frontiers | Frontiers in Forests and Global Change

ORIGINAL RESEARCH
published: 04 May 2022
doi: 10.3389/ffgc.2022.818722

Tangled Roots and Murky Waters: Piecing Together Panama's Mangrove Policy Puzzle

Sarah Chamberland-Fontaine[1], Stanley Heckadon-Moreno[2] and Gordon M. Hickey[1]*

[1] Department of Natural Resource Sciences, Faculty of Agricultural and Environmental Sciences, McGill University, Montreal, QC, Canada, [2] Earl S. Tupper Center, Smithsonian Tropical Research Institute, Panama City, Panama

Mangrove forest policies are often characterized by their fragmented nature, as multiple sectors, disciplines, and institutional structures interact to affect mangrove conservation and management. This study analyzes mangrove forest policies in Panama, a country known for its rich mangrove coverage and, conversely, its high rates of mangrove loss, urban expansion, and coastal development. To complement the policy analysis, key informant interviews with national policy actors are used to gather insights on policy implementation challenges and potential multi-actor collaboration opportunities. Results suggest that despite the development of multiple policies targeting wetlands and conferring a high conservation status to mangroves in Panama, mangrove protection is challenged by competing governmental agendas and policy implementation gaps. Efforts to strengthen mangrove conservation and initiate participatory management processes were also found to conflict with institutional structures that struggle to include local communities and foster collective action.

Keywords: mangrove forest policy, sustainable mangrove management, Latin America, collaborative governance, policy analysis

OPEN ACCESS

Edited by:
Valerie Hagger, The University of Queensland, Australia

Reviewed by:
Mischa Turschwell, Griffith University, Australia
Daniel Suman, University of Miami, United States

****Correspondence:***
Sarah Chamberland-Fontaine
sarah.chamberland-fontaine@mail.mcgill.ca

Specialty section:
This article was submitted to Tropical Forests, a section of the journal Frontiers in Forests and Global Change

Received: *19 November 2021*
Accepted: *28 March 2022*
Published: *04 May 2022*

Citation:
Chamberland-Fontaine S, Heckadon-Moreno S and Hickey GM (2022) Tangled Roots and Murky Waters: Piecing Together Panama's Mangrove Policy Puzzle. Front. For. Glob. Change 5:818722. doi: 10.3389/ffgc.2022.818722

INTRODUCTION

As outlined by many global conservation reports, mangroves are one of Earth's most productive, resilient, and biodiverse ecosystems, but also one of the most poorly protected (Van Lavieren et al., 2012; Duke et al., 2014; Slobodian and Badoz, 2019). Mangroves are often a "blind spot" in environmental policy because they cross multiple boundaries, partly coastal habitats, forests, and tropical wetlands. Despite their unique ecology, few countries have passed a law specifically designed for mangroves (Spalding et al., 2010). Instead, many of the national legal regimes governing mangrove ecosystems are fragmented and complex (Slobodian and Badoz, 2019). For example, mangroves are often managed under legal frameworks intended for the environment, forests, water, wetlands, and fisheries, which can fall under many governmental jurisdictions and sectoral responsibilities (Rotich et al., 2016). Policy tools to protect mangroves can take multiple forms, such as direct protection of mangrove species, protected areas, logging permits, Environmental Impact Assessments, integrated land-use planning, and collaborative management approaches—including Indigenous-led management (Friess et al., 2016; Slobodian and Badoz, 2019). Although many policy tools exist, legal effectiveness and compliance with mangrove policies are often found to be deficient, leading to accelerated mangrove loss (Rotich et al., 2016).

As the Central American country with the largest area of mangrove cover, Panama is a compelling site to study mangrove management policies (Spalding et al., 2010). A large extent of Panama's mangroves are included in the National System of Protected Areas (approximately 70,000 hectares), but mangrove coverage continues to decline rapidly (Tarté, 2013). Panama has lost at least 13 percent of its mangrove cover between 1996 and 2008 due to its growing infrastructure sector, among other reasons (Dow, 2008; Tarté, 2013; López-Angarita et al., 2016). The greatest proportion of mangrove destruction in Panama has occurred around Panama City, where the space occupied by wetlands competes against numerous projects of urban expansion (Kaufmann and Miró, 2012). Mangroves' prized location on coastal lands with high economic value generates pressure on their conversion due to other land uses (e.g., aquaculture, commercial, industrial, residential, ports) (Spalding et al., 2010). Aside from habitat loss, mangroves in Panama also face degradation from nutrient runoff, water contamination, and extreme weather events (Lin and Dushoff, 2004; Defew et al., 2005; Tarté, 2013).

Previous reviews of Panama's coastal and mangrove management policies have found that coastal policies face several administrative and structural gaps (Osorio, 1994; Suman, 2002; Spalding et al., 2015). For example, since the 1990s, a major institutional reorganization has been occurring in Panama, leading to coastal management responsibilities becoming fragmented among many government agencies. Interagency coordination is deficient in Panama with no formal coordination mechanism and limited cohesive vision appearing in coastal contexts (Suman, 2002; Spalding et al., 2015). Existing policies have been found to aggravate insecure property rights on Panama's coasts, as local communities struggle to own land and to secure access to coastal resources and economic activities such as fisheries and tourism (Spalding et al., 2015). Building on this work, our study aims to understand the extent to which national policies and legal instruments foster sustainable mangrove management in Panama and how responsible authorities coordinate mangrove management. Sustainable mangrove management can be defined as the inclusive application of practices that "will help to achieve multiple objectives of management and utilization of [mangrove] products without any undesirable effect on the physical and social environment" (Datta et al., 2010, p. 468), requiring "effective and accountable governance and the safeguarding of the rights of forest-dependent peoples" (Blaser, 2016, p. 11).

MATERIALS AND METHODS

We employ a hybrid approach combining policy analysis and a thematic analysis of qualitative interviews, following the combined approach by Spalding et al. (2015). Our approach had a "strategic" orientation (Srivastava and Thomson, 2009), as we identified avenues for policy improvement and/or new strategies, especially at the stage of policy implementation. For the policy analysis, we reviewed all existing policies related to mangroves at the national level in Panama, excluding soft laws and municipal council decisions. Data for this review were obtained by scanning the scientific literature and soliciting legal documents from government offices. Further, many mangrove policies were obtained *via* searches in InfoJurídica, a Panamanian legal database comprising detailed expression of laws' impacts, validity, and unconstitutionality (Infojurídica, 2020).

To complement the information contained in policy documents, we conducted eight semi-structured interviews lasting approximately 45 minutes with key informants involved in mangrove policy and management in Panama, including scholars, policymakers, members of mangrove advisory bodies, and non-governmental organization (NGO) experts (see **Table 1**). These actors were purposively selected based on their involvement in national mangrove policymaking and their participation in mangrove management groups, such as the National Committee on Wetlands (Palinkas et al., 2015). Interviews allowed us to gather deeper insights to the stakeholder interactions supporting policy objectives, in addition to better understanding the application of existing mangrove-related policies. Interviews were conducted in Spanish and English in Panama between February and March 2020, and online through password-protected video-conferencing platforms in April 2020. Interview question guides are available as **Supplementary Material**. All field research protocols were reviewed and approved by the McGill University Research Ethics Board (REB File #: 19-11-046) prior to data collection. The project also received a local research permit from the Smithsonian Tropical Research Institute (STRI) (Protocol # HS20005).

Interviews were fully transcribed and analyzed in MaxQDA, a qualitative analysis software that enabled data to be classified (coded) into themes (Guest et al., 2011). Coding of recurring themes was performed manually following an inductive-deductive approach (Fereday and Muir-Cochrane, 2006). Deductive reasoning was used to build a coding matrix based on recurrent mangrove policy challenges identified by Friess et al. (2016) and by A. K. Spalding et al. (2015), yielding the following broad themes: conflicting policy objectives, overlapping jurisdictions, implementation of protected areas, collaborative governance, increased role of the private sector in management, and coastal property regimes. To identify any relevant additional themes, we complemented our analysis with inductive reasoning, where new themes and categories emerged directly from the data through careful examination and constant comparison of interview transcripts and policies (Memon et al., 2017).

Small sample size is a limitation of this study, however is considered adequate because of the study's design, the presence of key informants, and the scoping intent of interviews. According to the "information power model," our study's design is compatible with smaller samples sizes because the selection of participants is highly specific to the study's aim and the interview dialog is strong (Malterud et al., 2016). In addition, interviews were mainly used to identify and scope potential mangrove management issues to be assessed in-depth in subsequent studies. Content validity in this study was ensured by conducting a pre-test of the interview guide with non-participating stakeholders and by using peer-reviewed frameworks on mangrove management (Brod et al., 2009). In addition, we employed a triangulation strategy in our research

TABLE 1 | Overview of interviewed stakeholders.

Stakeholder group	Informant's organization	Organization's role	Distribution per stakeholder group
Government	Ministry of Environment (various divisions) ARAP	Develop policies on the management of mangrove forests, manage protected areas, and allocate funding to projects in mangrove forests (restoration, education, protection) Manage the impact of mangrove forests on artisanal fisheries, and payments for mangrove clearing	4
Scientists	Smithsonian Tropical Research Institute International Maritime University of Panama	Provide scientific insight on mangrove management and policy	2
Non-governmental organizations	Centro de Incidencia Ambiental de Panamá (CIAM) Sociedad Audubon de Panamá	Support environmental protection and conduct strategic litigation Support the protection of mangrove ecosystems through community engagement and government partnerships to support bird populations	2
TOTAL			8

protocol by combining different methods (semi-structured interviews, participant observation, and documentary analysis) and by encouraging the participation of stakeholders from diverse backgrounds (Baxter and Eyles, 1997).

RESULTS

The Legal Framework of Mangrove Protection in Panama and Its Recent Developments

Even though Panama does not possess a law specifically designed for mangroves, many laws are used to govern mangroves and tropical wetlands (see **Table 2** for a list and description of relevant laws and policies). At first glance, Panama's laws and policies appear to support the preservation and sustainable management of natural resources; the most striking example of this being the strong environmental protection language used in the 1972 Constitution. Within the General Law for the Environment (Asamblea Legislativa, 1998), which regulates the use of natural resources and promotes the pursuit of environmental preservation, mangroves are given a high conservation priority. In 1989, Panama engaged in further steps to protect mangroves and other wetlands by signing the Ramsar Convention on Wetlands of International Importance. The implementation of the Convention was supported by the creation of the National Committee on Wetlands in 2007 and the Política Nacional de Humedales in 2018 (National Wetlands Policy) (Ministerio de Ambiente and the United Nations Development Programme [PNUD], 2018). Yet these efforts have been undermined by weak compliance with mangrove protection standards, as highlighted by our interviews. For example:

> "*Panama is a country where there are enough, if not too many laws. There are laws for everything, for everyone. But the problem is, in my opinion, compliance with these laws. There are many, many laws, but they are not enforced. [. . .] Whether I am a businessman with a lot of money or a common citizen, I must develop a feeling that I must comply with the law because otherwise I will be punished by the authorities*" (Scientist).

Mangrove protection policies are overshadowed by the dominant mangrove policy created in 2008 by the Autoridad de los Recursos Acuáticos de Panamá (ARAP), Panama's Authority on Aquatic Resources. Through Environmental Impact Assessments (EIA), ARAP requires authorization for any activities affecting mangrove ecosystems (Autoridad de los Recursos Acuáticos de Panamá, 2008a). However, key informants reported that EIA is "a formality" that often leads to approval of development projects (tourism, industry, and ports) occurring in mangrove habitat, to the point where land conversion is cited as the main source of mangrove loss in Panama (Kaufmann and Miró, 2012; López-Angarita et al., 2016).

The evolution of ARAP policies related to mangrove logging and deforestation support this claim, revealing a discounting of mangrove benefits. Early ARAP resolutions (Autoridad de los Recursos Acuáticos de Panamá, 2008a) described mangrove clearing fees, where permit fees for commercial projects reached 150,000 balboas (at par with US$) per hectare, while illegal logging of mangroves was fined 300,000 balboas per hectare. In 2012, commercial permit fees were reduced to 10,000 balboas per hectare, and illegal logging fines were reduced to 40,000 balboas per hectare (Autoridad de los Recursos Acuáticos de Panamá, 2012). Reduced permit fees coincide with a suspension of the Panama Bay Wildlife Refuge, a protected site known for its rich biodiversity, migratory species, and importance for local fisheries (Romero Hernández, 2016). Suspension occurred for suspected reasons of urban expansion and "interest in facilitating mangrove conversion to commercial and residential developments" (Suman, 2014). Faced with the imminent threat of deforestation in Panama Bay, more than 50 NGOs and community groups from across the country joined and participated in advocacy work to reverse the ARAP's 2012 resolution (Romero Hernández, 2016). Protection status was reinstated in Panama Bay in 2015 (Asamblea Nacional, 2015a), despite illegal deforestation for luxury properties, golf courses, and shopping malls continuing to be reported in the protected area (Castellanos-Galindo et al., 2017). The Supreme Court of Panama reached analogous conclusions. Autoridad de los Recursos Acuáticos de Panamá's (2012) resolution was declared unconstitutional and was voided by the Supreme Court in 2016,

TABLE 2 | Summary of main national laws and policies on mangroves in panama since the 1941 constitution.

Law/Policy/Norm	Number and date of the norm	Institution	Key features	Current validity
Constitución Política de la República de Panamá	1941	Asamblea Nacional	• Before the 1941 Constitution, private property rights were recognized over coastal land, including mangroves. The Constitution declared that all coastal land was the property of the State.	A new Constitution was passed in 1972.
Constitución Política de la República de Panamá	1972	Asamblea Nacional	• The 1972 Constitution declared all coastal land and seas as public goods that are open to the public are free from privatization (article 258). The use of these public properties was granted *via* administrative concessions (Suman, 2002). • The State and all the inhabitants of the national territory must prevent pollution of the environment, maintain ecological balance, and avoid destroying ecosystems (Article 119). • The State guarantees that the use and exploitation of forests, lands, and waters are carried out rationally, to ensure their preservation, renewal, and permanence (article 120).	Amended in 1983, 1993, 1994, and 2004 without changing articles relating to mangroves.
Por la cual se aprueba la Convención Relativa a los Humedales de Importancia Internacional	Asamblea Legislativa, 1989	Asamblea Legislativa	• Panama approved the Ramsar Convention on Wetlands of International Importance and ratified it in 1992. Through the Convention, Panama commits to preserving the wetlands designated as Wetlands of International Importance: Bahía de Panamá, Golfo de Montijo, Damani-Guariviara, Punta Patiño, and San San Pond Sak. Many of these wetlands comprise mangrove forests. Panama also commits to improving the conservation and wise use of wetlands across time through collaboration with Ramsar offices.	Still in effect.
Por medio de la cual se dictan medidas para el uso y protección del manglar	Resolución J. D. 08-94	Instituto Nacional de Recursos Naturales Renovables (INRENARE)	• Mangroves are recognized as essential natural resources and their use becomes regulated. Logging by individuals is permitted, but a fee between 0.2 and 5 balboas is incurred. Logging for private purposes is also allowed, although an Environmental Impact Assessment and authorization are required first. Mangroves must be restored after logging.	Replaced by Autoridad de los Recursos Acuáticos de Panamá, 2008a (ARAP).
Ley General de Ambiente	Asamblea Legislativa, 1998	Asamblea Legislativa	• Mangroves are declared to have a high conservation priority because of their high biodiversity and productivity (article 95). • The Autoridad Nacional del Ambiente (ANAM) is created as the entity responsible for natural resources and the environment.	ANAM's responsibilities regarding mangroves are later transferred to ARAP.
Norma que crea la Autoridad de los Recursos Acuáticos de Panamá (ARAP)	Asamblea Legislativa, 2006	Asamblea Nacional	• ARAP is created and has the responsibility to manage coastal resources such as mangroves, in addition to establishing coastal management areas and ensuring compliance with the Ramsar Convention. ARAP also monitors water quality and all fisheries activities. • Mangroves are given a high conservation priority.	Management responsibilities over coastal resources are transferred to Ministerio de Ambiente in Law n° 8, 2015
Por la cual se establece el Comité Nacional de Humedales	Autoridad Nacional del Ambiente, 2007	Autoridad Nacional del Ambiente (ANAM)	• The National Committee on Wetlands is created as the inter-institutional organization bridging the Government and civil society to implement national wetland policies and support the Ramsar Convention. Its participating entities are enumerated, which include NGOs, universities, and governmental agencies.	Still in effect.
Que reconoce derechos posesorios y regula la titulación de tierras en zonas costeras e islas	Asamblea Nacional, 2009	Asamblea Nacional	• Land titling processes cannot include mangroves or protected areas. However, this law is not retroactive. This explains why there are currently private projects in mangroves (Tarté, 2013).	Still in effect.
Por medio del cual se establecen todas las Áreas de Humedales Marino-Costeros, particularmente los manglares de la República de Panamá, como zonas especiales de manejo marino-costero	Autoridad De Los Recursos Acuáticos De Panamá, 2008b	Autoridad de los Recursos Acuáticos de Panamá (ARAP)	• The responsibility to grant special permits for the sustainable use of the mangrove and collect fines in compensation for its damage is transferred to ARAP. • All mangrove areas are designated as marine-coastal management areas, where logging, use, commercialization, and deterioration are prohibited, with the exceptions of projects that receive approval according to other ARAP regulations.	Complemented by Autoridad de los Recursos Acuáticos de Panamá, 2008a (ARAP)

(Continued)

TABLE 2 | (Continued)

Law/Policy/Norm	Number and date of the norm	Institution	Key features	Current validity
Por la cual se aprueban algunas tasas y cobros por servicios que presta la Autoridad de los Recursos Acuáticos de Panamá	Autoridad de los Recursos Acuáticos de Panamá, 2008a	Autoridad de los Recursos Acuáticos de Panamá (ARAP)	• Permit fees for artisanal mangrove logging are established at 3 balboas per hectare per year. Commercial projects are subjected to fees of 150,000 balboas per hectare and illegal logging to a fine of 300,000 balboas per hectare.	Fines were reduced in Resolución J. D. 20, 2012.
Por la cual se modifica la Resolución J. D. n° 01 de 26 de Febrero de 2008, que aprobó algunas tasas y cobros por los servicios que presta la entidad	Autoridad de los Recursos Acuáticos de Panamá, 2012	Autoridad de los Recursos Acuáticos de Panamá (ARAP)	• Permit fees are reduced to 10,000 balboas per hectare, in addition to a requirement to reforest 2 hectares of mangroves per logged hectare. Fines for illegal logging are reduced to 40,000 balboas per hectare.	This resolution is declared void and illegal by the Supreme Court of Panama in 2016.
Que crea el Ministerio del Ambiente, modifica disposiciones de la Autoridad de los Recursos Acuáticos de Panamá	Asamblea Nacional, 2015b	Asamblea Nacional	• The Ministry of Environment is created, and all responsibilities for environmental protection, conservation, and management of coastal resources and transferred to this entity.	Still in effect.
Que establece la Política Nacional de Humedales del Estado en la República de Panamá	Ministerio de Ambiente, 2018	Ministerio de Ambiente (MiAmbiente)	• A new, more ambitious national wetlands policy is created. It is based on many principles: the precautionary principle, integrated ecosystem approach to wetland management, public participation, respect for cultural diversity, and adaptive management. This new approach aims to enhance the participation of civil society in wetland management and conserve wetlands to attain multiple Sustainable Development Goals. • The policy is enacted until 2050 and must be updated and evaluated every 5 years.	Still in effect.

citing that the resolution did not respect the State's will to guarantee a healthy environment and to avoid the destruction of ecosystems (Corte Surprema de Justicia, 2016).

While this Supreme Court decision points to an appreciation for the value of mangroves, mangrove policy frameworks in Panama remain nebulous. As raised by key informants involved in developing new coastal management policies, mangrove policies are confusing: "Two streams of regulations were kept moving forward, which today has brought us management problems deciding what standard should be applied" (participant from the Ministry of Environment). As shown in **Table 2**, regulations developed by different institutions are overlapping and remain in effect. For instance, ARAP no longer has policy jurisdiction over mangrove management, but some of their regulations are still applicable. Meanwhile, the Ministry of Environment developed recent policies (Asamblea Nacional, 2015b; Ministerio de Ambiente, 2018) with themes of sustainable use of mangrove resources by local communities, reduction of mangrove threats, and integrated management of wetlands, which competes with the other policy theme of commercial development on mangrove coasts. The internal contradictions in mangrove legal frameworks remain a major challenge in Panama. To resolve issues of inconsistent legal standards, the Ministry of Environment is developing an executive decree to unify current legislation on marine and coastal zones and to create appropriate rules that address the reality of mangrove loss and degradation (Ministerio de Ambiente, 2022). The proposed decree intends to create mangrove-specific protection measures and promote new standards of departmental coordination to effectively implement policies. However, special permits may be granted for projects related to tourism or broader public interest to be developed in mangrove forests upon approval of an Environmental Impact Assessment, which risks perpetuating existing patterns of mangrove clearing (Ministerio de Ambiente, 2022). Other measures include the creation of new mangrove restoration areas to counteract extensive habitat loss, and the implementation of Strategic Environmental Assessments to comprehensively analyze proposed projects in mangrove ecosystems. Fines for mangrove logging would return to the level described in ARAP's 2008 Resolution J. D. 1. The adoption of this decree, as well as its use in the context of development pressures remain to be seen.

Legislation relating to land tenure in mangrove forests also adds to the confusion. Legislation from the 1960s states that mangrove lands are public, except for mangroves already titled by private owners (Asamblea Nacional, 1962; Comisión Legislativa Permanente, 1964). The National Assembly passed a law in 2009 (Asamblea Nacional, 2009) permitting individuals who occupy land within the coastal zone to obtain a title from the government, although land titling processes cannot include mangroves or protected areas (Spalding et al., 2015). Due to the preemptive nature of this law, previously titled mangrove

land remains private property and can continue to be developed (Tarté, 2013). These mechanisms facilitate the sale of coastal land for investment and create imbalances where land sales will mostly benefit elites and disempower local communities (Spalding et al., 2015). Questions have been raised on the willingness of public institutions to implement sustainable mangrove management across all zones (Suman, 2002), with issues of unclear land titles and non-compliance with laws reported by our key informants:

"*The Constitution states that mangroves and all wetlands belong to the government and not to private owners, but this does not apply to all people. It is a little bit contradictory. All the people that have owned land before the Constitution in the 1970s are not subjected to these regulations for the protection of mangroves. [. . .] This is a big issue*" (Government official).

"*Panama has signed the [Ramsar] Convention on Wetlands and was supposed to protect wetlands, but we have a big issue with private mangrove ownership. [. . .] Every time we make a law to protect mangroves, it does not continue because of this*" (Scientist).

Sectoral Responsibilities, Management, and Coordination

Mangroves have been under the jurisdiction of several government agencies. A wide range of agencies have had mangrove management responsibilities or have developed mangrove-related legislation, such as the Instituto Nacional de Recursos Naturales Renovables (INRENARE), Autoridad Nacional del Ambiente (ANAM), Autoridad de los Recursos Acuáticos de Panamá (ARAP), and the Ministerio de Ambiente (MiAmbiente) (see **Table 2**). Shifting institutional structure has led to an "institutional maze," where a lack of institutional memory has created high levels of confusion for the government and the public.

The Ministry of Environment (MiAmbiente) holds the central coordinating role in mangrove protection and inter-institutional collaboration. It exercises this authority employing the EIA process in which it must approve development projects across all sectors. However, current legislation fails to mention coordination between MiAmbiente and ARAP, who oversees the fisheries aspect of mangrove management. Some informants mentioned that coordination and communication are successful throughout the divisions of MiAmbiente that share responsibilities over mangrove forests: Dirección Forestal (Forestry Division), Dirección de Áreas Protegigas y Biodiversidad (Biodiversity and Protected Areas Division), and Dirección de Costas y Mares (Coasts and Ocean Division). Yet informants working for MiAmbiente did not mention coordinating with ARAP employees, and ARAP informants reported distrust with MiAmbiente's communication of information, in that little was shared with their institution:

"*It is hard to know how far their responsibility as an institution reaches and how far mine as an institution reaches, precisely because of this issue with the fishermen [who depend on mangroves]. We are the governing authority on the subject of fishing. How is it possible that they do not tell me anything?*" (ARAP informant).

Moreover, many of the most central actors in mangrove management and policy in Panama focus on the Ramsar Convention on Wetlands of International Importance, ratified in 1992. Panama purposefully created two institutions to advance the agenda of this convention, such as Ramsar-CREHO in 2003 (the Regional Ramsar Centre for the Western Hemisphere), and the National Committee on Wetlands (created through Resolución AG-0038 in 2007). Through concerted actions of academics, NGO leaders, government policymakers, as well as international cooperation with other Ramsar offices, these advisory bodies have multiple mandates: to manage wetlands, provide technical support to the National Government on wetland science and inventories, implement the National Policy on Wetlands, and promote outreach programs related to wetlands (Autoridad Nacional del Ambiente, 2007). Despite these mandates, many barriers reportedly slow their fulfillment. First, participants from the National Committee on Wetlands and Ramsar-CREHO outlined unclear responsibilities to develop and propose new regulations specifically designed for mangrove forests. Due to their ties to the government and their position as an advisory board, stakeholders in the National Committee are not in a suitable position to propose new legislation in the National Assembly and, instead, rely on non-governmental organizations to perform that task. Second, an important barrier was the lack of long-term financing. The Ministry of Environment's Division of Coasts and Oceans that also has a central role in wetland advisory boards, was reported to have a deficient operations budget and a lack of technical personnel. Monitoring of coastal habitats and patrolling are crucial operations amidst trends of deforestation, but they are also costly. While international funding is provided for sporadic initiatives, such as the "blue carbon" project that quantifies ecosystem services performed by coastal ecosystems (Ministerio de Ambiente, 2020; Ministerio de Ambiente, 2021), funding for monitoring and enforcement is intermittent. This situation can create significant power imbalances when facing corporate stakeholders, who may have a competing interest in mangrove management. More attention to the potential for public-private partnership models may be useful.

Research participants also described a general reluctance among government agencies to protect wetlands and a lack of political interest in that theme, aside from those governmental stakeholders directly involved in wetland advisory bodies. Some informants related this to private business interests, which allegedly interfere with State decisions:

"*We are talking about mangroves and suddenly someone comes with machinery. It is the tragedy of the commons, in the sense that generally mangroves are common lands of the State and many times there are the private interests of someone in particular who uses their economic or political influence to influence decisions, degrade the mangrove, and derive gain from those wetlands*" (Non-governmental organization).

"*Every time you do something about wetland protection, there is somebody trying to stop it*" (Government official).

FIGURE 1 | Summary of policy barriers and pathways to foster sustainable mangrove management in Panama.

A summary of findings is presented in **Figure 1**.

DISCUSSION AND CONCLUSION

Unclear or Conflicting Policy Objectives and Antagonism With Private Sector Actors

Mangrove policies in Panama are characterized by their multiplicity and internal contradictions. Because of the variety of institutions that shaped policy, multiple "streams" of policy have been developed over time, even though they are not consistent with one another. Cross-sector links between policies also appear deficient (Suman, 2002). This "divergent evolution" of mangrove policies creates conflicting objectives and can eventually lead to implementation failures. According to policy implementation theory (Hudson et al., 2019), policy failure in Panama's mangroves has occurred in the first stage of policy implementation: policy design. Faulty policy design can stem from many causes: poor understanding of the problem; insufficient knowledge of the implementation context; unclear and even contradictory goals; and absence of political backing (Hudson et al., 2019). In Panama, many causes appear to be present. International NGOs and agencies, as well as many environmental scientists, have shifted their discourse in recent years, claiming that conservation and development goals need to converge (Ioris, 2014; Ministerio de Ambiente and the United Nations Development Programme [PNUD], 2018). Yet the discourse of wetlands as a conservation priority does not seem to appeal to elected officials, with economic development often prioritized over environmental conservation. While mangrove benefits in Panama are known and celebrated in key national policy documents (Kaufmann and Miró, 2012; Romero Hernández, 2016; Ministerio de Ambiente and the United Nations Development Programme [PNUD], 2018), shared understandings between stakeholders and by the public are lacking. Environmental conflicts opposing private sector actors and civil society are common in Panama's mangrove management context (Mejía, 2020) and are mirrored by conflicting directives from governmental agencies. The Panamanian government has evolved a regulatory system that fosters economic growth through foreign investment in coastal zones, at times at the expense of environmental preservation (Spalding, 2013; Thampy, 2014). Refusing to gain an advantage when economic opportunities arise can be viewed as "un-Panamanian," even when the alternative involves the protection of key ecosystems (Spalding, 2013; Thampy, 2014).

Numerous laws have been developed to address ecosystem preservation and establish a high conservation priority for mangroves, but they are not fully utilized. Examples of this include legal exceptions to mangrove protection for approved development projects, which effectively dominate the policy discourse. Furthermore, compliance with mangrove protection laws is challenging. Faced with the superior bargaining power of actors associated with coastal development, proposed development projects can be approved while established protected areas and international agreements, such as the Ramsar Convention, are ignored (Suman, 2014). This incapacity to deliver on commitments made under conventions, combined with the subsequent lack of trust in governmental institutions responsible for wetlands displayed by civil society, are signs of weak forest governance (Irland, 2008). Results from this study emphasize that mangrove mismanagement in Panama appears

closely connected with competing agendas within government and pro-development politics that conflict with conservation policies, as argued by other authors (Suman, 2014; Castellanos-Galindo et al., 2017). These factors, combined with inadequate human and financial resources, mean further stages of policy implementation in Panama (tracking, implementation support, evaluation, policy review) have not yet been attained and could be further examined (Hudson et al., 2019).

In a systematic literature review on sustainability policy failure, Howes et al. (2017) found that recurring causes of implementation failure include the preference for economic outcomes over environmental ones, concern with market failure, and the lack of market instruments to address environmental issues. These findings apply to the context of mangrove management in Panama. To move beyond the expected environmental versus development trade-off, several studies have highlighted opportunities for greater private sector engagement in mangrove management. Private sector participation could, for example, strengthen the idea that conservation and development are not necessarily antagonistic and can foster more cooperative relationships between stakeholders (Nickerson, 1999; Friess et al., 2016). Private-sector approaches to mangrove management include traditional unilateral donors, corporate social responsibility initiatives, and market-based ecosystem service instruments (Friess et al., 2016). Of particular interest to Panama is the payment for ecosystem services (PES) tool, which can "address overlapping or conflicting policy objectives by [. . .] allowing stakeholders from community to national levels to coalesce around a clear PES objective" (Friess et al., 2016, p. 941). Due to heavy investments in Central America for "blue carbon" projects that require ecosystem service quantification, Panama appears well placed to engage in PES with private sector actors (Ministerio de Ambiente, 2021). This approach could also help generate much-needed funds for mangrove restoration and conservation.

Alternatives to private sector engagement could focus on stricter legal frameworks, an approach favored by many mangrove-bearing countries (Slobodian and Badoz, 2019). Environmental law "slippage," whereby compliance with laws is deficient and regulators fail to act on transgressions (Farber, 1999), was observed in our study and other mangrove management studies in Panama (Suman, 2014; Castellanos-Galindo et al., 2017). Lessons may be offered by Costa Rica and Chile's examples, having established an Environmental Administrative Tribunal as a mechanism enforcing environmental regulations, imposing sanctions, and applying interim protection measures after legal transgressions of different stakeholders, including land-use change in urban areas (Slobodian and Badoz, 2019). Similar tribunals adjudicating for sustainable mangrove management cases are also present in Kenya and India (Slobodian and Badoz, 2019). Nevertheless, in contexts where the government is considered complicit with transgressions, stronger enforcement measures and focus on compliance may be misguided and ineffective. Greater emphasis could be put on devolving more power to multi-party institutions like the National Committee on Wetlands, who are already dedicated to aligning policies with international discourses on habitat conservation, ecosystem services, and nature-positive cities. By including new actors in this committee, such as community representatives, such institutions could be better positioned to promote a more sustainable—and participatory—approach to wetland management.

Collaborative Management

Policy implementation failure can also be related to a lack of continuous collaboration between the multiple stakeholders at the political, policymaking, managerial, and administrative levels, as well as the lack of engagement of end-users and local communities (Hudson et al., 2019). This connects with Panama's history of agency overlap, confusing institutional landscape, and multiple policy "streams" (Spalding et al., 2015). Mangroves have been governed by at least twenty laws and policies, overseen by six different institutions (Tarté, 2013). These complex governance environments are common in mangrove forests but are known to impede coherent policy formation and leave agencies with conflicting aims and responsibilities (Friess et al., 2016). Due to recent policy updates, Panama has established central coordinating agencies that oversee mangrove management: The Ministry of Environment, in addition to the Ministry of Housing and Land Use Planning (MIVIOT) who is responsible for municipal land use plans. However, coordination and regular communication beyond the Ministry's divisions and across agencies were still reported to be challenging. Collaborative management strategies could help to address some of the issues identified, while also opening forest management discussions to other stakeholders.

Most importantly, more attention may be devoted to the influence of multiple parties in mangrove management with an emphasis on identifying which actors are—and are not—participating (Safford, 2012). Multi-stakeholder partnerships could include actors within universities, NGOs, coastal communities, and the private sector. Industry and business sector organizations have substantial influence over mangrove management, as seen in the case of Panama Bay (Suman, 2014; Castellanos-Galindo et al., 2017), but they tend to be peripheral players in multi-party management efforts, such as the National Committee on Wetlands. Political lobbying combined with an absence from multi-party processes have possibly impeded collaboration on mangrove management (Safford, 2012). As argued by Safford (2012), wetland managers could better acknowledge the political nature of management activities and illustrate to politically engaged actors that multi-party planning does not undermine their interest. Yet, when reuniting actors with vast power asymmetries, collaborative and equitable outcomes can be hindered, especially since lasting antagonism between land developers and coastal communities has led to environmental conflicts in the past (Mejía, 2020). Bringing these groups together and applying conflict resolution and mediation techniques have the potential to diffuse tensions and build a foundation for greater consensus (Safford, 2012).

Currently, local communities are also peripheral actors in Panama's mangrove management. Mangrove-dependent communities are closely intermeshed with ecosystem-level outcomes for reasons of resource use and poverty alleviation. The inclusion of local communities is likely to be particularly

important to avoid restricting community use of mangroves (Dev Roy, 2012; DasGupta and Shaw, 2017; Félix and Hurtado, 2019), as well as to address underlying issues of illegal logging and poaching, which are often connected to unresolved property rights (Clarke et al., 1993; Amacher, 2009). The needs of local communities in Panama's coastal management have been given scarce policy attention, as shown by evidence of unfair property rights and access to coastal zones (Spalding et al., 2015), deforestation of habitats that support artisanal fisheries (Suman, 2014), and absent community representation in management boards such as the National Committee on Wetlands. Collaborative management has the potential to reorient conversations about mangroves back to its primary users amidst trends of privatization of coastal land (Spalding et al., 2015). Recent policy developments such as the National Policy on Wetlands identify objectives of integrated coastal zone management (ICZM) and participatory approaches, yet mechanisms to devolve power to communities and move beyond consultation are unspecified (Ministerio de Ambiente and the United Nations Development Programme [PNUD], 2018). To ensure participation is effective and inclusive, participatory management in mangroves requires rigorous incentive design (DasGupta and Shaw, 2017). This is especially relevant due to historical inclinations of "top-down" forest management, strict control, and patrol of forests, which may create path-dependency and strong inertia toward institutional change. Without clearer roles for local communities in existing institutions, Panama risks further antagonizing its mangrove users.

Further research on the strategies of fisher groups, local resource users, and NGOs when facing power imbalances with private sector actors who interact frequently with natural resource management professionals and apply coercive pressure would be beneficial. In multi-actor management boards such as the National Committee on Wetlands, research to clarify the relationships between all participating actors, level of internal consensus, effective coordination strategies, shared recognition for the utility of collaborative inputs, consistent participation, and power differentials would also be valuable. Contemporary insights to these collaborative processes could help to clarify avenues for a more sustainable approaches to mangrove management, whereby multi-actor committees and civil society play a more active role.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by McGill University Research Ethics Board (REB File #: 19-11-046). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SC-F: conceptualization, data curation, formal analysis, investigation, methodology, project administration, and roles/writing—original draft. GH: conceptualization, methodology, project administration, resources, supervision, writing—review, and editing. SH-M: conceptualization, supervision, and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This research was carried out with the financial support of McGill University through the Natural Resource Sciences Department and the Neotropical Option program, as well as the Smithsonian Tropical Research Institute. The Social Sciences and Humanities Research Council of Canada (SSHRC), the Fonds de Recherche du Québec-Société et Culture (FRQSC), and the William Dawson Scholar Award, McGill University also funded this research. A special thanks to Owen McMillan from the Smithsonian Tropical Research Institute for his generous support of this research project and funding of a research assistant position.

ACKNOWLEDGMENTS

We would like to thank the Smithsonian Tropical Research Institute for their logistical support during fieldwork around Panama. We would like to thank you to our research assistant, Gabriel Thomas Estrada, for his precious help and insight during data collection. We are also grateful for the participation of all participants in the study for their time and effort.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/ffgc.2022.818722/full#supplementary-material

REFERENCES

Amacher, G. S., Koskela, E., and Ollikainen, M. (2009). Deforestation and land use under insecure property rights. *Env. Dev. Econ.* 2009, 281–303. doi: 10.1017/s1355770x0800483x

Asamblea Legislativa (1989). *Por La Cual Se Aprueba La Convención Relativa A Los Humedales De Importancia Internacional, Especialmente Como Hábitat De Aves Acuáticas (Convención De Ramsar) Y El Protocolo Con Vistas A Modificarlas, Ley 6, Gaceta Oficial Digital 21,211*. Panamá: Asamblea Legislativa.

Asamblea Legislativa (2006). *Que Crea La Autoridad De Los Recursos Acuáticos De Panamá, Unifica Las Distintas Competencias Sobre Los Recursos Marino-Costeros, La Acuicultura, La Pesca Y Las Actividades Conexas De La Administración Publica Y Dicta Otras Disposiciones, Ley 44, Gaceta Oficial Digital 25,680*. Panamá: Asamblea Legislativa.

Asamblea Legislativa (1998). *General de Ambiente de la Republica de Panama, Ley 41, Gaceta Oficial Digital No 23578.* Panamá: Asamblea Legislativa.

Asamblea Nacional (1962). *Por La Cual Se Aprueba El Codigo Agrario De La Republica, Ley 37, Gaceta Oficial Digital 14.726.* Panamá: Asamblea Nacional.

Asamblea Nacional (2009). *Que Reconoce Derechos Posesorios Y Regula La Titulacion En Las Zonas Costeras Y El Territorio Insular Con El Fin De Garantizar Su Aprovechamiento Optimo Y Dicta Otras Disposiciones, Ley 80, Asamblea Nacional. Gaceta Oficial Digital N° 26438-B*. Panamá: Asamblea Nacional.

Asamblea Nacional (2015a). *Que Declara Area Protegida Al Refugio De Vida Silvestre Sitio Ramsar Humedal Bahía De Panamá, Ley 1. Gaceta Oficial Digital N° 27717*. Panamá: Asamblea Nacional.

Asamblea Nacional (2015b). *Que Crea El Ministerio De Ambiente, Modifica Disposiciones De La Autoridad De Los Recursos Acuáticos De Panamá Y Dicta Otras Disposiciones, Ley 8, Gaceta Oficial Digital N° 27749-B*. Panamá: Asamblea Nacional.

Autoridad de los Recursos Acuáticos de Panamá (2008a). *Por La Cual Se Aprueban Algunas Tasas Y Cobros Por Servicios Que Presta La Autoridad De Los Recursos Acuaticos De Panama, Resolución J.D. 1, Gaceta Oficial Digital N° 26023*. Panamá: Autoridad de los Recursos Acuáticos de Panamá.

Autoridad De Los Recursos Acuáticos De Panamá (2008b). *Por Medio Del Cual Se Establecen Todas Las Áreas De Humedales Marino-Costeros, Particularmente Los Manglares De La Republica De Panamá Como Zonas Especiales De Manejo Marino-Costero Y Se Dictan Otras Medidas, Resuelto 1, Gaceta Oficial Digital 25988*. Panamá: Autoridad De Los Recursos Acuáticos De Panamá.

Autoridad de los Recursos Acuáticos de Panamá (2012). *Por La Cual Se Modifica La Resolución J.D. N° 01 De 26 De Febrero De 2008, Que Aprobo Algunas Tasas Y Cobros Por Los Servicios Que Presta La Entidad, Resolución J.D. 20 Gaceta Oficial Digital N° 27045*. Panamá: Autoridad de los Recursos Acuáticos de Panamá.

Autoridad Nacional del Ambiente (2007). *Por El Cual Se Establece El Comite Nacional De Humedales, Resolución AG-0038-2007 Gaceta Oficial Digital N° 25747*. Panamá: Autoridad Nacional del Ambiente.

Baxter, J., and Eyles, J. (1997). Evaluating qualitative research in social geography: establishing 'rigour' in interview analysis. *Trans. Inst. Br. Geogr.* 22, 505–525.

Blaser, J. (2016). *Criteria and indicators for the sustainable management of tropical forests. ITTO Policy Development Series No. 21. International Tropical Timber Organization*. Minato: Yokohama.

Brod, M., Tesler, L. E., and Christensen, T. L. (2009). Qualitative research and content validity: developing best practices based on science and experience. *Q. Life Res.* 18, 1263–1278. doi: 10.1007/s11136-009-9540-9

Castellanos-Galindo, G. A., Kluger, L. C., and Tompkins, P. (2017). Panama's impotent mangrove laws. *Science* 355, 918–919. doi: 10.1126/science.aam6909

Clarke, H. R., Reed, W. J., and Shrestha, R. M. (1993). Optimal enforcement of property rights on developing country forests subject to illegal logging. *Resour. Energ. Econ.* 15, 271–293. doi: 10.1016/0928-7655(93)90009-j

Comisión Legislativa Permanente (1964). *Por El Cual Se Restablece La Vigencia De Varios Artículos Del Código Fiscal Y Se Modifican Algunos De Ellos, Decreto Ley 12, Gaceta Oficial Digital 15.068.* Panamá: Comisión Legislativa Permanente.

Corte Surprema de Justicia (2016). *Por El Cual Se Declara Que Es Nula Por Ilegal La Resolución J.D. No. 020 De 23 De Mayo De 2012, Dictada Por La Junta Directiva De La Autoridad De Los Recursos Acuáticos De Panamá, Fallo N° S/N, Corte Surprema de Justicia. Gaceta Oficial Digital N° 28048*. Panamá: Corte Surprema de Justicia.

DasGupta, R., and Shaw, R. (2017). Perceptive insight into incentive design and sustainability of participatory mangrove management: a case study from the Indian Sundarbans. *J. Forest. Res.* 28, 815–829. doi: 10.1007/s11676-016-0355-6

Datta, D., Guha, P., and Chattopadhyay, R. N. (2010). Application of criteria and indicators in community based sustainable mangrove management in the Sunderbans, India. *Ocean Coast. Manag.* 53, 468–477. doi: 10.1016/j.ocecoaman.2010.06.007

Defew, L. H., Mair, J. M., and Guzman, H. M. (2005). An assessment of metal contamination in mangrove sediments and leaves from Punta Mala Bay, Pacific Panama. *Mar. Pollut. Bull.* 50, 547–552. doi: 10.1016/j.marpolbul.2004.11.047

Dev Roy. (2012). Participatory forest management for the sustainable management of the Sundarbans mangrove forest. *Am. J. Env. Sci.* 8, 549–555. doi: 10.1186/s40064-016-2816-y

Dow, E. J. (2008). *The Effect of Land Use/Land Cover on Mangrove Forest in the Northeastern Panama*. Berkeley, CA: University of California.

Duke, N., Nagelkerken, I., Agardy, T., Wells, S., and Van Lavieren, H. (2014). *The importance of mangroves to people: A call to action*. Cambridge, MA: United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC).

Farber, D. A. (1999). Taking slippage seriously: noncompliance and creative compliance in environmental law. *Harv. Env. Law Rev.* 23:297.

Félix, F., and Hurtado, M. (2019). "Participative Management and Local Institutional Strengthening: The Successful Case of Mangrove Social-ecological Systems in Ecuador," in *Social-ecological Systems of Latin America: Complexities and Challenges*, eds L. E. Delgado and V. H. Marín (New York, NY: Springer International Publishing), 261–281. doi: 10.1007/978-3-030-28452-7_15

Fereday, J., and Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development. *Internat. J. Qual. Methods* 5, 80–92. doi: 10.1177/160940690600500107

Friess, D. A., Thompson, B. S., Brown, B., Amir, A. A., Cameron, C., Koldewey, H. J., et al. (2016). Policy challenges and approaches for the conservation of mangrove forests in Southeast Asia. *Conserv. Biol.* 30, 933–949. doi: 10.1111/cobi.12784

Guest, G., MacQueen, K. M., and Namey, E. E. (2011). *Applied thematic analysis*. Thousand Oaks: Sage publications.

Howes, M., Wortley, L., Potts, R., Dedekorkut-Howes, A., Serrao-Neumann, S., Davidson, J., et al. (2017). Environmental sustainability: a case of policy implementation failure? *Sustainability* 9:165.

Hudson, B., Hunter, D., and Peckham, S. (2019). Policy failure and the policy-implementation gap: Can policy support programs help? *Policy Des. Pract.* 2, 1–14. doi: 10.1080/25741292.2018.1540378

Infojurídica (2020). *[Legal Database]. Infojurídica, Procuraduría de La Administración*. Available online at: http://infojuridica.procuraduria-admon.gob.pa/index (accessed date 29 March 2022)

Ioris, A. A. R. (2014). Environmental Governance at the Core of Statecraft: unresolved Questions and Inbuilt Tensions: theory and Ideology of Environmental Governance. *Geograp. Comp.* 8, 641–652. doi: 10.1111/gec3.12155

Irland, L. C. (2008). State Failure, Corruption, and Warfare: challenges for Forest Policy. *J. Sust. Forest.* 27, 189–223. doi: 10.1080/10549810802219963

Kaufmann, K. W., and Miró, R. (2012). *Nuestros humedales-nuestro futuro: Plan de conservación para los humedales de la Bahía de Panamá* (Sociedad Audubon de Panamá).

Lin, B. B., and Dushoff, J. (2004). Mangrove filtration of anthropogenic nutrients in the Rio Coco Solo, Panama. *Manag. Environ. Qual. Inter. J.* 15, 131–142. doi: 10.1108/14777830410523071

López-Angarita, J., Roberts, C. M., Tilley, A., Hawkins, J. P., and Cooke, R. G. (2016). Mangroves and people: lessons from a history of use and abuse in four Latin American countries. *Forest Ecol. Manag.* 368, 151–162. doi: 10.1016/j.foreco.2016.03.020

Malterud, K., Siersma, V. D., and Guassora, A. D. (2016). Sample size in qualitative interview studies: guided by information power. *Q. Health Res.* 26, 1753–1760. doi: 10.1177/1049732315617444

Mejía, M. (2020). *Caso de Los Residentes de Juan Díaz en Bahía de Panamá [Conference Presentation]*. Panama: CREHO Centro Regional Ramsar.

Memon, S., Umrani, S., and Pathan, H. (2017). Application of constant comparison method in social sciences: a useful technique to analyze interviews. *Grassroots* 51, 152–165.

Ministerio de Ambiente (2020). *Panamá, promueve una agenda azul en la COP25*. Available online at: https://www.miambiente.gob.pa/panama-promueve-una-agenda-azul-en-la-cop25/?print=print (accessed March 29, 2022).

Ministerio de Ambiente (2022). *Decreto de Manglares*. Available online at: https://www.miambiente.gob.pa/download/decreto-de-manglares/ (accessed March 29, 2022).

Ministerio de Ambiente (2018). *Que Establece La Política Nacional De Humedales Del Estado En La República De Panamá, Decreto Ejecutivo 127, Ministerio de Ambiente. Gaceta Oficial Digital N° 28679*.

Ministerio de Ambiente (2021). *Que Establece De Forma Progresiva Y Gradual El Mercado Nacional De Carbono De Panamá (MNCP), Decreto Ejecutivo 142,*

Ministerio de Ambiente. Gaceta Oficial Digital N° 29430. Panama: Ministerio de Ambiente.

Ministerio de Ambiente, and the United Nations Development Programme [PNUD] (2018). *Politica Nacional de Humedales y Plan de Acción de Panamá*. New York, NY: Ministerio de Ambiente.

Nickerson, D. J. (1999). Trade-offs of mangrove area development in the Philippines. *Ecological Economics* 28, 279–298. doi: 10.1016/s0921-8009(98)00044-5

Osorio, O. O. (1994). *Situación de los manglares de Panamá. In El Ecosistema De Manglar En America Latina Y La Cuenca Del Caribe: Su Manejo Y Conservación*. Rosenstiel School of Marine and Atmospheric Science. Miami, FL: Universidad de Miami.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., and Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administ. Policy Ment. Health Ment. Health Serv. Res.* 42, 533–544. doi: 10.1007/s10488-013-0528-y

Romero Hernández, L. G. (2016). *Plan de sitio para los humedales de la Bahía de Panamá: Implementación del Plan Nacional de Educación, Comunicación, Concienciación y Participación del Público (CECOP) para los humedales de Panamá.* Sociedad Audubon de Panamá/Fundación Natura/Fideicomiso Ecológico de Panamá.

Rotich, B., Mwangi, E., and Lawry, S. (2016). "Where land meets the sea: A global review of the governance and tenure dimensions of coastal mangrove forests," in *Center for International Forestry Research and United States Agency for International Development Tenure and Global Climate Change Program, Bogor*, (Washington, DC).

Safford, T. (2012). Organizational complexity and stakeholder engagement in the management of the Pantanal wetland. *Trop. Wetl. Manag.* 2012, 173–198.

Slobodian, E. L., and Badoz, L. (2019). *Tangled roots and changing tides: Mangrove governance for conservation and sustainable use. World Wildlife Fund Germany*. Berlin: Germany and International Union for Conservation of Nature, 296.

Spalding, A. K. (2013). Environmental outcomes of lifestyle migration: land cover change and land use transitions in the Bocas del Toro Archipelago in Panama. *J. Latin Am. Geograph.* 2013, 179–202. doi: 10.1353/lag.2013.0038

Spalding, A. K., Suman, D. O., and Mellado, M. E. (2015). Navigating the evolution of marine policy in Panama: current policies and community responses in the Pearl Islands and Bocas del Toro Archipelagos of Panama. *Mar. Policy* 62, 161–168. doi: 10.1016/j.marpol.2015.09.020

Spalding, M., Kainuma, M., and Collins, L. (2010). *World Atlas of Mangroves*. London: Earthscan.

Srivastava, A., and Thomson, S. B. (2009). Framework analysis: a qualitative methodology for applied policy research. *J. Adm. Gov.* 4, 72–79.

Suman, D. (2002). Panama revisited: Evolution of coastal management policy. *Ocean Coast. Manag.* 45, 91–120. doi: 10.1016/s0964-5691(02)00050-9

Suman, D. (2014). Panama Bay Wetlands: case Study of a Threatened Ecosystem. *Water Resour. Wetl.* 2014, 366–371.

Tarté, A. (2013). *Manglares de Panamá- Importancia, Mejores Prácticas y Regulaciones Vigentes* [Report]. Panamá: Autoridad Nacional del Ambiente y Autoridad de los Recursos Acuáticos de Panamá.

Thampy, G. (2014). Loci of greed in a Caribbean paradise: Land conflicts in Bocas del Toro. *Panama Econ. Anthropol.* 1, 139–153.

Van Lavieren, H., Spalding, M., Alongi, D. M., Kainuma, M., Clüsener-Godt, M., and Adeel, Z. (2012). *Securing the Future of Mangroves*. Hamilton, ON: United Nations University, Institute for Water, Environment and Health.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.