

**Policy Narratives surrounding Port Infrastructure Projects adjacent to Coral Reefs in
Florida and the Cayman Islands**

By

Sabine Bailey

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Approved by

Kelly Dunning, Chair, Assistant Professor of Conservation Governance
Sarah Zohdy, Associate Professor of Disease Ecology
Ryan Williamson, Assistant Professor of Political Science

Abstract

Coral reefs hold immense economic, ecological, and cultural value but are severely threatened by climate change and other local stressors, such as coastal development projects. In Florida and the Cayman Islands, two locations with vibrant coral reef ecosystems, large scale dredging port projects have either been planned or implemented. Environmental disputes emerged during both projects due to the uncertainty over ecological risks of dredging on coral ecosystems. A refined version of the Narrative Policy Framework was employed to understand how narratives were used by stakeholders, both supportive of and opposed to these dredging projects. A comparative case study design was used to analyze 991 statements from news articles, Facebook posts, press releases, and 16 semi-structured interviews with stakeholders across the Florida and Cayman cases. Results show that pro-project stakeholders place themselves as heroes in their narratives, in which they advocate for economic prosperity while simultaneously presenting their side as protecting the environment through mitigation strategies. On the other hand, anti-project stakeholders emphasize the environmental risks involved, contest the science presented, hold managers of the projects accountable, and, in the Cayman case, use narratives of democratic rights to heighten their messaging. As environmental disputes increase along with the impacts of climate change, understanding the narratives that coalitions of stakeholders employ to advocate for preferred policies will be important for global environmental policy-makers.

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1.0 Introduction

Coral reefs are rare, severely threatened, and hold immense economic, ecological, and cultural value. It is estimated that the annual global net economic value from reefs is ~375 billion US dollars when taking biodiversity, tourism, fisheries, and coastal protection ecosystem services into account (Hoegh-Guldberg, 2017).¹ In two locations where coral habitat and reef systems are present, specifically Florida in the United States and the Cayman Islands, dredging projects for upgrading major ports are either planned or have been implemented.² Since the widening of the Panama Canal in 2016, cruise and cargo ships have increased in size, some 2.5 times larger than prior ships (Cunning et al., 2019; Doyle & Havlick, 2009). Consequently, many governments are responding to increasing pressure to expand their ports and undergo dredging projects to accommodate these larger ships. These infrastructure projects have economic benefits to the tourism and freight sectors (Bottasso et al. 2014; Munim & Shramm, 2018), but preliminary evidence suggests that they come with uncertainty over ecological costs such as widespread coral reef mortality from sedimentation and possible long term, irreversible damage (Cunning et al., 2019).³

With rising sea surface temperatures causing more frequent coral bleaching events and other stresses to reefs, any new and preventable impacts to coral reefs must be scrutinized closely (Hoegh-Guldberg et al., 2017; Carlson et al., 2019). In response to these dredging projects,

¹ Ecosystem services can be defined as the direct or indirect benefits that the human population obtains from ecosystems (Costanza, 1997; *Millennium Ecosystem Assessment*, 2005).

² Dredging is the removal of unwanted sediment and debris from the ocean floor. As ships are getting larger, they need deeper navigation channels to ensure safe passage to ports, which is accomplished through dredging (Chopra, 2019).

³ This evidence has been supported by Miller et al., 2016 but disputed by Precht et al., 2019, Gintert et al., 2019; and Spadafore et al., 2021.

governments have implemented mitigation strategies, such as coral relocation and coral transplanting, to offset ecological costs. However their long-term efficacy and success has yet to be determined (Boström-Einarsson et al., 2020; Ware et al., 2020). Public policy and environmental laws in these places guarantee legal protection of several threatened and endangered reef species at the domestic and international level. Given the preliminary evidence of uncertainty over ecological damage attributed to these projects, climate-elevated risk, and public policy that strictly protects reefs, these projects are puzzling and worth investigation. I use two case studies to ask how policies to upgrade major ports are made despite ecological risks and preexisting environmental policy? My results shed light on how policy actors deploy strategic narratives in controversial environmental disputes, insights broadly applicable to a range of contexts, especially those in which the underlying science becomes a point of debate among factions.

In both the cases of Miami, Florida and the Cayman Islands, dredging for port expansion drew significant public controversy. This led to the formation of two distinct groups of stakeholders: those supportive of the project and those opposed to it. Major and on-going environmental disputes arose during both projects. Despite different outcomes regarding the projects' ultimate implementation, both cases resulted in heightened media press, public protests, and legal actions against the port projects, led by anti-project stakeholders.

Narratives, more often than facts, play a powerful role in shaping our perceptions and decisions, especially on controversial issues (Frazer et al., 2021). While there have been studies examining the role of stakeholders and policy beliefs in controversial infrastructure projects, few have

investigated the role of narratives (Durrant, 2015; Koppenol, 2014; Lawer, 2019; Vogeler and Bandelow, 2018; Xu & Pittock, 2020). As such, I deploy a refined theoretical framework for strategic narratives (Shanahan et al., 2018) from the discipline of public policy to examine the influence of strategic narratives used by pro-project stakeholders and anti-project stakeholders on the outcomes of the port projects.

In the Miami case, the dredging project was completed in 2015 but throughout the process, it garnered heightened negative public attention, especially regarding the potential violation of permits and the science conducted, which is still being debated today. In the Cayman Islands case, the proposed project was placed on an indefinite halt due to the triggering of the first people-initiated referendum in Caymanian history, as well as the onset of the COVID-19 global pandemic in March 2020 and change of government administration in April 2021. The Cayman project also gained major negative attention, which contested the government's intentions and the mitigation strategies proposed. In both cases, supporters and opponents of these projects deployed narratives to build popular support and coalitions to push their policy beliefs. I argue that these narratives play an outsized role in the ultimate implementation status of projects and the impacts therein.

I used a case study research design and a mixed methods approach to collect data in the form of stakeholder statements ($n= 991$) from newspaper articles, social media posts, and other documents, as well as key informant interviews ($n= 17$). Using the Narrative Policy Framework (Shanahan et al., 2018), I coded for how pro-project stakeholders and anti-project stakeholders across both cases deployed strategic narratives. Specific codes included how stakeholders 1) cast

different types of actors or “characters” (e.g. as *heroes, villains, or victims*), 2) expanded or minimized the benefits and risks of the port projects (e.g. *scope of conflict*), 3) assigned responsibility or blame (e.g. *causal mechanisms*), and 4) spoke villainously or heroically of stakeholders (e.g. *devil-angel shift*). To better deal with environmental disputes over vulnerable ecosystems, I offered novel additions, influenced by McBeth et al. (2007) and Stone (2012), to the Narrative Policy Framework (Shanahan et al., 2018) by testing the prevalence of *science* and *symbols* in narratives. As such, I also coded for how stakeholders 1) stated science with certainty or uncertainty (e.g. *science*), and 2) used symbols in their narratives to influence the outcome of the projects. I used statistical analysis to quantify how these different strategic narratives varied between pro and anti-project stakeholders across both cases.

My results show that there are key similarities across both the Miami and Cayman cases, most importantly in the way that anti-project stakeholders employ narratives that 1) cast themselves as heroes, 2) cast pro-project stakeholders as villains, and 3) cast the environment, specifically coral reefs, and the local citizens as victims. In both cases, anti-project stakeholders also emphasize the risks of proceeding with such controversial projects. In these cases they highlight the potential detrimental coral loss, and minimize the benefits of the projects, thus ensuring that project supporters must address the underlying ecological uncertainty of these projects in ways that may not have been required without highlighting risks. Anti-project stakeholders also place responsibility of failures and mistakes, such as coral loss or lack of good governance, on pro-project stakeholders and prevalently use the devil-shift to portray them as villainous, a narrative that the general public and media outlets aligned with in both cases. Anti-project stakeholders contest the science on ecological risks presented by pro-project networks, further expanding the

conflict, and in turn, provide their own evidence that these types of projects come with larger risks than supporters claim. Scientific information tended to be couched in language of certainty in their strategic narratives. Finally, anti-project stakeholders tend to use symbols to heighten the importance and value of vulnerable ecosystems, such as coral reefs, creating strategic narratives that emphasize the value of what the public stands to lose if ecological damage is done by the projects. In the Cayman case, the people-initiated referendum was used as a symbol of constitutional rights.

I also found key similarities across both cases in the way that pro-project stakeholders deploy strategic narratives. Specifically, pro-project stakeholders 1) cast themselves as heroes, 2) cast anti-project networks as villains, and 3) cast the environment, themselves, and citizens as victims. They emphasize the benefits, primarily increased economic opportunities, of these infrastructure projects while minimizing the risks. They do this to contain the scope of conflict, or restrict debate by presenting economic benefits as being the most important reason to proceed with projects; an action which protects the status quo. To a lesser extent than anti-project stakeholders, pro-project stakeholders use the devil-shift to portray opponents as villains using any means to delay the project. They also portray environmental mitigation strategies to offset the possible ecological damage of the projects in language that emphasized their certainty to be successful. Finally, pro-project stakeholders use symbols to focus on the economic importance of proceeding with these port expansion projects.

In sum, pro-project stakeholders place themselves as heroes in their narratives, in which they advocate for economic prosperity while simultaneously protecting the environment through

technological certainty of mitigation strategies. On the other hand, anti-project stakeholders emphasize the environmental risks involved, contest the science presented, blame and portray supporters as villainous, and in the Cayman case, used the people-initiated referendum as a symbol of democracy to heighten their messaging.

There are also important differences across the cases. In the Cayman case, project supporters deployed a sophisticated strategic narrative that focused on the risks of economic uncertainty and loss if the port expansion project were not to proceed. The Miami case, more prevalently than the Cayman case, saw narratives focused on competing scientific claims, with stakeholders regularly using the certainty of science that underpinned their vantage point in their narratives.

Furthermore, narratives steeped in symbols were used more prevalently by pro-project stakeholders in the Miami case, (e.g. casting the Port of Miami was the “gateway to the Americas”) while more by anti-project stakeholders in the Cayman case. Anti-project stakeholders used the people-initiated referendum as a powerful symbol of the citizens’ constitutional rights to have their voices heard. The difference between cases suggests that stakeholders deploy narratives of symbols with high degrees of cultural and contextual meaning.

Overall, my findings indicate that the role of narratives stakeholders employ in environmental disputes over vulnerable ecosystems is essential towards motivating actions and accelerating policy response. In the Miami case, this resulted in legal actions and scientific disputes regarding the impact of dredging on corals that continue to this day and likely influenced the delay of another port dredging project in Florida. In the Cayman case, this resulted in the indefinite halt of the proposed new cruise berthing facility project.

I shed light on the different types of narratives that can be used by stakeholders to tell their version of a story, or series of events, to capture or persuade the attention of the public and key decision-makers. I tested the Narrative Policy Framework theory which tells us that pro-project stakeholders will lessen the conflict by emphasizing benefits, anti-project stakeholders will intensify the conflict by emphasizing risks, a component of the theoretical framework that I found to be true. As a relatively new theoretical framework, results from prior studies have varied on the use of the devil-angel shift and causal mechanisms narrative across stakeholders. For example, Schlaufer (2018) found that anti-project stakeholders used the angel-shift, while Leong (2015) found that anti-project stakeholders used the devil-shift. In my case, I found that anti-project stakeholders used the devil-shift and intentional causal mechanism narratives significantly more than pro-project stakeholders. To supplement the Narrative Policy Framework, I also tested for the use of science and symbols in narratives. I found both of these additions were essential in characterizing the narratives used by stakeholders across both sides of the disputes. I found that the heterogeneity and dynamism in the use of science and symbols cannot be predicted by pro- or anti-project stakeholders but rather, are adaptable to either cause readily.

This paper proceeds in six sections. First, I introduce the case studies: the Deep Dredge Project in Port of Miami and the George Town Harbour New Cruise Berthing Facility in the Cayman Islands. Second, I review prior literature on the impacts of port infrastructure on the environment and the human dimensions of coral reefs. Third, I present the Narrative Policy Framework and its

components. Fourth, I report my methodology. Fifth, I present my findings. Sixth, I discuss my expectations and seventh, I conclude with a summary of my research.

2.0 Policy Context

2.1 Case 1: Miami Harbor Phase III Deepening Project

The Port of Miami is in Miami-Dade County, Florida, and is situated in a sub-tropical estuary characterized by seven connected ecosystems that include coastal strand, mangroves, seagrass beds, coral reefs, hard-bottom habitat, silt-bottom habitat, and rocky bottom habitat (FDEP, 2021). The Biscayne Bay in which the Port of Miami is located, falls within the ecologically sensitive Biscayne Bay Aquatic Preserve home to several listed species under the Endangered Species Act including manatees, crocodiles, several sea turtle species, small-tooth sawfish, and staghorn coral (*Acropora cervicornis*).

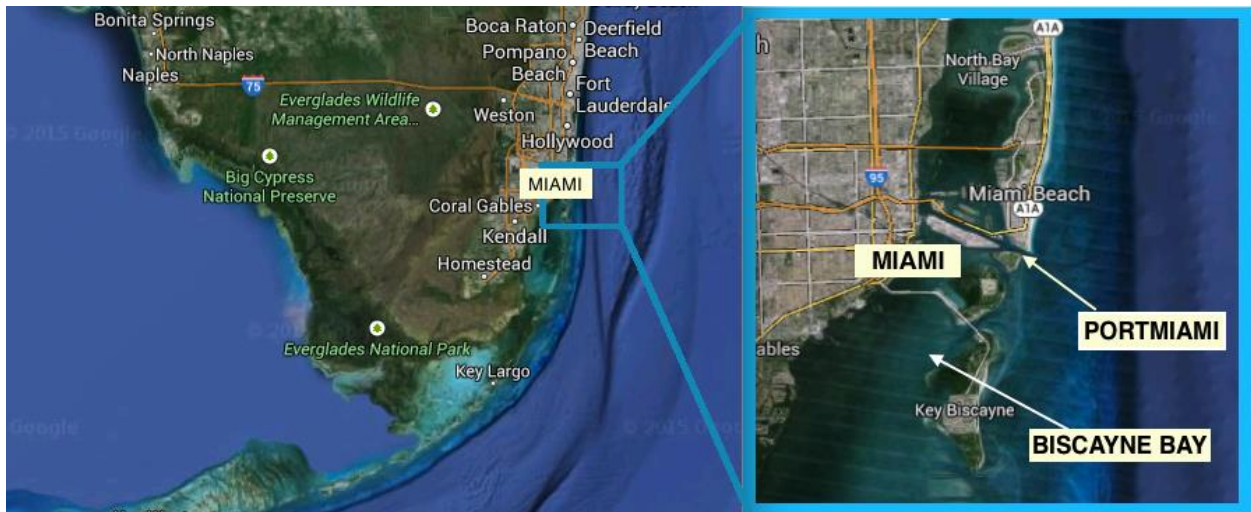


Figure 1. The Port of Miami known as “Port Miami” near Biscayne Bay, Florida (adapted from Google Maps).

Tourism and trade are two of the primary economic income sources for Miami-Dade County (*Miami: Economy*, 2021). The Port of Miami, branded as “PortMiami,” contributes over \$43 billion annually to the economy, sees over 6 million cruise passengers, over 1 million twenty-foot equivalent units,⁴ and supports over 300,000 jobs (*PortMiami - Miami-Dade County*, 2019). Aptly, it has branded itself as the “Cruise Capital of the World and Cargo Gateway of the Americas”.

The Port of Miami has a long history of deepening and dredging the harbor to accommodate larger vessels and meet the demands of the market. Beginning in 1990, Congress authorized the deepening of the Port to 42 feet, which was completed in 1993. Another port expansion project regarding the South Harbor was completed in 2006, paving the way for the largest port upgrade to date which was completed in 2014. This transpired in three parts, 1) a \$1 billion tunnel project to create direct access to the port from the interstate (2010-2014), 2) enhancing and repairing a rail link for direct cargo access to the national rail system (2014), and 3) the *Miami Harbor Phase III Deepening Project*, the subject of this research (2013-2015).

In 2012, the deepening and widening of the Port of Miami was approved and fast-tracked under the Obama administration, as part of the *We Can't Wait* initiative.⁵ The deep dredge project was to be built simultaneously with the tunnel and rail projects in response to the widening of the Panama Canal, which was completed in 2016. The stakeholders involved with managing the Port of Miami

⁴ Twenty-foot equivalent unit (TEU) is a shipping container that measures 20 feet by 8 feet long (Rodrigue, 2020).

⁵ The We Can't Wait Initiative was a campaign launched by the Obama Administration in 2011 to help revive the economy via executive orders and other administrative rule-making bypassing a gridlocked Congress.

wanted it to be ready to accommodate the safe passage of the Post-Panamax size vessels,⁶ which they foresaw as becoming the industry standard. The authorized project consisted of five dredging components which included deepening the main channel to 52 feet, deepening and widening a nearby channel, Fisherman’s Channel, to 50 feet, widening the channel entrance by 300 feet, and expanding the turning basin for large ships near Lummus Island (see Figure 2).

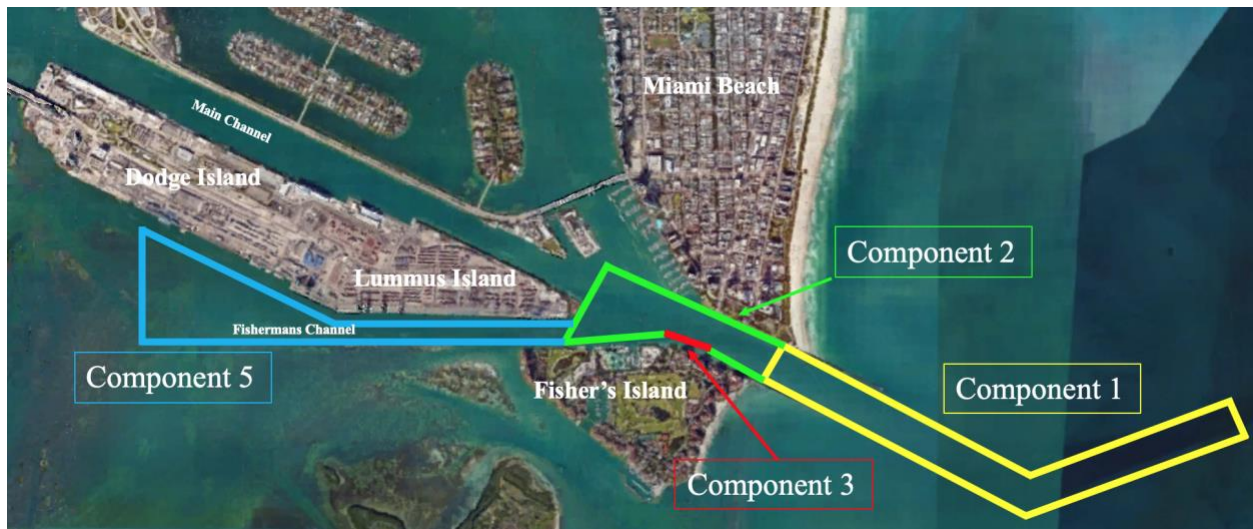


Figure 2. The Port of Miami Phase III Deepening Project plan (adapted from Dial, Cordy, and Associates Inc, 2016 using Google Earth).

Note: The following describes the dredging work associated with each component. *Component 1:* Widen seaward portion from 500 to 800 feet and deepen channel from 44 to 52 feet. *Component 2:* Increase Fisher Island turn basin from 1200 to 1500 feet and deepen from 42 feet to 50 feet. *Component 3:* Widen turn at Fishermans channel and deepen to 50 feet. *Component 5:* Expand berthing area by 60 feet and deepen channel from 42 to 50 feet.

The US Army Corps of Engineers (USACE) oversaw the project and contracted a private company, the Great Lakes Dredge and Docks for dredging services. The project cost \$205.6

⁶ Post-panamax II vessels (2000-onwards) can transport 6,000-8,500 TEUs, while neo-Panamax size vessels (2014-onwards) can transport 12,500 TEUs (Rodrigue, 2020).

million dollars and was funded by the state and local government, which was the first time a USACE project was funded by non-federal dollars (Fascell, 2013; USACE, n.d.). The Director of PortMiami at the time, Bill Johnson, praised the former Governor of Florida, Rick Scott, and former Mayor of Miami-Dade County, Carlos Gimenez, for spear-heading the project and contributing over a million dollars of state and county economies. Dredging began in November 2013 and was completed in September 2015.

During that time, over five million cubic yards of ocean bottom was removed (USACE, n.d.). Despite mitigation efforts including creating artificial reefs, seagrass restoration, and coral relocation, some claimed that damage to nearby corals and marine habitat still occurred (Cunning et al., 2019). This is significant as Florida is the only state in the continental United States (U.S.) to have extensive shallow coral reefs. The reefs of Southeast Florida stretch approximately 360 linear miles, from Northern Palm Beach County to Key West and Dry Tortugas, making it the third largest barrier reef in the world (FDEP, 2022). Barrier reefs provide ecosystem services such as critical coastal protection, ecological habitat for millions of organisms, underpin the tourism and fisheries industries, and hold immense cultural and recreational value (Brander et al., 2007; Costanza et al., 2014; Ferrario et al., 2014; Grafeld et al., 2017; Woodhead et al., 2019). In South Florida alone, the Reef Tract is estimated to have a value of \$8.5 billion dollars annually from tourism, local sales, and jobs (Towle, 2020).

The reefs of Florida are protected by laws and regulations enforced by different agencies at the local, state, and federal level. The Marine Protection, Research, and Sanctuaries Act, established in 1972, prohibits the dumping of materials in the ocean that would excessively threaten human

health or the marine environment. Under Section 103, the USACE is the federal agency responsible for issuing permits to authorize the disposal or dumping of dredged materials into the ocean. The USACE follows the Environmental Protection Agency ocean dumping criteria which includes considering the environmental impact on marine ecosystems, such as coral reefs. The Environmental Protection Agency also has the power to veto proposed permits (US EPA, n.d.).

In 1973, Congress passed the Endangered Species Act, which ensures that human actions do not threaten the listed species or result in destruction of critical habitat for the species and prohibits unauthorized harvest, all of which applies to U.S. reefs. The Endangered Species Act is considered one of the strongest laws for the protection of biodiversity worldwide (Saterson, 2013). Specifically, under Section 7 of the Endangered Species Act, federal agencies are required to seek consultation with the National Marine Fisheries Services to certify that actions permitted do not jeopardize any listed coral species (NOAA, n.d.a). Staghorn coral (*Acropora cervicornis*) and elkhorn coral (*Acropora palmata*), which inhabit the Florida Reef Tract, have been listed as threatened since 2006 (NOAA Fisheries, 2019). The Endangered Species Act has protected 2,900 square nautical miles of reef habitat for *Acropora cervicornis* and *Acropora palmata* in Florida (NOAA Fisheries, 2019). Anyone in violation of any regulations under the Endangered Species Act can be fined up to \$25,000 and/or be imprisoned for up to six months.

The Port of Miami abuts the Florida Keys National Marine Sanctuary and the Biscayne National Park, each of which have their own coral protection regulations. These include strict no harvest rules for hard corals and specific zones that limit fishing, setting up lobster traps, trawling, and discharge to further protect the reef (NPS, 2021; FKNMS, 2015).

Furthermore, the corals in Palm Beach, Broward, and Miami-Dade counties are protected through a web of additional regulations and management regimes. Beginning with the Coral Reef Conservation Program, established in 2000, the Florida Department of Environmental Protection manages these northern reefs of Florida and promotes their protection through research, monitoring, strategy development, and coordination of partnerships (FDEP, 2021). This program led to the foundation of the Southeast Florida Coral Reef Initiative in 2003. The Southeast Florida Coral Reef Initiative is an initiative to engage all stakeholders, public and private, to implement local action strategies to better protect the reefs (SEFCRI, 2022). Table 1 displays the policies, plans, and laws and supervising agencies that protect the reefs that are adjacent to the dredging project.

It is important to note that the corals that exist in the shipping channel by the Port of Miami are large individual coral colonies that may not serve the same ecosystem services as barrier reefs, such as coastal protection and tourism. However, certain species that reside there, such as staghorn corals, are protected by the Endangered Species Act. Furthermore, the corals have option value,⁷ as they may be more resistant to coral disease or coral bleaching.

Table 1: Policies, committees and corresponding agencies that protect the coral reefs in Florida.

Policy/Plan/Law	Agency in Charge	Purpose
Endangered Species Act (1973)	National Marine Fisheries Services	Prohibits destruction of critical habitat and unauthorized harvest of all listed species. Section 7 requires consultation with NMFS for actions concerning Staghorn coral

⁷ Option value considers the value or benefit a potential resource may have in the future.

		<i>(Acropora cervicornis)</i> and elkhorn coral <i>(Acropora palmata)</i> .
Coral Reef Conservation Act (2000)	US Coral Reef Task Force/ National Oceanic and Atmospheric Administration	To preserve and protect coral reef ecosystems, promote effective management and sustainable use, research and be informed by science, and assist programs that involve coral reefs and affected local communities.
Marine Protection, Research, and Sanctuaries Act (1972)	US Army Corps of Engineers/ Environmental Protection Agency	Prohibits the dumping of materials in the ocean that would excessively threaten human health or the marine environment. Under Section 103, USACE issues permits to authorize disposal and dumping of materials in the ocean, upon review by the Environmental Protection Agencies.
Florida Keys National Marine Sanctuary and Protection Act (1990)	Environmental Protection Agency/ National Oceanic and Atmospheric Administration/ Florida Department of Environmental Protection/ Florida Fish and Wildlife Conservation Commission	To protect marine resources, promote education about the Florida Keys to the public, and manage anthropogenic activities in accordance with the Act. The Florida Keys National Marine Sanctuary has strict no-take policies regarding removing, harvesting, taking, injuring coral or live rock and protected wildlife including fish. Discharging materials, operating vessels that will damage marine life, and dredging is also strictly prohibited.
Coral Reef Conservation Program (2000)	National Oceanic and Atmospheric Administration	To protect, conserve, and restore coral reef resources by maintaining healthy ecosystem function.
Southeast Florida Coral Reef Initiative (2000)	US Coral Reef Task Force/ Florida Department of Environmental/ Florida Fish and Wildlife	To develop a cooperative strategy with all interested parties to preserve and protect southeast Florida's coral reefs, with an emphasis on the balance between resource use and protection.

	Conservation Commission Protection	
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In 2008, under Section 103 of the Marine Protection, Research, and Sanctuaries Act, the USACE and Environmental Protection Agency issued an ocean dumping permit to the USACE Jacksonville District that authorized the disposal of dredged materials to specific dumping areas. Due to the acknowledged environmental impact of the dredging project, the private firm Great Lakes Dredge and Docks would be responsible for both dredging and implementing mitigation efforts. Mitigation efforts included the restoration of 16.6 acres of seagrass beds, creation of 9.8 acres of artificial reefs, and relocation of all hard corals greater than 25 cm and 1300 hard corals between 10 cm and 25 cm onto artificial or existing reefs outside the designated impact area (USACE, 2014). In addition, they subcontracted another private firm, Dial, Cordy & Associates, to conduct a baseline environmental assessment and monitor present and post-construction conditions of reef, seagrass, and hard-bottom habitat.

In May 2010, this subcontracting firm Dial, Cordy & Associates identified 31 staghorn coral (*Acropora cervicornis*) colonies, within the estimated impact zone of 150 meters from the dredging site. There was a special focus on staghorn coral because under the Endangered Species Act, consultation is required by the National Marine Fisheries Service to authorize any take of a listed species. Upon review of the initial survey in 2010, the National Marine Fisheries Service provided a Biological Opinion Statement and approved an Incidental Take Statement in 2011,⁸

⁸ A Biological Opinion is a document that states the National Marine Fisheries Service’s opinion on whether the actions of Federal agencies are likely to destroy critical habitat or threaten the continued existence of listed species. If appropriate, this can be accompanied by an Incidental Take Statement that provides an exemption to “take”,

authorizing the USACE to take the 31 identified staghorn colonies and transplant them outside the impact zone.

In August 2011, the Florida Department of Environmental Protection proposed to issue a permit to the USACE that would authorize the deepening and dredging of the Miami Harbor.⁹ Upon reviewing the proposed permit, interest groups and concerned citizens, including the Tropical Audubon Society, and Biscayne Bay Waterkeeper (“Reef Guard”), filed a lawsuit against the Florida Department of Environmental Protection and the USACE. The lawsuit sought to clarify and strengthen mitigation and monitoring efforts and scrutinized the impacts of confined blasting to deepen the channel.¹⁰ The lawsuit was settled when the USACE and the Florida Department of Environmental Protection agreed to amend the permit to limit the daily blasting timeframe and strengthen the monitoring parameters. Miami-Dade County also agreed to establish \$1.3 million dollars in a trust fund,¹¹ which would go towards monitoring of relocated corals and seagrass restoration, as well as enhance other environmental projects in South Florida (Miller, 2012). The permit was issued in 2012.

which can include injuring, wounding, hunting, killing, or collecting a specific amount of the listed species to minimize impacts from Federal actions. A re-initiation of consultation by either party must be requested if the amount of take exceeds what is stated in the Incidental Take Statement, or if new information and conditions have changed that impact the listed species to an extent not previously considered (FWS, n.d.; NOAA, n.d.b).

⁹ Permit No. 0305721-001-BI.

¹⁰ Confined blasting is when a hole is drilled in rock or limestone, filled with explosives, and capped with materials such as crushed rock to confine the explosion in the rock (Ellison, 2013).

¹¹ A trust fund is a collection of assets managed on the behalf of a third party. In this case, monies received to a county government trust fund are supervised by a county department to charge and collect fees to disburse money towards specific duties. For example, monies from the Biscayne Bay Environmental Enhancement Trust Fund can only be disbursed for environmental enhancement activities, such as the installation and management of artificial reefs and mooring buoys in the Biscayne Bay under the Board of County Commissioners (*Biscayne Bay Environmental Enhancement Trust Fund*, n.d.).

One month prior to dredging, in late September 2013, the subcontracting firm Dial, Cordy, and Associates went to identify the previously surveyed 31 staghorn coral colonies. However, due to miscommunication among organizations, it was found that there were over 243 staghorn coral colonies within the dredging impact zone.¹² With this new information, the USACE consulted the National Marine Fisheries Service. However, a government shutdown from October 1-17, 2013 meant that all agencies were on furlough, and thus no formal procedure on how to proceed, nor any official follow up from the USACE occurred thereafter. Instead, 38 staghorn colonies were relocated and 26 permanent monitoring sites were set up by the subcontractor Dial, Cordy, and Associates. Dredging then proceeded in November 2013.

In 2014, sedimentation, a process where dredged material is suspended in the water column, became a major public controversy and the public began to report observations of turbidity or sediment in the water column. In response, the Miami-Dade County Division of Environmental Resources Management and Florida Department of Environmental Protection each sent teams of scientists to inspect the dredging site in July 2014. They both discovered that wide-spread disturbances to corals due to dredging related activities were occurring well beyond what was allowed in the permit. The next month, the Florida Department of Environmental Protection sent the USACE a Warning Letter that requested the USACE to undertake an assessment of the sedimentation impact from dredging operations. From these inspections, the National Marine Fisheries Service requested an emergency relocation of all staghorn colonies in September 2014. In October 2014, the interest group Reef Guard also filed their second lawsuit against the

¹² According to Interview #4, there was an extrapolation error by another organization and 31 coral colonies should have been multiplied by nine to get the full number of coral colonies within the estimated dredging impact zone (~279 coral colonies).

USACE citing violations of the Endangered Species Act.¹³ They claimed that 1) the USACE had exceeded the amount of allowable take of staghorn corals as per the 2011 Incidental Take Statement, 2) continued dredging activities during consultation periods when it should have paused, and 3) that sedimentation from dredging was adversely impacting critical reef habitat. In response, the USACE agreed to pay over \$400,000 to relocate staghorn coral colonies to a coral nursery supervised by the University of Miami.

The EPA also raised concerns that the USACE was in violation of the ocean dumping permit issued in 2008. Specifically, the scows, or vessels which transport the dredging material to designated dump sites, were often overflowing to minimize the amount of trips and cost. However, scows would pass over “critical aquatic habitat... unnecessarily [risking] the health of the adjacent coral reef environment” further violating the Marine Protection, Research and Sanctuaries Act (Port Everglades- Notice to Sue, 2016, p. 9). The EPA outlined an additional 125 events of non-compliance. The USACE denied these violations stating that they had monitoring devices that notified them whether scows were overflowing. Despite growing opposition from the public, official warnings, violations of their permit and environmental policies, the USACE completed the dredging project in September 2015.

In 2016, the 2014 lawsuit by Reef Guard against the USACE for violating the Endangered Species Act was reopened. It was settled in 2018 which secured the restoration of an additional 10,000 corals in Miami-Dade county. As per the 2012 deepening permit issued by the Florida Department of Environmental Protection, monitoring and impact assessments led by the

¹³ Plaintiffs include the Tropical Audubon Society, Biscayne Bay Waterkeeper, and Captain Dan Kipnis, from the first litigation, in addition to the Miami-Dade Reef Guard Association.

subcontracting firm Dial, Cordy, and Associates, were required for three years post-dredging operations. They found that total coral mortality due to sedimentation from the project accounted for the death of 2.7% of tagged corals while disease accounted for the death of 32.1% of corals, and that sedimentation impacts were temporary. Dial, Cordy, and Associates noted that during the dredging project a coral bleaching event and disease outbreak complicated the identification of the source of coral mortality.¹⁴

However, these numbers are the subject of controversy and disagreement. There are competing versions and publications of ecological reef damages among stakeholders. For example, in 2016, the National Marine Fisheries Service published their own paper in November 2017, stating that the extent of sedimentation extended 700 meters beyond the dredging site. Subsequent reports by the private sector actors responsible for the monitoring of corals during the dredging such as Precht et al. (2019) stated that while sedimentation from dredging had an impact on stony corals, most of the mortality was caused by disease.¹⁵ Later that year, stakeholders from interest groups and scientists in Cunning et al. (2019) stated that over 560,000 corals were killed within 500 meters of the dredging site,¹⁶ largely from sedimentation burial and accumulation from dredge-related activities. More recently, two papers from Gintert et al., (2019) and Spadafore et al., (2021) have supported Precht et al.,'s (2019) findings.

¹⁴ When corals are exposed to adverse environmental conditions for prolonged periods of time, especially with rising sea surface temperatures, corals will respond by expelling the symbiotic zooxanthellae, revealing their underlying white calcium carbonate skeletons. This response is called “bleaching” (Wagner et al., 2010). It was identified that the first sightings of stony coral tissue loss disease were recorded during the Port of Miami dredging project (Precht et al., 2019). Presently, stony coral tissue loss disease is one of the biggest and widespread threats to coral reefs in the Caribbean and has resulted in devastating coral reef mortality (Estrada-Saldívar et al., 2020; Muller et al., 2020).

¹⁵ The primary author is the director of marine and coastal programs at Dial, Cordy and Associates.

¹⁶ One of the authors is the CEO of the Biscayne Bay Waterkeeper.

Despite the disagreements between stakeholders, agencies, and the published science, all agreed that improvements, from better surveillance and monitoring to transparent communication, could and should be implemented in the future (Miller et al., 2016; Precht et al., 2019). This is especially important since multiple port expansion projects are scheduled for the near future. For instance, Port Everglades, 30 miles north of PortMiami, is planning a deepening project that is currently in the preconstruction phase, and even further dredging of PortMiami was recently approved in September 2020. Though due to the continued COVID-19 global pandemic and legal actions filed by the Reef Guard, construction is presently delayed.

Because of the values that reefs hold, the stringent environmental regulations, impacts on corals, especially on staghorn corals, the Miami Deepening project garnered significant media attention that highlighted different narratives. The project became the subject of an environmental dispute among stakeholders, namely those for the deepening project, claiming it must be done for economic growth and nationwide prestige, and those against it, claiming the health of the corals and environment faced significant risks. Using the narrative policy framework, I analyzed how both sides employed strategic narratives to influence the decision and policy-making process that led to the completion of this project. Before delving into these findings, I will introduce my second case.

2.2 Case 2: The New Cruise Berthing Facility in George Town Harbour, Cayman Islands

The Cayman Islands are a self-governing overseas British territory in the Caribbean, approximately 450 miles south of Miami, comprising three islands: Grand Cayman, Little

Cayman, and Cayman Brac. The George Town Harbour is located on the western end of Grand Cayman, which is the largest of the islands and is known for its pristine beaches, historic sites, and marine attractions such as Stingray City, shipwrecks, and coral reefs (Cayman Islands Department of Tourism, 2021).



Figure 3. *Top*: Map of Grand Cayman Island. *Right*: The George Town Harbour and locations of adjacent reefs and wrecks threatened by the new cruise berthing facility project (adapted from Google Earth).

Finance and tourism are the two economic pillars of the Cayman Islands. As an international financial center with a tax-neutral platform,¹⁷ large multinational corporations, hedge funds,¹⁸ and others are attracted to the financial services provided by the islands, such as offshore banking services and fiduciary services (Boxall, 2021; Cayman Islands Government, n.d.). The finance sector is vital to the economy, contributing ~44% to the Cayman Islands' gross domestic product (Ministry of Financial Services, 2021). Tourism revenue comes from cruise passengers and stay-over visitors and contributes between 20-25% of the nation's gross domestic product (Matthews, 2020). Prior to the COVID-19 global pandemic, in 2019, the Cayman Islands saw a total of ~2.33 million tourists, 1.83 million from same-day visitors (i.e. cruise passengers who spend the day on the island and leave before nightfall) and over 500 thousand from stay-over visitors (López, 2021). The cruise industry makes up over 80% of Cayman's tourism and contributes over \$200 million annually. While stay-over tourists only make up ~20% of tourists, it contributes over 70% of the economic revenue from the tourism sector in the Cayman Islands (Cayman News, 2019; López, 2021).

Presently, the George Town Harbour is considered a tender port where cruise ships are assigned an anchor position and tender boats are used as a means of transport to and from the ship and island (see Figure 3). This system has been criticized as one that could negatively impact the visitor's experience and result in a greater number of canceled tours when weather is too extreme for tender boats to travel safely. Cruise lines such as Royal Caribbean and Carnival Cruise have publicly expressed that they may end visits to locations that lack cruise berthing facilities

¹⁷ The Cayman Islands do not impose taxes, including corporate, income, property, capital gain, payroll, withholding taxes making them a tax-neutral nation.

¹⁸ 85% of the world's hedge funds are located in the Cayman Islands (Boxall, 2021).

(“Moses Kirkconnell: Why We Need Cruise Berthing Piers,” 2018; McCarthy, 2018).¹⁹ As such, in 2013, the former Cayman Islands Government announced that they would build a new cruise berthing facility in the George Town Harbour that included two piers, land reclamation, and dredging works (see Figure 4).



Figure 4. *Left:* Current state and layout of the George Town Harbour area. *Right:* Future model of the George Town Harbour for the proposed new cruise berthing facility project (adapted and taken from *supportourtourism.com*).

George Town Harbour is surrounded by several iconic, popular and vibrant reefs that attract tourists from all over the world. These include Balboa’s Reef and Wreck, Eden Rock, Soto’s Reef, and Devil’s Grotto. These reefs hold cultural, historic, ecological, and economic significance to the Caymanian people. For example, Soto’s Reef is named after Bob Soto who is widely credited for establishing the first dive shop in the world in 1957 as well as the overall recreational diving industry in the Caribbean (Dunning, 2021). The historic Balboa shipwreck, which sank in a hurricane in the 1930s, also holds cultural heritage importance. Furthermore, each acre of reef in the George Town Harbour is worth approximately \$1,630,860 annually from tourism, coastal protection, and habitat for marine organisms (Baird, 2015). The reefs are also unique due to their ease of access, where hundreds of visitors and Caymanians can enjoy these

¹⁹ Carnival and Royal Caribbean are two of the world’s largest cruise corporations and make up the majority of cruise passenger arrivals (Ebanks, 2019).

reefs with a quick swim from a public parking lot onshore (Dunning, 2021). According to an environmental impact assessment conducted by a private sector firm Baird in June 2015,²⁰ the project footprint would directly impact ~15 acres of coral reef and associated marine habitat, which included the aforementioned reefs and wrecks of Caymanian cultural and ecological importance (Baird, 2015). Coral mitigation efforts, such as coral relocation and restoration were proposed to reduce adverse coral reef impacts.

The Cayman Islands have strong international and domestic policies to protect their reefs. In 1992, the United Kingdom signed the Convention on Biological Diversity,²¹ which is a legally binding international treaty that tasks signatories to develop and implement conservation management plans to preserve species and ecologically important habitat. Upon the request of the Cayman Islands Government, this commitment and with it, the adoption of the treaty's Aichi Targets was extended to the Cayman Islands. The Aichi Targets aim to reduce direct pressure on biodiversity, address underlying causes of biodiversity loss across signatory governments, preserve ecosystems, and enhance ecosystem services and biodiversity benefits for all (*Aichi Biodiversity Targets*, 2020). Furthermore, under Principle 4 of the Cayman Islands Environment Charter,²² a legally binding document with the United Kingdom government, the Cayman Islands Government is required to perform environmental impact assessments and accept stakeholder involvement in the decision-making process across government agencies, environment and heritage organizations, and the

²⁰ Baird is a privately owned environmental and engineering consulting agency that was contracted by the former Cayman Islands Government.

²¹ The Cayman Islands is a UK Overseas Territories (UKOT) which is under the formal control and sovereignty of the UK but is not part of the UK and is self-governing.

²² Environment Charter Commitments between the United Kingdom and UKOTs ensure shared responsibility of the conservation of the UKOT's environment and international commitments.

public for major development projects that substantially impact the environment (Cayman Islands Environment Charter, 2001).

Domestic policies that protect reefs in the Cayman Islands include the long-standing Marine Conservation Law. The law was first implemented in 1978, which helped establish marine parks and reserves in the Cayman Islands and penalized the unlicensed taking of all coral species (*The Marine Conservation Law, 1978 (1995 Revision)*, 1995).²³ Other regulations include Part I of the Cayman Constitution (2009), which orders the government to limit ecological degradation, advance conservation, and ensure that economic or social developments are ecologically sustainable for present and future generations (*The Cayman Islands Constitution Order*, 2009). Prompted by the Convention on Biological Diversity treaty, the Cayman Islands developed a National Biodiversity Action Plan (2009), Habitat Action Plan (2009), and Species Action Plan (2009) for the Cayman Islands with a simple goal to achieve “zero extinction in the Cayman Islands” (Department of Environment, 2009). More specifically, the coral reef Habitat Action Plan (2009) works towards placing all coral reefs under legislative protection, recovering degraded reefs, establishing new marine protected areas that incorporate 50% of coral reef habitat, and opposing developments that threaten net loss or damage coral reefs (Department of Environment, 2009). Finally, the National Conservation Law (2013) is a strong piece of legislation that protects all coral species at all times and prohibits any development that adversely affects a protected area or priority species (see Table 2 for an overview of the Cayman Islands policies).

²³ Part of George Town Harbour used to be inside a marine reserve, however it was recently converted to a port anchorage area which is presently being legally disputed.

Table 2: International and domestic policies and corresponding governing agencies that protect coral reefs in the Cayman Islands.

Policy/ Plan/ Law	Agency in Charge	Purpose
<i>International</i>		
Convention on Biological Diversity (1992)	Conference of the Parties ²⁴	Legally binding international treaty that tasks signatories to develop and implement conservation management plans to preserve species and ecologically important habitat.
Aichi Biodiversity Targets (2011-2020)	Conference of the Parties	Reduce direct pressure on biodiversity, address underlying causes of biodiversity loss across governments, preserve ecosystems, and enhance ecosystem services and biodiversity benefits for all.
Cayman Islands Environment Charter (2001)	Cayman Islands Government and United Kingdom Government	This Charter ensures that the environmental resources are extracted sustainably and used wisely, that the risks and benefits are assessed regarding development projects, that environmental impact assessments are performed prior to development projects, the government commits to open consultancy and transparency about development projects, that legislation enforces a “polluter-pays” principle, and that natural heritage is passed

²⁴ The Conference of the Parties is the decision-making body for the Convention. All Parties that signed the Convention on Biological Diversity are represented. Together they review and promote the implementation of action plans and convene annually.

		down generations through education and preservation.
<i>Domestic</i>		
Marine Conservation Law (1978)	Marine Conservation Board ²⁵	The purpose is to preserve the marine environment of the Cayman Islands for future generations. There are different zones, including the Marine Park Zone, which prohibits the taking of any marine life. Violations of these laws result in hefty fines or imprisonment or both.
Cayman Constitution (2009)	Cayman Islands Government	This is the highest order of law in the Cayman Islands. Part I Paragraph 18 outlines that the government should protect the environment for future generations while promoting justifiable economic development. It should ensure that development is sustainable and limits ecological degradation and promotes conservation.
National Biodiversity Action Plan (2009)	Cayman Islands Department of Environment	The goal of this action plan is to have zero extinction in the Cayman Islands while ensuring the protection of natural resources.
Habitat Action Plan (2009)	Cayman Islands Department of Environment	Attain legislative protection status for all coral reefs,

²⁵ The Marine Conservation Board consists of nine members appointed by the Governor, three of which need to be residents of Cayman Brac or Little Cayman (Marine Conservation Law, 1978).

		expand marine parks, and oppose developments that result in coral reef loss.
National Conservation Law (2013)	National Conservation Council ²⁶	To protect and preserve endemic, endangered, and threatened flora and fauna and their respective habitats and prohibits any development that adversely affects a protected area or priority species such as coral reefs.

The 2015 environmental impact assessment was reviewed by the Cayman Islands Environmental Assessment Board and found that adverse impacts to adjacent reefs were underestimated and performance of coral mitigation practices were overestimated (Dunning, 2021).²⁷ The government also solicited public comment pertaining to the findings of the environmental impact assessment, many of which did not support the project. Despite the stringent environmental policies, environmental impact assessment review, and public comments, the former Cayman Islands Government announced that they would proceed with the cruise berthing project four months later, in October 2015. The Environmental Assessment Board review and announcement raised concerns among some members of the public. Citizens began a campaign to collect signatures of 25% of eligible Caymanian voters to trigger a people’s initiated referendum,²⁸

²⁶ The National Conservation Council has 13 voting members, who come from the Department of the Environment, Department of Agriculture, Department of Planning, and the National Trust. Some members are also appointed by the cabinet based on the geographic districts in the Cayman Islands. Decisions are made via majority vote (Dunning, 2021).

²⁷ The Environmental Assessment Board, a subset of the National Conservation Council, includes the Port Authority, National Roads Authority, the Department of Planning, Department of the Environment, and the National Museum (Dunning, 2021).

²⁸ Under Section 70 of the Cayman Constitution (2009), a people’s initiated referendum can be triggered via petition.

which would be a first of its kind for all UK Overseas Territories. The referendum would ask the public to vote whether they wanted the cruise berthing facility project to proceed. Campaigners formed a coalition called *Cruise Port Referendum* (CPR Cayman) which was led by interest groups, the National Trust of the Cayman Islands,²⁹ and Opposition members of the legislative assembly. In June 2019, CPR Cayman successfully collected over 5,000 signatures and handed them over to the Cayman Islands Government for verification.

In July 2019, the former Cayman Islands Government announced private sector actor Verdant Isle Port Partners as the preferred bidder to design, finance, build, and manage the ~\$240 million dollar berthing facility project.³⁰ The government claimed that this financial model would pose no financial risk to the Caymanian people and it would not involve any government loans or bonds (Panadès-Estruch, 2020). However, the government would surrender \$2.32 of the head tax, defined as a uniform tax for each cruise passenger entering the Cayman Islands, to VIPP over the next 25 years (Klein, 2019).

In response to the grassroots public campaign opposing the project, those in favor of the project, also formed a coalition called *Support Our Tourism* in 2018. It was led by elites within the regime, mainly the premier and its cabinet, the Ministry of Tourism, and later on, leadership from Verdant Isle Port Partners, the preferred bidder in the private sector. Once the preferred bidder was announced, Support Our Tourism launched an updated campaign that they claimed

²⁹ The National Trust is a non-governmental organization with statutory authority established in 1987 with the purpose of preserving natural resources and historical sites under Cayman Law.

³⁰ Verdant Isle Port Partners is a consortium which consists of four businesses including McAlpine Ltd, Carnival Corporation, Royal Caribbean Cruises Ltd. and Orion Marine Construction Inc. Carnival and Royal Caribbean are two of the world's largest cruise corporations, McAlpine Limited is a construction company in the Cayman Islands, and Orion Marine Construction Inc. is an international marine construction company.

was more environmentally friendly, advertising a new project design that consisted of two extended finger piers to mitigate the damage on coral reefs (see Figure 6). However, the environmental impact assessment was not redone to assess the ecological impacts of this new project design. Support Our Tourism also pledged to replant 30-50% of the affected coral,³¹ relocate 100% of threatened coral species, and provide 10:1 mitigation efforts, in which they would replant ten corals for every coral that was lost due to the project. They claimed that the project would *increase* coral cover and biodiversity due to this mitigation plan.

The CBF Project New Design



Figure 5. New project design offered by the Cayman Islands Government and Verdant Isle Port Partners in an effort to minimize impacts on surrounding reefs (taken from supportourtourism.com).

In September 2019, the Cayman Islands Election Office verified the petition and the Cayman Islands Government set a referendum date for December 19, 2019. Because of a lack of

³¹ Replanting a coral means either moving a coral from one location to another by placing it onto substrate for coral to attach to or growing corals in a tank and once large enough, planting the small coral onto substrate for corals to attach to and grow.

precedence of the first-initiated people's referendum, the policies to set up the referendum were unclear. The government decided that 51% of 21,200 eligible voters, including Caymanians overseas, would have to vote "no " to stop the project and that any no-show vote would be entered as a de-facto "yes". Citing an unconstitutional nature of the vote, two legal challenges emerged, one by a member of CPR Cayman and one by the National Trust, which were later combined into one. These challenges were filed to delay the referendum. The legal challenge claimed that 1) the Cayman Islands Government misinterpreted and violated the law on how to proceed with the referendum, 2) the newly proposed design required an updated EIA before a vote could be called for, and 3) that the port project violated Cayman laws. The legal challenge was upheld in the Grand Court and the referendum was successfully delayed until 2020.

However, with the onset of the COVID-19 global pandemic in March 2020, the cruise berthing facility project came to a halt, and with it the urgency to set the referendum.

In July 2020, an appeal made by the government overturned the ruling that the referendum had been unconstitutional. CPR Cayman is still asking for a referendum that could assess whether future governments would be able to proceed with a port project. However, the former Cayman Islands Government refused to hold the referendum, claiming that the requested referendum was specific to the proposed cruise berthing facility which was indefinitely on pause (Cayman News, 2020). In April 2021, a general election in the Cayman Islands resulted in a new premier and cabinet that stated they would not pursue the cruise berthing project during their term (Ragoonath, 2021). However, Royal Caribbean has made it clear that they are still undecided on how to proceed and that this project is temporarily halted (Whittaker, 2021). As such, it is likely

that the same interests will continue to lobby for berthing piers once the pandemic ends and tourism recovers.

This case study presents the dispute regarding the environmental and economic impact of the cruise berthing facility project among stakeholders networks that began in the early 2010s. Two distinct networks of stakeholders emerged as leaders on both sides of the dispute. Pro-project stakeholders formed a coalition called *Support Our Tourism*, and anti-project stakeholders formed *CPR Cayman*. Using a narrative policy framework, I analyze how both sides employed strategic narratives to influence the decision and policy-making process that led to the present port project outcome. The next section reviews the theories of policy narratives that I test in my research.

3.0 Literature Review

Other research on both the environmental impacts of infrastructure and the human dimensions of coral reefs have findings relevant to this study. The urgency to conserve global ecosystems has heightened globally (Dunlap & Mertig, 1991; Stalley & Yang, 2006). Political action and advocacy to protect ecosystems from further human-caused damage has intensified worldwide. The increasing number of new environmental policies being implemented and greater public participation and engagement is proof of this rising trend (Bernauer & Betzold, 2012).

Contemporary infrastructure projects and investments now have a strong focus on environmentally friendly, energy efficient, and resilient projects that can withstand the consequences of climate change, such as sea level rise and extreme weather (Chester et al., 2019; Schweikert et al., 2014; Wilbanks & Fernandez, 2014). Furthermore, infrastructure projects that

are harmful to the environment often face resistance from citizens or environmental groups, interactions which can cause environmental disputes to arise (Durrant, 2015).

Environmental disputes are defined here as the challenges that arise between groups or individuals who feel that their values are being threatened. Often, one side values the environment and the other pushes for economic development (Susskind & Weinstein, 1980). A high profile contemporary example includes the North Dakota Access Pipeline protests led by Native Americans, where protests and litigation led to delays of construction of an oil pipeline amidst national outcry, a process that is ongoing and unresolved (McQueen, 2018; Willis, 2021). Hydroelectric dam projects also spark environmental disputes due to potential watershed disruptions and impacts on marginalized communities versus the economic benefits of producing electricity (Degeorges & Reilly, 2006; Schulz & Adams, 2019; Shah et al., 2019). Environmental disputes are often accompanied by the formation of interest groups (Prewitt et al., 2014; Shah et al., 2019).

Port infrastructure projects have similar environmental dispute dynamics. Pallis (2020) suggests that important changes in the port industry are currently taking place, with more ports trying to portray themselves as sustainable. This process is being driven by both environmental legislation and pressure from interest groups with increasing levels of influence as stakeholders (Lawer, 2019; Pallis, 2020). The transition to a sustainability focus has changed port governance to aim to adhere to policies that promote sustainability, such as the use of cleaner fuels or renewable energy sources (Ashrafi et al., 2020; T. R. Walker et al., 2015; Wooldridge et al., 1999). The sustainable ports movement has led to budding interest in indicators which can help evaluate the

sustainability of ports. Indicators can include water consumption, waste generation, environmental accidents, pollutant emissions, environmental training, energy consumption, effects on the local ecosystem, environmental policy, noise pollution, environmental costs, green technology and construction, and efficient management (Lirn et al., 2013; Park & Yeo, 2012; Peris-Mora et al., 2005; Puig et al., 2017; Roos & Kliemann Neto, 2017; Saengsupavanich et al., 2009). Sustainable port best management practices have been documented and include: optimizing space and land use before extensive expansion and construction (Yap & Lam, 2013); integrating coastal management and networking initiatives across ports (Nebot et al., 2017); mitigating sediment loss to reduce dredging needs (Cappucci et al., 2011); citizen outreach to educate about the environmental impacts of recreational ports (e.g. those focused on tourism) (Ibabe et al., 2020); framework agreements such as the *Green Marine Environmental Program* established to reduce environmental footprints (Walker, 2016); and the increasing role of stakeholders in port governance to advocate for the sustainability of ports (Ashrafi et al., 2020; Denktas-Sakar & Karatas-Cetin, 2012; Dooms et al., 2013; Lam et al., 2013).

Despite sustainability initiatives, negative impacts of port infrastructure projects on port-adjacent communities and the surrounding environment are still present (Liu et al., 2016; Maragos, 1993; Sharma & Das, 2020; Shenghui et al., 2018). Impacts such as increased air pollution, traffic, and environmental degradation have laid the foundation for socio-environmental disputes to arise between different networks of stakeholders advocating for or against the port infrastructure projects. For example, public resistance by nature preservation and interest groups during port expansions of the largest ports in the region of Hamburg, Germany and Le-Havre, France led to conflicts and delays of construction (Koppenol, 2014). In the case of the Port of Rotterdam in the

Netherlands, interest groups were able to influence policy changes. These were critical to implementing structural solutions (e.g. changing spatial planning policies) between policy-makers and citizens to proceed with the project (Koppenol, 2014). Another example of arising disputes is the Tema Port in Ghana. Despite its environmental assessment and stakeholder engagement components, the project ignored the requests of the local community to protect the Meridian Rock, a culturally significant resource. This resulted in litigation which delayed the construction of the port (Lawer, 2019). This case also presents the capacity of interest groups to impact the process of decision-making in port expansion projects.

Studies on port projects and reefs have primarily examined the impacts of dredging. Beginning in 1978, Bak found that the effects of dredging a channel on a fringing coral reef in the Caribbean reduced light access from 30% to 1%, decreased calcification of coral species by 33%,³² and was fatal to species that were insufficient at rejecting sediment.³³ Similar findings have been observed by the expansion of the Veracruz Port in Mexico. Port construction in the nineteenth and early twentieth century led to 50% of direct loss of one reef adjacent to the port and the complete sediment burial of another (Valadez-Rocha & Ortiz-Lozano, 2013). In Brazil, the construction of the Port Complex of Suape altered tidal cycles which negatively impacted the micro-benthic communities on reefs (Costa et al., 2014).

³² Light access to corals is important because they have a symbiotic relationship with a dinoflagellate algae, zooxanthellae, that lives inside coral polyps and photosynthesizes providing the coral with up to 95% of its energy needs (Al-Hammady, 2013). Calcification is an indication of growth rates for hard sclerotin corals, defined as corals with calcium-carbonate skeletons, because they deposit calcium carbonate to grow their skeletal structure.

³³ Too much sedimentation leads to burial of corals which is fatal.

There have been several studies examining the impacts of port projects on coral reefs along the Florida coast. Walker et al. (2012) documented shipping-related and port development impacts of the Port of Miami, Port Everglades, and Port of Palm Beach on coral reef habitat. Using topography data beginning in the 1920s, authors discovered that over 300 hectares of reef habitat were impacted and that burial from dredge material was the greatest impact. Most recently, studies by Miller et al. (2016) and Cuning et al. (2019) have indicated that sedimentation from the Deep Dredge project at the Port of Miami (one of the cases of this research) extended 700 meters, instead of the predicted 150 meters, from the dredging channel and killed over 560,000 corals.

Some researchers have disputed the extent of impacts and sediment burial from dredging close to coral reefs. This research states that 1) short term versus long term effects of sediment burial should be acknowledged (Brown et al., 1990; Precht et al., 2019), 2) dredging may only have localized impacts (Adjeroud et al., 2016; Precht et al., 2019), 3) corals recovered after dredging (Brown et al., 1990; Precht et al., 2019), and 4) coral mortality may have been due to something other than dredging, such as disease or coral bleaching (Precht et al., 2019). The relationship between increased likelihood of coral disease and presence of dredging has been studied in Australia. One study found that corals exposed to the longest period of sedimentation were twice as likely to be infected with disease, linking dredging with elevated disease presence (Pollock et al., 2014). However, another study refuted this claim and suggested that specific impacts of dredging are difficult to isolate and dredging was not an early indicator of coral disease (Stoddart et al., 2019). These differences suggest the science has yet to be settled.

Efforts and suggestions to mitigate dredging impacts on coral reefs have been studied. For instance, given the wide range of sensitivity in coral species, such as the ability of corals to reject sediment and varying light requirements, evaluating the coral species assemblage of site-specific dredging areas is critical because this variability will determine adequate mitigation needs (Erftemeijer et al., 2012). Modeling tools to better predict sediment diffusion and quantity have been successfully applied, which can be used for future site planning and mitigation to limit coral reef exposure (Gailani et al., 2016; Nelson et al., 2016). Multiple port projects are proposing and relying on coral restoration, transplantation, and relocation techniques to ‘offset’ their ecological footprint and mitigate impacts on coral reefs (Dunning, 2021; Kenny et al., 2012; Nanajkar et al., 2019). Due to the severity of coral reef degradation around the world,³⁴ coral restoration could be critical to preventing global extinction of coral reef ecosystems. Coral restoration can provide us more time to reduce global and local threats such as increasing surface water temperatures, ocean acidification, pollution and fishing impacts (*Restoring Coral Reefs*, 2019). However, success of long-term coral restoration has yet to be determined (Boström-Einarsson et al., 2020). A recent study on survivorship of restored corals in the Florida Keys estimated that only 0-10% would survive beyond seven years (Ware et al., 2020). Furthermore, transplanted and fragments of corals do not provide the same ecological functions of century-old coral colonies, and if permissible, would take thousands of years to return to that state.

The field of human dimensions of coral reefs provides insights on how to sustainably manage coral reefs in light of global and manmade changes and threats. The majority of this literature examines how institutions influence management of fisheries and reef ecosystems. Institutions

³⁴ 30-50% of the world’s coral reefs have been lost in the last 70 years ([Arizona State University](#), 2020)

are defined as systems structured by accepted norms, strategies, and rules which can be reorganized via human interactions (Crawford & Ostrom, 1995). Institutions can include organizations, government agencies, places of worship, all with an emphasis on shared rules and regulations. Institutions are primarily created to help solve social issues and dilemmas (Imperial & Yandle, 2005).

There are several types of institutional arrangements for fisheries and coral reef management, such as bureaucracy and market-based institutions.³⁵ In the early 2000s, a well-studied institutional arrangement called community-based resource management received significant attention in the literature (Johannes, 2002; Pomeroy, 1995). Community-based resource management is where participatory stakeholders, such as fishermen, develop rules to regulate the resource among themselves. Generally, studies on coastal community-based resource management have found that it can be successful if 1) strong leadership and community initiative is present (Ayers & Kittinger, 2014; Dunning, 2021; Haley & Clayton, 2003; Imperial & Yandle, 2005); 2) regulation of resources is reflective of cultural and political context (Blaikie, 2006; Cinner et al., 2005; White & Vogt, 2000); and 3) if community trust, learning, and understanding prevails (Ayers & Kittinger, 2014; Cinner et al., 2005; Christie et al., 2017; Imperial and Yandle, 2005). However, without some of these critical factors, rules and sanctions for broken rules can fail, which can result in depleted resources and rising conflicts.

³⁵ In a bureaucracy based institutional arrangement, the government sets the rules and regulations on behalf of the public. In a market-based institutional arrangement, a trading system between the buyer- often the government who also sets the rules and regulation- and seller- resource owners or acquirers- is established (Imperial & Yandle, 2005).

These possible failures, as well as the pitfalls of centralized governance,³⁶ have been some of the drivers towards establishing what is known as a *co-management* style of resource governance (Ayers & Kittinger, 2014). Co-management is a hybrid institutional arrangement in which both the government and participatory stakeholders share the responsibility to manage the natural resources (Imperial & Yandle, 2005). Success of co-management has also been varied. One study found that co-management reduced the resilience of a resource by highlighting differences in livelihoods between resource users (Gelcich et al., 2006), while another study found co-management was beneficial to social-ecological systems,³⁷ especially to wealthy resource users (Cinner et al., 2011). Studies suggest that success is contingent upon defining the problem and mutual interests, establishing trust between the state and communities, understanding responsibilities and roles of organizations, equitable distribution of power and management, and incorporation of local knowledge (Ayers & Kittinger, 2014; Cinner et al., 2012; Clarke & Jupiter, 2010; Gelcich et al., 2006; and Imperial, 2008).

Adaptive governance for coral reef ecosystems is an increasingly popular policy model in coral reef management. Adaptive governance can be defined as the interactions between institutions to achieve a desired condition for the social-ecological system. Critical to adaptive governance is gathering knowledge about the resource, monitoring resource use, and responding accordingly to available and accumulated information to build resilience to the system (Chaffin et al., 2014).³⁸

³⁶ Centralized governance is where few policy makers at the top of the hierarchy hold power and manage the resources, often compared to a top-down government controlled approach of management. These have been criticized due to a lack of incorporating local knowledge and imposing regulations that result in depleted resources and decreased livelihoods of local resource-dependent communities (Ayers & Kittinger, 2014)

³⁷ Social-ecological systems examine how biophysical and social factors interact and impact each other in a contained system (Redman, 2004).

³⁸ Ecological resilience can be defined as the ability for an ecosystem to maintain its function after undergoing disturbances and how quickly it can recover from them (Walker, 2004).

Adaptive governance can be incorporated into institutional arrangements, such as co-management and community-based resource management.

In the face of climate change and other threats rapidly degrading coral reef ecosystems, recent literature has focused on how to manage reefs in the Anthropocene.³⁹ Studies have found that returning to historic states of coral reefs may be impossible and that local management systems are insufficient to rescue them (Bellwood et al., 2019; Hughes et al., 2017). Instead, researchers have suggested implementing multi-level, international initiatives such as the Coral Reef Triangle Initiative in Southeast Asia or polycentric governance of the Great Barrier Reef in Australia to promote large scale ecosystem recovery (Fidelman et al., 2014; Morrison, 2017). Other policy responses include government assistance for livelihoods and building capacity for local communities to adapt to change (McClanahan et al., 2008). Overall, findings on human dimensions of coral reefs suggest that public engagement, flexible institutions, and multi-scale governance to manage coral reef ecosystems are critical to build socio-ecological resilience and adapt to change.

In sum, there is an environmental movement in the field of infrastructure largely driven by environmental policy and civil society. The majority of research studying the intersection between port infrastructure and coral reefs have examined the impacts of dredging on reefs and solutions to mitigate them. Human dimensions of coral reefs have primarily focused on how management is influenced by institutions and how governance is evolving in the face of climate change.

³⁹ The Anthropocene is a geological age in which human activity has been the main driver of environmental change (Lewis & Maslin, 2015).

My research builds upon these literatures by offering novel insights through the use of a policy process approach that allows us to examine the role of participatory stakeholders and how they frame, manage, and deal with external threats, such as a port infrastructure project. A similar study using a policy process approach found that coalitions with greater power and resources in the Port of Miami Deep Dredge project were able to dominate the policy issue and effect change (van Tuijin, 2015). Another study analyzed how coral reef governance changed in light of the policy dispute of the reefs of George Town Harbour and its port expansion. This study found that public discourse and the decision-making process is significantly influenced by an active civil society (Dunning, 2021). However, foundational gaps remain on how stakeholders frame relevant issues in a port dispute to influence policy change. Understanding how different coalitions frame their side's arguments during an environmental dispute can unlock insights into the way that policy will change. These insights go beyond port sustainability and are instead relevant to environmental disputes in general. Using a policy process approach allows my research to focus on the influence of stakeholders, primarily through their narratives, to impact policy change in large infrastructure projects adjacent to coral reefs. As environmental disputes increase along with the impacts of climate change, understanding the narratives that coalitions of stakeholders employ to advocate for preferred policies will be important for global environmental policy-makers. The following section describes the theoretical underpinnings of my research.

4.0 Theory

Both the Port of Miami dredging project and the proposed new cruise berthing facility for the George Town Harbour in the Cayman Islands are examples of environmental disputes among stakeholders regarding the impacts on adjacent coral habitat. The environmental disputes that occurred in Florida and the Cayman Islands led to the formation of two distinct interest groups, namely one that supported and advocated the project and another that opposed it. Building on the Advocacy Coalition Framework which details how interest groups are formed to examine power dynamics between them (Heikkila et al., 2014; Jenkins-Smith et al., 2018; van Tuijin, 2015), in this study, I focus on the narrative strategies used by interest groups to influence policy outcomes to achieve their policy beliefs. To do this I employ the Narrative Policy Framework outlined by Shanahan et al. (2018). To better deal with these cases, I also offer a refined theory influenced by McBeth et al. (2007)'s work examining the use of *science* in narratives as well as Deborah Stone's (2012) work on *symbols*. Narratives, even more so than facts, can shape our perceptions, especially on controversial topics such as these environmental disputes, which influence our decisions and actions.

4.1 Narrative Policy Framework

Storytelling and narratives have been observed as central to public policy and influencing policy outcomes (Angstadt, 2020; Crow et al., 2017; Crow & Jones, 2018; McBeth et al., 2013; Stone, 1989). The Narrative Policy Framework offers an empirical and testable way to examine whether “narratives play an important role in the policy process” (Shanahan et al., 2018, p. 173). With over a decade of research, the Narrative Policy Framework has become a widely used public policy framework (Brewer, 2020; Pierce et al., 2014; Shanahan et al., 2011, 2018).

The majority of existing peer-reviewed papers that use the Narrative Policy Framework have focused on environmental topics (Pierce et al., 2014). These have included examining different narratives about climate change (Jones, 2014a, 2014b; Weible et al., 2016); analyzing the policy debate in the Greater Yellowstone Area (McBeth et al., 2005, 2007, 2012; Mcbeth & Shanahan, 2004); assessing the policy debate regarding fracking in Scotland (Stephan, 2020); studying the divergent narrative framing of hydraulic fracturing in Colorado (Heikkila et al., 2014); assessing how climate stories are cognitively processed (Jones & Song, 2014), evaluating the role of narratives in restoring the Florida Everglades (Knox, 2013); measuring the political polarization of recycling in the U.S. (Lybecker et al., 2013); examining nuclear energy policy in the U.S. (Gupta et al., 2018); and assessing media coverage of catastrophic wildfires in Colorado (D. A. Crow et al., 2017). Generally, findings suggest that narratives made by stakeholders are purposeful to influence policy change and that the systematic assessment of narratives increases our understanding of strategies employed by policy actors in conflicts to persuade the public.

The Narrative Policy Framework has also been applied to a considerable number of other disciplines such as public health to determine attitudes towards obesity (Clemons et al., 2012); education to examine the influence of coalitions regarding higher education policy (Martinez, 2019; Price, 2019) and to discuss the benefits of the Narrative Policy Framework in a classroom setting (McBeth & Pearsall, 2019); aging science to examine the connection between aging populations and welfare in China (Van Gerven, 2019); media studies to analyze the narrative use of media sources such as Twitter and YouTube concerning gun laws, nuclear energy, and the US-Mexican border (Brewer, 2020; Gupta et al., 2018; Lybecker et al., 2015; Merry, 2016;

Shanahan et al., 2008); politics to navigate narrative tactics made by Trump (Jones & McBeth, 2020) and to analyze legislation documents in the European Union (Radaelli et al., 2013); and theory-building to advance the theoretical scholarship of the Narrative Policy Framework (Brekken & Fenley, 2021; Chang & Koebele, 2020; McBeth et al., 2007; Shanahan et al., 2013).

The Narrative Policy Framework features three levels of analysis: micro-level, macro-level, and meso-level. Analysis at the micro-level investigates how individuals influence or are influenced by policy narratives. These analyses usually employ surveys, experiments, interviews and focus groups to assess how participants engage with various narratives (D. A. Crow et al., 2017; Jones & McBeth, 2020; Shanahan et al., 2016, 2018). Research at the macro-level examines policy narratives that describe social constructs, cultures, or institutions and how they shape public policy. Macro-level data often come from original artifacts and archives (Shanahan et al., 2018). Meso-level analysis typically uses content analysis to evaluate how policy actors from interest groups strategically employ narratives to advocate for outcomes geared towards their policy preference (D. A. Crow et al., 2017; D. Crow & Jones, 2018; Shanahan et al., 2018). The majority of studies that have employed the Narrative Policy Framework focus on this meso-level of analysis (Pierce et al., 2014; Shanahan et al., 2016). My research adds to this branch of literature because it focuses on the meso-level to analyze how policy actors from opposing interest groups present narratives to support or review, delay, cancel port infrastructure projects and their impacts on adjacent coral reefs.

According to the Narrative Policy Framework scholarship, policy narratives consist of two core components: the form and the content (D. A. Crow et al., 2017; Jones & McBeth, 2020; Pierce et

al., 2014; Shanahan et al., 2016, 2018). The form refers to the structural context of the policy issue at hand, in this case the port dredging projects. The form consists of four narrative elements: *setting*, *characters*, *plot*, and *moral of the story*. The setting places the policy issue in a contextual manner and can include geographic location, population, and laws. Characters can be assigned as victims, those who are potentially harmed; villains, those who do the harm; and heroes, those who alleviate or stop the harm from occurring. Other authors have proposed additional and more nuanced characters such as opponents, beneficiaries and allies (Merry, 2016; Weible et al., 2016). While some authors argue that characters must have human agency (Weible et al., 2016), most accept that non-human entities, such as coral reefs or the economy, can be assigned as characters (Shanahan et al., 2016). The plot places the characters in relationship with each other, the setting, and describes the actions that transpired. The moral of the story is the offered policy solution and call-to-action. This is often in the form of intermediary steps such as “sign this petition or contact your representative”, typically brought forth by the perceived hero. For the scope of this study, I specifically focus on characters and how narratives cast both humans and non-human entities as heroes, villains, and victims.

The second core component of a policy narrative is the content, which instills the narrative with meaning (Shanahan et al., 2016). The content is highly variable but the Narrative Policy Framework specifically focuses on two categories: *belief systems* and *strategies*. These categories were chosen because they provide the materials needed to study policy changes and outcomes (Shanahan et al., 2018). Policy beliefs are values and ideologies that interest groups and stakeholders can coalesce behind. In this study, policy beliefs are broadly divided in two: stakeholders that are supportive of the port project, namely ‘pro-project’ stakeholders, and

stakeholders that are against or question the validity of the project, namely ‘anti-project’ stakeholders. Narrative strategies are often composed with a purpose to persuade, blame, excite, recruit, take action, and more to progress policy outcomes towards their policy beliefs (D. A. Crow et al., 2017; Shanahan et al., 2016, 2018). Both intentional and unintentional policy narratives will be considered in this study.⁴⁰ The Narrative Policy Framework outlines three types of strategies that can be employed: *scope of conflict*, *causal mechanisms*, and *devil-angel shift*. I analyze all three of these for this research.

The *scope of conflict* examines how policy narratives either intensify or reduce the conflict, which primarily in this case, is the port project’s impact on coral reefs (Shanahan et al., 2018). Message sources intensify the conflict by highlighting risks and reducing or hiding benefits. For example, anti-project stakeholders will emphasize risks, such as the loss of coral reefs, and downplay benefits, stating that only a few companies or people will benefit from the project. Message sources reduce the conflict by highlighting benefits and hiding costs to maintain the status quo. For example, pro-project stakeholders will largely emphasize benefits, touting the economic benefits to the entire community, and speak very little about the environmental risks of the port project. Throughout this section, I provide expectations, akin to hypotheses but specialized for qualitative research in a case study setting. As such, I expect pro-project entities to highlight benefits and reduce risks, while anti-project entities will highlight risks and reduce benefits.

⁴⁰ Unintentional narratives refer to narratives used by stakeholders that may not perceive or be aware that their messaging influences policy outcomes.

Causal mechanisms are used to assign responsibility and shift the blame of perceived positive or negative consequences of a policy issue (Shanahan et al., 2018; Stone, 1989). The four types of causal mechanisms, which are based on Stone's (2012) work, include accidental, intentional, inadvertent, and mechanical mechanisms. The first two mechanisms, accidental and intentional, are relatively strong and definite arguments of causation compared to the other two (Stone, 1989). Accidental causal arguments are used to shift the blame onto events that are uncontrollable by humans, such as natural disasters or machine failures. For example, some may argue that the majority of coral mortality was because of coral disease, something that was out of their control, and not because of dredging itself. Intentional causal arguments state that an action or decision was deliberately made that knowingly caused the occurring consequences. Conspiracy theories, where actions were willfully taken but concealed also fall into this category. For example, some may argue that environmental monitoring of relocated corals was deliberately underfunded to deter proper data collection.

Inadvertent cause is when unintended consequences occur from guided human action, which are often blamed on ignorance or carelessness. For example, environmental assessments can underestimate the distance and spread of sedimentation caused by dredging which can lead to unintentional yet significant negative impacts on adjacent coral reefs. Mechanical causal arguments concern the lack of control or will of an entity and shift the blame onto something or someone else's guidance. For example, the argument of "I was just doing what I was told and trained to do" or the computer model of an environmental impact assessment working as it's programmed to would fall under this causal argument. Regarding the impact of dredging on corals, I expect pro-project entities to employ accidental, inadvertent, and mechanical causal

mechanisms more compared to anti-project entities. Whereas, anti-project entities will use intentional causal mechanisms compared to pro-project entities.

In the Narrative Policy Framework, the *devil-angel shift* examines how villainously the policy actor identifies the opposing interest group, especially in comparison with how heroically the policy actor identifies themselves (Shanahan et al., 2018). For example, anti-project stakeholders may use language to villainize the pro-project stakeholders, calling them highly irresponsible and unresponsive, while announcing their good deeds by bringing this issue to the public eye, and vice versa. As such, I expect pro-project entities to use the angel-shift strategy, portraying themselves as heroes, whereas anti-project entities use the devil-shift strategy, painting the perceived villains as exceptionally villainous. Figure 6 below shows a flow diagram of how the Narrative Policy Framework components relate to each other.

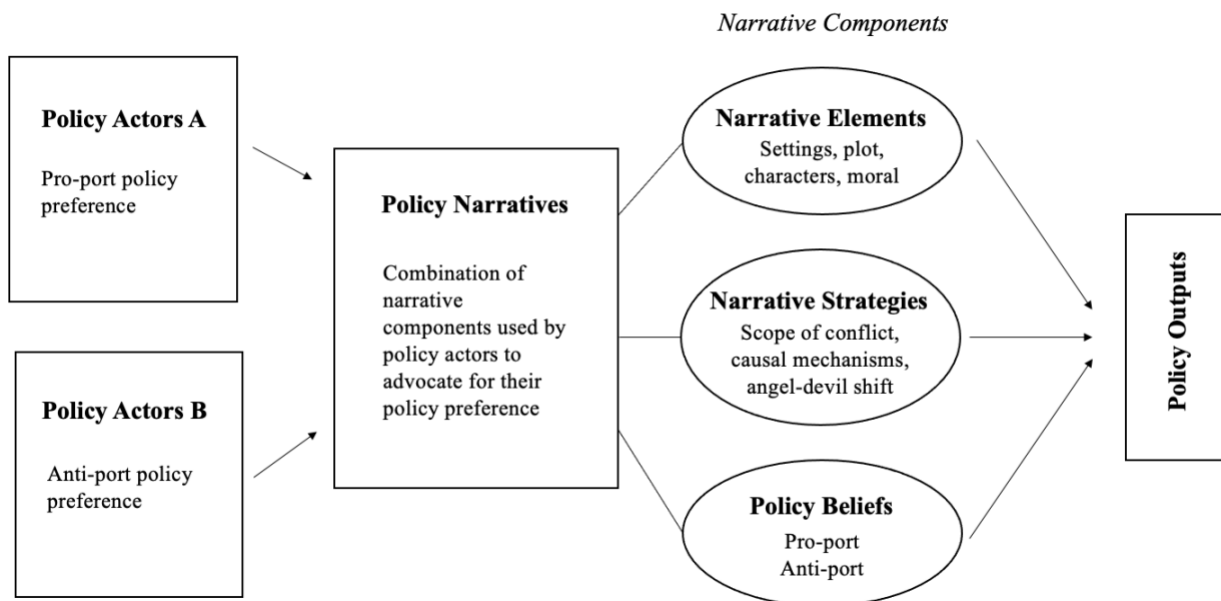


Figure 6. Flow diagram of the Narrative Policy Framework (adapted from Shanahan et al., 2018).

To supplement my analysis on how narrative strategies are used during environmental disputes over vulnerable ecosystems such as coral reefs, I created a new theory. In this new theory, influenced by McBeth et al. (2007) and Deborah's Stone's work (2012), I examine the use of *symbols* and *science* across narratives (see Figure 7). The addition of *science* was made because Nie (2003) suggests that the role of science has increased in natural resource policy-based conflicts and that scientific disagreements between political actors may even inflate the conflict. McBeth et al. (2007) further argue that some groups will use science with certainty to contain the conflict, while other groups will question or attack the science to prolong the debate and expand the conflict. With this in mind, I expect that pro-project entities will use science with certainty, whereas anti-project entities will question the science presented.

In my novel theory, I also examine Stone's (2012) definition of a *symbol* which is the following: "a symbol is anything that stands for something else. Its meaning depends on how people interpret it, use it, or respond to it" (157). For example, coral reefs may be perceived as a natural treasure or national icon or the Port of Miami may be seen as the "Cruise Capital of the World" or "Gateway to the Americas". I am interested to see how both interest groups utilize symbols in their narratives to enhance the importance of their messaging, and expect them both to use them equally to amplify the importance of their narratives. Refinements to the Narrative Policy Framework (i.e. the original components of *characters*, *scope of conflict*, *causal-mechanisms*, and *devil-angel shift*, plus my added components of *science* and *symbols*) are depicted in green in Figure 7 below.

While I did not code for this, I acknowledge that ambiguity is present in policy narratives across both interest groups. Ambiguity in policy narratives allow for multiple interpretations in which policy actors can manipulate to their favor (Stone, 2012). Ambiguity in the environment sector

has prevalently been used with words and phrases such as ecosystem restoration, sustainability, and significance levels regarding biodiversity (Ainsworth, 2020; Knox, 2013; Walker et al., 2008). While ambivalence can be helpful to unite and facilitate communication across diverse stakeholders, researchers have found that it can lead to frustration, inaction, and postponement of plans due to a lack of clarity. It is also exacerbated by scientific uncertainty and contradictory information (Ainsworth, 2020; Knox, 2013; Messer et al., 2010; Nie, 2003; D. Stone, 2012).

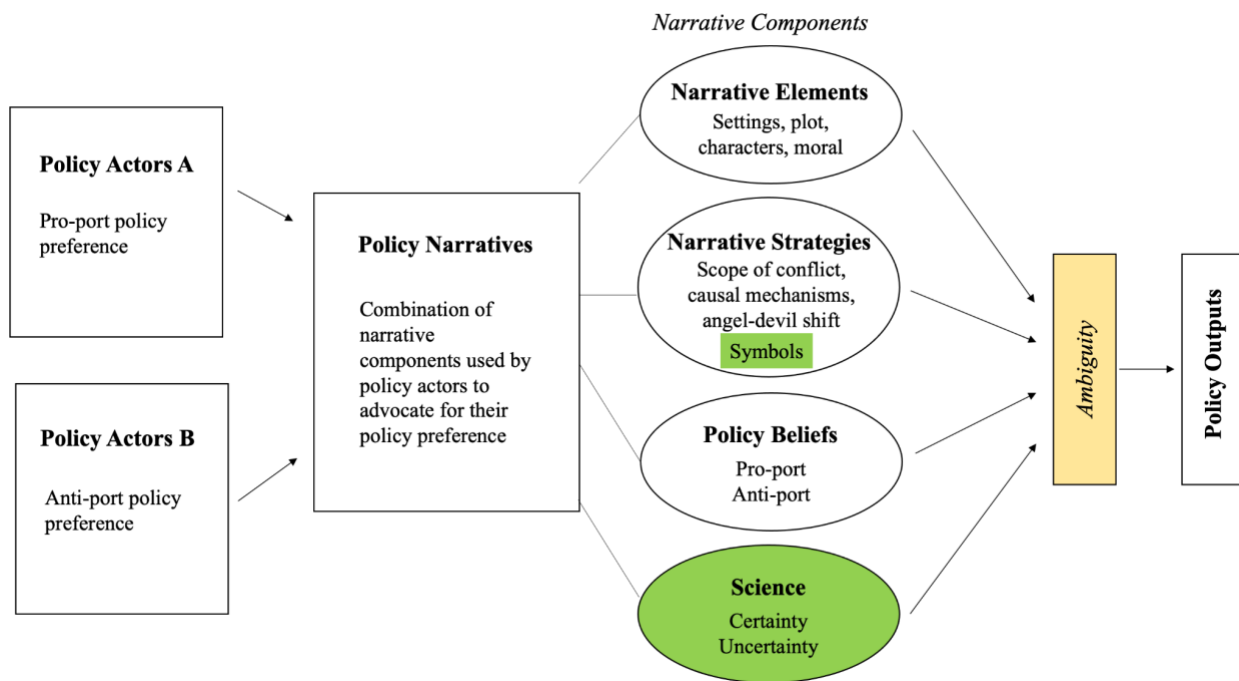


Figure 7. Flow diagram of the Narrative Policy Framework with the novel additions of symbols, science, and ambiguity (adapted from Shanahan et al., 2018).

In my analysis, I use the concepts developed here to examine how stakeholders employ strategic narratives in environmental disputes over vulnerable ecosystems. These insights help us understand how policy is changing as a result of environmental disputes.

5.0 Methods

5.1 Case selection

The Deep Dredge Project in Port of Miami and the George Town Harbour New Cruise Berthing Facility in the Cayman Islands were the selected case studies for this research. These case studies are logical comparisons because both ports are adjacent to and threaten coral reef habitat. In both cases, environmental disputes arose specifically concerning the uncertainty over ecological impacts of these projects on reefs. Furthermore, both Miami and the Cayman Islands are popular destinations in the tropics, whose economies are strongly tied to the tourism industry. These port projects take place in wealthy locations based on their respective gross domestic products and have institutions and resources that allow for interest groups to emerge.⁴¹ I apply the Narrative Policy Framework as the theoretical lens to assess how narrative strategies were used to influence policy outcomes regarding these port projects.

5.2 Research design

The case study is the research design for this study, and it is appropriate because it allows the researcher an in-depth investigation to answer why and how decisions were made, examines contemporary events over which the researcher has no control over, and enables multiple sources of data to converge towards an explanation (Yin, 2018). The project specifically uses a multiple

⁴¹ 2019 USA gross domestic product (GDP) per capita is 65,297.52 USD (WorldBank); 2017 Miami-Fort Lauderdale GDP per capita is 48,140 USD (FRED Economic Data); 2018 Cayman Islands GDP per capita is 85,975 USD (WorldBank); the average GDP per capita as of 2019 is 11,433 USD (WorldBank).

case study design and mixed methods⁴² to provide more rigorous and robust findings (Creswell & Clark, 2019; Johnson et al., 2007; Yin, 2018). Specifically, I used an exploratory sequential mixed-methods design, where I collected qualitative data in the first phase and then built upon these findings with quantitative analysis in the second phase. Separate phases allow for a straightforward and manageable research design where insights can build upon prior insights (Creswell & Clark, 2019). Furthermore, this type of analysis ensures that qualitative findings corroborate with quantitative findings, serving as additional verification of the analysis. For the qualitative phase, I collected document and interview data from decision-makers and interest groups from both port projects to identify the narrative strategies that were employed. Then, I used quantitative methods to analyze differences in the narrative strategies used between pro-project and anti-project stakeholder groups.

5.3 Data collection

For the Port of Miami case study, data were collected from four sources: the NexisUni database, the US Army Corps of Engineers (USACE) Jacksonville District news archive, the Miami WaterKeeper press and blog archive, and the World Access News database. A total of $n=103$ documents were collected, which consisted of news releases, articles, and position statements. Using the search terms “Miami” and “Deep Dredge Project” between 2010 and 2020 in NexisUni resulted in $n=65$ documents. This date range was chosen because political leaders announced the start of the deep dredge project in 2010 and even though the project was completed in 2015, coral mortality reports and papers were published from 2016 to 2019. I chose

⁴² Mixed methods research is when a researcher combines qualitative and quantitative elements of research methods and integrates multiple forms of data (Creswell & Clark, 2019).

2020 as the cut off because articles concerning the USACE and port construction were primarily focused on the Port Everglades project, which is the next big port dredging project scheduled in South Florida. I excluded 35 documents from these results because they were either duplicates, focused on the Port Everglades project, or merely mentioned the deep dredge project in passing. The included documents were primarily news releases or position statements from various political leaders. The USACE Jacksonville District news archive was chosen because they were the supervisors of the project and thus integral to this research. The news archive provided $n=19$ articles that were tagged with “Miami” or “Dredging” or “Harbor” ranging from 2012 to 2019, of which $n=12$ were included for data analysis. Those excluded either were not relevant to the Port of Miami project or focused on the Port Everglades project. The Miami WaterKeeper press and blog archive was chosen because they were one of the organizations that spearheaded the narrative that contested the dredging impacts on reefs. The blog archive collected articles from various news sources, such as the Miami New Times, Miami Herald, New York Times, dating from 2014 to 2019. The platform had $n=47$ articles regarding the Port of Miami dredging project, $n=36$ of which were included for data analysis. The remaining 11 were duplicates of the same press release published across different news outlets. To ensure I had reached information saturation, using the same search terms as the NexisUni database, I searched the World Access News database for more articles. There were $n=83$ results, of which I included $n=25$ articles as the rest were irrelevant or had already been accounted for.

For the Cayman Islands case study, data were drawn from two interest groups, one supportive of the project and one opposing it: *Support Our Tourism* and *CPR Cayman*. Data was collected from Facebook pages of both groups and from the CPR Cayman Website “Latest News” section.

A total of $n=608$ documents were collected which consisted of Facebook posts, news articles, position statements, and opinion letters. Facebook posts relevant to the new cruise berthing facility were included from both groups from their inception in 2018 to July 2021. This yielded $n=307$ posts from the Support Our Tourism page and $n=251$ from the CPR Cayman page. Unfortunately, at the time of data collection the Support Our Tourism website had been shut down. The CPR Cayman “Latest News” section had $n=57$ articles, of which $n=40$ were included. Those excluded were official reports or did not mention the proposed cruise berthing facility. The included documents were news articles from the Cayman Compass, Cayman News Service, the British Broadcasting Corporation (BBC), and Travel Weekly, institutional position statements, official correspondences, press announcements, and opinion letters from concerned citizens. Tables 4 and 5 provide a summary of my policy document data collection.

To ensure narratives from both cases were authentic representations, I restricted analysis to quotations, which I counted as individual data points. Data points (total $n=991$) from documents were collected until I reached information saturation (Saunders et al., 2018). To supplement and triangulate my document data points, I interviewed $n=16$ stakeholders from both interest groups for each case study (Nightingale, 2020; Price, 2019). I conducted $n=10$ semi-structured interviews for the Miami case study and $n=6$ for the Cayman Islands case study (see Table 3 for more details). To find potential respondents, I used a snowball sampling technique where I asked interviewees to recommend other stakeholders for me to interview (Sadler et al., 2010; Taherdoost, 2018). Interviews were conducted between May 2021 and September 2021. At the beginning of each interview, respondents were asked for permission to record the interview via Zoom. If permission was given, the interview was recorded and transcribed from the recording at

a later time. If permission was not given, their responses were transcribed during the interview and edited at a later time, only to improve coherency of the sentences. Respondents were asked 9 questions about the costs and benefits of the project, its impact on coral reefs, and the use of science regarding the port projects. Interviews ranged from 19 to 229 minutes (interview questions can be found in Appendix A). Due to the anonymity and given verbal consent by respondents in these interviews, ethical status was maintained.⁴³

Table 3: Respondent categories

Respondent type	Examples of respondents	Number of respondents for the Miami case	Number of Respondents for the Cayman Islands case
Interest groups	Local citizen groups, environmental conservation organizations, local advocacy groups	3	5
Private sector	Contracting companies, contracted scientists and universities	6	1
Federal actors	Managers, support staff	1	0

Table 4: Port of Miami Deep Dredge Project data collection summary

	Documents	Data Points	Pro-project	Anti-project
Nexus Uni	30	46	42	4
USACE News Archive	12	18	16	2
Miami WaterKeeper Blog Archive	36	87	20	65

⁴³ Protocol # 21-103 EX 2102.

World Access News	25	50	32	18
Interviews	10	10	2	8
Sum	113	211	114	97

Table 5: Cayman Islands data collection summary

	Documents	Data Points	Pro-project	Anti-project
SupportOur Tourism Facebook	307	363	358	13
CPR Cayman Facebook	252	347	88	243
CPR Cayman Website	43	74	14	58
Interviews	6	6	0	6
Sum	608	780	460	320

5.4 Data coding

Data points and interview transcripts were coded using a codebook based on the Narrative Policy Framework and adapted for this research for my new theory by coding for the use of science and symbols (Shanahan et al., 2016, 2018). I focused primarily on the presence and absence of specific narrative elements and coded 1 for presence and 0 for absence. If the element was present, I used a subcode of the element to keep track of its frequency to aid in quantitative and qualitative analysis later on (Saldaña, 2016). For example, if a hero character was present in a data point, I coded this as a 1 and had an accompanying subcode indicating who the perceived hero was, such as “Hero: FL Governor”. A codebook of the narrative elements that I was coding

for, which include *characters, scope of conflict, causal mechanisms, devil-angel shift, scientific certainty* and *uncertainty* and use of *symbols* can be found in Appendix B.

For the Port of Miami data, the coding was done by me. However, to increase reliability, a second coder analyzed every five statements coded. Across these 17 codes, intercoder agreement was on average 91%.⁴⁴ Upon sufficient inter-coder agreement, the two coders coded the Cayman case data together. For further quality assurance, I returned and double checked all codes that were assigned three months later.

5.5 Data analysis

The Narrative Policy Framework at the meso-level analysis offers multiple expectations to test (Shanahan et al., 2016). As suggested in the theory section, my expectations are as follows:

Expectation 1A: Pro-project stakeholders highlight benefits and reduce risks more than anti-project stakeholders.

Expectation 1B: Anti-project stakeholders reduce benefits and highlight risks more than pro-project stakeholders.

Expectation 2A: Pro-project stakeholders will use inadvertent, mechanical, or accidental causal mechanisms more than anti-project stakeholders.

⁴⁴ 80-90% intercoder agreement is the benchmark (Saldaña, 2016).

Expectation 2B: Anti-project stakeholders will use intentional causal mechanisms more than pro-project stakeholders.

Expectation 3A: Pro-project stakeholders will employ the angel-shift more than anti-project stakeholders.

Expectation 3B: Anti-project stakeholders will employ the devil-shift more than pro-project stakeholders.

Expectation 4A: Pro-project stakeholders will use science with more certainty.

Expectation 4B: Anti-project stakeholders will use science with more uncertainty.

Expectation 5: Both stakeholder groups will utilize symbols to enhance the importance of their narratives.

To test these expectations, I performed quantitative analyses and created contingency tables. One set of tables showed the percentages of messages containing each of these codes, and the second showed these percentages broken down by pro-project and anti-project entities, with two tailed hypothesis tests of different proportions. I also utilized the subcodes to provide further analysis of the casting of characters by pro and anti-project stakeholders. These findings are presented below.

6.0 Findings

Both the Miami and Cayman Islands cases present a classic environment dispute: do we prioritize potential economic growth over environmental services? I look to the strategic narratives used to influence policy outcomes and decision making. From my findings, across both cases, the most frequently used narrative strategies in decreasing order include the *scope of conflict*, *causal mechanisms*, *science*, *devil-angel shift*, and *symbols* (see Figure 10).⁴⁵

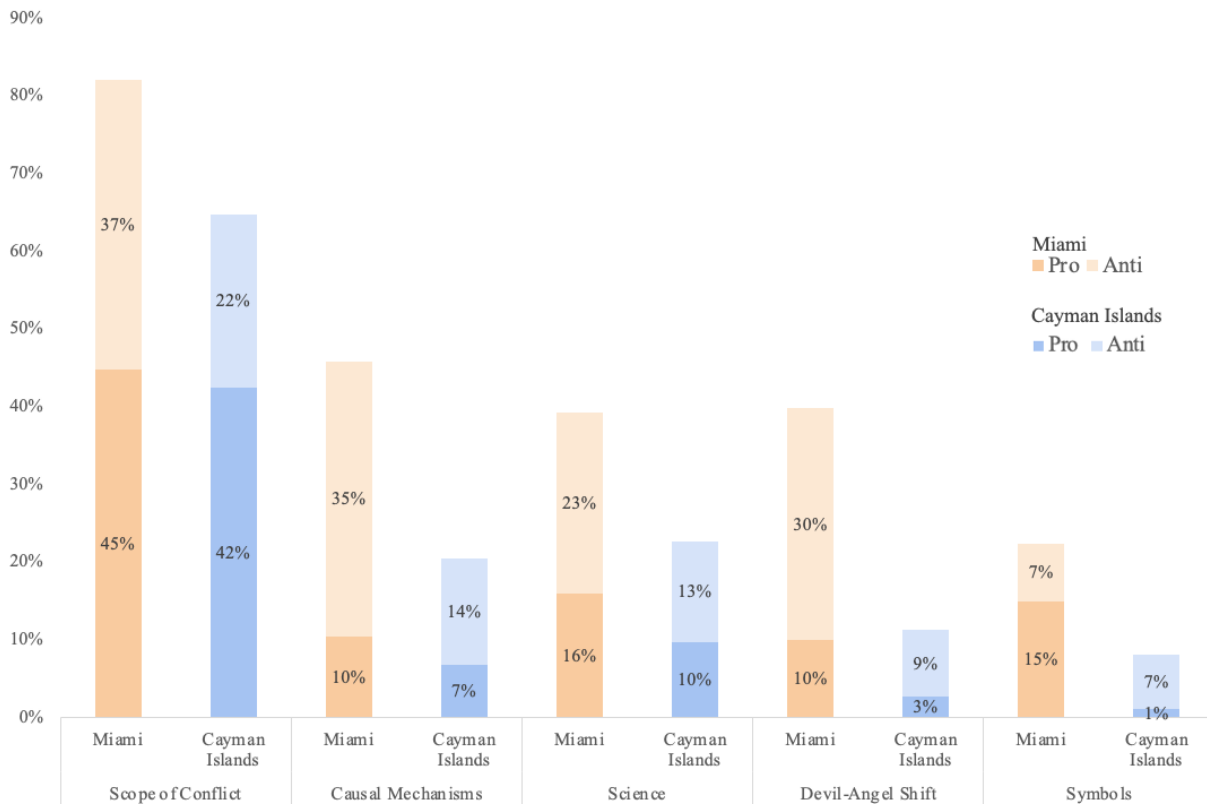


Figure 8. Aggregate summary of how many times stakeholders from both sides of the environmental dispute used the scope of conflict, causal mechanism, science, devil-angel shift, and symbols in their narratives in the Miami and the Cayman Islands cases.

The most frequently used concept across both cases was the *scope of conflict*. The scope of conflict refers to a type of narrative that intensifies or reduces the conflict and allows

⁴⁵ Narratives of casting characters were not explored in this section because, according to the Narrative Policy Framework, casting characters is not a narrative strategy but rather a method for researchers to identify how stakeholders perceive each other. I go into detail on how characters are cast by pro and anti-project stakeholders across both the Miami and Cayman cases in Section 6.1.

stakeholders from both sides to express their beliefs. Actors substantiate their beliefs by either emphasizing the benefits (thereby decreasing the conflict) or emphasizing the risks (thereby inflaming the conflict). 82% of Miami messages contained scope of conflict messages, as did 64% of Cayman messages. In both cases, anti-project stakeholders were successful in expanding the conflict beyond the local scale. In the Miami case, anti-project stakeholders garnered significant national scale attention from prominent newspapers, such as *The New York Times*. In the Cayman case, an international online petition gathered 30,000 signatures with prominent diving organizations to ask the Cayman government to stop the cruise berthing facility from proceeding.⁴⁶ International scientists and prominent conservationists were able to validate and support the anti-project stakeholders' scientific claims of uncertainty regarding the proposed coral mitigation efforts. Interestingly, in the Cayman case, pro-project stakeholders also attempted to expand the problem by asserting the risks of not proceeding with the berthing facility project. For example, they claimed that the cruise industry and all associated jobs would diminish significantly without the cruise berthing facility. However, the pro-project economic risk narrative was not enough to overcome the environmental risk narrative that anti-project stakeholders produced.

The second most frequently used narrative types were *causal mechanisms*. 45% of Miami messages contained causal mechanism-themed messages, as did 21% of Cayman messages. The intentional causal narrative was used significantly more than inadvertent, mechanical, and accidental causal narratives across both cases (see Tables 10 and 11). Use of intentional causal narratives was most prevalently observed in the Miami case. Primarily, it was used by anti-

⁴⁶ The two organizations included the Diving Equipment and Marketing Association (DEMA) and the Professional Association of Diving Instructors (PADI).

project stakeholders to put blame on and hold those who they believed were the villains (e.g. the USACE and its contractors) accountable. Anti-project stakeholders claimed that these “villains” were not practicing good governance and inflicting harm on victims (e.g. environment and corals).

The third most frequently used concept of *science* was often the source of the controversy underlying the dispute, since infrastructure projects look to science to decide whether a project should proceed (NEPA, 2021). 39% of Miami messages contained science-themed messages, as did 23% of Cayman messages. The use of science in narratives in the Miami case was greater than in the Cayman case. In the Miami case, the scientific dispute focused on the impact of the dredging project on corals. The project was contested from its approval in 2012 by local citizens and interest groups pushing for greater environmental protection and the impacts are still being disputed to this day.⁴⁷ Ambiguity, miscommunication on procedure, and the disputed sources of coral mortality among stakeholders continued to fuel this debate. For example, coral bleaching and a disease outbreak occurred during the dredging project, which complicated the identification of the source of the coral mortality that occurred. Pro- project stakeholders believed that they had done everything according to environmental laws, policies, and procedures, while anti-project stakeholders believed that laws had been violated and that the reported results on the dredging impact on corals were inaccurate. For example, private contractors in charge of coral monitoring reported that six corals out of 643 tagged corals died from dredging impacts, which anti-project stakeholders believed was “absurdly” low (Precht et

⁴⁷ There is currently an open federal investigation in regards to how corals were impacted by the project.

al., 2019; Staletovich, 2019). Stakeholders on both sides of the debate used science with certainty to justify and validate their beliefs to both the public and the court.

In the Cayman case, the concept of *science* in narratives primarily concerned predictions of environmental impacts of the berthing facility on adjacent coral reefs as well as impacts of the proposed mitigation efforts. First, the public was unclear on exactly how much environmental and coral damage was to be expected. To lessen the public outcry concerning the predicted 15 acres of pristine reef to be destroyed, the Cayman government published a second updated design for the project that never underwent an updated environmental impact assessment, a legal requirement. Second, the government claimed that they would relocate several culturally important marine ecosystems and heritage sites, including the historic Balboa wreck, piece by piece, and replace every coral that was lost. Pro-project stakeholders further pledged to increase the current coral cover ten-fold through coral fragmentation and restoration mitigation measures.⁴⁸ Anti-project stakeholders claimed that coral relocation and restoration of this scale had never been done before and success was very uncertain, a claim that is verifiable in the published literature on coral restoration (Boström-Einarsson et al., 2020; Ware et al., 2020). Anti-project stakeholders further believed that replacing the value of ancient coral reef stands and relocating wrecks was impossible given current technology. While both pro- and anti-project stakeholders used science with certainty in their messaging, anti-project stakeholders also emphasized the uncertainty of mitigation efforts and the high costs that would occur if the

⁴⁸ Fragmenting corals, similar to branches of a tree, allows them to grow 25-40 times faster than their natural growth rate. Coral restoration uses the coral fragments and glues them onto the reef using a marine epoxy. This allows the coral fragments to grow on the reef at a faster rate than usual. However, coral fragments, which typically range from 10-20 cm, do not provide the same ecosystem services, such as storm protection, as hundred year old coral colonies.

mitigation failed. For example, the revenue from tourism that relies on the pristine reefs would be significantly diminished if coral relocation was unsuccessful.

The fourth most frequently used narrative type was the *angel-devil shift*. 40% of Miami messages contained devil-angel-themed messages, as did 12% of Cayman messages. The devil-shift tactic was mostly used by anti-project stakeholders in Miami making it evident who the “devils” were (the USACE and its contractors) and who the “angels” were (themselves) –from the perspectives of the speakers. The press also agreed with anti-project stakeholders, criticizing the USACE and its contractors. In the Cayman case, while the use of the devil-angel shift narrative appeared less frequently in the data than expected, both sides of the debate used the devil-shift, each blaming and claiming that the other was spreading misinformation at the expense of the public.

Symbols were the least frequently mentioned concept in narratives present in 22% of Miami messages and 8% of Cayman messages. Symbols in narratives are used to enhance the importance of the message. Pro-project stakeholders in the Miami case used symbols to reinforce the nationwide significance of the Port of Miami. Anti-project stakeholders in the Cayman Islands used symbols to emphasize the importance of constitutional rights, a concept that has been shown to engage the public reliably and attract attention (Beckman, 2017; Starger, 2016; Wardle, 1996; Zick, 2020). For example, anti-project stakeholders employed the symbols of voting rights, and invoked the importance of the possibility to have your voice heard by the government. The demonstrated success of triggering the people-initiated referendum resulted in the delay and eventual indefinite hiatus of the project (a pause that occurred in conjunction with

the onset of the COVID-19 global pandemic in March 2020 and change in government administration in April 2021).

In both cases, I observe that the narratives produced by anti-project stakeholders had a strong influence on policy outcomes of the port expansion projects. In the Miami case, anti-project actors used a narrative of the project resulting in significant coral loss due to a lack of mitigation and response efforts, casting themselves as the heroes at the potential expense of the villains. While potential tragic levels of coral mortality still occurred, their narratives promoted by the media and their legal efforts resulted in 1) \$400,000 to perform mitigation by relocating corals, 2) an additional restoration of 10,000 corals in Miami-Dade county, and 3) a \$1.3 million Miami-Dade trust fund towards environmental projects in the area. Furthermore, this environmental dispute likely influenced the delay of the dredging project planned for Port Everglades by five years as the same organizations threatened legal actions unless environmental protection efforts were more stringent.⁴⁹ In effect, anti-project actors are trying to ensure that mistakes are not repeated in Port Everglades. In the Cayman case, contesting the narrative made by pro-project stakeholders and triggering the first-people initiated referendum was crucial in the indefinite halt on the proposed cruise berthing facility. The next sections unpack these concepts in greater detail, highlight the differences of the uses of strategic narratives across stakeholders and cases, and provide more examples.

6.1 Characters: Heroes, Victims, and Villains

⁴⁹ The onset of the COVID-19 pandemic was also cited as a reason to delay the project. However, the project was planned to begin construction in 2016.

Using the Narrative Policy Framework, I compare messaging in the Cayman and Miami port projects beginning with narratives that focus on characters, specifically employing the concept of heroes, villains, and victims. The concept of characters deals with policy actors casting themselves and others as specific types of characters according to their perspective (such as a decision-maker describing their actions as heroic). In general, I found that in both the Port of Miami case and the Cayman case, the people who supported the port projects used narratives of heroes to describe themselves. In contrast, people against the port projects used narratives of villains and of victims. Tables 6 and 7 illustrate the quantitative breakdowns for instances where pro- and anti-project stakeholders used heroes, villains, and victims in their narratives.

Table 6: Use of different characters as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Characters						
	Pro-project: Heroes	Anti-project: Heroes	Pro-project: Villains	Anti-project: Villains	Pro-project: Victims	Anti-project: Victims
Statements using code	94	47	19	60	12	73
Total messages	112	89	112	89	112	89
Percent present	84%	53%	17%	67%	11%	82%
Z-score	4.80		-7.27		-10.2	
P-value	< .00001*		< .00001*		< .00001*	

*P-value is significant at ≤ 0.10

Table 7: Use of different characters as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Characters						
	Pro-project: Heroes	Anti-project: Heroes	Pro-project: Villains	Anti-project: Villains	Pro-project: Victims	Anti-project: Victims
Statements using code	299	137	36	118	92	113
Total messages	460	313	460	313	460	313
Percent present	65%	44%	7.8%	38%	20%	36%
Z-score	5.84		-10.2		-4.98	
P-value	< .00001*		< .00001*		< .00001*	

*P-value is significant at ≤ 0.10

My results show that in the Miami case, project supporters used a strategic narrative involving heroes in 84% of their messages, compared to project opponents using heroes in 53% of their narratives ($p < 0.001$). The same trend was present in the Caymanian case, where project supporters used strategic narratives of heroes 65% of the time, while project opponents used heroes 45% of the time ($p < 0.001$). This suggests that stakeholders who want to see these projects take place cast themselves or these port projects in a heroic light. In contrast, for both the Miami and Cayman Islands case, project opponents used villain and victim narratives significantly more frequently than project supporters ($p < .001$).

In the Miami case, pro-project stakeholders cast the Deep Dredge Project or Floridian government officials as heroes, Miami citizens as the victims, and opponents of the project as villains. Citizens of Miami were cast as victims because pro-project stakeholders believed that they would lose out on economic opportunities, specifically jobs associated with the maintenance

of the port expansion. Anti-project stakeholders cast opponents of the project as heroes, the environment, coral reefs, and citizens as the victims, and primarily the USACE as villains, as can be seen in Figures 9 and 10 below.

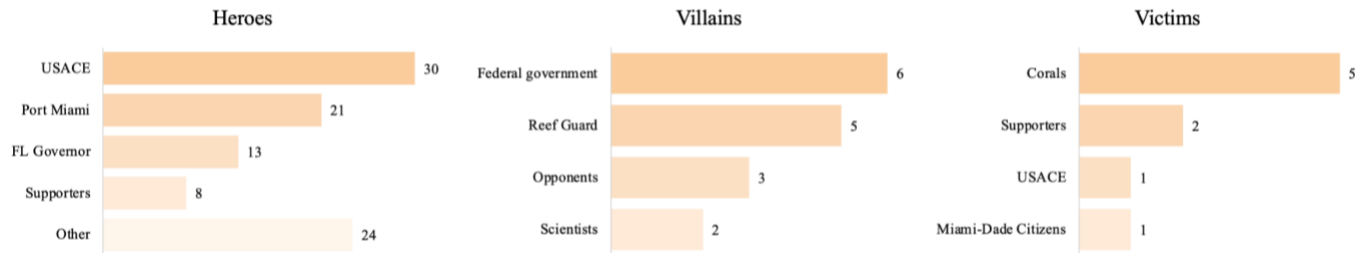


Figure 9. Distribution of characters cast as heroes, villains, and victims across pro-project port stakeholders in the Miami case.

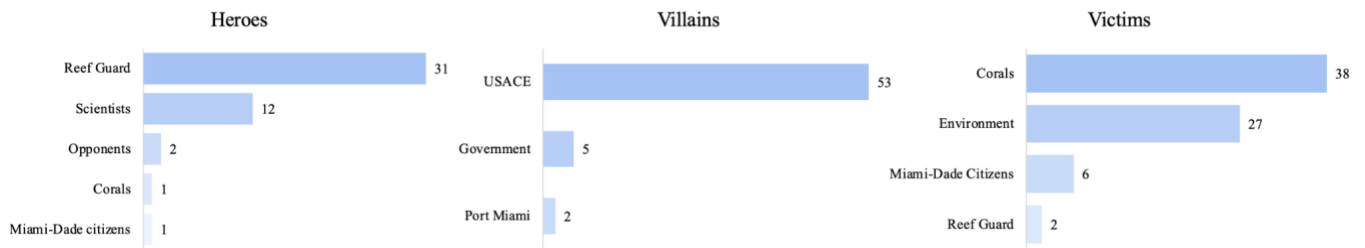


Figure 10. Distribution of characters cast as heroes, villains, and victims across anti-project port stakeholders in the Miami case.

Similarly, in the Cayman Islands case, supporters cast the Caymanian government and cruise berthing facility as heroes, Caymanians as victims, and opponents as villains. Caymanians were cast as victims due to the loss of job opportunities as well as the decrease of cruise passenger spending on local businesses and restaurants. Opponents cast themselves and the referendum as heroes; coral reefs, historic wrecks, and Caymanians as victims; and the Cayman Islands Government as villains, see Figures 11 and 12 below.

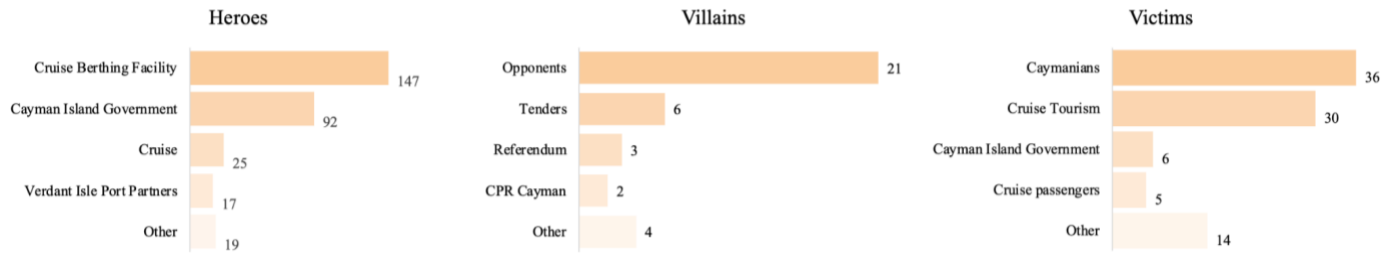


Figure 11. Distribution of characters cast as heroes, villains, and victims across pro-project port stakeholders in the Cayman case.

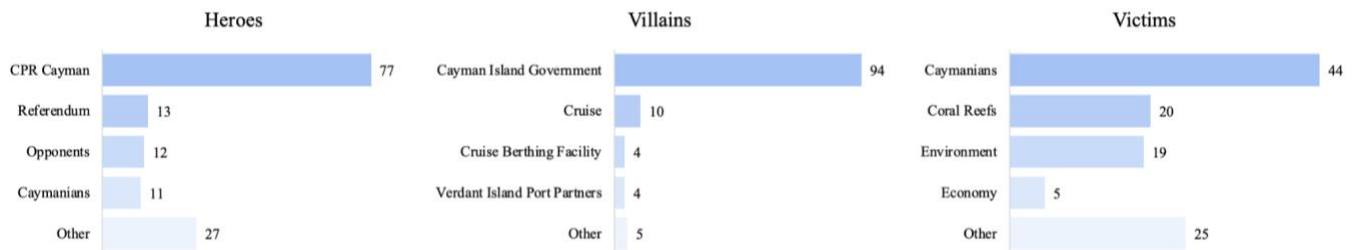


Figure 12. Distribution of characters cast as heroes, villains, and victims across anti-project port stakeholders in the Cayman case.

Representative statements for heroes from pro-project stakeholders include: “I want to congratulate PortMiami on their Deep Dredge project, and their continued commitment to creating jobs for Florida families” (*Miami Examiner*, 2013, para. 2).

This creates a heroic narrative because it highlights the project and policy actors as people that provide solutions, fix problems, and initiate societal progress. For pro-project stakeholders, heroic acts consisted of generating economic growth, bringing jobs to the state, and successfully implementing mitigation efforts to ensure development did not harm coral reefs. For anti-project stakeholders, heroes were policy actors that advocated for increased environmental protection and initiated legal actions against those harming the environment. This was similar to the Caymanian case, where heroes for pro-project stakeholders were those that touted economic growth via the cruise industry and local job opportunities for future generations. In contrast,

heroes for anti-project stakeholders were those that demanded for greater information and transparency from the government, contested the benefits of the port project, and called for a people-initiated referendum for Caymanians to have the voice of the public heard.

The following is an example by a pro-project stakeholder, the former Cayman Minister of Tourism: “The mandate of the Ministry and Department of Tourism is to facilitate annual growth in visitation and economic contribution; my Ministry pursues this strategically each year” (*Caribbean Journal*, 2019, para. 5).

Narratives used the idea of victims to describe entities that could be harmed. Representative statements from anti-project stakeholders from the Miami case include narratives such as: “In an ironic twist, Miami’s taxpayers will suffer a double loss: permanent damage to our invaluable natural resources on the one hand, and a requirement that we pay the cost of the damage on the other” (*Miami WaterKeeper*, 2014, para. 10).

Representative statements from anti-project stakeholders from the Cayman case include narratives such as: “...the people of the Cayman Islands would have been saddled with an additional economic burden and other consequences of a stalled construction project at these difficult times” (*Cayman News Service*, 2020, para. 8).

In these narratives, victimhood is largely based on taxpayers paying for something that irreversibly damaged natural resources or placed an additional economic burden on the taxbase if

the project was delayed. Besides citizens, in both cases, the surrounding environment, especially corals, were frequently described as victims at the mercy of the project impact.

In narratives, the perceived villains from anti-project stakeholders' viewpoints were actors who harm others or obstruct the visions of the perceived heroes. For policy actors supportive of the projects, people contesting and delaying the port project, and therefore hindering economic growth, were cast as villains in both cases. For opponents of the project in the Miami case, villains were those that severely impacted corals by violating laws, permits, and insufficient mitigation efforts. In the Cayman case, villains were spreading misinformation, withholding information, ignoring the citizens' wills, and violating constitutional principles. Largely, these statements were similar to the victims narrative, where accountability to taxpayers and good governance was centered as a core concept that port projects violate.

Representative statements for villains for the Miami case include: "The Corps has violated and is violating the Endangered Species Act by 'taking' far more staghorn corals than authorized and by destroying staghorn critical habitat with dredge-related sediments" (Lidgett, 2016, para. 5).

Representative statements for villains for the Cayman case include: "The impact of this non-compliance is that solid principles of procurement and good governance are not being observed and the necessary accountability for and management of government resources are consequently being undermined" (*Cayman News Service*, 2018, para. 2).

6.2 Scope of Conflict: Risks and Benefits

Scope of conflict deals with the way that policy actors describe the benefits and risks. In terms of employing strategic narratives on benefits and risks, my findings show that in both cases, project supporters constructed narratives emphasizing benefits and project opponents constructed narratives emphasizing the risks of the port projects. In the Miami case, project supporters focused on benefits 75% of the time and project opponents focused on risks 82% of the time ($p < .001$, see Table 8 below). Similarly, in the Cayman Islands case, project supporters diffused or inflated the benefits 49% of the time and project opponents diffused risks 49% of the time, as can be seen from Table 9 below ($p < .001$).

Table 8: Employing the scope of conflict by using benefits and risks as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Scope of Conflict				
	Pro-project: Benefits	Anti-project: Benefits	Pro-project: Risks	Anti-project: Risks
Statements using code	82	1	8	75
Total messages	112	89	112	89
Percent present	73%	1%	7%	84%
Z-score	10.3		-11.0	
P-value	< .00001*		< .00001*	

*P-value is significant at ≤ 0.10

Table 9: Employing the scope of conflict by using benefits and risks as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Scope of Conflict				
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	Pro-project: Benefits	Anti-project: Benefits	Pro-project: Risks	Anti-project: Risks
Statements using code	225	20	103	153
Total messages	460	313	460	313
Percent present	49%	6%	22%	49%
Z-score	12.5		-7.68	
P-value	< .00001*		< .00001*	

*P-value is significant at ≤ 0.10

In the Miami case, specific benefits that pro-project stakeholders mentioned in their messaging were fourfold. These included increased economic growth embodied in the job opportunities generated by port construction and maintenance; the urgency of staying competitive in world trade; overall economic resilience for Florida, and the demonstrated capacity of balancing port infrastructure with environmental mitigation efforts. Similarly, in the Cayman Islands case, benefits identified by pro-project stakeholders included increased economic development embodied in cruise tourism (from job opportunities to higher spending from cruise passengers); the urgency of staying competitive in cruise industry; enhanced and improved cargo and docking facilities; a unique and risk-free deal to finance the project; and expertise to mitigate impacts on coral reefs. A representative statement from the Miami case from a pro-project stakeholder that emphasizes benefits is found below:

The completion of the deep dredge and the intermodal on-dock rail project are a major milestone not only for Miami-Dade County and PortMiami, but for all of Florida because

the entire Sunshine State will benefit from increased trade opportunities once the expanded Panama Canal opens in 2016. (*Targeted News Service*, 2015, para. 4)

This statement is representative of the narrative around benefits employed by actors in its use of global competitiveness and economic growth. The Caymanian case also emphasized global competitiveness and economic growth as a justification for the project, as seen by the following example: “By allowing larger cruise ships the ability to dock, we are ensuring that we maintain this critical industry into the future” (Whittaker, 2018, para. 8).

In the Miami case, risks mentioned by port opponents all concerned the environmental impact, specifically of coral mortality from dredging the Port of Miami. In the Cayman case, risks cited by anti-project stakeholders similarly emphasized the destruction of coral reefs and historic shipwrecks and mitigation efforts proposed by the Cayman Islands Government. They were also concerned by the potential future financial burden, sustainability of the cruise tourism, and increased water, air, and noise pollution for Caymanians by the proposed cruise berthing facility.⁵⁰

A representative statement from the Cayman Islands case from an anti-project stakeholder that diffuses risks is as follows: “The economic costs associated with unavoidable environmental

⁵⁰ The proposed cruise berthing facility project was estimated to cost over \$200 million dollars, making it one of the most expensive infrastructure projects the Cayman Islands has ever undertaken. The government advertised a “risk-free” financial model, wherein the preferred bidder (VIPP) would pay for the project. However, \$2.32 of head tax per cruise passenger, which would have gone to the Cayman Islands, would be relinquished to VIPP over the next 25 years or more, pending on cruise passenger numbers.

damage may exceed the long-term economic benefits that can be reasonably expected from the proposed port development” (Duncan, 2015, para. 4).

This is a representative statement because of its emphasis on unavoidable environmental damage and the tradeoffs between economic growth and these damages. These statements focus on dredging’s impact on a slow growing organism, coral, which can grow from a few millimeters to ten centimeters annually depending on the species, and take centuries to form barrier reefs (*National Ocean Service*, n.d.).

Interestingly, I also found that in the Cayman Islands case, supporters of the project used the language of risks almost a quarter (22%) of the time in their messaging which is greater than in the Miami case (8%). For example, Support Our Tourism, the pro-project project coalition, made regular statements via their Facebook page such as: “As the only destination in the Caribbean without cruise berthing, Cayman will be left behind” (2018) and “4,500 Caymanians work in the cruise tourism industry...[if] the industry is reduced to half, where are these people going to find work?” (2018). Instead of pro-project stakeholders promoting the benefits of the project, as in the Miami case, they frequently advertised the risks of not going through with the project.

6.3 Causal Mechanisms: Mechanical, Intentional, Accidental, Inadvertent

Causal mechanisms are strategic narratives created by policy actors to place blame or assign responsibility to an issue. I focused on four different types of mechanisms which included

mechanical, intentional, accidental, and inadvertent⁵¹ causal narratives. In both cases, narratives employed intentional causal mechanisms far more than any of the other concepts. The Miami data shows that intentional causal mechanisms were used in 58% of the messages by anti-project stakeholders and only in 9% of messages by pro-project stakeholders ($p < .001$). The other types of causal mechanisms were rarely used, often in fewer than 10% of messages across both supporters and opponents of the projects (see Table 10). The Cayman data also showed low levels of narratives involving causal mechanisms, less than 10% for mechanical, accidental, and inadvertent mechanisms across both coalitions. The highest use of causal mechanisms were intentional narratives as well, which were employed in 25% of the messages by anti-project stakeholders and 5% of messages by pro-project stakeholders (see Table 11).

Table 10: Use of different causal mechanisms as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Causal Mechanisms								
	Pro-project: Mechanical	Anti-project: Mechanical	Pro-project: Intentional	Anti-project: Intentional	Pro-project: Accidental	Anti-project: Accidental	Pro-project: Inadvertent	Anti-project: Inadvertent
Statements using code	4	7	10	53	3	1	4	4
Total messages	112	89	112	89	112	89	112	89
Percent present	4%	8%	9%	60%	3%	1%	4%	5%

⁵¹ As a reminder, mechanical causal narratives deal with people having little control over the consequences, such as following instructions or policies; intentional causal narratives associate consequences due to purposeful actions such as suing someone; accidental causal narratives deal with unknown consequences such as disease or natural disasters; and inadvertent causal narratives associate unintended consequences with purposeful actions such as underestimating environmental impact of a project.

Z-score	-1.33	-7.68	0.784	-0.332
P-value	0.184	< .00001*	0.433	0.740

*P-value is significant at ≤ 0.10

Table 11: Use of different causal mechanisms as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Causal Mechanisms								
	Pro-project: Mechanical	Anti-project: Mechanical	Pro-project: Intentional	Anti-project: Intentional	Pro-project: Accidental	Anti-project: Accidental	Pro-project: Inadvertent	Anti-project: Inadvertent
Statements using code	23	22	23	79	5	1	2	3
Total messages	460	313	460	313	460	313	460	313
Percent present	5%	7%	5%	25%	1%	0.32%	0.44%	1%
Z-score	-1.50		-8.16		1.20		-0.89	
P-value	0.134		< .00001*		0.230		0.373	

*P-value is significant at ≤ 0.10

Narratives using intentional causal mechanisms state that results or consequences were brought about by deliberate actions. In the Miami case, narratives of negative consequences resulting from the project (e.g. sediment burial of corals) were portrayed as intentional and oppressive, often by anti-project stakeholders, while positive results (e.g. job growth or lawsuits) were portrayed as intentional and the result of rational calculation.

An example of both negative and positive intentional narratives includes the following quote by an anti-project stakeholder: "...the Corps is not intending to improve its practices in Port Everglades after destroying over 200 acres of reef in Miami, and with this letter we show our intent to push for better protection for Fort Lauderdale's reefs" (*Targeted News Service*, 2015, para. 3).

This is a representative statement of an intentional narrative because it states an intentional dismissal of accountability of potentially destroying coral habitat as well as intent to sue for better coral protection in future port dredging projects. In the Cayman Islands data, intentional narratives by opponents of the project mentioned a deliberate lack of transparency and information and that the Cayman Islands Government was intentionally spreading misinformation to promote the project.

A representative statement includes: "The government and its agents are deliberately misrepresenting facts to suit their narrative on multiple platforms. Government has failed to answer basic questions and be transparent with the public" (*Cayman News Service*, 2018, para. 8).

In response, supporters used intentional narratives that claimed opponents were also spreading misinformation and using any means to cancel the project. Furthermore, although only used 7% of the time, the Cayman Islands Government responded by employing mechanical causal narratives, stating that they were following procedure and thus, could not release information when the public demanded it.

6.3 Science: Certainty and Uncertainty

To add to the Narrative Policy Framework theory, I also examined the use of science, scientific certainty, or scientific uncertainty in strategic narratives. Anytime a message mentioned science, such as coral relocation or coral health, to define or counter a problem or to justify a policy approach, it would be coded as a scientific narrative. Across both cases, my findings show that anti-project stakeholders talked about science more than pro-project stakeholders. I also find that scientific certainty was employed the most across both cases and coalitions. Specifically, in both the Miami and the Caymanian case, pro-project actors used scientific certainty in 94% and 91% of their messaging, respectively. In the Miami case, even though statistically significantly different, anti-project actors also applied certainty in 71% of their messages, which is notably high. The same applies in the Caymanian case, where anti-project messages spoke of scientific certainty 63% of the time, see Tables 12 and 13 below.

Table 12: Use of science and scientific certainty or uncertainty as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Science						
	Pro-project: Science	Anti-project: Science	Pro-project: Certainty	Anti-project: Certainty	Pro-project: Uncertainty	Anti-project: Uncertainty
Statements using code	33	48	31	34	2	14
Total messages	112	89	33**	48**	33**	48**
Percent present	29%	54%	94%	71%	6%	29%

Z-score	-3.49	2.80	-2.56
P-value	0.0005*	0.0050*	0.0106*

*P-value is significant at ≤ 0.10

**Total messages derived from messages coded as using science

Table 13: Use of science and scientific certainty or uncertainty as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Science						
	Pro-project: Science	Anti-project: Science	Pro-project: Certainty	Anti-project: Certainty	Pro-project: Uncertainty	Anti-project: Uncertainty
Statements using code	75	100	68	63	7	37
Total messages	460	313	75**	100**	75**	100**
Percent present	16%	32%	91%	63%	1%	37%
Z-score	-5.10		4.17		-4.17	
P-value	< .00001*		0.00003*		0.00003*	

*P-value is significant at ≤ 0.10

**Total messages derived from messages coded as using science

In the Miami case, messages that spoke of science primarily concerned the quality of mitigation efforts and the sediment coral burial impacts from dredging. An example of the use of science in a narrative includes the following: “These corals may be pre-adapted to deal with warmer temperatures and harsher environments, and it's a huge loss to destroy them when they may be the most resilient corals in the area” (*Targeted News Service*, 2014, para. 6).

In the Cayman case, messages of science revolved around proclaimed coral relocation and mitigation proposals by the Cayman Islands Government and the extent of damage on pristine coral reefs in George Town Harbour. Messages of scientific certainty in their messaging from supporters include: “Coral relocation is part of our plan and has been hugely successful across the globe” (Support Our Tourism, 2019).

From opponents of the project, messages of scientific certainty include statements such as: “Low coral cover is of critical concern because as the reef structure degrades so does its capacity to protect against storms and wave action, meaning the Cayman Islands will likely be at risk of greater coastal erosion” (*Central Caribbean Marine Institute*, 2018, para. 5).

In the Miami case, an example of a message using scientific certainty among pro-stakeholders includes: “The cooperative effort to safely remove and replace corals close to the project site shows that we can protect the environment while undertaking a vital economic infrastructure improvement project” (*US Army Corps of Engineers Jacksonville District Website*, 2014, para. 7).

These statements are representative of scientific certainty because either policy actors used science to establish certainty in their statements or perceived their statements to reflect scientific reliability and accuracy.

In contrast, a message employing scientific uncertainty was when a policy actor presented uncertainty in their statement or questioned or disputed a scientific argument made by other

policy actors. For example, an anti-stakeholder statement in the Miami case questioning the method of coral removal is the following: “Who’s going to prove (they moved the corals)...where is this natural reef they’ve selected?” (*US Army Corps of Engineers Jacksonville District Website*, 2014, para. 9).

In the Cayman case, an example of opponents of the project using scientific uncertainty, questioning the science presented, is: “All of these factors make it difficult to predict the success of a coral relocation project in the long term” (Whittaker, 2019, para. 17).

6.5 Devil-Angel Shift

Another messaging tactic among stakeholders is the use of the angel-shift and the devil-shift. The angel-Shift inflates the “good-ness” of an actor, and the devil-shift inflates the “evil-ness” of an actor. I found that anti-project stakeholders used both the angel and devil-shift tactic more than pro-project stakeholders in both cases. Furthermore, I found that this strategic narrative was used less often than anticipated in the Caymanian case, (see Table 14) compared to the Miami case (see Table 15). In the Miami case, anti-project actors used the devil-shift tactic 43% of the time in their narratives, while pro-project actors only used it 6% ($p < .001$). The angel-shift was also used by anti-project actors significantly more than pro-project actors, 22% and 13% respectively ($p < .047$). In the Cayman case, opponents of the project used the devil-shift 13% of the time, while supporters used it 3% of time in their messaging. Both pro and anti stakeholders used the angel shift tactic less than 10% of the time. Although the devil-shift was used less in the

Cayman case, stronger language against opponents was used by the pro-project coalition in the Cayman case than in the Miami case.

Table 14: Use of devil-angel shift as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Devil-Angel Shift				
	Pro-project: Devil	Anti-project: Devil	Pro-project: Angel	Anti-project: Angel
Statements using code	6	40	14	20
Total messages	112	89	112	89
Percent present	5%	45%	13%	22%
Z-score	-6.64		-1.87	
P-value	< .00001*		0.061*	

*P-value is significant at ≤ 0.10

Table 15: Use of devil-angel shift as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Devil-Angel Shift				
	Pro-project: Devil	Anti-project: Devil	Pro-project: Angel	Anti-project: Angel
Statements using code	13	43	8	23
Total messages	460	313	460	313
Percent present	3%	13%	2%	7%

Z-score	-5.74	-3.90
P-value	< .00001*	.00001*

*P-value is significant at ≤ 0.10

In the Miami case, pro-project actors used angel-shift to highly commend powerful supporters, such as government officials and port directors, as well as the progress of the project. The same policy actors used the devil-shift narrative to call opponents of the project a “small group of obstructionists” employing delay tactics (McGrory and Morgan, 2012, para. 9). Anti-project policy actors used the devil-shift narrative to state that actions of certain pro-project stakeholders were of “egregious conduct” and unlawful (Parker, 2016, para. 6). In the Cayman Islands case, anti-project coalitions used the angel-shift narrative to call those who organized the political referendum a “little group of people who [got] together to do wonderful things” and held the government accountable (Harris, 2020, para. 15). Pro-project actors used the Devil-shift to discredit the anti-project coalition. Specifically, the Cayman Islands Minister of Tourism, said that the anti-project stakeholders spread “nothing more than deliberative gossip and untruths” (Cayman News Service, 2019, para. 5). Anti-project stakeholders said that supporters in government had “contempt for the people” (Ragoonath, 2020, para. 13).

6.6 Symbols

Finally, I come to the concept of symbols, my second addition to the Narrative Policy Framework theory. Symbols are defined as representing something larger than itself. My findings show that pro-project stakeholders in the Miami case used symbols more in their narratives than anti-project stakeholders whereas in the Cayman case, anti-project stakeholders

used symbols more than pro-project stakeholders. In the Miami case, symbols were used 28% of the time versus port opponents, who used them 16% of the time, as can be seen in Table 16 ($p < 0.05$). In contrast, in the Caymanian case, anti-project stakeholders used symbols in their narratives more than pro-project stakeholders, 17% of time versus 2% of the time, see Table 17 ($p < .001$).

Table 16: Use of symbols as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Miami case.

Symbols		
	Pro-project: Symbols	Anti-project: Symbols
Statements using code	30	15
Total messages	112	89
Percent present	28%	16%
Z-score	1.90	
P-value	0.0286*	

*P-value is significant at ≤ 0.10

Table 17: Use of symbols as a strategic narrative between pro-project stakeholders and anti-project stakeholders in the Cayman case.

Symbols		
	Pro-project: Symbols	Anti-project: Symbols
Statements using code	9	54
Total messages	460	313
Percent present	2%	17%

Z-score	-7.63
P-value	<.00001*

*P-value is significant at ≤ 0.10

In the Miami case, pro-project actors used symbols to enlarge the Port of Miami calling it the “Gateway to America”, a competitive world player, economically vital and historic. For example, former Port of Miami director stated: “The Deep Dredge has not only regional and statewide significance, but has been called as a nationally significant project by the Army Corp of Engineers” (Miami-Dade County, 2010, para. 5).

Anti-project actors mainly used symbols to talk about the corals in the port, calling them “corals of opportunity”, “engines of the local economy”, and “as rare and unique as the geysers of Wyoming or the sequoias or the redwoods in California... that deserve the same level of attention and the same level of protection from our government and the public” (FitzGerald and Wernick, 2016, para. 16).

In the Cayman Islands case, pro-project stakeholders symbolized the cruise berthing facility of “utmost economic importance” and as a “lifeline of [their] economy” (Cayman’s Port. Cayman’s Future, 2014; Support Our Tourism, 2019). Anti-project stakeholders symbolized Cayman’s pristine environment, particularly coral reefs, calling them “internationally renowned” and an “important, historic, cultural, and natural heritage site” (CPR Cayman, 2020; Spinks, 2020, para. 12). Most prominently however, in 50% of anti-project stakeholder messages, the people-initiated referendum was used as a symbol, where it was referred to as “a monumental for

Cayman” and “part of history” and represented the people’s constitutional right to have a say in the project (Harris, 2020, para. 16; Ragoonath, 2019, para. 13).

Table 18 below is a summary of the qualitative findings of each component across both the Florida and Cayman case that was examined for this research.

Table 18: A summary of qualitative findings matching the criteria used to code stakeholder statements.

Findings	Criteria	Code	Strategy	Case study
<p><i>Pro:</i> The project will bring economic prosperity and keep the Port of Miami a competitive player in world trade; thanking and commending project directors, managers, mayors, governors and legislators for their work and support</p> <p><i>Anti:</i> Miami Reef-Guard, Miami WaterKeeper CEO for bringing legal action against the USACE; coral scientists relocating and saving corals; coral reefs as pillars of the economy and providing ecosystem services</p>	Mention of those who take action to fix the problem at hand	Hero	Character	Miami
<p><i>Pro:</i> Opponents of the Deep Dredge project contesting and attempting to delay it</p> <p><i>Anti:</i> The USACE; overflowing barges; contractors findings and reports on survival rate of corals</p>	Mention of those who create harm or oppose the aims of the hero	Villain	Character	Miami
<p><i>Pro:</i> Floridians and Miami-Dade citizens losing out on economic resilience and job opportunities from the Deep Dredge project</p> <p><i>Anti:</i> Corals and Biscayne Bay environment at the mercy of the dredging</p>	Mention of those who are harmed by a particular action or inaction	Victim	Character	Miami

<p>impacts; Miami-Dade citizens for having to pay for the environmental consequences</p>				
<p><i>Pro:</i> The cruise berthing facility project will progress the cruise tourism industry; bringing economic prosperity and job opportunities for Caymanians; supportive stakeholders including the government; expert consultants and contractors; preferred bidder; cruise lines</p> <p><i>Anti:</i> Campaigners against the project and other opposing stakeholders including private businesses, scientists, government officials on the opposition; the referendum allowing Caymanians to cast their vote; coral reefs for providing economic benefits and ecosystem services</p>	<p>Mention of those who take action to fix the problem at hand</p>	<p>Hero</p>	<p>Character</p>	<p>Cayman</p>
<p><i>Pro:</i> Opponents or “rascals” doing everything they can to cancel the port expansion project and spreading misinformation; tendering is unsafe for cruise passengers; the referendum will lead to the demise of the project</p> <p><i>Anti:</i> The Cayman Islands Government for deceiving the public; lack of transparency and impact assessments; using public funds for pro-project campaign; preferred bidders and cruise lines for pressuring Cayman Islands and disregarding their well-being</p>	<p>Mention of those who create harm or oppose the aims of the hero</p>	<p>Villain</p>	<p>Character</p>	<p>Cayman</p>
<p><i>Pro:</i> The safety of cruise passengers from tendering and without an upgraded berthing facility and cargo; future generations; Caymanians losing out on the cruise industry</p> <p><i>Anti:</i> “World-class” reefs and historic shipwrecks; future generations; tendering and diving businesses; Caymanian well-being and constitutional rights</p>	<p>Mention of those who are harmed by a particular action or inaction</p>	<p>Victim</p>	<p>Character</p>	<p>Cayman</p>

<p><i>Pro:</i> Staying competitive in world trade; economic opportunities through trade and the creation of jobs; capacity of mitigating infrastructure impacts on the environment</p> <p><i>Anti:</i> N/A</p>	<p>The statement expands or concentrates the benefits of the port project</p>	<p>Benefits</p>	<p>Scope of Conflict</p>	<p>Miami</p>
<p><i>Pro:</i> Acknowledgement of some but minimal impact on surrounding environment</p> <p><i>Anti:</i> Sedimentation and turbidity impact on corals; mortality of corals; impact on Biscayne Bay environment; loss of environmental services for Miami citizens; decreasing water quality</p>	<p>The statement expands or concentrates the risks of the port project</p>	<p>Risks</p>	<p>Scope of Conflict</p>	<p>Miami</p>
<p><i>Pro:</i> Increased cruise tourism sector; secure the cruise tourism industry; increase job opportunities; increase cruise passenger expenditure and customer service; enhanced cargo expansion; unique financial model; increased safety for everyone; increased coral biodiversity through mitigation program; securing economic prosperity for Cayman Islands; ownership and control of cruise berthing facility; mitigating environmental impact</p> <p><i>Anti:</i> Increased cruise passenger experience from remodeling the embarking area (including shaded areas)</p>	<p>The statement expands or concentrates the benefits of the port project</p>	<p>Benefits</p>	<p>Scope of Conflict</p>	<p>Cayman</p>
<p><i>Pro:</i> Loss of job opportunities; loss of cruise industry; loss of financial agreement; loss of cruise passenger numbers; overall economic loss; acknowledgement of coral reef loss; loss of economic and financial security; cruise passenger safety risks with tendering</p> <p><i>Anti:</i> Historic and cultural loss of shipwrecks; coral reef destruction; scalability of mitigation efforts; questionable governance; economic risk;</p>	<p>The statement expands or concentrates the risks of the port project</p>	<p>Risks</p>	<p>Scope of Conflict</p>	<p>Cayman</p>

lack of transparency; overcrowding tourism; financial model				
<p><i>Pro:</i> Mitigation efforts sufficient and successful; monitoring tagged corals well executed; quality control/quality assurance affirmation; results accurate</p> <p><i>Anti:</i> Corals are essential to environment; corals getting buried with sedimentation; mortality rate greater than reported; the USACE violated Incidental Take Statement due to higher coral mortality</p>	The message source uses science to establish certainty in their argument	Certainty	Science	Miami
<p><i>Pro:</i> Impact of bleaching and disease versus dredging on coral mortality; source of coral mortality and disease</p> <p><i>Anti:</i> Future value of corals in Miami Port channel; survivorship results from the USACE and contractors; impact on corals from dredging; source of disease; mitigation efforts and response sufficient to protect corals</p>	The message source questions or disputes the science used by the opposition	Uncertainty	Science	Miami
<p><i>Pro:</i> Mitigation effort success including silt curtains and coral relocation and restoration; contracting best scientists for coral restoration; increasing coral cover through restoration; project does not pose threat to Seven Mile Beach; project will be climate resilient</p> <p><i>Anti:</i> Immense loss of coral reefs; lack of thorough research; importance of reefs against storm protection; presence of threatened species; sedimentation will be detrimental to reefs</p>	The message source uses science to establish certainty in their argument	Certainty	Science	Cayman
<p><i>Pro:</i> Travel of sedimentation from dredging</p> <p><i>Anti:</i> Impact of new project design due to lack of fully updated EIA; extreme uncertainty regarding the success of coral</p>	The message source questions or disputes the science used by the opposition	Uncertainty	Science	Cayman

mitigation efforts; impact on water clarity and quality; impact on Seven Mile Beach				
<p><i>Pro:</i> Inability to move pilings because it would cost taxpayers thousands of dollars; contractors abiding laws and permits; the USACE has followed procedures according to laws and permits; conclusions drawn from scientific data; climate change, bleaching, and disease making it harder to interpret coral mortality</p> <p><i>Anti:</i> Permit does not sufficiently protect coral reefs, no deadline to get to a resolution, barges leaking sediment and leaving plumes of sediment, coral relocation dives cut short due to elevated sedimentation, disease does not cause sedimentation</p>	The statement associates unintended consequences by purposeful action	Mechanical	Causal Mechanism	Miami
<p><i>Pro:</i> County needs to contribute financially to port project, the USACE intends to pursue project in least impactful way possible, environmental impact in line of expectations, anti-project stakeholders employing tactics to delay the project, anti-project stakeholders cherry-picking data</p> <p><i>Anti:</i> The USACE intentionally not following rules and violating permits, not learning from mistakes, not responding to high sedimentation and coral burial, withholding information, spreading misinformation regarding the source of coral death, and cutting corners; anti-stakeholders intention to sue the USACE and educating the public</p>	The statement associates intended consequences by unguided actions	Intentional	Causal Mechanism	Miami
<p><i>Pro:</i> Bleaching and disease during dredging project impacted coral survivorship</p> <p><i>Anti:</i> N/A</p>	The statement source associates unintended consequences by unguided actions	Accidental	Causal Mechanism	Miami

<p><i>Pro:</i> Possibility of impacts on corals, learning group that learns from unforeseen consequences</p> <p><i>Anti:</i> Unintended consequences, scientific missteps by the USACE and NOAA, monitoring falling short</p>	<p>The statement associates intended consequences by purposeful actions</p>	<p>Inadvertent</p>	<p>Causal Mechanism</p>	<p>Miami</p>
<p><i>Pro:</i> Could not release information prior to announcing preferred bidder; proceeding according to procedure and law; port can only be built in George Town Harbour; stay-over tourism cannot replace cruise tourism; Department of Environment removed because no longer needed in procedure; cannot separate cruise from cargo facility; people had a year to register and vote for referendum; “just doing my job”; verification is necessary part of procedure</p> <p><i>Anti:</i> Caught up in debate due to intensity; procedure to become registered voter is unclear; new design requires new EIA; unclear referendum laws; unsustainable tourism if project goes through</p>	<p>The statement associates unintended consequences by purposeful action</p>	<p>Mechanical</p>	<p>Causal Mechanism</p>	<p>Cayman</p>
<p><i>Pro:</i> Cruise companies not stopping by Cayman Islands without cruise berthing facility; people taking advantage of this dispute for political gain; purposefully predetermining mindsets; rumors are deliberate gossip; spreading misinformation to public</p> <p><i>Anti:</i> The Cayman Islands Government deliberately misrepresenting facts; spreading misinformation to public; using fear-mongering tactics; withholding information; cruise lines agenda to control cruise industry; the Cayman Islands Government manipulating referendum and unlawful; international organizations urging Cayman Islands Government to stop plans; voice of</p>	<p>The statement associates intended consequences by unguided actions</p>	<p>Intentional</p>	<p>Causal Mechanism</p>	<p>Cayman</p>

people need to be heard; legal actions against the Cayman Islands Government; coral reef destruction				
<i>Pro:</i> Cruise anchors destroy reefs at George Town Harbour; onset of COVID-19 <i>Anti:</i> COVID-19	The statement associates unintended consequences by unguided actions	Accidental	Causal Mechanism	Cayman
<i>Pro:</i> N/A <i>Anti:</i> Selling more land and business to foreigners with project; unable to enforce regulations with increased tourism	The statement associates intended consequences by purposeful actions	Inadvertent	Causal Mechanism	Cayman
<i>Pro:</i> Congress not providing enough funds for project; “Obstructionists” of the Deep Dredge project contesting and attempting to delay it; cherry picking data and publishing “bad” science; defaming the USACE and contractors and inability to retaliate <i>Anti:</i> The USACE and contractors for cutting corners inflicting irreversible environmental damage, refusing to learn from mistakes, and withholding information	The statement inflates the “evil-ness” of an entity	Devil	Devil-Angel Shift	Miami
<i>Pro:</i> FL governor’s true commitment to job creation and project; coral scientists relocating corals during dangerous conditions; the USACE using best science and engineering techniques; the USACE doing good progress on project <i>Anti:</i> Miami Reef-Guard, Miami WaterKeeper CEO for bringing legal action against the USACE and educating the public; coral scientists doing “coralitarian” job relocating and saving corals	The statement inflates the “good-ness” of an entity	Angel	Devil-Angel Shift	Miami

<p><i>Pro:</i> Anti-project stakeholders are “rascals”; deliberately spreading misinformation; doing anything for political gain; opponents for delaying projects and bullying people into anti-project mindsets; social activism on steroids;</p> <p><i>Anti:</i> The Cayman Islands Government using fear mongering tactics and “politricks”; nothing short of propaganda; failing a good governance; VIPP and cruise lines exploiting Cayman; the Cayman Islands Government misusing public funds for marketing materials; the Cayman Islands Government destroying reefs; the Cayman Islands Government manipulating referendum and “roughhousing” people’s rights</p>	<p>The statement inflates the “evil-ness” of an entity</p>	<p>Devil</p>	<p>Devil-Angel Shift</p>	<p>Cayman</p>
<p><i>Pro:</i> The Cayman Islands Government for ensuring prosperity of cruise industry; proceeding at the best of international standards with the project; hiring the best contractors possible</p> <p><i>Anti:</i> Doing what’s right for Caymanians; CPR Cayman doing wonderful things for the Cayman Islands and stepping up; transparency of CPR Cayman; CPR Cayman rescuing reefs; citizens coming together and standing up to the Cayman Islands Government; referendum changing the course of Cayman history</p>	<p>The statement inflates the “good-ness” of an entity</p>	<p>Angel</p>	<p>Devil-Angel Shift</p>	<p>Cayman</p>
<p><i>Pro:</i> Port of Miami is the “Gateway to Americas”; competitive world trade player; economically vital and historic</p> <p><i>Anti:</i> corals as rare and unique as geysers of Wyoming, sequoias, and redwoods; corals of opportunity; engines of the local economy</p>	<p>The message source uses a symbol to represent something larger than itself</p>	<p>Symbols</p>	<p>Symbols</p>	<p>Miami</p>
<p><i>Pro:</i> Cruise is “lifeline” of economy, project of utmost historic importance</p>	<p>The message source uses a</p>	<p>Symbols</p>	<p>Symbols</p>	<p>Cayman</p>

<i>Anti:</i> World class and renowned coral reefs; historic shipwrecks; natural heritage coral reef sites; referendum a historic feat	symbol to represent something larger than itself			
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7.0 Discussion

7.1 Expectations

My findings above show that both pro-project and anti-project coalitions in both the Miami and Cayman Islands case studies employed narrative tactics that could be implicated in policy outcomes. My results show that in both cases, characters were cast similarly wherein pro-project actors used the heroic narrative significantly more than anti-project actors. In turn, anti-project actors used the villainous narrative four times more than pro-project actors and significantly employed the victim narrative more as well. These findings align with Heikkila, Weible, and Pierce (2014) who found that anti-fracking coalitions in New York used the narrative of victims significantly more than pro-fracking coalitions. They also align with Shanahan et al. (2013) who found that each coalition portrays itself as heroes while portraying the opposing coalition as villains.

In both cases, an important pattern emerges within the Narrative Policy Framework where those who support a major infrastructure project speak in heroic narratives and those who oppose the project employ narratives of victims or of villains to constitute their opposition. Powerful actors, such as corporations and politicians with industry ties, use heroic narratives to try to increase support for a project. Whereas weaker actors, such as interest groups, may employ the language

of victimhood and criticize powerful figures as villains in their own narratives. My findings also show that pro-project heroes in both cases are typically government or industry actors who use infrastructure to facilitate economic growth. By contrast, anti-project victims are everyday citizens, taxpayers, who are asked to fund infrastructure projects that irrevocably damage important natural resources. In effect, their money is being used to achieve adverse outcomes over which there is unsettled science on the long term consequences. Villains are governmental actors that facilitate this relationship and violate principles of good governance and pre-existing laws that offer protections for ecosystems. The common thread of economics runs through all three concepts, which I find to be an important persuasive tool in narrative building.

Both case data support the Narrative Policy Framework theory and met my expectations that policy actors supportive of the port project emphasized benefits and reduced risks, whereas policy actors opposed to the port project emphasized risks and reduced benefits. This finding is congruent with many other papers examining the strategic use of expanding and containing the scope of conflict on controversial topics (Gupta et al., 2018; McBeth et al. 2007; Shanahan et al. 2013; Uldanov et al. 2021). Although risks were employed by anti-project actors significantly more than pro-project actors, in the Cayman case, pro-project actors surprisingly used the language of risks in 22% of their messaging. In effect, this intensified the conflict by emphasizing economical risks. Stephan (2020) also found this pattern arising in pro and anti-fracking coalitions in Scotland, wherein containing the conflict became less important than expanding it, even for pro-fracking actors. The author attributed this to the Scottish government taking a larger role in containing the conflict and pro-fracking actors losing incentive to use reassuring messaging as the debate on safety and science continued. This is not fully applicable

to my case as it was the Cayman Islands Government proclaiming the risks of not proceeding with the cruise berthing facility project. However, as the debate on the uncertainty of the environmental impact and mitigation strategies continued, pro-project actors may have tried to expand the scope of conflict in another direction than anti-project actors. This is important because it indicates the language of risks and benefits can be employed in narratives in unexpected ways and is worthy of further research.

Regarding the use of causal mechanisms, which are used to assign responsibility or blame for consequences, my first expectation stated that pro-project entities would use inadvertent, mechanical, or accidental causal mechanisms more frequently than anti-project entities. I thought this would be the case because of two assumptions. First, as the more powerful actors (government officials and corporations), they would avoid shifting blame directly and intentionally onto the weaker actors (interest groups). Second, as the port project would inevitably impact the coral reefs and surrounding environment, supporters would state negative consequences were due to procedural actions (mechanical cause), natural disasters (accidental cause), or unforeseen circumstances (inadvertent cause). My second expectation stated that anti-project entities would use intentional causal mechanisms more frequently than pro-project entities. As opponents were contesting the port project due to its potential environmental impact, it would be logical to place blame of any resulting negative consequences onto the project and its supporters.

Most prominently, in the Miami case, I found my second expectation to be true. This showed an attempt by interest groups to hold decision makers accountable for adverse outcomes. Due to the

low use of causal mechanisms and lack of statistical significance I cannot confirm my first expectation. Prior research has also found that intentional causal mechanism is the dominant strategy used among competing coalitions (Shanahan et al. 2014). Shanahan et al.'s (2014) research reveals that causal mechanisms are impactful in the short-run and that intentional causal mechanism narratives can influence opinions, unlike the use of inadvertent causal mechanisms in narratives. This may be indicative of the low levels of inadvertent, mechanical, and accidental causal mechanisms in narratives represented in my findings. Low use may come from these large infrastructure projects having a multitude of stakeholders and processes over long periods of time that asserting blame on certain entities is more challenging. With our technological advances and policies in place, not taking accountability for inadvertent environmental impacts or failing procedures (mechanical cause) may be seen as inexcusable. Furthermore, diplomacy, taking accountability and learning from mistakes, rather than shifting blame, may be more beneficial for stakeholders in the long run. Other authors, like Ertas and Mcknight (2020) had trouble identifying causal mechanisms, which might also suggest that some types of causal mechanisms (in our case, mechanical, inadvertent, and accidental) may be too nuanced or ineffective as a narrative tactic.

The use of science in both cases was of especial interest to me. My first expectation was that pro-project entities would use science with more certainty. I thought that pro-project stakeholders would want to assure the public that the science behind environmental mitigation efforts compensated for the impacts of the port project. While my findings support this, I also found that anti-project stakeholders frequently employed scientific certainty as well in both cases. This suggests that scientific certainty as a strategic narrative transcends either side of the

environmental dispute. This may be because environmental disputes based on infrastructure heavily rely on science to make decisions regarding mitigation efforts (McBeth et al., 2007). Furthermore, using certainty allows policy actors to feel comfortable to approve the project or even relieve responsibility of making tough choices (Nie 2003). Finally, using certainty and technical knowledge also invokes confidence and can help persuade people on the fence of a debate (Shanahan et al., 2018). My second expectation proposed that anti-project entities would present scientific uncertainty and question the science presented. I thought this because opponents would want to highlight gaps of scientific results to continue deliberation. I found evidence that supports this in both the Miami and Cayman cases. This shows that science, specifically portraying scientific uncertainty, can be utilized as a tactic to expand the scope of conflict.

The devil-angel shift narrative tactic has been studied using varying contexts. McBeth et al. (2007) describes coalitions as losing or winning and found that losing coalitions can descend to devil-shift narratives of the opposing coalition in a need to retaliate, which I observe in both of the cases as well. Both Stephan (2020) and Shanahan et al. (2013) found that overall, losing coalitions employ devil-shift narratives significantly more than winning coalitions, which I also found. Chang and Koebele (2020) and Gottlieb et al. (2018) found that policy position (i.e. pro- and anti- beliefs) is a greater influence concerning the use of the devil-angel shift narrative tactic rather than being on the perceived winning or losing coalition. Basing my expectations on policy preference, I expected that pro-project entities would use the angel shift more, and anti-project entities would employ the devil-shift more. This was because I assumed supporters of the project would want to frame the project and its benefits in the most positive light possible, while

opponents would want to discredit the project, highlighting its potential negative consequences. Surprisingly, in both the Miami and the Caymanian case, anti-project actors used both the angel and devil-shift narrative more commonly than anyone else. This suggests that authors of strategic narratives opposed to the port project wield these concepts more than those supporting the project. This may be because pro-project powerful actors, especially government officials holding elected positions, are more restrained in their narratives and would be frowned upon for severely criticizing interest groups. Whereas, weaker policy actors contesting government are often seen as courageous. Furthermore, as the less powerful group, they may need more persuasive tactics to garner attention and influence.

Finally, I expected both pro and anti-project coalitions to use symbols equally. This was because each side of the environmental dispute would want to enhance the importance of their messaging. My findings show that in the Miami case, pro-project actors used symbols significantly more than anti-project actors, while the opposite was true in the Cayman Islands case. The divergence between these cases could be due to the policy actors and contextual difference in the cases themselves. For instance, in the Cayman case, the George Town Harbour coral reefs have historical and cultural importance. Furthermore, these reefs contribute directly to the local economy through tourism and provide ecosystem services such as storm protection. While the corals in the port channel in Miami may have greater resilience to disease and other threats, they are not a tourist attraction and as large patches of corals instead of a barrier reef, they do not provide the same ecosystem services as a reef. Additionally, the PortMiami Deep Dredge project had the full support of local, regional, and national government officials, who greatly endorsed the project. Unlike the Caymanian case, where some government officials were

much more reserved in their support. Finally, as the first people-initiated referendum in Caymanian history, it's an evident symbolic feat for the people of Cayman. The referendum was mentioned in almost 50% of the anti-project stakeholders' messages, where some beheld it as their constitutional right to have their say on the proposed cruise berthing facility.

7.2 Implications

Prior studies find evidence that narratives influence our decisions on environmental conservation, especially when combined with scientific data (Kelly et al., 2014; Lawton and Rudd, 2015; Wilder et al., 2015). Narratives can highlight risks and benefits to avoid uncertainty and environmental harm, increase the understanding of statistical data and complex findings to promote conservation action, and create connections among stakeholders and networks to influence decision making. As such, knowing what types of narratives are used by different stakeholders in environmental disputes is important. In my case studies, I find narratives that 1) expand the scope of conflict by emphasizing risks, 2) critically villainize opponents, 3) contest scientific evidence by providing new and different information, and 4) in one case, highlight constitutional rights, accelerate policy action towards scrutinizing environmental impacts and promoting conservation.

7.3 Refining Theory

To better understand environmental disputes over vulnerable ecosystems, I developed and tested for differences between two cases for a refined theory for the Narrative Policy Framework.

Influenced by the work of McBeth et al. (2007) and Stone (2012), I quantified the presence and absence of all original theoretical components of the Narrative Policy Framework, including the *characters*, *scope of conflict*, *causal-mechanism*, and *devil-angel shift*, as well as additional concepts of *science* and *symbols*. I then tested differences between cases according to these concepts.

For one of the newly added concepts, that of *science*, I quantified not only the prevalence of its use, but also whether it was used with certainty or uncertainty in narratives. The other newly added concept to the framework was that of *symbols*, which I quantified in narratives.

Refinements to the Narrative Policy Framework (i.e. the original components of *characters*, *scope of conflict*, *causal-mechanisms*, and *devil-angel shift*, plus my added components of *science* and *symbols*) are depicted in green in Figure 7 in Section 4.0.

Refining my theory to include *science* was essential, and makes this research broadly relevant to the wider field of environmental dispute resolution. Environmental disputes often focus on science. Science can take many forms in disputes, ranging from the population data needed for the delisting of a species from the Endangered Species Act, or in this case, whether environmental impact assessments accurately represent the impacts on reefs from dredging. In an ideal world, these types of decisions would largely be based on the available science, however narratives surrounding the science play a large role as well. Thus, it is still essential to examine who the stakeholders are and what their interests are (identified in their narratives), which the Narrative Policy Framework enables me to do. Most importantly, I found that using narratives of scientific certainty transcended both sides of the dispute. In other words, both pro- and anti- port

stakeholders used scientific certainty to craft their narratives. Thus, stakeholders believe that speaking about science with certainty invokes confidence and persuasion in their narratives (Shanahan et al., 2018).

Refining my theory to include *symbols* allowed me to analyze what pro- and anti-project stakeholders thought were worth glorifying (predictably and respectively, economic opportunities versus corals). In the Cayman case, anti-port stakeholders used narratives on Constitutional Rights as symbols to convince people of their duty to participate in the first ever people-initiated referendum in the Cayman Islands. The people-initiated referendum was symbolized in narratives as a crucial part of history or having the government hear the voice of the public. This narrative likely contributed to the success of gathering enough signatures to trigger the people-initiated referendum. The triggering of the people-initiated referendum was indeed pivotal in the fight against the proposed port project.

7.4 Weaknesses

Analyzing strategic narratives is just one specific lens of many to examine how environmental disputes unfold over vulnerable ecosystems. Future research examining the types of stakeholders involved and their strategies to advocate for their position beyond constructing narratives, such as networking and campaigning, can provide further insight into this subject. My findings on the frequency of strategic narratives used is likely to be context dependent, as is observed in the use of *science* and *symbols*, potentially limiting the generalizability of my research. Examining more case studies with my refined Narrative Policy Framework theory can help review the

generalizability of my findings. Furthermore, for the Cayman Islands case, I was unable to conduct interviews with pro-project stakeholders. It was indicated that they did not want to speak about the subject anymore. In the Miami case, government officials and private firms contracted by the government did not want to speak with me as there is an on-going federal investigation on the dredging impacts. For future research, acquiring a greater number of interview respondents would be beneficial to further substantiate document data findings.

8.0 Conclusion

For this research, I used a refined version of the Narrative Policy Framework (Shanahan et al., 2018) to examine how stakeholders from both sides of an environmental dispute over vulnerable ecosystems, namely coral reefs. This new framework added two concepts, *science* and *symbols* to the original concepts of *characters*, *scope of conflict*, *causal mechanisms*, and *devil-angel shift*. Specifically, I quantify the types of strategic narratives used between pro and anti-project stakeholders during port infrastructure projects that threatened coral habitat and reef ecosystems in Miami and the Cayman Islands. I also tested the differences between the use of narratives in both cases, while performing qualitative analysis to provide additional detail.

Across both cases, I found that several of my expectations were met. First, pro-project stakeholders cast themselves as heroes, opponents as villains, and citizens as victims. Second, pro-project stakeholders emphasize benefits and minimize risks to contain the scope of conflict. This suggests that actors who support major infrastructure projects see persuasive potential in narratives that depict themselves as heroes, their opponents as impediments, and citizens as victims who will miss out on economic opportunities if a project is not completed as planned. Project supporters focus on the benefits and downplay the risks of major infrastructure projects, a

strategy that can allow the public to ignore potential damage to the corals as was seen in the Miami case, or possible failed mitigation strategies as were planned in the Cayman case.

Third, anti-project stakeholders cast themselves as heroes, supporters as villains, and corals and citizens as victims. Fourth, anti-project stakeholders emphasize risks and minimize benefits to expand the scope of conflict. This suggests that those who oppose major infrastructure projects (just like supporters) depict themselves as heroes, project supporters as villains, and the reefs and citizens as victims. One area that requires further research is whether the use of non-persons (e.g. coral reefs) as victims is an effective persuasive technique in narratives that impacts decision-making. Further examination of the persuasive potential of narratives that cast ecosystems as victims can shed light on one of the main communication strategies used by environmental interest groups. There is a real possibility that depicting ecosystems as victims may not work, compared to depicting humans as victims. Polling on this subject can help environmental agencies and interest groups in refining their narratives.

Project opponents also are the main actors that are highlighting the risks of the proposed project, specifically by pushing back against the big promises made in mitigation plans through coral restoration and relocation. This suggests that if there is limited interest group presence on the ground to pushback, perhaps in a place with diminished civil society or under an authoritarian regime, nobody will be there to question the science presented. Further research in contexts like this can help us better understand the role of contested science in places with weaker civil society. This is closely related to the fifth expectation, which found that intentional causal mechanisms were used significantly more by anti-project stakeholders to assign responsibility

for failures on the government and pro-project stakeholders. Sixth, the devil-shift tactic was used significantly more by anti-project stakeholders portraying the government and pro-project stakeholders as villainous. This means that those opposed to the project were more likely to use criticism in their narratives. Further research that builds on the large body of literature on negative campaigning might be useful for determining the effectiveness of negativity in narratives.

Contrary to expectations, I found low frequency in the use of causal mechanism narratives (except for intentional causal narratives) across both cases, which suggests that this may be an ineffective narrative strategy over long-term projects. This might be because stakeholders change over decades, or deflecting blame on procedures can easily be refuted and used as fuel to increase the debate, or no one wants to take responsibility for bad consequences. Additionally, I expected that only anti-project stakeholders would use narratives of risk. However, I found that in the Cayman case, pro-project stakeholders used the language of risks to heighten the conflict. Pro-project stakeholders used the narrative that without the cruise berthing facility, the cruise industry would bypass the islands all together, placing the economy at risk. This suggests that using narratives on risks is a powerful persuasion tool to stakeholders that oppose or support major infrastructure projects. It can transcend the position held by the stakeholder, and be used by both sides.

Speaking about science with certainty transcended both sides of the environmental dispute for both cases, with each group attempting to assure the public that their narratives about science were accurate. Symbols were used more by pro-project stakeholders in the Miami case to

heighten the importance of the dredging project. In contrast, anti-project stakeholders in the Cayman case used symbols more to emphasize the pristine quality of the reefs but more significantly, the constitutional importance of the first people-initiated referendum in Caymanian history.

Overall, my findings indicate how different types of narratives are used by stakeholders to impact policy outcomes in environmental disputes over vulnerable ecosystems. In the Miami case, narratives influenced greater coral monitoring and relocation efforts and potentially the delay of another Floridian dredging project by five years. In the Cayman case, narratives were integral to the indefinite delay of the proposed cruise berthing facility. Furthermore, my additions to the Narrative Policy Framework of testing for the use and prevalence of *science* and *symbols* proved to be critical for these cases. Future research incorporating this refined theory can enhance our understanding on how to conserve vulnerable environments as vulnerable ecosystems, such as coral reefs, continue to face serious threats. My research can be applied beyond port infrastructure controversies. As the impacts of climate change increase and threats over vulnerable ecosystems are scrutinized, understanding narratives that stakeholders employ during environmental disputes will be an important skill for global environmental policy makers.

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Appendix A

Interview Manual Miami Respondents

1. What was your role during the Port of Miami Dredging Project that took place from 2013 to 2015?
2. What were/are the benefits of the dredging project?
3. Who is or will be benefiting from them?
4. What were/are the costs of the dredging project?
5. Who is or will be paying for them?
6. In Florida, there are established rules for protecting coral reefs. Did the port dredging project challenge this in any way?
7. How did your organization ensure that science was used to inform the project?
8. How did your organization use social or regular media to portray the project?
9. Did communicating about this project involve significant legal or financial efforts from your organization?

Cayman Islands Respondents

1. What was your role during the George Town Harbour Cruise Berthing Facility project that took place from 2013 to 2015?
2. What were/are the benefits of the dredging project?
3. Who is or will be benefiting from them?
4. What were/are the costs of the dredging project?
5. Who is or will be paying for them?
6. In the Cayman Islands, there are established rules for protecting coral reefs. Did the port dredging project challenge this in any way?
7. How did your organization ensure that science was used to inform the project?
8. How did your organization use social or regular media to portray the project?
9. Did communicating about this project involve significant legal or financial efforts from your organization?

Appendix B

Table B.1
Narrative elements used for data coding

Code	Definition
<i>Characters</i>	
Perceived Hero	Those who take action to fix the problem at hand
Perceived Villain	Those who create harm upon a victim or one who opposes the aims of the hero.
Perceived Victim	Those who are harmed by a particular action or inaction
<i>Strategies</i>	
<i>Scope of conflict</i>	
Benefits (diffused)	The message source expands and heightens the benefits of the port project
Benefits (concentrated)	The message source contracts and diminishes the benefits of the port project
Risks/ costs (diffused)	The message source expands and heightens the risk of the port project
Risks/ costs (concentrated)	The message source contracts and diminishes the costs of the port project
<i>Causal mechanisms:</i>	
Inadvertent cause	The message source associates unintended consequences by purposeful action
Mechanical cause	The message source associates intended consequences by unguided actions
Accidental cause	The message source associates unintended consequences by unguided actions

Intentional cause	The message source associates intended consequences by purposeful actions
<i>Devil-Angel Shift</i>	
Devil-shift	The message source inflates the “evil-ness” of an entity
Angel-shift	The message source inflates the “good-ness” of an entity
<i>Science and Symbols</i>	
Use of science	The message source uses science to define a problem, counter a problem definition, or justify a policy approach
Scientific uncertainty	The message source questions or disputes the science used by the opposition
Scientific certainty	The message source uses science to establish certainty in their argument
Use of symbols	The message source uses a symbol to represent something larger than itself