoning would be appropriate.

4.5.4 Inter-organizational coordination and cooperation

The involvement of stakeholders, coordination and cooperation within the organization, and cooperation with other agencies are all important in securing a CMPA’s success. Each indicator within the inter-organization coordination and cooperation component was given a score of 0, 1, or 2. A score of “0” represents that the indicator was not identified, present, or recognized in the plan. A score of “1” says that the indicator was present in the plan, but the indicator was not considered with detail or was superficially mentioned. A score of “2” was given for an indicator that was considered in detail and was thoroughly explained in the plan.

For example, the Guana Tolomato-Matanzas NERR was given a score of “0” for the coordination and cooperation indicator identifying “coordination with private sector (including industry)” because nowhere in the plan was there any mention of private sector coordination (Department of Environmental Protection & Office of Coastal and Aquatic Managed Areas, 2009). Charlotte Harbor Aquatic Preserves Management Plan was given a score of “1” for the “coordination with private sector” indicator because it specifically mentioned Florida Power and Light Company in the management plan, but did not fully meet its potential with regards to coordination with the private sector

(Department of Natural Resources, et al., 1983a, p. 63). Lignumvitae Key AP was given a score of “2” for the “coordination with private sector” indicator because they had a specific task identified within their education goals specifically designed to “coordinate with commercial and recreational fishing interests in order to educate and disseminate information…” (Department of Natural Resources, Division of Recreation and Parks, & Bureau of Environmental Land Management, 1984, p. 115).

4.5.5 Implementation and monitoring

A plan should be implemented or monitored in order to be successful. Indicators for implementation specifically identify techniques used to ensure plan implementation. Each indicator within the implementation and monitoring component was given a score of 0, 1, or 2. A score of “0” represents that the indicator was not identified, present, or recognized in the plan. A score of “1” says that the indicator was present in the plan, but the indicator was not considered with detail or was superficially mentioned. A score of “2” was given for an indicator that was considered in detail and was thoroughly explained in the plan.

The implementation and monitoring indicator that “identified costs of funding” scored as 0, 1, and 2 in the sample. For example, Loxahatchee River- Lake Worth Creek AP was scored as “0” because there was no identification of any cost of funding in the management plan (Department of Natural Resources, et al., 1984). Fort Pickens AP was scored as a “1” for the same indicator because the plan outlined an “anticipated budget” for salaries, operating capital outlay, and operating expenses for the first and second years of the AP’s existence (Martin, Department of Natural Resources, Bureau of

Submerged Lands and Preserves, Division of State Lands, & Northwest Florida Aquatic Preserve Office, 1992, p. 83). An example of plan which was scored as a “2” for the “identification of cost of funding” indicator is the Florida Keys NMS, which identified anticipated costs in tabular format at the end of each action plan within the management plan, allowing for detailed tasks and objectives to be tracked in terms of anticipated costs (United States Department of Commerce, et al., 2007).

This is not an exhaustive protocol. There are many factors that might influence the quality of a CMPA plan. Berke et al. suggest evaluating plans in terms of internal versus external quality (Berke, Godschalk, et al., 2006). This newer concept of external quality is not within the scope of this project, although aspects of this concept have been incorporated into the protocol. Examples of external quality included in the protocol include presence of a table of contents, clear and measurable objectives, and the use of tables and clear graphics to display factual information (see Appendix B, indicators FB_14, FB_19 and FB_20).

4.6 Independent variable measurement

The independent variables are summarized in terms of the variable measurement operation, data source, and scale in the following sections and in tabular form (see Table 4.3).

4.6.1 Contextual independent variables

The selection of these contextual variables was based on CMPA evaluation protocols prepared for the World Bank (Staub & Hatziolos, 2003) and the IUCN (Hockings, et al., 2000; Hockings, et al., 2006). *Size of CMPA* was measured in acres using Florida GIS data and agency reported CMPA areas. The *age of the CMPA* was obtained from the written plan and is the number of years since the CMPA was established. *Years since current plan authorized (plan age)* was measured as the number of years since the plan was authorized as described in the written CMPA plan. Identification of the *management authority* for each CMPA is descriptive and refers to the categorization of each CMPA as being under the authority of CAMA’s AP, NERR, or NMS programs.

4.6.2 Environmental threat independent variables

The selection of the environmental variables is influenced by the idea that threatened natural areas or areas with a perception of threat are more likely to be protected. The first factor is adjacent land use focusing on the perception that developed land will pose a water quality threat to an adjacent CMPA. *Adjacent land use* measures the percent of land adjacent to the CMPA that is categorized as developed or agricultural as measured from the NOAA Coastal Change Analysis Program (C-CAP) dataset (http://www.csc.noaa.gov/digitalcoast/data/ccapregional/) utilizing a buffer of 1 mile and excluding adjacent waters. The buffer calculations were calculated in Arc GIS using the land use and change data in the 2005 NOAA C-CAP dataset. The *percent change in housing units* variable measures percent change in housing units for the two censuses prior to the year the current plan was updated. Percent change in housing units was calculated as a function of the county adjacent to the CMPA. For CMPAs with boundaries adjacent to more than one county, the value is the mean of the sum of the adjacent counties. Housing unit data comes from the US Censuses in 1970, 1980, 1990, and 2000 (U.S. Census Bureau, 1972; U.S. Census Bureau & Population Division, 2009). *Threatened biodiversity* is the total number of species listed in each management plan as threatened, endangered, or species of special concern. This variable was collected after the management plans were scored for plan quality. The species listed in the plans were classified as endangered, threatened or species of special concern by publications of the Florida Department of Agriculture and Consumer Services, Florida Game and Fresh Water Commission, United States Fish and Wildlife Service and other agencies involved in listing endangered species and then included in the CMPA plans.

4.6.3 Participation independent variable

The participation and stakeholder input variable is based on research that suggests that CMPAs formed and managed with a supportive and involved public will be more successful and have higher levels of compliance (Conroy & Berke, 2004). *Participation* was measured using the text of the management plans and plan appendices and is a score based on the amount of public involvement in the creation of the plan using a sum of three indicators (see Table 4.4). This variable was measured as part of the management plan quality evaluation, but the data obtained was not included in the final plan quality score, ensuring that the variable "public participation" was utilized only once, and was considered an independent variable in this study. Total participation scores could have a range of 0 to 3.0. Participation indicator breadth and depth scores were calculated as described in a previous section.

Table 4.4. Participation independent variable.**

Indicators used to measure participation	Scoring*
Advisory council formed with representation of major stakeholder groups	0, 1
Public input forums provided during management plan reviews allow for objectives to be created in a collaborative process that involves scientists, local communities, user groups and management authorities	0, 1
Organizations and individuals that were involved in plan preparation are identified	0, 1

*Each indicator scored as 0 or 1. 0 for no presence of an indicator, 1 if there is any level of the indicator in the management plan. **Final participation variable calculated for each CMPA as a sum of the three participation indicators, for a total score of 0-3.

4.6.4 Socioeconomic independent variables

The use of socioeconomic variables helps to provide a social context for the CMPA, and using US Census data, information regarding adjacent counties' population numbers, annual household income, and household level of education. All of the socioeconomic variables were calculated as a function of the county adjacent to the CMPA. For CMPAs with boundaries adjacent to more than one county, the value measured was the mean of the sum of the adjacent counties' US Census data. *Household income as a measure of wealth* variable was measured as the average annual income of households within a county. *Education* was measured as the percent of individuals with a college education within a county (this measure was not a measure of individuals with a bachelor's degree or higher education, only those with a bachelor's degree). *Population* is the total population from the county adjacent to the CMPA. For plans authorized in the 1980s, the 1980 US Census was used, for plans authorized in the 1990s, the 1990 US Census, and finally plans authorized after 2000 utilized the 2000 US Census for measuring population change (U.S. Census Bureau & Population Division, 2009; United States Bureau of the Census, 1972; U.S. Census Bureau, 2009). This allowed the data used in the research to be from the time period directly prior to the authorization of each individual management plan.

4.7 Data analysis

The statistical tests and diagnostics used in this research included descriptive statistics, regression models, and tests of regression reliability. Statistical analyses were conducted using SPSS version 15.0.1 for Windows and STATA version SE 10.1 for Windows.

4.7.1 Descriptive statistics

Basic descriptive statistics were conducted on the dependent variable and independent variables. Basic statistics included the range, mean, and standard deviation. Plan quality scores were calculated for each individual plan, for each of the five plan components, and for each of the individual indicators that made up each plan component.

4.7.2 Regression models

Multivariate analysis was conducted to measure the effects of plan quality on coastal and marine protected areas management while controlling for socioeconomic, environmental, participation and contextual factors. With a sample size of 40 and 10 independent variables, it was not appropriate to model all of the variables together. A block analysis was used to determine which of the different variables from each of the independent variable groups (blocks) belong in a final model (Brody, 2003c, 2003d, 2003f; Brody, et al., 2004). Additional analyses were done to evaluate the research hypotheses utilizing regression statistics.

Regression block models that were analyzed include the following:

CMPA contextual variables: $Y_i = \beta_o + \beta_1$ size of protected area + β_2 age of protected area + β_3 age of management plan + E_i

Participation variable: $Y_i = \beta_o + \beta_1$ stakeholder participation + E_i

Environmental threat variables: $Y_i = \beta_o + \beta_1$ percent change in housing units + β_2 threatened biodiversity + β_3 adjacent land use (percent developed and agricultural) + E_i

Socioeconomic variables: $Y_i = \beta_o + \beta_1$ household income + β_2 college education + β_3 population + E_i

A full model was analyzed utilizing those independent variables which tested significant in each of the above block models after conducting Pearson's product moment correlation coefficients to test the degree of association among variables and subsequent F-tests for significance (Sheskin, 2004). Those independent variables which were most influential were incorporated into a final model. Each of the groups of independent variables was tested against the plan quality scores using ordinary least squares regression (OLS), then, as indicated by significance and F-tests, was added to a final predictive model.

The block of independent variables focused on CMPA capacity, which included CMPA budget, salaries and number of full time employees, was not included in the regression analysis due to high levels of multicollinearity and potential violations of regression assumption. While this research study's sample size was too small to eliminate all potential multicollinearity problems and too small to fully specify the theoretical model in regression analysis, the CMPA capacity variables were reported in terms of their correlation scores and their descriptive statistics in the results sections of the research study.

4.7.3 Tests of reliability

In order to have confidence in the regression models, a number of tests were conducted to avoid potential error. The data were examined in terms of the reliability and validity of the data. Tests of reliability are commonly accepted when using regression models (Sheskin, 2004). Examination of the data to avoid multicollinearity, heteroskedasticity, the presence of outliers or influential data, and model misspecification was conducted. Other issues addressed were inter-item correlation and scale reliability (Sheskin, 2004).

4.7.3.1 Multicollinearity

Multicollinearity occurs when the independent variables in a regression model are highly correlated with one another. High levels of correlation can cause inflated variance, standard error and parameter estimates in a regression model. Tests measuring variance inflation factors for the independent variables (VIF) were conducted to ensure that no issues of multicollinearty would result in unstable models. There was no multicollinearity of the independent variables in the block and final regression models.

The CMPA capacity variables for budget, salaries and number of full time staff (FTEs) exhibited extreme multicollinearity regardless of the inclusion of a single variable, combination of variables, or scales made up of the variables. The CMPA capacity variables are included in the descriptive statistics and correlation results because they display an interesting aspect of the CMPAs, but they were not included in any regression models in this research. This exclusion of one of the blocks from the model reduced problems of multicollinearity and violations of the assumptions of regression, but it causes other problems, such as model misspecification, which are discussed in a following subsection 4.8.3.4. Future research could attempt to eliminate these problems of multicollinearity with a larger sample size or by creating different scales from the problematic variables.

4.7.3.2 Heteroskedasticity

Heteroskedasticity occurs when the residuals of a regression model do not have constant variance. The Breusch-Pagan / Cook-Weisberg test for heteroskedasticity was conducted and no problems were found. In addition, regression residuals were plotted against the dependent variable.

4.7.3.3 Outliers and influential data

Analysis of the data included tests for influential data points or outliers. Because the sample size of 40 is relatively low, although several very high quality individual management plans appeared as outliers, they were included in the final analysis because they are genuine findings, not statistical anomalies. Because of the small sample size (n=40), the outliers are statistically important. Final results do not change drastically by excluding these outliers (such as the FKNMS or NERRs).

There were a few CMPAs which exhibited characteristics worth further observation when using Cook's D and leverage measurements on the independent variables, but no one site exhibited tendencies so high that it made it worthy of removal from the data set. The individual CMPAs were determined to be exhibiting real differences.

4.7.3.4 Model misspecification

Model misspecification can occur when non-linear combinations of the estimated values are used to explain a related variable. The Ramsey regression specification error test (RESET) was used to test for model misspecification. No model misspecification was detected.

4.7.3.5 Inter-item correlation and scale reliability

The reliability of the plan coding measurement scale is an important aspect of overall reliability of the research model. It is important for a measure to be able to be conducted repeatedly and yield consistent results. Analysis of the research model for the dependent variable plan quality and for the independent variable participation using a Cronbach alpha reliability coefficient (Cronbach, 1951) was helpful. It is expected that as the Cronbach's alpha levels increase (Cronbach's alpha > 0.70), precision increases, and alleviates concerns regarding the reliability of the measurement scales for participation and the dependent variable.

4.8 Threats to validity

The four types of validity threats, statistical conclusion validity, internal validity, construct validity and external validity were addressed in this research (Shadish, Cook, & Campbell, 2002).

4.8.1 Statistical conclusion validity

It is important to address statistical conclusion validity because of the potential for Type I and Type II error, i.e. to incorrectly conclude that the dependent and independent variables covary when they do not, or inversely, to assume lack of covariance when it exists. This study may experience a lower level of statistical power due to the small sample size ($n = 40$) and it is possible that the relationship between the independent and dependent variable may be inappropriately declared insignificant or significant (Type I or II error). In addition the number of independent variables in the model, ten, is relatively high compared to the total sample size. One way this was addressed is by testing for covariance and using a block group method for determining a final statistical model. A block group method allowed the ten independent variables proposed in the conceptual model to be tested in groups (CMPA contextual, participation, environmental threats, and socioeconomic factors), thereby attempting to decrease issues of multicollinearity. This research has a small sample size and the use of ten independent variables is relatively high when compared with sample size which necessitated the use of block models to limit the total number of independent variables included in the full model. Independent variables which were significant at the $p < 0.05$ level were included in the final regression model, resulting in a lower number of independent variables in the final regression model.

4.8.2 Internal validity

Internal validity determines if there is a valid causal relationship between the independent and dependent variables. Threats to the internal validity in this research may come from a single factor, multiple factors or other interaction factors. There may be policy internal validity threats which come from the way different agencies manage the three types of CMPAs within CAMA. Internal validity was increased in this study due by collecting all samples in one state, Florida, in coastal protected areas, all under the same regulatory agency, CAMA. Alternatively, since some of the management plans were written in the 1980s while others were written in the 1990s or just in the past few years, events occurring in those time frames may cause those plans written in different time frames to be dissimilar.

The writing of CMPA management plans occurs in a complex political, social, regulatory framework, which cannot be adequately represented by statistical modeling. Representation of environmental threats was conducting using three different variables, collected from three different data sources and time frames. Participation is an incredibly complex, dynamic process that involves a myriad of stakeholders, activities, and events that were fully represented by the three indicators used in this research. Instead, the variable measures were the best available for the research, and were applied consistently to the entire sample. Finally, the internal validity of the plan quality analysis can be threatened or enhanced by the consistency in which the plan coding was conducted, and the level of understanding and interpretation factors of the individual researcher.

4.8.3 External validity

External validity describes how well the conclusions of this research can be generalized to other settings. External validity in this study may be low due to the fact that only three types of CMPAs were analyzed and the fact that all cases are located in

Florida. This may result in low external validity when trying to make generalizations about the results and extend them to coastal protected areas in other states or other countries throughout the world. Florida has its own set of social, political, geographic and ecological factors which may influence the external validity of this research.

4.8.4 Construct validity

The construct validity of the research study examines if the statistical inferences about the measurement of the variables can be reliably applied to the theoretical model (Shadish, et al., 2002). The conceptual model was based on established literature in an effort to improve the theoretical basis of the model. In terms of the dependent variable of CMPA quality, the construct validity is dependent upon the consistency in which the plan coder scored the plans. The plan coding evaluation protocol was created following the established literature and guidelines, and then pretested before being applied to all plans in the sample.

CHAPTER V

CHARACTERIZING CMPA PLAN QUALITY

5.1 CMPA plan quality results

Thirty-three management plans representing 40 CMPAs were evaluated for plan quality. The CMPAs were designated as protected areas by the State of Florida between 1968 and 1999, a thirty-one year range, with a mean age of 36 years. The CMPAs range in size from Rocky Bayou State Park Aquatic Preserve’s 480 acres to Florida Keys National Marine Sanctuary’s 2,457,888 acres. The most recent management plan for each site was evaluated. Plan completion dates range from 1983 to 2009, a twenty-five year range with a mean age of 18 years (Table 5.1). Five management plans covered two or more CMPAs. The shared management plans occur when the CMPAs share boundaries, are regionally connected, or share management leadership. Nineteen CMPAs management plans evaluated in this study were published in the 1980s, thirteen in the 1990s, and eight after 2000.

Table 5.1. Summary of CMPA management plans and sites.

CMPA Name	Plan Title	Year Plan Published	Year CMPA Designated	CMPA Size (acres)
Alligator Harbor AP	Alligator Harbor Aquatic Preserve Management Plan	1986	1969	14,366
Apalachicola Bay AP	Apalachicola Bay Aquatic Preserve Management Plan	1992	1969	80,000
Apalachicola NERR	Apalachicola National Estuarine Research Reserve Management Plan 1998 - 2003	1998	1979	246,766
Banana River AP	Banana River Aquatic Preserve Management Plan	1985	1970	29,696
Big Bend Seagrasses AP	Big Bend Seagrasses Aquatic Preserve and Big Bend Marsh Buffer Management Plan, Public Meeting Draft	1988	1985	450,000
Biscayne Bay - Card Sound AP	Management Plan (cabinet draft) for Biscayne Bay Aquatic Preserve - Card Sound	1991	1974	17,000
Boca Ciega Bay AP	Boca Ciega Bay and Pinellas County Aquatic Preserves Management Plan	1987	1968	22,000
Cape Haze AP	Charlotte Harbor Aquatic Preserves Management Plan	1983	1978	11,000
Cape Romano-Ten Thousand Islands AP	Rookery Bay and Cape Romano-Ten Thousand Islands Aquatic Preserves Management Plan	1988	1969	27,642
Cockroach Bay AP	Cockroach Bay Aquatic Preserve Management Plan	1987	1976	3,600
Coupon Bight AP	Coupon Bight Aquatic Preserve Management Plan	1992	1969	6,000
Estero Bay AP	Estero Bay Aquatic Preserve Management Plan	1983	1966	9,600
Florida Keys NMS	Florida Keys National Marine Sanctuary Draft Revised Management Plan, February 2005	2005	1990	2,457,888
Fort Clinch State Park AP	Nassau River St. Johns River Marshes and Fort Clinch State Park Aquatic Preserves Management Plan	1986	1970	9,000
Fort Pickens AP	Fort Pickens Aquatic Preserve Management Plan	1992	1970	34,000
Gasparilla Sound-Charlotte Harbor AP	Charlotte Harbor Aquatic Preserves Management Plan	1983	1979	79,168
Guana River Marsh AP	Guana River Marsh Aquatic Preserve Management Plan	1991	1985	40,000
Guana Tolomato Matanzas NERR *	Guana Tolomato Matanzas National Estuarine Research Reserve Management Plan, May 2009 - April 2014	2009	1999	64,487

Table 5.1. Continued.

CMPA Name	**Plan Title**	**Year Plan Published**	**Year CMPA Designated**	**CMPA Size (acres)**
Indian River-Malabar to Vero Beach AP	Indian River-Malabar to Vero Beach Aquatic Preserve Management Plan	1986	1969	27,966
Jensen Beach to Jupiter Inlet AP	Jensen Beach to Jupiter Inlet Management Plan Phase I	1990	1973	1,242 **(22,000)
Lemon Bay AP	Lemon Bay Aquatic Preserve Management Plan	1992	1986	7,667
Lignumvitae Key AP	Lignumvitae Key Aquatic Preserve Management Plan	1991	1969	7,500
Loxahatchee River- Lake Worth Creek AP	Loxahatchee River- Lake Worth Creek Aquatic Preserve Management Plan	1984	1970	9,000
Matlacha Pass AP	Charlotte Harbor Aquatic Preserves Management Plan	1983	1972	12,500
Mosquito Lagoon AP	Mosquito Lagoon Aquatic Preserve Management Plan, August 2009 - July 2019	2009	1970	4,740
Nassau River-St. Johns River Marshes AP	Nassau River St. Johns River Marshes and Fort Clinch State Park Aquatic Preserves Management Plan	1986	1969	57,000
North Fork St. Lucie River AP	North Fork St. Lucie River Aquatic Preserve Management Plan, August 2009 - July 2019	2009	1972	2,972
Pellicer Creek AP	Guana Tolomato Matanzas National Estuarine Research Reserve Management Plan, May 2009 - April 2014	2009	1970	505
Pine Island Sound AP	Charlotte Harbor Aquatic Preserves Management Plan	1983	1970	54,000
Pinellas County AP	Boca Ciega Bay and Pinellas County Aquatic Preserves Management Plan	1987	1972	336,265
Rocky Bayou AP	Rocky Bayou State Park Aquatic Preserve Management Plan Adopted December 17, 1991	1991	1970	480
Rookery Bay AP	Rookery Bay and Cape Romano-Ten Thousand Islands Aquatic Preserves Management Plan	1988	1977	32,035
Rookery Bay NERR	Rookery Bay National Estuarine Research Reserve Management Plan, 2000 - 2005	2001	1978	110,000
St. Andrews State Park AP	St. Andrews State Park Aquatic Preserve Management Plan	1991	1972	25,000
St. Joseph Bay AP	St. Joseph Bay Aquatic Preserve Management Plan - September, 2008 - August, 2018	2008	1969	73,000
St. Martins Marsh AP	St. Martins Marsh Aquatic Preserve Management Plan	1987	1969	23,123
Terra Ceia AP	Terra Ceia Aquatic Preserve Management Plan, August 2009 - July 2019	2009	1984	21,736

Table 5.1. Continued.

CMPA Name	**Plan Title**	**Year Plan Published**	**Year CMPA Designated**	**CMPA Size (acres)**
Tomoka Marsh AP	Tomoka Marsh Aquatic Preserve Management Plan	1992	1969	8,000
Vero Beach to Fort Pierce AP	Indian River Lagoon Aquatic Preserves Management Plan (Vero Beach to Fort Pierce and Jensen Beach to Jupiter Inlet)	1985	1969	11,000
Yellow River Marsh AP	Yellow River Marsh Aquatic Preserve Management Plan	1991	1970	16,435

* The Guana Tolomato Matanzas National Estuarine Research Reserve Management Plan, May 2009 - April 2014 as pertaining to Guana River Marsh AP was not used in the study. Instead the 1991 Guana River Marsh AP Management Plan was used for data regarding Guana River Marsh AP.
** The plan refers to the smaller area, while the entire AP encompasses the larger area.

The mean total plan quality score for all CMPAs was 29.40 out of a total possible 50.00 (see Table 5.2). Biscayne Bay-Card Sound AP and St. Andrews State Park AP had a total plan quality score of 29.76 and 29.09 respectively, providing examples of “average” management plans. Factual basis was the lowest scoring plan component on average with a mean of 5.73, while goals and objectives, policies, tools and strategies, and inter-organizational coordination and cooperation all had mean scores of 5.83, 5.90 and 5.78 respectively. The implementation and monitoring component had the highest mean plan quality score at 6.40.

Table 5.2. Descriptive plan quality scores for each plan component.

Plan component	N	Minimum	Maximum	Mean	Standard deviation
Factual basis	40	4	9	5.73	1.57
Goals and objectives	40	3	9	5.83	1.52
Policies, tools and strategies	40	4	9	5.90	1.34
Inter-organizational coordination, cooperation	40	3	10	5.78	1.79
Implementation and monitoring	40	4	10	6.40	1.61
Total plan quality score	40	20	47	29.40	7.07

Note. Maximum score by plan component is 10.00. Maximum score for total plan quality is 50.00.

The CMPA with the lowest final plan score of 20.18 was for *Indian River Lagoon Aquatic Preserves Management Plan (Vero Beach to Fort Pierce and Jensen Beach to Jupiter Inlet)* (Department of Natural Resources, Division of Recreation and Parks, & Bureau of Environmental Land Management, 1985) (see Table 5.3). The CMPA with the highest final plan score of 46.55 was the Florida Keys National Marine Sanctuary (FKNMS) (see Table 5.3). The Vero Beach to Fort Pierce AP has 11,000 acres, was established in 1969, is located in the Indian River Lagoon on the Atlantic coast of Florida, and the plan used in this research was approved in 1985 (see Table 5.1). Vero Beach to Fort Pierce AP shares a border with Avalon and Fort Pierce Inlet State Parks and Indian River and St. Lucie Counties. The FKNMS is over 2.45 million acres, was established in 1990 from existing marine sanctuaries, surrounds the Florida Keys island chain, is located primarily in Monroe County and the plan used for this study was finalized in 2005 (see Table 5.1).

Table 5.3. Descriptive plan quality scores for each CMPA.

CMPA plan	**Factual basis**	**Goals & obje-ctives**	**Policies, tools, & strate-gies**	**Coor-dinat-ion**	**Imple-menta-tion & monit-oring**	**Final plan score**
Alligator Harbor AP	5.00	5.16	5.25	5.71	5.36	26.48
Apalachicola Bay AP	8.25	7.19	7.00	6.07	6.07	34.58
Apalachicola NERR	7.25	5.78	8.25	7.50	8.57	37.35
Banana River AP	4.25	4.84	6.00	4.64	5.36	25.09
Big Bend Seagrasses AP	5.25	3.91	5.25	4.64	5.00	24.05
Biscayne Bay - Card Sound AP	6.50	5.94	6.25	4.64	6.43	29.76
Boca Ciega Bay AP [5]	3.75	4.84	4.25	3.21	4.64	20.70
Cape Haze AP [2]	3.50	4.84	4.75	4.64	5.36	23.09
Cape Romano-Ten Thousand Islands AP[3]	5.75	4.53	4.00	5.36	6.07	25.71
Cockroach Bay AP	6.00	5.63	5.25	5.00	6.07	27.95
Coupon Bight AP	5.00	4.69	4.75	5.36	5.36	25.15
Estero Bay AP	4.25	4.38	5.50	5.36	6.07	25.55
Florida Keys NMS	9.25	8.91	8.75	9.64	10.00	46.55
Fort Clinch State Park AP [4]	4.00	6.72	6.25	6.07	5.71	28.75
Fort Pickens AP	5.25	7.97	6.00	5.71	6.07	31.00
Gasparilla Sound-Charlotte Harbor AP[2]	3.50	4.84	4.75	4.64	5.36	23.09
Guana River Marsh AP	6.50	4.38	5.00	4.64	5.71	26.23
Guana Tolomato Matanzas NERR[6]	7.50	8.75	8.00	9.29	9.29	42.82
Indian River-Malabar to Vero Beach AP	4.50	3.13	4.75	4.64	5.00	22.02
Jensen Beach to Jupiter Inlet (Phase 1 1990) AP	5.00	4.38	5.25	4.64	6.79	26.05
Lemon Bay AP	6.50	5.00	4.50	4.64	5.00	25.64
Lignumvitae Key AP	7.25	7.66	6.50	6.79	8.57	36.76
Loxahatchee River- Lake Worth Creek AP	5.25	4.53	4.75	4.29	4.29	23.10
Matlacha Pass AP [2]	3.50	4.84	4.75	4.64	5.36	23.09
Mosquito Lagoon AP	8.50	7.34	8.00	8.93	9.29	42.06
Nassau River- St. Johns River Marshes AP[4]	4.00	6.72	6.25	6.07	5.71	28.75
North Fork St. Lucie River AP	8.25	6.88	7.50	8.21	7.50	38.34
Pellicer Creek AP [6]	7.50	8.75	8.00	9.29	9.29	42.82
Pine Island Sound AP [2]	3.50	4.84	4.75	4.64	5.36	23.09
Pinellas County AP [5]	3.75	4.84	4.25	3.21	4.64	20.70
Rocky Bayou AP	5.50	4.84	6.00	4.29	6.79	27.42
Rookery Bay AP [3]	5.75	4.53	4.00	5.36	6.07	25.71
Rookery Bay NERR	7.00	7.34	8.00	8.93	8.57	39.84
St. Andrews State Park AP	4.50	6.09	6.00	5.36	7.14	29.09
St. Joseph Bay AP	7.25	6.09	5.75	7.86	7.86	34.81

Table 5.3. Continued.

CMPA plan	Factual basis	Goals & obje-ctives	Policies, tools, & strate-gies	Coor-dinat-ion	Imple-menta-tion & monit-oring	Final plan score
St. Martins Marsh AP	4.00	6.56	6.00	5.36	5.71	27.63
Terra Ceia AP	6.75	7.19	6.50	8.21	8.93	37.58
Tomoka Marsh AP	6.00	6.72	6.50	5.00	6.07	30.29
Vero Beach to Fort Pierce AP [1]	4.00	4.22	3.75	3.21	5.00	20.18
Yellow River Marsh AP	5.00	3.91	6.00	4.29	5.36	24.55

[1]Shared management plan with Jensen Beach to Jupiter Inlet (1985) AP (not included in sample and excluded from regression) due to presence of a Jensen Beach to Jupiter Inlet AP management plan for 1990 which was included in the sample.

[2] Charlotte Harbor Aquatic Preserves Management Plan covered these four APs.

[3] Rookery Bay and Cape Romano-Ten Thousand Islands Aquatic Preserves Management Plan covered these two APs.

[4]Nassau River St. Johns River Marshes and Fort Clinch State Park Aquatic Preserves Management Plan for these two APs.

[5]Boca Ciega Bay and Pinellas County Aquatic Preserves Management Plan.

[6]Guana Tolomato Matanzas National Estuarine Research Reserve Management Plan, May 2009 - April 2014 covered the NERR, Pellicer Creek AP and the Guana River Marsh AP (note that the 1991 Guana River Marsh AP stand alone plan was used in this study for the AP plan, although the NERR and Pellicer Creek AP data came from the newer joint plan).

The five oldest management plans evaluated in this study are some of the lowest scoring plans and are also all clustered together on the Gulf of Mexico shoreline of Florida near Fort Myers (see Figures 5.1 and 5.2). Four of the CMPAs shared a management plan written in 1983, the Charlotte Harbor Aquatic Preserves Management Plan and were designated as wilderness preserves to be managed for multiple uses such as boating, recreational and commercial fishing, swimming, and bulk petroleum storage facilities (Department of Natural Resources, et al., 1983a). The four protected areas that share a management plan are Cape Haze, Matlacha Pass, Pine Island Sound, and Gasparilla Sound-Charlotte Harbor Aquatic Preserves, and are all part of the Charlotte Harbor estuary located near Pine Island, with a large presence of mangroves in the shallow waters adjacent to the barrier islands, including the popular vacation spots of Captiva and Sanibel Islands. Adjacent to these four protected areas is the Matlacha Pass, Pine Island, and Ding Darling National Wildlife Areas, several state parks, and to the south is Estero Bay Aquatic Preserve. Estero Bay Aquatic Preserve had its own management plan also written in 1983 and was kept separate for management purposes due to higher development threats due to housing tracts, marinas, highways and business districts (Department of Natural Resources, Bureau of Environmental Land Management, & Division of Recreation and Parks, 1983b). All five of these aquatic preserves had some of the lowest quality management plans, and the oldest plans, written in the early 1980s (see Figure 5.1). A geographic representation of the total plan quality scores is seen in Figure 5.2.

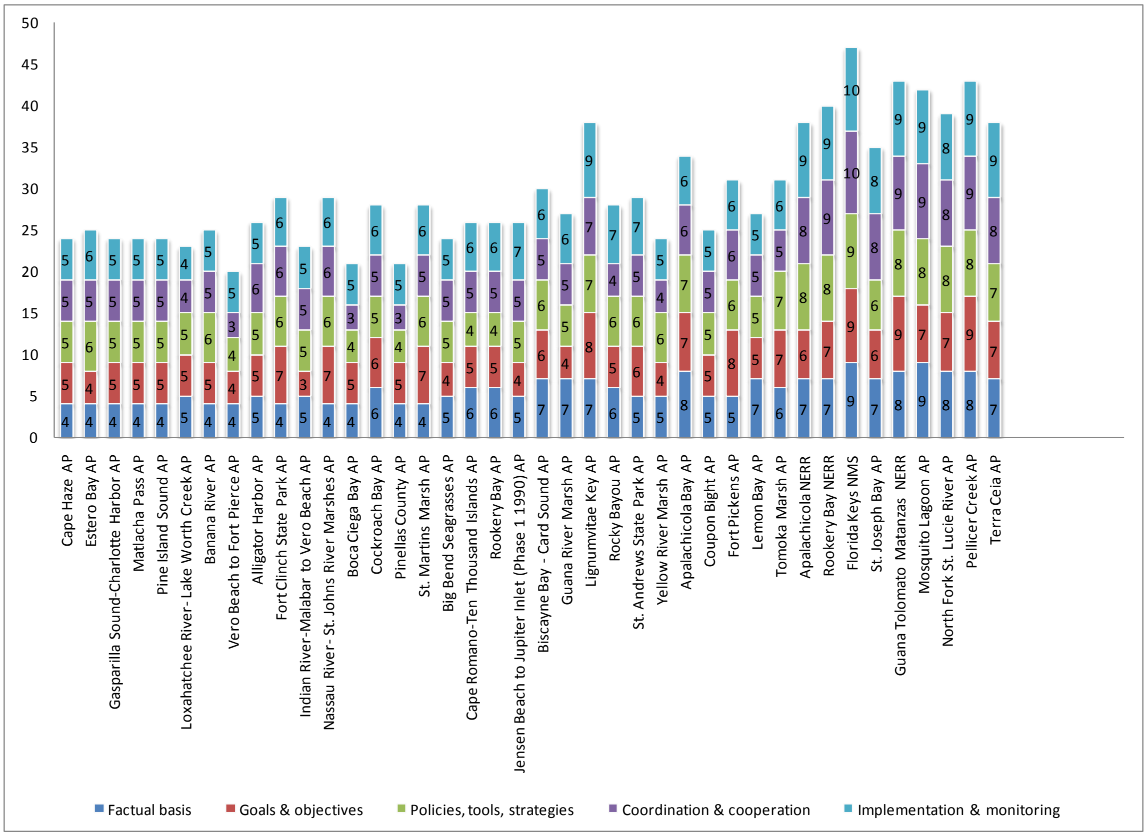

Figure 5.1. Total plan quality scores, sorted by age of plan, with oldest on the left to newest on the right.

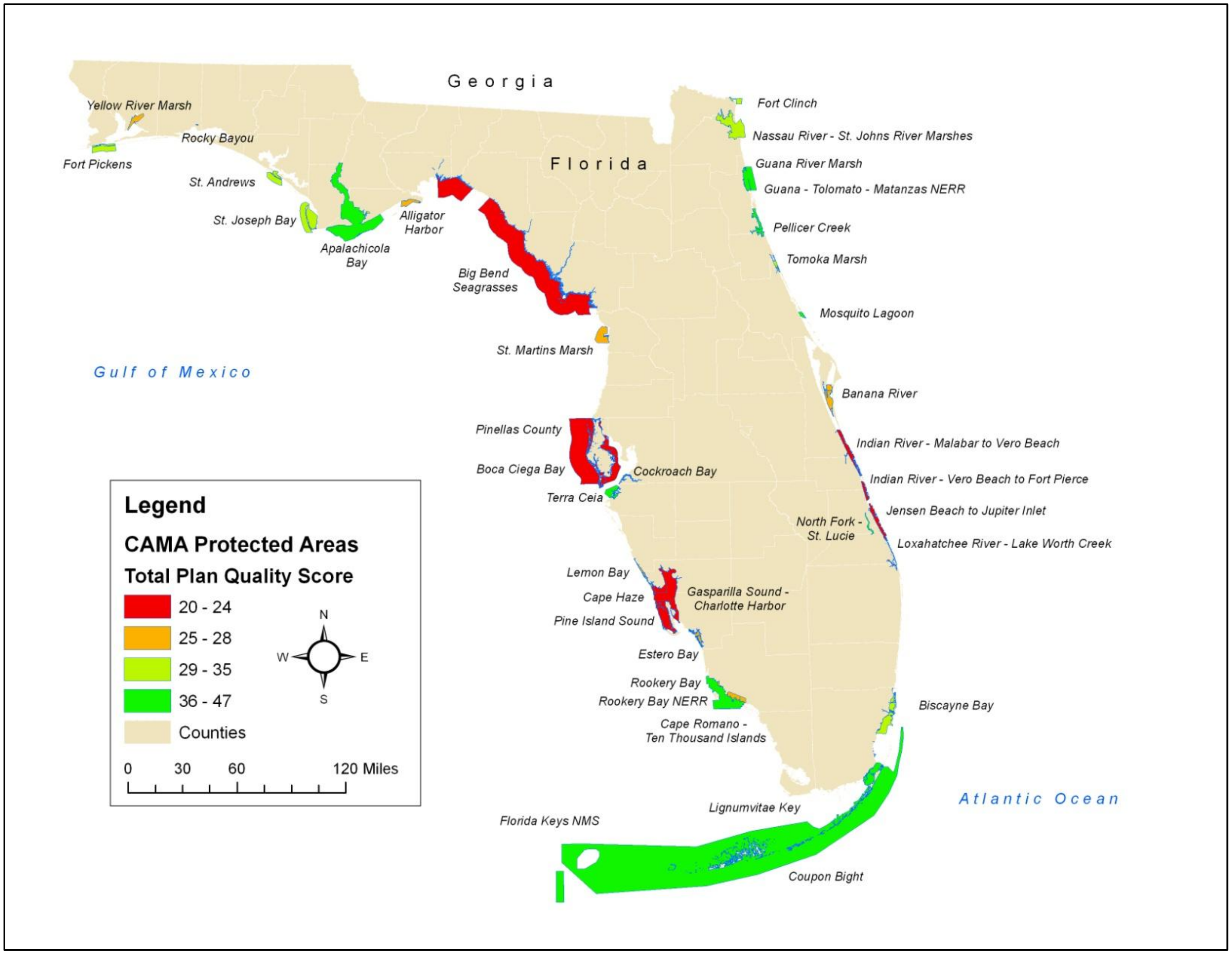

Figure 5.2. Map of total plan quality scores for all 40 CMPAs.

One plan that does not follow the same trend as the other plans in the 1990s is that of Lignumvitae Key AP, which had a total plan quality score of 36.76 in 1991 (see Figures 5.1 and 5.2). Lignumvitae Key APs high plan scores may be explained by its location in the Florida Keys and shared boundaries with the Everglades National Park, Indian Key State Historic Site, Lignumvitae Key State Botanical Site, and Shell Key State Preserve. It is possible that when the plan was written in 1991 there was special attention given to Lignumvitae Key AP due to its location near these natural areas with national significance. Lignumvitae Key AP had 49 types of threatened biodiversity, which was higher than the average of 33. Lignumvitae Key AP had an implementation and monitoring plan component score of 8.57. This is a very high quality of implementation as compared to other plans written in the same time frame. Lignumvitae Key AP was divided into several management areas which allowed for specific management of the various users and resources found in this “exceptional water resource of the state” (Department of Natural Resources, Bureau of Aquatic Preserves, & Division of State Lands, 1991). Lignumvitae Key AP is currently managed as part of the larger Florida Keys NMS and has no designated staff or funding as of 2010.

The highest scoring management plan is that of the Florida Keys National Marine Sanctuary, written in 2005 (see Figure 5.1). The Florida Keys NMS is the only NMS in Florida, and as such was the only NMS included in this research sample of Florida CMPAs. The Florida Keys NMS is jointly managed by the State of Florida’s CAMA agency and the federal National Oceanic Atmospheric Administration’s National Marine Sanctuary Program. The management plan for the Florida Keys NMS was exemplary in all 5 plan component areas, and received a perfect score for the implementation and monitoring component and scores over 9 for both factual basis and coordination and cooperation components.

5.1.1 Factual basis plan component results

The management plans were relatively strong for biophysical inventory indicators. All plans identified depleted, threatened, rare, or endangered species or populations, but just more than half identified invasive/exotic species (see Table 5.4). Of those 22 plans that identified invasive or exotic species, there was an indicator quality of only 0.39, indicating that most mentions of invasive species were only in passing or failed to provide detailed analysis.

While plans provided strong socio-cultural inventory information, there was a lack of economic inventory information. All but one plan identified culturally sensitive areas, archaeological sites and shipwrecks (see Table 5.4). All 40 plans identified some level of recreational and commercial uses of the CMPA. All 40 plans identified stakeholders at some level, although only 61 percent at a high level of quality. In many cases there was no separate section dedicated to the identification of stakeholders, rather they were identified in passing as users, collaborators, or partners, but rarely was the specific term “stakeholder” used in the plans.

The economic inventory indicators were the weakest of all factual basis indicators collected. While seventy percent of plans identified commercially important species, only 38 percent of those plans (n=28) provided a high level of detail (i.e. information beyond listing one or two species of commercial significance) (see Table

5.4). Only 33 percent of plans presented any type of financial breakdown of annual cost of goods and services that depend upon the CMPA and of those the quality was only 0.20.

Indicators relating to the public accessibility of the management plans were generally present in all plans. Public accessibility indicators which had lower indicator quality included the inclusion of an executive summary, inclusion of supporting documentation and accessibility of plan, and the use of high quality maps and tables to display information. The public accessibility of the plans was strong for all indicators with the exception that only seven of the plans provided a glossary of terms (see Table 5.4). In general, the plans were written in clear English that was easily accessible to a general population, avoiding jargon (see Table 5.4).

Table 5.4. Indicator scores for the factual basis plan component.

	Indicator	**Indicator breadth**	**Number of CMPAs**	**Indicator quality**
	Biophysical inventory			
FB_1	Depleted, threatened, rare, or endangered species or populations are identified	1.00	40	0.78
FB_2	Representative habitats and ecosystems are inventoried and mapped to provide baseline data	0.90	36	0.68
FB_3	Biodiversity identified to the species, population and genetic level	0.98	39	0.58
FB_4	Commercially important species identified with baseline scientific data, including critical life-history traits, fishing mortality, adjacent yield, spawner biomass	0.70	28	0.38
FB_5	Invasive/exotic species identified	0.55	22	0.39
FB_6	Other biophysical facts	0.70	28	0.61
	Socio-cultural inventory			
FB_7	Culturally sensitive areas, archaeological sites, shipwrecks identified	0.98	39	0.64
FB_8	Recreational, commercial uses identified	1.00	40	0.71

Table 5.4. Continued.

	Indicator	Indicator breadth	Number of CMPAs	Indicator quality
FB_9	Stakeholders identified	1.00	40	0.61
FB_10	Other socio-cultural facts	0.88	35	0.55
	Economic inventory			
FB_11	Commercially important species catches, yields, threats, other issues identified	0.70	28	0.39
FB_12	Financial breakdown of annual cost of goods and services that depend on MPA	0.33	13	0.20
FB_13	Other economic facts	0.35	14	0.20
	Public accessibility			
FB_14	Detailed table of contents is included (not just a list of chapters)	1.00	40	0.91
FB_15	A glossary of terms and definitions is included	0.18	7	0.14
FB_16	Executive summary	0.80	32	0.56
FB_17	Plain English is used (or appropriate national language) (avoids jargon-filled, unclear, verbose language) *	1.00	40	1.00
FB_18	Supporting documents are included with the plan (videos, GIS, website, CD) and plan is available electronically	1.00	40	0.59
FB_19	Maps are included and display information that is clear, relevant and comprehensible	0.95	38	0.70
FB_20	Tables aggregate data relevant and meaningful to the planning area under study	0.95	38	0.60

Note. * Indicates that this indicator was excluded from the Factual Basis scale reliability calculation of Cronbach's Alpha due to a lack of variation in the indicator.

5.1.2 Goals and objectives plan component results

The goals and objectives plan component had a range of scores from 3-9 with a mean of 5.83 and a standard deviation of 1.52 (Table 5.2). All of the plans had some type of guiding statement, although that was generally attributable to the overall agency vision or mission statement resulting in a quality score of 0.64 (Table 5.5). Very few of the plans had their own CMPA specific guiding statement, but all had some version of the following statement.

"*The mission of the Office of Coastal and Aquatic Managed Areas in relation to Florida's 41 aquatic preserves, 3 National Estuarine Research Reserves,* *National Marine Sanctuary, and Coral Reef Conservation Program is to protect Florida's coastal and aquatic resources*" (Department of Environmental Protection & Office of Coastal and Aquatic Managed Areas, 2008).

Table 5.5. Indicator scores for the goals and objectives plan component.

	Indicator	**Indicator breadth**	**Number of CMPAs**	**Indicator quality**
	Guiding statement			
GO_1	Plan has one or all of the following: vision, mission or value statement and precisely describes the aforementioned in the following terms	1.00	40	0.64
	Bio-Physical goals: Conservation of Biodiversity and Habitat			
GO_2	Protect depleted, threatened, rare, or endangered species or populations	1.00	40	0.91
GO_3	Preserve or restore the viability of representative habitats and ecosystems	1.00	40	0.95
	Bio-Physical goals: Fishery Management			
GO_4	Control exploitation rates	0.68	27	0.44
GO_5	Protect critical stages of the species' life history	0.83	33	0.48
GO_6	Reduce secondary fishing impacts	0.65	26	0.41
GO_7	Ensure against possible failures of conventional regulatory systems	0.60	24	0.35
GO_8	Conserve life-history traits and genetic diversity	0.65	26	0.35
	Bio-Physical goals: Scientific Knowledge			
GO_9	Provide a source of baseline data	1.00	40	0.88
GO_10	Conduct monitoring and maintain inventory of resources	1.00	40	0.86
GO_11	Other bio-physical goals	0.65	26	0.56
	Socio-Economic goals: Educational Opportunities			
GO_12	Environmental awareness and knowledge enhanced through a formalized education and awareness program	1.00	40	0.76
GO_13	Enhancement of Recreational Activities and Tourism	0.85	34	0.56

Table 5.5. Continued.

	Indicator	**Indicator breadth**	**Number of CMPAs**	**Indicator quality**
	Socio-Economic goals: Sustainable Environmental Benefits			
GO_14	Food security enhanced or maintained	0.63	25	0.38
GO_15	Livelihoods enhanced or maintained	0.53	21	0.26
GO_16	Non-monetary benefits to society enhanced or maintained	0.80	32	0.56
GO_17	Benefits from the MPA equitably distributed	0.70	28	0.46
GO_18	Maintain intergenerational sustainability of ecosystems	0.93	37	0.71
	Socio-Economic goals: Protection of Cultural Heritage			
GO_19	Compatibility between management and local culture maximized	0.88	35	0.59
GO_20	Balance human use with maintaining viable wildlife populations	1.00	40	0.74
GO_21	Protect and maintain archaeological & historical sites	0.85	34	0.70
GO_22	Other socio-economic goals	0.08	3	0.05
	Governance Goals			
GO_23	Ensure effective stakeholder participation and representation through a communication program	0.68	27	0.45
GO_24	Enhanced management plan compliance by resource users	0.90	36	0.63
GO_25	Manage and reduce resource use conflicts	0.73	29	0.45
GO_26	Implement management effectiveness monitoring program	0.85	34	0.59
GO_27	Clear designation of management responsibilities	1.00	40	0.71
GO_28	Inclusion in a network of protected areas / sanctuaries	1.00	40	0.83
GO_29	Other governance goals	0.28	11	0.25
	Goals, Objectives, & Policy Language			
GO_30	Goals are clearly stated/specified	0.98	39	0.65
GO_31	Presence of measurable objectives	0.98	39	0.60
GO_32	Policies are mandatory (with words like shall, will, require, must) as opposed to suggestive (with words like consider, should, may)	1.00	40	0.63

Goals and objectives pertaining to the bio-physical goals of conservation of biodiversity and habitat were of high quality and existed in all plans (see Table 5.5). They were the protection of depleted, threatened, or endangered species and populations, and the goal to preserve or restore the viability of representative habitats and ecosystems. These are two of the most common goals and objectives found in CMPAs in general around the world.

Bio-physical goals pertaining to fishery management were less frequent and where they did exist were less specific or vaguer resulting in partial presence scores (i.e. scores of 1 out of 2 cause lower indicator quality scores). With the exception of the protection of critical states of the species' life history, which was present in 83 percent of plans, the remaining fishery management indicators were present in less than 70 percent of plans (see Table 5.5). Regardless of the fishery management indicator, they were all of low quality with indicator quality scores between 35 and 48 percent. The least common fishery management indicator found in plans was the goal or objective to ensure against possible failures of conventional regulatory systems.

Bio-physical goals focused on scientific knowledge were present in all plans and were generally strong for both collecting baseline scientific information and monitoring existing resources. These types of goals are considered traditional to protected areas in general.

In the category of socio-economic goals, only the goals of having formal educational programs and balancing human use with maintaining viable wildlife populations were present in all management plans. Other frequently occurring socioeconomic goals included enhancement of recreational activities and tourism, maintain intergenerational sustainability of ecosystems, and protect and maintain archaeological and historical sites. The protection of archaeological and historic sites is part of the Florida Historical Resources Act (Chapter 267, F.S.), and as such was specifically referenced in the management plans, as one of many pieces of legislation pertaining to CMPAs in this study. Socio-economic goals that were generally absent from plans included those that focus on the sustainable environmental benefits of enhanced or maintained food security and enhanced or maintained livelihoods.

There were two socio-economic goals focusing on educational opportunities. The indicator measuring goals for environmental awareness and knowledge enhanced through a formalized education and awareness program was present in all 40 plans and had a 76 percent quality score. The goal of enhancement of recreational activities and tourism was present in 85 percent of plans but had a low quality score of 0.56, or 56 percent.

There were 5 indicators measuring socio-economic goals focusing on sustainable environmental benefits. The most frequently used goal was that to maintain intergenerational sustainability of ecosystems, present in 93 percent of plans, with an indicator quality of 71 percent. The least prevalent goal, present in only 53 percent of plans, was livelihoods enhanced or maintained, with a quality of just 23 percent. Goals focusing on food security were present in only 63 percent of plans with a quality of only 38 percent or 0.38. Goals and objectives pertaining to equal distribution of benefits from the CMPA were present in 70 percent of plans with an indicator quality score of 0.46.

Goals and objectives pertaining to non-monetary benefits to society being enhanced or maintained were present in 80 percent of plans with an indicator quality score of 0.56.

Socio-economic goals focusing on the protection of cultural heritage included those focused on the maximization of compatibility between management and local culture which was present in 88 percent of plans with an indicator quality of 0.59. All 40 plans had goals to balance human use with maintaining viable wildlife populations with an indicator quality score of 0.74. Goals focusing on the protection and maintenance of archaeological and historic sites were mentioned in 85 percent of plans, with an indicator quality of 0.70 for those plans.

Governance goals were measured using seven indicators. The two indicators found in 100 percent of plans were clean designation of management responsibilities and inclusion in a network of protected areas or sanctuaries with indicator quality scores of 0.71 and 0.83 respectively. The next most prevalent governance goal was enhanced management plan compliance by resource uses with 90 percent of plans having this type of goal with an indicator quality of 0.63. Goals to implement management effectiveness monitoring programs were present in 85 percent of plans with an indicator quality of 0.59. Goals to manage and reduce resource use conflicts were present in 73 percent of plans with those plans having an indicator quality of 0.45. The final governance goal was to ensure effective stakeholder participation and representation, present in 68 percent of plans, and of those plans the indicator quality was 0.45.

The last three indicators that made up the goals and objectives plan component were those pertaining to the goals, objectives and policy language. Ninety-eight percent of plans (n=39) had both “goals clearly stated and specified” and “the presence of measureable objectives,” although the indicator quality for those indicators were 0.65 and 0.60 respectively. All 40 plans had some policies written in mandatory language, although the indicator quality score was 0.63.

5.1.3 Policies, tools and strategies plan component results

The eleven regulatory tool indicators were found in almost all plans, with indicator breadth ranging from 0.80 to 1.00 (see Table 5.6). The use of zoning was present in all CMPAs although the indicator quality was 0.61 suggesting a lack of fully utilizing the zoning tool. CMPAs with specific management zones described in the plan got full scores (2) while CMPAs that did not differentiate between zones or did not list them in their management plans were given scores of 1. The two strongest regulatory tools were those providing restrictions on native vegetation removal and controls on construction or development activities (including docks, pipelines, platforms and artificial reefs) with 100 percent indicator breadth (i.e. present in all 40 plans) and 0.93 indicator quality, indicating very strong fully realized regulations in almost all plans. The indicator which would “prohibit pesticide and biocide use within PA (lobby against upstream use)” may also have been helped by the classification of all Florida CAMA managed resources as Outstanding Florida Waters (62-302.700 F.A.C.) in addition to their Florida surface water classifications (62-302.400 F.A.C.). These water quality classifications provide the areas with protection intended to prevent the lowering of existing water quality in the designated area.

Incentive-based tools are commonly used in land-based planning. The incentive-based tools of user fees and impact fees were only mentioned in two out of 40 plans, while the use of education/awareness strategies was mentioned in 39 plans or 98 percent of plans with an indicator quality score of 0.74. Based on this research, CMPA plans are focused almost entirely on using regulatory tools to increase management plan compliance, with the exception of the use of education in almost all plans.

Table 5.6. Indicator scores for the policies, tools & strategies plan component.

	Indicator	**Indicator breadth**	**Number of CMPAs**	**Indicator quality**
	Regulatory Tools			
PTS_1	Resource use restrictions	1.00	40	0.78
PTS_2	Zoning is specified (if appropriate) and utilizes a system of multiple core areas or conservation zones	1.00	40	0.61
PTS_3	Prohibit pesticide and biocide use within PA (lobby against upstream use)	1.00	40	0.84
PTS_4	Restrictions on native vegetation removal	1.00	40	0.93
PTS_5	Removal of exotic/invasive species	0.80	32	0.58
PTS_6	Public or vehicular access limited (includes prohibiting floating residential units)	1.00	40	0.79
PTS_7	Controls on construction/development activities (includes docks, pipelines, platforms, artificial reefs)	1.00	40	0.93
PTS_8	Targeted growth away from habitat/ coordination with adjacent areas	1.00	40	0.73
PTS_9	Habitat restoration actions	1.00	40	0.83
PTS_10	Permits required for research, manipulation, or collections	0.98	39	0.80
PTS_11	Other regulatory tools	0.13	5	0.08
	Incentive-Based Tools			
PTS_12	User fees	0.05	2	0.04
PTS_13	Impact fees	0.05	2	0.05
PTS_14	Education/awareness strategies	0.98	39	0.74
PTS_15	Other incentive-based tools	0.33	13	0.23

Table 5.6. Continued.

	Indicator	Indicator breadth	Number of CMPAs	Indicator quality
	Spatial Design tools			
PTS_16	Zoning plan incorporates a system of multiple/ redundant core and buffer areas	0.80	32	0.48
PTS_17	Zoning plan utilizes clear, easily identifiable boundaries (e.g. Surface features, major navigation features)	0.88	35	0.65
PTS_18	Plan identifies techniques for managing PA including seasonal closures, multiple use zones, specific areas for research, education, fisheries closures	0.88	35	0.55
PTS_19	Plan proposes to map resources if they are not already mapped; or proposed regular updates to existing maps	1.00	40	0.84
PTS_20	Other spatial design tools	0.28	11	0.23

Five categories of spatial design tools were measured. The only tool found in 100 percent of plans was that the plan proposes to map resources if they are not already mapped, or proposed regular updates to existing maps. Eighty percent of plans mentioned some level of the indicator that the zoning plan incorporates a system of multiple, redundant core and buffer areas, but there was a low indicator quality of 0.48 suggesting that those plans that had zoning did not fully utilize the capabilities. For example, some plans mentioned having one or more zoned areas specific to research or fishing but, with the exception of the Florida Keys NMS, none incorporated redundant core or buffer areas. The indicator measuring if the zoning plans utilize clear, easily identifiable boundaries (e.g. surface features and major navigation features) was identified in 88 percent of plans, with an indicator quality of 0.65, suggesting that there could have been improvement in 35 percent of those boundaries. The indicator measuring if a plan identifies techniques for managing the CMPA, including seasonal closures, multiple use zones, specific areas for research, education, or fisheries closures, was present in 88 percent of plans, but the indicator quality score was only 0.55, suggesting that of those 35 plans, only about half fully realized their potential. The final indicator measured if the plans used “other” spatial design tools, present in only 11 plans, and at a low quality of 0.23, based in most cases on a mention of the use of Geographic Information Systems (GIS) for collecting information about the CMPA.

5.1.4 Inter-organizational coordination plan component results

All ten indicators used to measure inter-organizational coordination scored highly in terms of indicator breadth (see Table 5.7). All 40 plans mentioned coordination with other jurisdictions and within jurisdiction, specified intergovernmental agreements, utilized joint databases, identified other organizations and stakeholders, and encouraged information sharing. Of those plans with 100% indicator breadth, indicator quality ranged from 0.99 to 0.71 suggesting relatively strong quality of the indicators’ use within the plans.

Table 5.7. Indicator scores for the inter-organizational coordination and cooperation plan component.

	Indicator	Indicator breadth	Number of CMPAs	Indicator quality
CC_1	Coordination *with other* jurisdictions specified	1.00	40	0.99
CC_2	Coordination *within* jurisdiction specified	1.00	40	0.86
CC_3	Intergovernmental bodies specified	0.98	39	0.70
CC_4	Intergovernmental agreements	1.00	40	0.76
CC_5	Joint database production utilized	1.00	40	0.71
CC_6	Coordination with private sector (including industry)	0.73	29	0.41
CC_7	Other organizations/stakeholders identified	1.00	40	0.70
CC_8	Information sharing encouraged	1.00	40	0.81
CC_9	Commitment of financial resources	0.88	35	0.50
CC_10	Other forms of coordination (non-profits, academia)	0.95	38	0.61

Intergovernmental bodies were specified in all but one plan with an issue quality of 0.70 (see Table 5.7). Commitment of financial resources was specified in 88% of plans but with an indicator quality of only 0.50, due to a significant underfunding or lack of clearly designated funds specified in the plans. While a majority (73% , n=29) of the plans mentioned coordination with private sector (including industry), the indicator quality of those 29 plans was 0.41, suggesting that most CMPAs in this study have room for improvement with regards to private sector coordination efforts. The indicator measuring other forms of coordination, specifically those partnerships with non-profits and academia, was present in 95 percent of plans, but with an indicator quality of 0.61 suggesting that those plans which did mention some level of coordination, were not fully capitalizing on their potential.

5.1.5 Implementation and monitoring plan component results

There were 10 indicators used to measure the implementation aspect of the implementation and monitoring plan component. Six of those indicators were found in all 40 plans and included: identification of organizations with responsibility to implement policies; adequate technical resources; specification of enforcement; description of the administrative authority for planning; description of education outreach, and research; and monitoring efforts (see Table 5.8). Of those indicators, enforcement had the lowest indicator quality of 0.54 suggesting a low level of stated enforcement capacity within the plans. The presence of adequate technical resources, although in 100% of plans, had an indicator quality score of 0.61, suggesting room for improvement in many of the plans. Seventy percent (n=28) of plans described sanctions with those plans having an indicator quality of 0.36, suggesting that the plans either did not describe the sanctions in detail or those sanctions detailed were determined to be ineffective or of low quality. Eighty percent (n=32) of plans identified actions and timelines for implementing plans with an indicator quality of 0.58 for those plans, again suggesting that there was room for improvement.

Monitoring indicators present in all plans included discernable measurable objectives and specified organizations identified as responsible for monitoring and/or providing data for indicators. However, fewer plans (n=34, 85%) identified the indicators for monitoring plan effectiveness and response to new information; and (n=36, 90%) socioeconomic and environmental monitoring components. The quality of these monitoring indicators was lower at 0.54 and 0.56 respectively. Thus almost half of the plans identifying the previous two indicators had scores of 1 for those indicators and could have been improved upon.

Table 5.8. Indicator scores for the implementation and monitoring plan component.

	Indicator	Indicator breadth	Number of CMPAs	Indicator quality
	Implementation			
IM_1	Actions and timelines for implementing plans are clearly identified and/or prioritized (e.g. Timetable for plan assessment and updates)	0.80	32	0.58
IM_2	Organizations with responsibility to implement policies are identified/ Designation of responsibility	1.00	40	0.81
IM_3	Adequate technical resources are available	1.00	40	0.61
IM_4	Enforcement is specified, with adequate resource for size/scope of PA (monitoring compliance)	1.00	40	0.54
IM_5	Identification of costs or funding	0.98	39	0.61
IM_6	Capacity of the institution is specified. Number of employees is reasonable for size of PA.	0.95	38	0.59
IM_7	Sanctions are clearly described	0.70	28	0.36
IM_8	The administrative authority for planning is indicated (federal, state, international law, local resolution, fisheries council)	1.00	40	0.98
IM_9	Education and outreach efforts by the PA to increase stakeholder awareness are explicitly described	1.00	40	0.75
	Research and monitoring efforts to be conducted by the PA are explicitly described	1.00	40	0.78
IM_10	*Monitoring*			
IM_11	Monitoring goals are quantified based on measurable objectives (simple programs)	1.00	40	0.65
IM_12	Organizations are identified that are responsible for monitoring and/or providing data for indicators	1.00	40	0.64
IM_13	Monitoring for plan effectiveness and response to new information	0.85	34	0.54
IM_14	Monitoring program includes socioeconomic and environmental monitoring components	0.90	36	0.56

5.2 Participation indicator results

Participation was included in the research model as a single independent variable constructed from three characteristics of participation identified in Table 5.9. One quarter (n=10) of CMPA plans mentioned an advisory council, and 28% of plans mentioned public input forums provided during management plan reviews (see Table 5.9). Seventy percent of plans identified organizations and individuals that were involved in plan preparation. When looked at as a single variable, participation (sum of all three indicators) had a range of 0 to 3 and a mean score of 1.22 of out a possible 3.

Table 5.9. Indicator scores for the participation independent variable.

	Indicator	**Indicator breadth**	**Number of CMPAs**
	Participation		
P_1	Advisory council formed with representation of major stakeholder groups	0.25	10
P_2	Public input forums provided during management plan reviews allow for objectives to be created in a collaborative process that involves scientists, local communities, user groups and management authorities	0.28	11
P_3	Organizations and individuals that were involved in plan preparation are identified	0.70	28

5.3 Inter-item correlation and scale reliability results

Cronbach’s alpha was measured on each of the plan components that made up the dependent variable and then on the total plan quality scale as a dependent variable. In all cases, the resulting Cronbach’s alpha values were over 0.80 indicating construct validity (i.e. a reliable measurement scale was used) (see Table 5.10). Participation had a lower Cronbach alpha of 0.70, although still indicated a reliable measurement scale.

Table 5.10. Inter-item correlation and scale reliability.

Plan component and total plan quality	**Number of indicators**	**Cronbach's alpha**	**Cronbach's alpha based on standardized items**
Factual Basis	* 19	.886	.884
Goals and Objectives	32	.898	.906
Policies, Tools, and Strategies	20	.831	.823
Inter-Organizational Coordination and Cooperation	10	.808	.808
Implementation and Monitoring	14	.877	.878
Total Plan Quality	95	.964	.965
Total Plan Quality (calculated using 5 standardized components)	5	.938	.940
Participation **	3	.704	.708

* One indicator dropped due to lack of variation (indicator measuring presence of plain English in plan was present in all plans).
** Collected as an independent variable and not included in total plan quality calculations.

5.4 Descriptive statistics results for variables

CMPAs were on average 111,109 acres, with a range of 480 to over 2 million acres (see Table 5.11). Plans ranged from 53 to 369 pages in length with the average length being 154 pages. The total number of full time employees (FTEs) ranged from 0 to 68 with the average number of employees for a single CMPA being 3.362. Budgets for salaries averaged $189,003 per year with a $661,525 standard deviation due to a range of $0 to over $4 million per year. Operating funds budgets ranged from $0 to $1.9 million with a mean of $189,033 per year. Total annual budgets ranged from $0 to over

$6.1 million per year. High standard deviations in budget numbers are due to the very high levels of funding for the FKNMS in comparison to the other CMPAs.

Table 5.11. Descriptive statistics for dependent and independent variables.

Variable	Type	Range	Mean	Standard deviation
CMPA Plan Quality	Dependent	20 – 47	29.40	7.07
Age of CMPA Plan (Years)	Independent	1 – 27	18.05	8.56
Size in acres	Independent	480 – 2,457,888	111,109.50	39,1391.10
Number of pages	Descriptive	53 – 369	154.60	65.48
Age of CMPA (Years)	Independent	11 – 44	36.15	7.16
Population	Independent	7661 – 1,166,476	231,765.00	257,790.10
Percent Change in Housing Units	Independent	5 – 184	71.32	52.59
Household Income (average)	Independent	15,825 – 54,816	29,567.15	9,855.59
Percent High School Educated	Descriptive	15 – 31	24.52	4.83
Percent College Educated	Independent	4.71 – 17.37	11.03	3.43
Threatened Biodiversity	Independent	7 – 132	33.20	26.21
Adjacent Land Use (excluding open water)	Independent	1.18 – 79.69	29.68	20.36
Adjacent Land Use (including open water)	Descriptive	0.63 – 58.62	19.03	15.91
Participation	Independent	0 – 3	1.22	1.07
Number of Employees (FTEs)	Descriptive	0 – 68	3.36	10.82
Budget (salaries)	Descriptive	0 – 4,164,937	189,033.40	661,525.70
Budget (Operating funds)	Descriptive	0 – 1,954,608	126,708.20	337,032.10
Budget (Total)	Descriptive	0 – 6,119,545	315,741.60	989,429.60

The average population of counties adjacent to CMPAs in the study was 231,765 with a range of 7661 to 1,166,476 and a standard deviation of 257,790. The percent change in housing units in counties adjacent to the study sites had a range of 4.99% to 183.99%. Average percent change in housing units was 71.3%. The county average household income was $29,567.15 per year with a range of $15,825 to $54,816 per year.

Adjacent counties had an average of 24.5% high school educated population and an average of 11% had college education as their highest level of education.

Threatened biodiversity (sum of all threatened, endangered and species of special concern as reported in the plan) ranged from 7 to 132 species with an average of 33 species. The mean percent of developed or agricultural land use adjacent to the CMPAs was 29.68% (excluding adjacent open water) and 19.03% (including adjacent open water).

CHAPTER VI

FACTORS INFLUENCING CMPA PLAN QUALITY

6.1 Correlation analysis

While the descriptive data presented in Chapter V gives a picture of the status of plans in general, the obvious number of variables that might influence that data needs further explanation. Correlation of the variables was conducted using Pearson correlation coefficients. Table 6.1 displays the results of these correlations showing that the total plan quality exhibited a significant positive correlation with the following variables ($p<0.05$): the order in which the plans were evaluated; size of protected area; threatened biodiversity; and household income. Total plan quality had a significant negative correlation with the following variables ($p<0.05$): age of protected area; age of management plan; percent change in housing units; household income; and percent with only high school education. Other notable significant positive correlations occur between the size of a protected area, the annual budget and number of full time FTEs, indicating that the larger the protected area, the greater the budget and number of FTEs. Education correlations indicate that when the number of individuals who only complete high school as highest level of education increases, the plan quality decreases. Inversely when the number of individuals who complete college as highest level of education increases, plan quality increases, but not significantly.

Table 6.1. Correlation coefficient analysis.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Total plan quality score													
2	Size of protected area in acres	.379 (*)												
3	Age of protected area (years)	-.361 (*)	-.423 (**)											
4	Age of management plan (years)	-.875 (**)	-.236	.376 (*)										
5	Total population	.158	.556 (**)	-.155	-.085									
6	Housing units (percent change)	-.502 (**)	-.197	.127	.562 (**)	-.285								
7	Land use (calculated excluding adjacent waters)	-.289	-.213	.135	.100	.427 (**)	-.168							
8	Threatened biodiversity	.565 (**)	.633 (**)	-.381 (*)	-.412 (**)	.343 (*)	-.249	-.270						
9	Household income (average)	.747 (**)	.207	-.389 (*)	-.822 (**)	.179	-.351 (*)	.023	.358 (*)					
10	Percent with high school education	-.621 (**)	-.295	.267	.573 (**)	-.226	.670 (**)	.188	-.481 (**)	-.413 (**)				
11	Percent college educated	.018	-.200	-.055	-.050	-.055	-.114	.201	.083	.215	-.371 (*)			
12	Participation in plan creation (0-3)	.762 (**)	.263	-.395 (*)	-.788 (**)	-.004	-.391 (*)	-.077	.311	751 (**)	-.255	-.084		
13	Total annual budget (dollars)	.484 (**)	.947 (**)	-.449 (**)	-.315 (*)	.504 (**)	-.156	-.276	.744 (**)	.297	-.364 (*)	-.099	.315 (*)	
14	Number of full time staff (FTEs)	.464 (**)	.963 (**)	-.433 (**)	-.294	.523 (**)	-.166	-.262	.718 (**)	.273	-.350 (*)	-.122	.303	.997 (**)

1. Total plan quality score; 2. Size of protected area in acres; 3. Age of protected area (years); 4. Age of management plan (years); 5. Total population; 6. Housing units (percent change); 7. Land use (calculated excluding adjacent waters); 8. Threatened biodiversity; 9. Household income (average); 10. Percent with high school education; 11. Percent college educated; 12. Participation in plan creation (0-3); 13. Total annual budget (dollars); 14. Number of full time staff (FTEs) . ** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

There is a significant negative correlation with the age of management plan and participation in plan creation (-0.788, $p<0.01$), indicating that newer plans had higher levels of recorded participation in plan creation. CMPA age displays significant negative correlation with FTEs, budget and CMPA capacity ($p<0.01$). Correlations indicate that newer CMPAs have higher numbers of FTEs, annual budgets or CMPA capacity (an additive of FTEs and budget).

6.2 Regression analysis

6.2.1 CMPA contextual block model results

The contextual block model was used to test the age of plan, size of CMPA, and age of CMPA as independent variables with the dependent variable CMPA plan quality as displayed in Table 6.2. Age of plan was a significant contributor to CMPA plan quality ($p<0.001$). The age of plan coefficient was -0.696, indicating that as the age of a plan increased, the CMPA plan quality decreased. Size of CMPA was a significant contributor to the model ($p=0.012$), while the age of a CMPA was not a significant factor. This model has an R-squared value of 0.781, explaining 78 percent of the variation in the dependent variable CMPA plan quality. The results of the CMPA contextual block model support *Hypothesis 1* and *Hypothesis 3* that increasingly large CMPAs will have higher CMPA plan quality and that more recently authorized CMPA plans will have higher CMPA plan quality.

Table 6.2. CMPA contextual block model.

Variable	Coefficient	Standardized coefficient	Standard error	T-value	Two-tailed test	One-tailed test
Age of plan	-0.696	-0.843	0.067	-10.373	0.000	0.000
Size of CMPA	0.000004	0.196	0.000	2.362	0.024	0.012
Age of CMPA	0.038	0.039	0.086	0.444	0.660	0.330
Constant	40.188		3.084	13.032	0.000	0.000
N	40					
F-ratio (3,39)*	47.290					
Prob >F	0.000					
R2	0.798					
Adj. R2	0.781					

*Degrees freedom listed (df regression, df total).

6.2.2 Participation block model results

The results of the participation model in Table 6.3 show a positive coefficient for participation of 5.012 and a significant correlation with CMPA plan quality ($p<0.000$). R-squared for the participation block model is 0.569. *Hypothesis 4*, that plan quality increases as reported participation in plan creation increases, is supported by these results.

Table 6.3. Participation block model.

Variable	Coefficient	Standardized coefficient	Standard error	T-value	Two-tailed test	One-tailed test
Participation	5.012	0.762	0.692	7.244	0.000	0.000
Constant	23.261	1.121		20.752	0.000	0.000
N	40					
F-ratio (1, 39)*	52.479					
Prob >F	0.000					
R2	0.580					
Adj. R2	0.569					

*Degrees freedom listed (df regression, df total).

6.2.3 Environmental threat block model results

The environmental threats regression block model results are reported in Table 6.4. The adjusted R-squared for the model is 0.477. Threatened biodiversity is significant in the model at the p=0.002 level, while percent of developed adjacent land use and percent of change in housing units are both significant at the p=0.021 and p<0.000 levels respectively. *Hypothesis 7*, that CMPA plan quality will increase as the number of threatened and endangered species increases was supported by this block model. Although there were significant results for both percent change in housing units and percent of adjacent land use, the hypothesized direction for each was not as predicted. *Hypothesis 5*, that CMPA plan quality will increase as percent change in housing units increase, was not supported, but the opposite was the case; that in actuality CMPA plan quality decreased as percent change in housing units increased. *Hypothesis 6*, that CMPA plan quality will increase as a function of a unit increase in the total area of adjacent agricultural and developed land use, was also not supported in the direction predicted. In actuality, the block model results indicated that CMPA plan quality decreased as there was an increase in percent adjacent developed land (coefficient = -0.091, p=0.021).

Table 6.4. Environmental threats block model.

Variable	Coefficient	Standardized coefficient	Standard error	T-value	Two-tailed test	One-tailed test
Threatened biodiversity	0.103	0.382	0.034	3.018	0.005	0.002
% Developed land use	-0.091	-0.262	0.043	-2.106	0.042	0.021
% Change housing units	-0.061	-0.451	0.017	-3.650	0.001	0.000
Constant	33.000		2.743	12.030	0.000	0.000
N	40					
F-ratio (3, 39)*	12.877					
Prob >F	0.000					
R2	.518					
Adj. R2	.477					

*Degrees freedom listed (df regression, df total).

6.2.4 Socioeconomic block model results

The socioeconomic block model explained 54.4 percent of the dependent variable CMPA plan quality (see Table 6.5). Average household income was significant ($p<0.000$). This result supported *Hypothesis 8*, that CMPA plan quality will increase by a unit increase in average household income in adjacent communities.

The percent of population with a college education was significant at the $p<0.100$ level with a one-tailed test ($p=0.096$), but not included in the full model. The full model only included variables significant at the $p<0.05$ level. *Hypothesis 9*, that CMPA plan quality will increase with a unit increase in population with a college degree in adjacent communities was not supported. The direction of the coefficient suggested that if there was a relationship, as the percent of college educated public increases, CMPA plan quality decreased, which was the opposite of the hypothesized direction.

There was no significant correlation of population on CMPA plan quality in the socioeconomic block model (p=0.459) (see Table 6.5). *Hypothesis 10*, that a unit increase in population in adjacent communities will significantly increase CMPA plan quality, was not supported by this research.

Table 6.5. Socioeconomic block model.

Variable	**Coefficient**	**Standardized coefficient**	**Standard error**	**T-value**	**Two-tailed test**	**One-tailed test**
Population	0.0000003	0.011	0.000	0.103	0.919	0.459
Household income	0.001	0.776	0.000	6.874	0.000	0.000
% College educated	-0.305	-0.148	0.229	-1.330	0.192	0.096
Constant	16.235		3.181	5.104	0.000	0.000
N	40					
F-ratio (3,39)*	16.487					
Prob >F	0.000					
R2	0.579					
Adj. R2	0.544					

*Degrees freedom listed (df regression, df total).

6.2.5 Full model results

The full model included variables significant at the p<0.05 level using one-tailed tests from the specific block models (see Table 6.7). All four block models and the full model are presented in a single table in Appendix C. The independent variables included are listed in Table 6.7 along with the results of the regression model. The full model had 7 independent variables. The adjusted R-squared value was 0.831, suggesting that this model accounts for 83% of the variance in the dependent variable CMPA plan quality.

The age of the management plan is the most important indicator of plan quality with a standardized coefficient of -0.483, suggesting that newer management plans exhibit higher plan quality than older management plans (see Table 6.7). Percentage of adjacent developed land use is also significant (p=0.007) but may not be as meaningful since the data is from one specific date since it was not available in a time series. Participation was a significant positive influence on CMPA plan quality indicating that higher levels of reported public participation in plan creation may lead to higher plan quality (p=0.066). Finally, threatened biodiversity was significant at the p=0.034 level indicating that plans with higher numbers of threatened biodiversity had higher plan quality.

Table 6.7. Full model.

Variable	**Coefficient**	**Standardized coefficient**	**Standard error**	**T-value**	**Two-tailed test**	**One-tailed test**
Age of plan	-0.399	-0.483	0.130	-3.057	0.004	0.002
Size of CMPA	-0.0000035	0.019	0.000	0.221	0.827	0.414
Participation	1.163	0.177	0.753	1.546	0.132	0.066
Household income	0.0000835	0.116	0.000	0.896	0.377	0.189
Threatened biodiversity	0.048	0.178	0.025	1.898	0.067	0.034
% Developed land use	-0.068	-0.196	0.026	-2.605	0.014	0.007
% Change housing units	-0.014	-0.105	0.026	-1.194	0.241	0.121
Constant	34.102		4.401	7.749	0.000	0.000
N	40					
F-ratio (7, 39)*	28.357					
Prob >F	0.000					
R2	0.861					
Adj. R2	0.831					

*Degrees freedom listed (df regression, df total).

Independent Variables [1]

- Size of CMPA
- Age of authorized management plan **
- Participation *
- % Change in housing units
- Adjacent land use (% developed & agricultural) **
- Threatened biodiversity (threatened/ endangered spp.) *
- Household income (measure of wealth)

→

Dependent Variable: CMPA plan quality

1. Fact base
2. Goals & objectives
3. Policies, tools & strategies
4. Collaboration / intergovernmental coordination
5. Implementation & monitoring

* Indicates significant results (p<0.10); ** indicates significant results (p<0.01).
[1]This model reflects the results of the regression models and does not include the CMPA capacity variables, which although conceptually important in determining plan quality were not statistically viable for the regression analysis.

Figure 6.1. Final research model for evaluation of CMPA plan quality.

The full model (see Figure 6.1) did not support *Hypothesis 1*, that increasing size of CMPA would increase plan quality, while *Hypothesis 3*, that increasing age of a CMPA plan would decrease plan quality was supported. *Hypothesis 4*, that CMPA plan quality will increase as a function of unit increase in public participation was supported. *Hypothesis 6*, that CMPA plan quality will increase as percent change in housing units increases was not supported in the full model. *Hypothesis 6*, that CMPA plan quality will increase as a function of unit increase in the percent total area of adjacent agricultural and developed land use was not supported, but was significant in the opposite direction (one-tailed p=0.0007). *Hypothesis 7*, that CMPA plan quality will increase as the number of threatened and endangered species increases was supported at the $p=0.034$ level. *Hypothesis 8*, that CMPA plan quality will increase by unit increase in average household income in adjacent communities was not supported at the $p=0.189$ level.

CHAPTER VII

DISCUSSION

7.1 Discussion of plan quality analyses

7.1.1 CMPA plan quality evaluation protocol

The quality of the management plans evaluated in this research ranged from 20 to 47 on a scale of 50. In general, the plans which received low scores, scored low for each of the five components and the plans with high overall plan quality scores, scored high for each individual plan component (see Figure 5.1). This suggests that the plans were consistent in their quality within each plan, and that there was some other influencing factor of what would cause a plan to be low or high quality. In comparison to prior plan quality research, these CMPA plans scored somewhat better on average than the comprehensive plans evaluated in other studies (see discussion below).

7.1.2 Factual basis component

The plan quality evaluation protocol used in this research appears to be a good measurement tool for CMPAs. There was only one indicator out of a total of 96 plan quality indicators that had no variation. The indicator in the factual basis component that measured the presence of plain English was fully realized in all 33 management plans. Although there was no variation in this one indicator, it should be included in future studies because it is always important to ascertain if a management plan is readable and accessible to the general public for which it was written. Obviously, management plan evaluations in other countries would need to adjust their requirements to their national language or other standard language.

Low factual basis scores occur when there is lack of general knowledge about a CMPA and its resources at the time of plan writing. While all management plans had some level of guiding statement, the indicator quality was 0.64 indicating that many of the plans did not include a vision, mission and value statement. The lower scores for the guiding statements occurred when the plans identified only one of the three components that make up a guiding statement. In most plans, the only guiding statement came from the larger management agency's program wide guiding statement and the localized CMPA plan did not have its own site specific guiding statements.

7.1.3 Goals and objectives component

Bio-physical goals focusing on conservation of biodiversity and habitat have strong indicator breadth and quality, reinforcing the knowledge that the CMPAs in the sample are focused on protected, depleted, threatened and endangered species and populations in addition to preserving or restoring representative habitats and ecosystems. Other strongly represented bio-physical goals focused on scientific knowledge. On the other hand, biophysical goals focusing on fishery management were less prevalent in the plans (in only 60 percent to 68 percent) for issues such as controlling exploitation rates and reducing secondary fishing impacts. The indicator focusing on protecting critical stages of species' life history was most prevalent in 33 of 40 plans. This suggests that while the goals of CMPAs in the sample are strong in focusing on protecting threatened species and habitats, there is less emphasis on potential impacts relating to fisheries in the management plans. Many of Florida's important fisheries are located in both state and federal waters and are managed by both the Florida Fish and Wildlife Conservation Commission (FWC) and federal agencies. The South Atlantic Fishery Management Council manages fisheries in federal waters (beyond three miles) off the Florida Atlantic coast and the Gulf of Mexico Fishery Management Council manages fisheries in federal waters (beyond nine miles) off the Gulf coast. It is possible that the lower scores for fishery management related indicators in the plans are due to the fact that the management plans choose to defer to the fishing regulatory bodies in Florida for fishery related goals. The fishery management indicators utilized in this study explicitly describe specific goals and objectives for protecting and maintaining fisheries. The multiple use missions of many of the CMPAs in this sample may inherently include a desire to protect fisheries, but the plans failed to provide explicit support for the protection of fisheries. This failure to put into words a support for fisheries management may have been an oversight, or perhaps was due to a fear of appearing to step on the feet of the fisheries advisory councils which are authorized to regulate fisheries in the CMPAs.

The governance goal indicators which had the strongest presence in this study were focused on the basic regulations such as inclusion in a network of protected areas and designation of management responsibilities. There was an effort by almost all plans to focus on “enhanced management plan compliance by resource users” which were generally linked directly to their education and outreach programs. The governance goals were lacking in their efforts to work with constituents and stakeholders to provide representation and conflict reduction services. Evidence in the field of environmental planning suggests that the involvement of the public and stakeholders may result in more tendencies towards compliance and ownership of the plan (Wondolleck & Yaffee, 2000). To acknowledge that the management of environmental resources inevitably results in conflicts that need to be managed is a step toward which the CMPAs in this study have yet to reach (Daniels & Walker, 2001).

7.1.4 Policies, tools, and strategies component

The policies, tools and strategies component was divided into three categories: regulatory tools, incentive-based tools, and spatial design tools. One hundred percent of plans (n=40) had 8 of 11 regulatory tools in their pages, while the only incentive-based tool that received strong representation (n=39) within the plans sampled was the education/awareness strategies indicator. Aquatic Preserves exist within a highly complicated regulatory framework in which they depend upon previously existing regulations at the federal, state and local level within the state of Florida, and as a result focus on activities that fall under the regulatory tool category. The strong leaning towards regulatory tools in the plans may be misleading, as the plans were given credit for coordination with other agencies which hold enforcement capacity for the regulatory tools measured.

The use of spatial design tools is an area in which all the plans could use improvement. The lowest scoring area was the “other spatial design tools” indicator which measured the use of tools such as GIS databases and internet databases shared with other agencies.

7.1.5 Inter-organizational coordination and cooperation component

The plans included in this research study were generally good about including information about coordination and cooperation. All of the plans outlined some level of coordination with other jurisdictions and within jurisdiction. All plans identified intergovernmental agreements and joint database utilization. This is not surprising due to the limited legal ability of the APs to regulate the resources within their boundaries. The APs especially rely upon collaboration and cooperation with other local, state and federal entities in Florida to carry out their mandates. The only statutory regulation applicable to all CAMA CMPAs is the Outstanding Florida Waters designation, which is designated to maintain water quality. The APs are not designed to be no-take, fully protected areas and the management of the APs is specifically designed to work cooperatively with adjacent counties in Florida. Most of the management objectives in the plans are focused on coordination with the multitude of agencies which have jurisdiction in each AP, NERR or NMS. The staff of CAMA spend most of their time working collaboratively with other authorities within each CMPA to guide their decision making processes in a way that is in synchrony with the goals and objectives of each CMPA. This is most commonly in the form of permit reviews.

7.1.6 Implementation and monitoring component

High average implementation and monitoring scores suggest that the majority of CMPAs had mechanisms in place to monitor resources and implement rules and regulations. While most CMPAs (36 of 40) had a monitoring program in place, the combination of socioeconomic and environmental components was less frequent. Most

CMPA plans focused on the environmental monitoring aspects and did not mention socioeconomic monitoring. Traditionally, CMPAs have been focused on the environmental benefits of protection. The interconnectedness of many socioeconomic factors related to the coastal environment has been slow to be incorporated into the monitoring and implementation aspects of CMPAs. CMPA managers have an easy time getting budget approval for standard monitoring of water quality, ecosystem studies or even endangered species populations, but when it comes to collecting data regarding the economic value of the goods and services that depend upon our coastal and marine resources, there is less support. This is counterintuitive, since generally policy makers prefer to make decisions based upon how it will affect their constituents, not necessarily the ecosystem and its services first.

Within CAMA there is an effort to establish a monitoring program for plans. All newly revised management plans (since 2005) are anticipated to be 10-year plans and each CAMA CMPA is developing separate annual work plans and three year business plans (personal comm., Stephanie Bailenson and Karen Bareford, CAMA).

7.1.7 CMPA plan quality compared to other plan quality research

The total plan quality results of this study are higher than in previous similar studies. Average plan quality in this study was 29.40 out of 50 as compared to Brody's (2003e) research of ecosystem plan quality in Florida with a mean total plan quality of 20.62 out of 50. Research in California by Tang (2007) evaluating environmental assessment plan quality in a sample of 40 plans had a mean total plan quality score of 23.95 out of 50. In a study evaluating flood mitigation plan quality in Florida, Kang's

(2009) 54 plans had an average total plan quality of 38.55 out of a total possible 108. Each of these four studies was completed with a single individual conducting the plan coding, and each used a study specific set of indicators to measure total plan quality. The findings in this study had higher plan quality scores than the other three studies indicating that either the quality of CMPA plans is generally higher than the local plans included in previous studies or that the scoring of the plans was more generous than the other researchers. Tang's research is the most similar to the current study, and also has the most similar plan quality scores. Tang's factual basis component was lower with a mean 4.54, but his goals and objectives section scored almost the same with 5.58 compared to this study's 5.83. Other similarities were found between Tang's inter-organizational coordination and cooperation score and this study's similar plan component with mean scores of 5.84 and 5.78 respectively. The results of this study had higher implementation and monitoring, policies, tools and strategies, and factual basis plan component scores when compared with Brody and Tang's research. It is possible that CMPA plans are more focused and specific than comprehensive plans, resulting in CMPA plans having higher plan quality scores.

An evaluation of the impacts of state planning mandates on plan quality that looked at the natural hazard elements of 139 community plans found that the state planning mandate resulted in higher quality plans in states with planning mandates (Berke, et al., 1996). In general for the six states sampled they found that the policy actions in the plans scored lowest, followed by the fact basis indicators, and that the goals were on average the highest scoring indicators (Berke, et al., 1996). In a study comparing plan quality in regional policy statements versus district plans in New Zealand the researchers utilized 8 plan components, each scored on a 0-10 scale (Berke, et al., 1999). The components used in the New Zealand study were internal consistency, identification of issues, fact base, organization or presentation, integration with other plans or policy statements, interpretation of mandate, clarity of purpose and monitoring (Berke, et al., 1999). The lowest scoring component was fact base with mean scores of 0.62 and 1.20 for district plans and regional policy statements respectively (Berke, et al., 1999). The next lowest component was monitoring at 2.07 and 3.87 for district plans and regional policy statements respectively.

The results of this research, although based on the same theoretical planning techniques of the previously mentioned studies, are the first of their kind with regards to coastal and marine protected areas (CMPAs). All of the plans in the research sample were available electronically at the time of this study, but the accessibility of the plans varied widely between the 1980s and the 2000s. The internet and the World Wide Web did not exist prior to 1993 in the capacity in which it is used today. The plans written in the 1980s and 1990s were only recently scanned and uploaded to the internet as the technology became accessible and affordable. The Aquatic Preserves' management plans changed in 1992 from generic plans with the minimum required site specific information, to plans which were meant to reflect site specific information, criteria and management information (Department of Natural Resources, et al., 1992). More recently in the 2000s there is an initiative within CAMA as they revise the AP management plans to create dynamic management documents which can serve as a stand-alone guidebook to any resource manager charged with managing one of the APs (personal communication, Stephanie Bailenson).

7.2 Discussion of statistical analyses

7.2.1 Discussion of correlation results

Correlation results indicated that younger CMPAs had higher numbers of FTEs, annual budgets and salaries (see Table 6.1). Based on the research sample, the newer protected areas are more likely to have a higher allocation of resources, suggesting that newer CMPAs have the opportunity to be more than paper parks. Another explanation is that current public policy does not allow for the creation of CMPAs without a funding mechanism in place to provide adequate management.

Although there was significant correlation between plan quality and the size of an adjacent county's population, population did have a positive correlation relationship with the size of a CMPA and its budget and number of FTEs. This significant positive correlation between the size of a CMPA and the total population in adjacent counties may be due to a perceived need to protect a precious resource, or it could stem from the tendencies of settlers to locate themselves adjacent to plentiful resources, such as those that are found in the bountiful bays, harbors and estuaries that have subsequently been protected as we understand their significance as sources of food, livelihood and recreation. In addition, population was significantly correlated in the positive direction with percent developed and agricultural adjacent land use, which is expected. This also helps to confirm the usefulness of the data used in measuring percent of adjacent land use, because it is correlated positively with the population data which corresponds to the decade prior to each plan's authorization (i.e. the date plan was written).

Another correlation result of interest pertains to education levels. There was a significant correlation between plan quality and percent of the population with high school as their highest level of education (see Table 6.1). As a population's percentage of college degrees decreased there was an increase in percent high school education. A less educated population was correlated to a lower quality CMPA management plan while there was no significant correlation between the percent of individuals with a college degree. This result suggests that in this study sample, plan quality suffered when the number of individuals who ended their education with a high school degree increased. Although percent of adjacent counties with final educational level of high school was significantly correlated with plan quality, it was not included in the block models due to high levels of multicollinearity with several other variables in the model.

7.2.2 Discussion of CMPA capacity regression results

The three variables included in the CMPA contextual block model were the age of a plan, the size of the CMPA and the age of the CMPA. Both age of plan and size of CMPA were significant in the model for predicting the dependent variable of total plan quality. The age of the CMPA was not significant. It was hypothesized that the older a CMPA, the more opportunities there would have been for consideration of the needs of the CMPA, resulting in stronger plan quality. In hindsight, this does not necessarily make a stronger plan, because as the results of the regression model show, a much stronger indicator of plan quality is the age of the plan. If the oldest CMPA in the sample also has the oldest management plan, then the quality of the plan as compared to newer plans will negate the age of the CMPA. Larger CMPAs were also significant in the block model for predicting the quality of plans. As shown in the correlation analysis, the strength of the association on plan quality was stronger between total plan quality and age of the plan than size of CMPA and age of plan (see Table 6.1).

The most important conclusion that can be made from CMPA contextual regression model is that newer management plans are of higher quality. Frequent plan updates and using the most up to date information for evaluating plan quality when conducting plan revisions should be standard practice.

7.2.3 Discussion of participation regression results

As hypothesized, the quality of CMPA plans increased with increasing levels of public participation in the plan making process. The three measures of participation in this study were the identification in the plan of an "advisory council formed with representation of major stakeholder groups," identification of public input forums used during management plan writing, and the identification of the organizations and individuals that were involved in plan preparation within the plan itself. The presence of these basic public participation activities in the plans was found to be statistically linked to increased total plan quality in this study.

The National Environmental Policy Act (NEPA) of 1969 in the United States mandates the formalization of informing the public of any federal decision making that would impact the environment by presentation to the public of formal environmental impact statements (EIS) and subsequently seeking the public's comments and feedbacks with regards to any potential impacts on the environment (42 U.S.C. § 4332c). The formats of public participation that should be required and the degree to which public input should influence decision-making are frequently debated and there is much room for growth in this area (Peterson & Franks, 2006). The CMPAs in this study were overwhelmingly lacking in identifying any public participation within their management plans. It is possible that from the introduction of NEPA in 1970 to the plans of the 1990s, there has been a slow trickledown effect of the importance of incorporating public participation in plan development, resulting in the best plans in the 2000s in this sample.

7.2.4 Discussion of environmental threats regression results

All three types of environmental threats were significant in the block model. The threatened biodiversity measure was a summation of threatened, endangered and species of special concern. Threatened biodiversity (i.e. endangered species, threatened species and species of special concern) are protected by multiple agencies at the state, federal and international level, subsequently resulting in CMPA plans that were stronger in terms of overall plan quality due to increasing strength of policies, tools and strategies for protecting threatened species. The linkage between increased numbers of threatened species and increased factual basis of the plan was not specifically evaluated in this study but it is reasonable to assume that areas with threatened biodiversity have an increased level of research focused on the individual species and their habitats resulting in a higher overall factual basis of the plans. In a similar plan quality study focused on comprehensive plans, Brody (2003b) found that the combination of disturbed land use area and high levels of biodiversity resulted in increased plan quality.

In the environmental threats block model, the percent of adjacent developed land use was significant in the negative direction, suggesting that as the percent of adjacent development increased, CMPA plan quality decreased. This result was not expected and it is possible that the data for the land use variable, which was collected for a single time period in 2005 and does not correlate directly with the adjacent land use at the time each plan was written, is not reflecting a true relationship. Alternatively, it is possible that as areas adjacent to CMPAs become more developed (with urban and agricultural uses) there is a competition for resources or a perception that there is a degraded watershed, and less of a need to create a strong CMPA plan. Said in another way, CMPAs adjacent to lots of concrete, industry and agriculture have a large number of stakeholder users competing for access to the CMPA, so there will be a perception of the CMPA as already being a multi-use area, focused on the needs of its users and perhaps less of a focus on the area as needing protection.

The variable measuring the percent change in housing units was also found to be significant in the negative direction, suggesting that as percent change in housing units increases, plan quality decreased. In other words, a rapid relative rate of development for the counties adjacent to a CMPA in the decade preceding the writing of a plan resulted in lower total CMPA plan quality. This result was not predicted, but it is possible that instead of a perceived need for stronger protection, the reality is that a focus in these rapidly developing urban areas was on meeting the needs and immediate desires of homeowners and developers, and not on strengthening environmental protection for the coastal and marine resources adjacent to urban areas.

7.2.5 Discussion of socioeconomic regression results

Household income was the only socioeconomic variable which was a significant indicator of CMPA plan quality, and it displayed a positive correlation with CMPA plan quality, as hypothesized. This result confirms suggestions that wealthy populations are more likely to have resources to invest in ensuring that adjacent CMPAs have high quality planning efforts.

The hypothesized correlation between CMPA plan quality and the percent of the population with a college degree in adjacent communities was not supported by the results. At the $p < 0.10$ level, increased percent of college educated population was associated with a decrease in CMPA plan quality. This was not an expected result and although it was significant at the $p<0.10$ level, the independent variable, college education, was not included in the final full model because its significance was less than $p<0.05$ level.

The size of adjacent county populations had no significant influence on plan quality in this research study. Although previous research on ecosystem plan quality has found significant correlation between population and plan quality in Florida and California, there was no significant correlation between population and CMPA plan quality in this research (Brody, 2003c; Tang & Brody, 2009).

7.2.6 Discussion of full model regression results

In the full regression model three independent variables were significant at the $p<0.05$ level and one variable was significant at the $p<0.10$ level. The quality of the CMPA plans was influenced by the age of the plans, participation, threatened biodiversity and the percent of developed land use. Independent variables that were not significant indicators of CMPA plan quality in the final model were the size of the CMPA, household income, and the percent change in housing units.

In this sample of Florida CMPAs, plan quality increased for newer plans. Older plans had lower plan quality scores. This result is most likely due to the fact that newer plans reflect the newest concepts in planning, but additionally the newer plans were more comprehensive, provided more factual basis, and were written in clear, specific formats. The newer plans had numbered lists of goals and objectives as compared to the older plans that incorporated goals and objectives into paragraph form, never specifically identifying goals. Newer plans reflect an initiative in both state and federal government for measuring accountability, with tables summarizing specific action items, costs to achieve those items, and timelines expected for completion.

A 2007 interview with the director of CAMA and the planning director of CAMA revealed that there is a place-based, ecosystem based management focus in CAMA. CAMA has been moved within the Florida government from agency to agency every three to five years. It was previously a Bureau and included responsibility for upland preserves in addition to submerged lands. Additionally, the current director of CAMA has implemented an effort to review all of the management plans in CAMA's authority. The process began with the APs that included some type of upland component in the past or present due to a mandate in upland preserves for management plan revision every ten years (personal communication).

Plans with higher reported participation were correlated with higher quality plans. This result supports previous research and the currently held belief in social systems models that increased public participation leads to higher quality planning processes and user compliance. CMPA managers should consider the use of participation as a tool for not only enhanced management plan compliance, and to further engage stakeholders, but as a potential way to increase management plan quality.

Threatened biodiversity is a significant positive predictor of CMPA plan quality. This result is expected, as the presence of endangered, threatened and species of special concern bring a host of federal and state requirements, that in turn will be translated into the factual basis, goals and objectives, policies, coordination and monitoring of a CMPA. There is often not only more information available about threatened and endangered species, there is more money available to study these species.

Percent adjacent developed and agricultural land use was significant, but in the negative direction. This means that the CMPAs which are receiving the most watershed pressures (i.e. threats from urban and agricultural runoff) had weaker total plan quality. This is worrisome because the number one stated concern in the CMPA plans in this study was maintaining or increasing water quality. However, as development and agriculture increase in the one mile buffer surrounding the CMPAs, the plan quality was decreasing. The C-CAP data for adjacent land use was from a single time capture in

2005, but it still represents a picture of what the land use is like adjacent to the CMPAs. It is possible that results might have been different if land use data had been utilized for each decade represented in the plans, instead of using 2005 data for all three decades.

7.3 Policy implications and recommendations

7.3.1 General policy implications and recommendations

First, this study provides the CMPA field a framework to evaluate management plans. Prior initiatives began to create guidance on what to include in a CMPA plan and how individual CMPAs could evaluate their plans. This study provides a technique for evaluating CMPA plan quality in a quantitative and defendable manner, and which allows for comparing those results across jurisdictions. The governments and NGOs responsible for managing CMPAs should include the evaluation of management plan quality when evaluating the future and continued success of CMPAs.

Second, although the implementation and monitoring component of the plans in this study scored highest, the indicator measuring actions and timelines for implementing plans did not score as highly. CMPAs should link their measurable goals and objectives with clear actions and timelines for implementation. These timelines for goals and objective implementation should include not only timelines for achieving each goal and objective, but also should include timetables for plan assessments and plan updates. Plans that contain a specific plan implementation component are correlated with a greater degree of plan implementation (Brody & Highfield, 2005a). Thus, by enhancing the implementation aspects of CMPA plans there may be an opportunity to see greater plan implementation results in the field. As McClendon (2003) said: “One of the major benefits of a good comprehensive plan is that it communicates a vision of the future in a way that unites and inspires the community to implement it" (p. 228).

Third, this study aims to move the basic concept of applying the urban planning concept of plan quality evaluation into to mainstream of the CMPA field of study. International organizations charged with the management and monitoring of CMPAs have already begun large scale initiatives to evaluate the effectiveness of CMPAs. It is time for those efforts to include the evaluation of the quality of the management plans that are being used to direct our precious coastal and marine protected area resources. Policy organizations, governments and NGOs responsible for the management of CMPAs should incorporate plan quality analysis into their monitoring programs. There is still much that CMPA managers and researchers can learn from the field of environmental and urban planning.

Finally, the strongest indicator of management plan quality in this study was the age of the management plan. If there is one message that would be taken from this study, it is that management plans need to be reviewed and rewritten regularly in order to achieve high plan quality. The process of revising a management plan can be arduous if it is not completed on a regular schedule, but management plans which are reviewed every 5 to10 years are much stronger and display the strongest plan quality. These results have been found in similar research by Tang (2007) who discussed that newer management plans had higher plan quality in his research on California coastal jurisdictions.

7.3.2 CAMA policy recommendations

Florida has a statewide planning mandate, requiring that all local governments have a comprehensive plan and that they conduct regular updates to those plans. As early as 1991 in the Saint Andrews State Park Aquatic Preserve Management Plan, there was as a sense of coordination with the state planning mandates:

> *"The intent of the Aquatic Preserve Program is to guide local governments during their planning process towards developing local plan criteria and standards that will be consistent with the objectives of the program. Therefore, if coordinated properly, the management plan for an aquatic preserve can serve as the waterward extension of the local government comprehensive plan"*(Department of Natural Resources, Division of State Lands, et al., 1991, p. 14).

It is possible that the culture of mandatory local land use planning in Florida helped to enhance planning efforts in the CAMA plans. One limitation in the Aquatic Preserve plans is that the format in which responsible regulatory agencies were presented in the plans made it difficult to ascertain which coordinating agency was responsible for specific regulations. The APs are mostly paper parks in that they have very little regulatory ability, but hold a high level of influence when it comes to directing the policy and permitting decisions in neighboring and cooperating jurisdictions.

The results of this study indicate that that Florida should embrace a more user friendly and transparent method for presenting the suite of regulations governing CMPA resources. Currently there is a myriad of agencies, levels of government and governing bodies responsible for the policies of the coastal waters of Florida. It is challenging at best to decipher the web of rules. Inclusion in each CMPA plan of an organizational chart linking all of the agencies, organizations and levels of local, state and federal government responsible for the management of each CMPA would be a simple step in the right direction. A chart depicting the management history of the AP program within the State of Florida's government for each Aquatic Preserve, including changes in shared management authority (such as APs who were responsible for upland preserves at one point) would help illuminate the changes in status and agency that have occurred over the years. Finally, each plan should include a diagram or chart showing the regulating agencies that currently have overlapping jurisdiction within the APs, NERRs, or NMSP.

NOAA's National Marine Sanctuary Program at one point in the late 1990s proposed to revisit each management plan every 5 years, but in practice it has taken much longer, as the agency works out a process for revision of the management plans with a high level of public participation. At the national level, the NMSP does have the opportunity to revisit its regulations every four to five years if necessary. Based on the high quality of the FKNMS management plan, it would seem that this policy is serving to enhance the quality of the management plans. There is currently an effort by the management of CAMA to revise all of the Aquatic Preserve management plans. This has been a slow process, due to the fact that CAMA has utilized a public participation process that includes creation of advisory councils and public scoping meetings. The continued review of the CAMA AP management plans on a regular schedule, every 5 to

10 years, will serve to enhance the quality of their plans, and subsequently the effectiveness of management in the CMPAs that they manage.

CHAPTER VIII

CONCLUSIONS

8.1 Research summary

This research presents the first coastal and marine protected areas specific quantitative management plan evaluation protocol. The protocol combined urban and land use planning techniques and marine protected areas techniques to create a quantitative measure of coastal and marine protected areas management plan quality. While plan quality has been considered a reasonable first evaluation measure for the success of urban areas, it is a novel concept in the coastal and marine protected areas field. Although environmental and land use planners have been evaluating management plans for a number of years, MPA managers are only beginning to ask questions about how to manage CMPAs successfully and effectively. There has been little or no quantitative research evaluating the quality of CMPA management plans to date. This research addresses this critical gap in the CMPA research literature by creating a protocol for evaluating CMPA plan quality utilizing a combination of MPA and land use planning techniques for the first time, then applies it to a sample of CMPAs providing both descriptive results of CMPA plan quality and analysis of factors that might influence plan quality.

8.2 Study limitations

This study is presented as a model for evaluating the success of coastal and marine protected areas by looking at the quality of the written management plan of those areas. There are some limitations to this research. First, plan quality is an indicator of success, but it does not necessarily lead to plan implementation. While a good plan is more likely to lead to strong land management practices, without implementation the plan may not be that useful. Evaluation of the implementation of the management plans was beyond the scope of this dissertation. Second, the sample size was small, which can cause low statistical power. Third, there was only one person evaluating each management plan, which although it eliminated the need to determine inter-rater reliability, it also introduced the element of potential inconsistency in evaluation from plan to plan due to individual error (Berke & Godschalk, 2009). Fourth, the independent variables from the Census were collected from the census decade prior to each management plan’s authorization. This use of decadal Census information was necessary in order to obtain socioeconomic data pertaining to adjacent counties to the CMPAs, but has the potential to introduce error as Census data may be collected differently from one Census to the next (although efforts were made in this research to avoid those types of inconsistencies).

Fifth, participation was measured as an independent variable, although the variable was calculated by evaluating the management plans for mention of participation techniques. This introduces a potential endogenous problem. In addition, older management plans tended to have less mention of participation, although that could be due to the fact that in the past the inclusion of participation in a management plan was not common practice, or it could be that participation truly was lower in older management plan writing processes.

Sixth, the results of the fully specified regression model should take into account the fact that interpretation may be problematic for Hypothesis 6, that CMPA plan quality will increase as a function of unit increase in the total area of adjacent agricultural and developed land use. As the percent of adjacent developed land increased, so did the quality of the CMPA plans. This could be due to an actual response to perceived threats during the writing of the plans, or it could be an after-the-fact coincidence, since the data for land use was from 2005 and the plans ranged over three decades.

Seventh, the threatened biodiversity independent variable was collected as reported by the management plans. The management plans collected their data from threatened species lists published by U.S. Fish and Wildlife Service and National Fish and Wildlife Service designated as endangered species managers. The collection of the biodiversity variable from the plans themselves poses an endogenous problem, but because the CMPA plans reported figures that they, the CMPAs, did not directly collect, this is likely not a true limitation of the data.

Finally, this study measures merely what was reported in the written management plans. The protocol did not provide a way to measure the actual management initiatives that were being undertaken by each CMPA on a day-to-day basis. Thus, there is a possibility that there were many aspects of daily management that were missed by looking at only a management plan. While this may have caused a CMPA to receive a low plan quality score, when in actuality it might be doing high quality management, the issue of actual management quality was beyond the scope of this research.

8.3 Future research

Future research is indicated to examine CMPA plan quality data to determine what influences each plan component, versus the total plan quality in this study. Is there a correlation between high levels of inter-organizational coordination and cooperation and high levels of household income in adjacent counties? With a higher tax base, perhaps local governments, agencies and businesses would have a greater role in collaboration and cooperation.

Future research may also look at expanding the sample size to CMPAs around the US, or merely begin with all protected areas in Florida, instead of those protected areas under the mandate of a single agency. The CMPA plan evaluation protocol used in this study was developed with global CMPAs in mind, using the best available knowledge of the early 2000s, thus some of the criteria did not match the agency mandates of CAMA perfectly, with many of the plans being written in the 1980s and 1990s. With this said, there was a reasonable total quality of scores for all plans included in this study with variation, suggesting that this protocol would be relevant for future research on other CMPAs around the US and the world.

Future research could attempt to make a different set of scales combining budget, total number of employees and other independent variables such as population in order to decrease the problems of multicollinearity in the regression model. Berke et al. (1999) found that areas with high populations had higher planning staff capacity, thus suggesting it may be reasonable to link population with budget and staff numbers to create a scale. An additional independent variable for future research could be the generation of the management plan. In other words, would the number of times a management plan has been officially revised and authorized increase its overall total plan quality?

While this CMPA plan evaluation protocol was adequate for this research, this protocol was in no way exhaustive. There are many other levels of evaluation that could be added to a plan evaluation protocol, such Berke and Godschalks' (2009) idea of internal versus external plan quality or regionally specific concepts. Future protocols may include specific criteria relating to resiliency, hazards reduction and recovery, and response to natural and man-made disasters, among others. Future research should utilize a multiple coder approach in order to increase reliability of results (Berke & Godschalk, 2009). In addition, future research could utilize a plan coding scale of zero and one, instead of the 0, 1, 2 scale used in this plan, to decrease any coding errors made by having a single individual code all plans. On the other hand, it would be interesting to determine which of the indicators used in this research were the most important predictors of overall total plan quality and create a more streamlined series of indicators to measure total plan quality.

Future research could benefit by looking at more specific levels of participation. Participation data could be enhanced if the sample of management plans included those plans created after the introduction of online news media archiving which would allow for examination of local news media publications. Participation could be measured in future studies not only by that which is reported in the management plan itself, but by the number of public meetings held, the number and quality of public announcements inviting participation from the general public, and the number of formats of participation that were provided during a management plan revision process.

Future research could also look at public access issues, evaluating the public accessibility of CMPAs, determining if those areas which are highly accessible to the public foster a stronger sense of responsibility for protection of an area. Variables which could be evaluated when measuring the public accessibility of a CMPA include paddling trails, boat docks and ramps, adjacency to other types of parks, quality of view sheds, access to beaches, parking facilities, restrooms, educational facilities and finally, adjacency to academic research institutions. Senecah's (2004) trinity of voice theory suggests "…*that the key to effective process is an ongoing relationship of trust building to enhance community cohesiveness and capacity, and results in good environmental decisions*" (p. 23). If access, standing, and influence are the trinity of voice, this researcher would like to suggest that access is not only the ability of one to have one's opinion heard, but it is the opportunity to experience a protected area first hand in order to develop a sense of place and value for the resource (Cantrill, 2004; Senecah, 2004). Thus future research would build upon these ideas and look at public access to CMPAs as a possible influencing factor in the level of public participation when creating and revising CMPA management plans.

One additional future research study could link the quality of the CMPA management plans in this or future studies to the implementation of those plans in practice. Future evaluations of plan quality may be enhanced by conducting a survey of CMPA staff to determine why they are or are not utilizing their written plans.

Implementation measurement is one direction in which MPA management is moving and it is essential that we do not forget the lessons that can be learned from environmental and land use planning as we move forward into evaluation and accountability measures in our coastal and marine protected areas.

In conclusion, in July of 2010 a new Executive Order was issued by the United States Office of the President establishing a National Ocean Council, responding to the Deepwater Horizon oil spill, and establishing management plan development for coastal areas. The order eloquently explains why the management and planning for our coastal areas is so important:

> *The ocean, our coasts, and the Great Lakes provide jobs, food, energy resources, ecological services, recreation, and tourism opportunities, and play critical roles in our Nation's transportation, economy, and trade, as well as the global mobility of our Armed Forces and the maintenance of international peace and security. The Deepwater Horizon oil spill in the Gulf of Mexico and resulting environmental crisis is a stark reminder of how vulnerable our marine environments are, and how much communities and the Nation rely on healthy and resilient ocean and coastal ecosystems. America's stewardship of the ocean, our coasts, and the Great Lakes is intrinsically linked to environmental sustainability, human health and well-being, national prosperity, adaptation to climate and other environmental changes, social justice, international diplomacy, and national and homeland security* (President Barak Obama, 2010).

Additionally, the Executive Order “Stewardship of the Ocean, Our Coasts, and the Great Lakes” established a mandate for development of coastal and marine spatial plans to enhance existing decision-making and planning processes, highlighting the relevancy of this research on creating a high quality CMPA plans:

> *This order also provides for the development of coastal and marine spatial plans that build upon and improve existing Federal, State, tribal, local, and regional decisionmaking and planning processes. These regional plans will enable a more integrated, comprehensive, ecosystem-based, flexible, and proactive approach to planning and managing sustainable multiple uses across sectors and improve the conservation of the ocean, our coasts, and the Great Lakes* (President Barak Obama, 2010).

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APPENDIX A

Coastal and marine protected areas plan evaluation protocol.

CMPA Name: ____

Plan Name: ____

Date plan evaluated:
____

Plan accepted? ____________ **Plan Gazetted?** __________
Date current plan accepted/gazetted: __________

Size of CMPA (include units):
____

Percent of CMPA that is terrestrial:
____

Total number of pages in plan:
____

Location of PA: ____

Protected Area Designations:
____

Management Authority (State Federal Local or combo):
____

Other notes: ____

Component 99 plan evaluation elements	**Indicator** Each element will be given a score of 0, 1 or 2. 0 for not present, 1 for present but not fully realized, and 2 for fully realized and present.	**Eval-uation Score**	**Page # (s)**
Factual Basis			
Biophysical inventory	• Depleted, Threatened, Rare, or Endangered Species or Populations are identified		
	• Representative Habitats and Ecosystems are inventoried and mapped to provide baseline data		
	• Biodiversity identified to the species, population and genetic level		
	• Commercially important species identified with baseline scientific data, including critical life-history traits, fishing mortality, adjacent yield, spawner biomass		
	• Invasive/exotic species identified		

	• Other biophysical facts		
Socio-cultural inventory	• Culturally sensitive areas, Archaeological sites, Shipwrecks identified		
	• Recreational, commercial uses identified		
	• Stakeholders identified		
	• Other socio-cultural facts		
Economic inventory	• Commercially important species catches, yields, threats, other issues identified		
	• Financial breakdown of annual cost of goods and services that depend on MPA		
	• Other economic facts		
Public accessibility	• Detailed table of contents is included (not just a list of chapters)		
	• A glossary of terms and definitions is included		
	• Executive summary		
	• Plain English is used (or appropriate national language) (avoids jargon-filled, unclear, verbose language)		
	• Supporting documents are included with the plan (videos, GIS, website, CD) and plan is available electronically		
	• Maps are included and display information that is clear, relevant and comprehensible		
	• Tables aggregate data relevant and meaningful to the planning area under study		
Goals & Objectives			
Guiding statement	• Plan has one or all of the following: vision, mission or value statement and precisely describes the aforementioned in the following terms: ○ Vision statement is provided that identifies in words an over-all guiding image of what the PA wants to look like, its unique image of success in terms of a contribution to society ○ Mission statement is provided and summarizes the protected area's reason for being, it precisely describes what the protected area does ○ Values governing the organization and its conduct or relationships with society, customers, suppliers, employees, local community and other stakeholders are identified.		
Bio-physical goals	**Conservation of Biodiversity and Habitat**		
	• Protect Depleted, Threatened, Rare, or Endangered Species or Populations		
	• Preserve or Restore the Viability of Representative Habitats and Ecosystems		
	Fishery Management		
	• Control Exploitation Rates		
	• Protect Critical Stages of the Species' Life History		
	• Reduce Secondary Fishing Impacts		
	• Ensure Against Possible Failures of Conventional		

	Regulatory Systems		
	• Conserve Life-History Traits and Genetic Diversity		
	Scientific Knowledge		
	• Provide a source of Baseline Data		
	• Conduct monitoring and maintain inventory of resources		
	• Other bio-physical goals		
Socio-Economic goals	**Educational Opportunities**		
	• Environmental awareness and knowledge enhanced through a formalized education and awareness program		
	• Enhancement of Recreational Activities and Tourism		
	Sustainable Environmental Benefits		
	• Food security enhanced or maintained		
	• Livelihoods enhanced or maintained		
	• Non-monetary benefits to society enhanced or maintained		
	• Benefits from the MPA equitably distributed		
	• Maintain intergenerational sustainability of ecosystems		
	Protection of Cultural Heritage		
	• Compatibility between management and local culture maximized		
	• Balance human use with maintaining viable wildlife populations		
	• Protect and maintain archaeological & historical sites		
	• Other socio-economic goals		
Governance Goals	• Ensure effective stakeholder participation and representation through a communication program		
	• Enhanced management plan compliance by resource users		
	• Manage and reduce resource use conflicts		
	• Implement management effectiveness monitoring program		
	• Clear designation of management responsibilities		
	• Inclusion in a network of protected areas / sanctuaries		
	• Other governance goals		
Goals, Objectives, & Policy Language	• Goals are clearly stated/specified		
	• Presence of measurable objectives		
	• Policies are mandatory (with words like shall, will, require, must) as opposed to suggestive (with words like consider, should, may)		
Policies, Tools, and Strategies			
Regulatory Tools	• Resource use restrictions		
	• Zoning is specified (if appropriate) and utilizes a system of multiple core areas or Conservation zones		
	• Prohibit pesticide and biocide use within PA (lobby against upstream use)		
	• Restrictions on native vegetation removal		
	• Removal of exotic/invasive species		

	• Public or vehicular access limited (includes prohibiting floating residential units)		
	• Controls on construction/development activities (includes docks, pipelines, platforms, artificial reefs)		
	• Targeted growth away from habitat/ coordination with adjacent areas		
	• Habitat restoration actions		
	• Permits required for research, manipulation, or collections		
	• Other regulatory tools		
Incentive-Based Tools	• User fees		
	• Impact fees		
	• Education/awareness strategies		
	• Other incentive-based tools		
Spatial Design tools	• Zoning plan incorporates a system of multiple/ redundant core and buffer areas		
	• Zoning plan utilizes clear, easily identifiable boundaries (e.g. Surface features, major navigation features)		
	• Plan identifies techniques for managing PA including seasonal closures, multiple use zones, specific areas for research, education, fisheries closures		
	• Plan proposes to map resources if they are not already mapped; or proposed regular updates to existing maps		
	• Other spatial design tools		
Inter-Organizational Coordination & Cooperation			
Cooperation	• Coordination *with other* jurisdictions specified		
	• Coordination *within* jurisdiction specified		
	• Intergovernmental bodies specified		
	• Intergovernmental agreements		
	• Joint database production utilized		
	• Coordination with private sector (including industry)		
	• Other organizations/stakeholders identified		
	• Information sharing encouraged		
	• Commitment of financial resources		
	• Other forms of coordination (non-profits, academia)		
Participation (collected as independent variable)	**Mechanisms for stakeholder participation in decision-making and/or management activities** ****this was recoded as 0, 1 and excluded the "other forms of participation" measure from the participation variable***		
	• Advisory council formed with representation of major stakeholder groups		
	• Public input forums provided during management plan reviews allow for objectives to be created in a collaborative process that involves scientists, local communities, user groups and management authorities		
	• Organizations and individuals that were involved in plan preparation are identified		
	• Other forms of participation		
Implementation & Monitoring			

Implementation	• Actions and timelines for implementing plans are clearly identified and/or prioritized (e.g. Timetable for plan assessment and updates)		
	• Organizations with responsibility to implement policies are identified/ Designation of responsibility		
	• Adequate technical resources are available		
	• Enforcement is specified, with adequate resource for size/scope of PA (monitoring compliance)		
	• Identification of costs or funding		
	• Capacity of the institution is specified. Number of employees is reasonable for size of PA.		
	• Sanctions are clearly described		
	• The administrative authority for planning is indicated (federal, state, international law, local resolution, fisheries council)		
	• Education and outreach efforts by the PA to increase stakeholder awareness are explicitly described		
	• Research and monitoring efforts to be conducted by the PA are explicitly described		
Monitoring	• Monitoring goals are quantified based on measurable objectives (simple programs)		
	• Organizations are identified that are responsible for monitoring and/or providing data for indicators		
	• Monitoring for plan effectiveness and response to new information		
	• Monitoring program includes socioeconomic and environmental monitoring components.		

APPENDIX B

Detailed description of CMPA plan quality indicators.

Indicator code	Description
96 plan evaluation elements	Each element will be given a score of 0, 1 or 2. 0 for not present, 1 for present but not fully realized, and 2 for fully realized and present.
Factual Basis	
	Biophysical inventory
FB_1	Depleted, Threatened, Rare, or Endangered Species or Populations are identified
FB_2	Representative Habitats and Ecosystems are inventoried and mapped to provide baseline data
FB_3	Biodiversity identified to the species, population and genetic level
FB_4	Commercially important species identified with baseline scientific data, including critical life-history traits, fishing mortality, adjacent yield, spawner biomass
FB_5	Invasive/exotic species identified
FB_6	Other biophysical facts
	Socio-cultural inventory
FB_7	Culturally sensitive areas, Archaeological sites, Shipwrecks identified
FB_8	Recreational, commercial uses identified
FB_9	Stakeholders identified
FB_10	Other socio-cultural facts
	Economic inventory
FB_11	Commercially important species catches, yields, threats, other issues identified
FB_12	Financial breakdown of annual cost of goods and services that depend on MPA
FB_13	Other economic facts
	Public accessibility
FB_14	Detailed table of contents is included (not just a list of chapters)
FB_15	A glossary of terms and definitions is included
FB_16	Executive summary
FB_17	Plain English is used (or appropriate national language) (avoids jargon-filled, unclear, verbose language)
FB_18	Supporting documents are included with the plan (videos, GIS, website, CD) and plan is available electronically
FB_19	Maps are included and display information that is clear, relevant and comprehensible
FB_20	Tables aggregate data relevant and meaningful to the planning area under study
Goals and Objectives	
	Guiding statement
GO_1	Plan has one or all of the following: vision, mission or value statement and precisely describes the aforementioned in the following terms
	Bio-Physical goals: Conservation of Biodiversity and Habitat
GO_2	Protect Depleted, Threatened, Rare, or Endangered Species or Populations
GO_3	Preserve or Restore the Viability of Representative Habitats and Ecosystems
	Bio-Physical goals: Fishery Management
GO_4	Control Exploitation Rates
GO_5	Protect Critical Stages of the Species' Life History
GO_6	Reduce Secondary Fishing Impacts
GO_7	Ensure Against Possible Failures of Conventional Regulatory Systems
GO_8	Conserve Life-History Traits and Genetic Diversity
	Bio-Physical goals: Scientific Knowledge
GO_9	Provide a source of Baseline Data

GO_10	Conduct monitoring and maintain inventory of resources
GO_11	Other bio-physical goals
	Socio-Economic goals: Educational Opportunities
GO_12	Environmental awareness and knowledge enhanced through a formalized education and awareness program
GO_13	Enhancement of Recreational Activities and Tourism
	Socio-Economic goals: Sustainable Environmental Benefits
GO_14	Food security enhanced or maintained
GO_15	Livelihoods enhanced or maintained
GO_16	Non-monetary benefits to society enhanced or maintained
GO_17	Benefits from the MPA equitably distributed
GO_18	Maintain intergenerational sustainability of ecosystems
	Socio-Economic goals: Protection of Cultural Heritage
GO_19	Compatibility between management and local culture maximized
GO_20	Balance human use with maintaining viable wildlife populations
GO_21	Protect and maintain archaeological & historical sites
GO_22	Other socio-economic goals
	Governance Goals
GO_23	Ensure effective stakeholder participation and representation through a communication program
GO_24	Enhanced management plan compliance by resource users
GO_25	Manage and reduce resource use conflicts
GO_26	Implement management effectiveness monitoring program
GO_27	Clear designation of management responsibilities
GO_28	Inclusion in a network of protected areas / sanctuaries
GO_29	Other governance goals
	Goals, Objectives, & Policy Language
GO_30	Goals are clearly stated/specified
GO_31	Presence of measurable objectives
GO_32	Policies are mandatory (with words like shall, will, require, must) as opposed to suggestive (with words like consider, should, may)
Policies, Tools and Strategies	
	Regulatory Tools
PTS_1	Resource use restrictions
PTS_2	Zoning is specified (if appropriate) and utilizes a system of multiple core areas or Conservation zones
PTS_3	Prohibit pesticide and biocide use within PA (lobby against upstream use)
PTS_4	Restrictions on native vegetation removal
PTS_5	Removal of exotic/invasive species
PTS_6	Public or vehicular access limited (includes prohibiting floating residential units)
PTS_7	Controls on construction/development activities (includes docks, pipelines, platforms, artificial reefs)
PTS_8	Targeted growth away from habitat/ coordination with adjacent areas
PTS_9	Habitat restoration actions
PTS_10	Permits required for research, manipulation, or collections
PTS_11	Other regulatory tools
	Incentive-Based Tools
PTS_12	User fees
PTS_13	Impact fees
PTS_14	Education/awareness strategies
PTS_15	Other incentive-based tools
	Spatial Design tools
PTS_16	Zoning plan incorporates a system of multiple/ redundant core and buffer areas

PTS_17	Zoning plan utilizes clear, easily identifiable boundaries (e.g. Surface features, major navigation features)
PTS_18	Plan identifies techniques for managing PA including seasonal closures, multiple use zones, specific areas for research, education, fisheries closures
PTS_19	Plan proposes to map resources if they are not already mapped; or proposed regular updates to existing maps
PTS_20	Other spatial design tools
Inter-Organizational Coordination & Cooperation	
CC_1	Coordination *with other* jurisdictions specified
CC_2	Coordination *within* jurisdiction specified
CC_3	Intergovernmental bodies specified
CC_4	Intergovernmental agreements
CC_5	Joint database production utilized
CC_6	Coordination with private sector (including industry)
CC_7	Other organizations/stakeholders identified
CC_8	Information sharing encouraged
CC_9	Commitment of financial resources
CC_10	Other forms of coordination (non-profits, academia)
Implementation and Monitoring	
	Implementation
IM_1	Actions and timelines for implementing plans are clearly identified and/or prioritized (e.g. Timetable for plan assessment and updates)
IM_2	Organizations with responsibility to implement policies are identified/ Designation of responsibility
IM_3	Adequate technical resources are available
IM_4	Enforcement is specified, with adequate resource for size/scope of PA (monitoring compliance)
IM_5	Identification of costs or funding
IM_6	Capacity of the institution is specified. Number of employees is reasonable for size of PA.
IM_7	Sanctions are clearly described
IM_8	The administrative authority for planning is indicated (federal, state, international law, local resolution, fisheries council)
IM_9	Education and outreach efforts by the PA to increase stakeholder awareness are explicitly described
	Monitoring
IM_10	Research and monitoring efforts to be conducted by the PA are explicitly described
IM_11	Monitoring goals are quantified based on measurable objectives (simple programs)
IM_12	Organizations are identified that are responsible for monitoring and/or providing data for indicators
IM_13	Monitoring for plan effectiveness and response to new information
IM_14	Monitoring program includes socioeconomic and environmental monitoring components.

Note: FB = Factual Basis; GO = Goals and Objectives; PTS = Policies, Tools and Strategies; CC = Inter-organizational Coordination and Cooperation & Collaboration; IM = Implementation and Monitoring

APPENDIX C

Comparison of block model regression results.

Dependent: plan quality	Model 1	Model 2	Model 3	Model 4	Full model
CMPA contextual					
Age of plan	-0.696***				-0.399**
	-0.843				-0.483
Size of CMPA	0.000004**				-0.0000035
	0.196				-0.019
Age of CMPA	0.038				
	0.039				
Participation					
Participation		5.012***			1.163*
		0.762			0.177
Socioeconomic					
Population				.0000003	
				.011	
Household income				.001***	0.00008
				.776	0.116
% College educated				-.305	
				-.148*	
Environmental threats					
Threatened biodiversity			0.103***		0.048**
			0.382		0.178
% Developed land use			-0.091**		-0.068**
			-0.262		-0.196**
% Change housing units			-0.061***		-0.014*
			-0.451		0.105
Constant (coef.)	40.188	52.479	33.000	16.235	34.824
N	40	40	40	40	40
F (df regression, df total)	47.290 (3, 39)	52.479 (1, 39)	12.877 (3, 39)	16.487 (3, 39)	28.357 (7, 39)
Prob >F	0.000	0.000	0.000	0.000	0.000
R2	0.893	0.580	.518	0.579	0.861
Adj. R2	0.781	0.569	.477	0.544	0.831

Note: Presents unstandardized coefficient, then standardized coefficient. Significance results presented are one tailed.
*<0.1 level, **<0.05 level, and ***<0.001 level

APPENDIX D

Marine Protected Area (MPA) - "the full configuration of protected areas in coastal areas and oceans" (Agardy et al., 2003)

Coastal and Marine Protected Area (CMPA) - This is a broader definition of MPAs that includes coastal areas, estuaries, and other ecosystems that are adjacent to the coastline in addition to areas that are completely surrounded by open water.

Effective - Specifically refers to the management effectiveness of protected areas. Meeting the goals and objectives set by the stakeholders.

Marine reserve - A restricted use area limiting the taking of fisheries species for any human use, commercial, subsistence or recreational.

Biodiversity - The measure of all life (Noss & Cooperrider, 1994). In this research biodiversity is measured as a sum of all threatened, endangered and species of special concern.

Coastal zone – The area that includes the ocean adjacent to the coastline and the land extending inland some distance which is determined to be influenced by coastal processes. This definition varies from state to state and around the world.

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