Strengthening Fisheries Management with Data Tools and Technology: Report on a Caribbean-wide Virtual Event

Environmental Law Institute

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Acknowledgements

About the Environmental Law Institute's Ocean Program

ELI's Ocean Program supports healthy oceans through collaborations with communities, scientists, policymakers, government representatives, and other stakeholders. The Ocean Program is a research center that works in countries around the world on legal and policy frameworks, and their implementation. We particularly focus on sustainable fishing, marine protected areas, marine spatial planning, and coastal resilience and restoration. Our team regularly convenes and facilitates seminars, working groups, panels, and meetings. We support effective and sustainable solutions based on transparent and inclusive processes, local priorities, and best available information.

Report on a Caribbean-wide Virtual Event. A PDF file of this report may be obtained for no cost from the Environmental Law Institute website at www.eli.org. Please contact oconnor@eli.org for more information.

Cover image: Fishing boats, Villa Pesquera, Humacao (Angel Xavier Viera-Vargas).

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I. Event Overview

On March 27, 2024, ELI hosted a virtual event on *Strengthening Fisheries Management Through the Use of Data and Data Tools: Experiences in the Caribbean Region*. This event focused on the role new technology can play in strengthening fisheries management. For example, technology can help collect and analyze information about catch, effort, and biological data used for stock assessments. There are tools that track vessel movement, analyze their behavior, and identify potential illegal, unreported, and unregulated (IUU) fishing activities. New tools can also help improve ecosystem health, support the small-scale fishing sector, promote transparency and marketing of harvested resources, and meet other needs related to fisheries management.

This region-wide event brought together stakeholders from over 15 countries to discuss the importance of data, data tools, and technology used for fisheries management in the Caribbean. During the event, country representatives and local practitioners helped lead a peer-to-peer exchange of ideas on common issues and potential solutions, explaining how certain tools and technologies work. This Report contains a summary of the information presented at the event, including common challenges identified in the region, possible solutions, and key takeaways from each presentation. A summary of the audience discussion and a list of relevant resources conclude the Report.

You can view the full recording of the event here: https://www.eli.org/events/strengthening-fisheries-management-through-use-data-and-data-tools-experiences-caribbean.

II. Common Challenges

A. Data Issues

Reliable data is key to successful fisheries management. The general lack of data to inform fisheries management decisions in the Caribbean region was widely acknowledged. Panelists noted various types of data gaps, including data related to catch, fishing effort, biological data, impacts of climate change, data about nursery and spawning areas, and socioeconomic data. Lack of data can lead to decision-making that is not adequately informed. Caribbean countries also have regional obligations to collect, analyze, and share their data.

Countries in the Caribbean region often rely on traditional methods of data collection, which can require significant time and resources. Data may be recorded on paper, and not in a consistent, standardized, or centralized manner. Unfortunately, this can result in data gaps, making it difficult to manage fisheries. To make collection, management, and analysis of data easier, countries are starting to incorporate various new data tools and technologies into their fisheries management processes. Some speakers noted that the use of new technologies in combination with some traditional methods might be particularly useful.

B. Limited Capacity and Resources

Fisheries departments in the Caribbean region and around the world have limited capacity, resources, and finances, making it difficult to adequately manage fisheries. Collection and analysis of data, and subsequent incorporation of that data into decision-making processes, require significant time and effort.

Underscoring the data deficiencies in the region, some speakers noted that Caribbean countries often do not have sufficient resources to collect the data or conduct stock assessments, and often lack technical capacity to analyze the data. They noted that new data tools and technologies can help overcome these challenges, saving time and resources, and streamlining processes. Some panelists also noted that countries need to increase their enforcement capacity, and some countries have started relying on new technologies to strengthen monitoring and enforcement.

C. IUU Fishing and Overfishing

Panelists discussed the increasing challenges posed by IUU fishing and overfishing. These problems represent significant threats to the marine environment, fisheries sectors in the region, and countries' economies. For example, TNC estimates that if catches from IUU fishing were landed legally, it could increase The Bahamas' annual GDP by over $65M. Furthermore, IUU fishing and overfishing present serious challenges to conservation efforts aimed at protecting endangered and threatened species.

D. Environmental Threats

Environmental threats, such as climate change and invasive species, are increasingly disrupting fisheries management. As the waters warm, movement patterns of fish populations may change, certain populations may decline, and natural disasters may become more common. Without more advanced data tools and technology to understand and adapt to this rapidly changing environment, these environmental threats may exert further pressure on fisheries in the Caribbean.

III.   Possible Solutions

In addition to acknowledging challenges related to data, capacity and resources, IUU fishing and overfishing, and environmental threats, speakers proposed various approaches to address these issues.

A. A Centralized and Standardized Data Collection and Analysis System

Speakers offered several ideas for improving data collection and analysis in the region. First, data collection processes could be improved through standardization. For example, a fisheries

division could institute a uniform process for data collection, as well as standardized metrics. Second, countries in the region would benefit from centralized systems for data input and analysis. Panelists discussed benefits of both a centralized data system used for domestic fisheries management and a regional system to facilitate coordination among Caribbean nations.

Throughout the various levels of data collection, input, and analysis, speakers noted the importance that data systems are:

➢ not overly burdensome for those involved in the processes (fisherfolk, data collectors, fisheries managers, etc.);
➢ accessible and inclusive, so that a wider range of groups can participate in the process, as well as view and use the resulting data; and
➢ integrated into decision-making processes.

As discussed during the event, CRFM is currently developing the Fisheries Manager tool, which can be used at the national and regional levels. This tool can serve as a centralized, standardized, and comprehensive data management and analysis system for fisheries management. St. Lucia, St. Kitts and Nevis, and Jamaica are piloting this tool at the national level, and CRFM is starting to pilot this tool at the regional level. In addition to streamlining data input, analysis, and reporting, the tool would act as an accessible database for statistics, as well as a hub for various sustainable fisheries management tools.

As mentioned during the discussion, FAO also offers the Calipseo tool, which helps countries manage their fisheries data. This tool strengthens countries' capacity to integrate diverse data sources and produce fisheries statistics, assisting with decision-making and reporting.

B. Technology Integration to Enhance Data Collection, Visualization, and Analysis

While speakers recognized the upfront costs of technology integration, they maintained that it is an essential component of improving fisheries management in the long run. Integrating technology into various aspects of the data collection and analysis process can significantly improve the ability of fisheries managers to use data and make data-informed decisions.

For example, the DigiFish Initiative in Barbados promotes "the use of digital technologies and innovative data analytical methods" to support the ecosystem approach to fisheries management. Currently, the country is digitalizing its data collection processes through digital forms, data management software, and smart tablets for data collectors. Furthermore, they have begun to install cellular and satellite vessel monitoring systems on small-scale and long-line vessels to monitor and analyze vessel behavior. The data from these devices will lead to new capabilities and insights. For instance, the Barbados Fisheries Division will be able to map

catch-per-unit effort, or the relative efficiencies of fishing in different areas of the sea. In addition, Barbados is piloting the use of smart scales, which will help promote traceability and integrate more sophisticated catch data into data analysis and decision-making. Speakers and participants also discussed the need for various data tools and technologies to be compatible with each other, helping to accomplish various goals.

C. Innovative Data Tools to Meet Specific Needs in Fisheries Management

Innovative data tools can play a significant role in strengthening fisheries management. There are a variety of tools available – many of them free of charge – designed to meet specific needs of fisheries managers. Broadly speaking, there are: tools that help collect and record data; tools that help store, organize, manage, and analyze data; and tools that provide additional external data (some also allow to integrate your own data with external data). Furthermore, some tools provide additional benefits, such as alerts and improved traceability and marketability of catch.

Some of the data tools that help collect fisheries data include mobile apps and vessel monitoring systems. Mobile apps can help record catch data – which is often lacking in the Caribbean countries – in a quick, standardized manner, with data integrated into one location for analysis. Mobile apps make it easy for fishers to participate in the collection and reporting of their catch data. In addition, some apps provide incentives for fisher participation by, for example, helping fishers improve marketability of their catch. A mobile app called OurFish, discussed during the event, is one such example, as it helps collect catch data, conduct transactions between fishers and fish buyers, and manage related financial data.

Vessel monitoring systems can help collect data related to fishing effort, which represents another common data gap in the region. These systems can also improve monitoring and enforcement by identifying which vessels fish within allowed zones and which do not. During the event, participants discussed Pelagic Data Systems and Remora vessel monitoring systems.

Data analysis tools help analyze collected data and inform decisions. Data analysis is a critical, but often expensive and labor-intensive step in fisheries management. Data tools make it easier and cost-effective to analyze fisheries data. Data analysis tools can identify potential management approaches based on the existing data and can also identify additional types of data needed to improve decision-making. During the event, participants discussed the following data analysis tools: the Fisheries Management Assessment Tool (FishMAT), FishPath, and CRFM's Fisheries Manager. Information about FAO's Calipseo tool was also provided during the discussion.

There are also tools that provide additional external data, including satellite and other data about vessels located within countries' ocean waters. These tools can provide information about vessels themselves (including vessels' identification and historical data), as well as

information about vessels activities, including when vessels engage in fishing and suspicious behavior. Such tools are particularly useful to help governments and fisheries managers spot and combat IUU fishing. Often, countries' resources are limited to identify and track all the vessels within their waters, and patrols on the water are expensive. These new data tools help countries identify potential violators and prioritize when and how to spend their limited resources. During the event, speakers discussed Skylight and Global Fishing Watch's Marine Manager Tool.

D. Increased Research to Fill Gaps and Strengthen the Science-Policy Link

In response to the lack of data in certain areas, some speakers suggested investing in research to fill these gaps. As mentioned before, at least in some countries, these under-researched areas include mapping critical nursery and spawning areas, artisanal fisheries, and socioeconomic drivers. It is also important to better understand connections between different species and ecosystems, the effects of climate change on fisheries, and the nature and severity of IUU fishing and overfishing. To maximize the value of this research, it should be used to inform and update fisheries science-based regulations.

E. Community Engagement

During the event, speakers emphasized the importance of engaging community members in fisheries management. By engaging community members, fisheries managers strengthen the capacity for compliance and enforcement. For example, a workshop can help community members understand rationale behind management decisions, as well as connections between various issues. Outreach to community members can also help increase community awareness about the importance of data collection and analysis. This better understanding may increase community members' compliance, their support for fisheries regulations, and their engagement in the implementation.

Speakers mentioned several data tools that help community members participate in the collection and use of fisheries data. By helping collect data, fishers can help address important data gaps, including those related to catch and fishing effort. Certain technologies also help fishers use collected data for other purposes, including marketing of their catch.

IV.   Main Takeaways from Each Presentation

A. Regional Needs, Challenges, and the Fisheries Manager Tool in the CRFM Region *by* June Masters, *Statistics & Information Analyst*, Caribbean Regional Fisheries Mechanism

June Masters first provided an overview of the CRFM, an inter-governmental organization consisting of 17 member states that works on fisheries issues in the Caribbean region. Ms. Masters discussed fisheries management needs in the region and several data tools used. She

particularly focused on CRFM's efforts to improve data collection and analysis processes through the CARICE project, a collaborative effort with Iceland. The project aims to create the Fisheries Manager tool: a centralized, standardized, digital database that simplifies the data submission process and provides data-driven insights to facilitate effective fisheries management. Currently, CRFM is piloting the tool regionally and in three countries: St. Lucia, St. Kitts and Nevis, and Jamaica.

B. Importance of Reliable Data and Relevant Tools for Fishery Management *by* Dr. Krista Sherman, *Senior Scientist, Fishery Research and Conservation*, Perry Institute for Marine Science

Dr. Krista Sherman emphasized that fisheries are an intricate part of cultural heritage in the region. In addition to providing food security and nutrition, they help sustain thousands of livelihoods. However, the region's fisheries face increasing threats from overfishing, IUU fishing, climate change, invasive species, diseases, and natural disasters. Based on Dr. Sherman's research papers on understanding fish populations and fisheries management challenges, as well as her work leading the fisheries research & conservation program at the Perry Institute for Marine Science, Dr. Sherman discussed challenges, research gaps, and tools used for fisheries management. Dr. Sherman focused on the existing research and data gaps in the commercial, recreational, and artisanal fisheries sectors in The Bahamas.

Dr. Sherman's presentation concluded with various recommendations to strengthen fisheries management, including: creating adaptable science-based regulations to improve the link between science and management; improving compliance and enforcement; using data tools and improving data management; adopting ecosystem-based and precautionary management approaches for data deficient species; and using fair, equitable, and transparent governance processes.

C. FishPath: Sustainable Fisheries in The Bahamas *by* Natalie Miaoulis-Maillis, *Fisheries Specialist, Northern Caribbean Region*, The Nature Conservancy

Natalie Miaoulis-Maillis provided an overview of the regional needs and focused her presentation on TNC's FishPath Tool, a decision support system for fisheries managers. FishPath uses available data to help fisheries managers understand their potential management options. It provides pros and cons of various options, without prescribing specific management actions. The tool also can show users what additional data and capacity they may need to become better equipped to take certain management actions. In addition, through the FishPath Process, users can engage community members. They can also learn from fisheries managers in other countries through the FishPath Network.

Ms. Miaoulis-Maillis explained how TNC used FishPath in The Bahamas for queen conch, and how it is now using the tool for multiple snapper and grouper species. Ms. Miaoulis-Maillis also mentioned several electronic monitoring pilots in The Bahamas and the Skylight tool used to support enforcement.

D. OurFish & Fisheries Management Assessment (FishMAT) *by*
George Stoyle, *Director, Technology Solutions*, Rare

George Stoyle described various issues related to understanding small-scale fisheries, including lack of catch data, decentralized nature of small-scale fishing operations, use of traditional methods to collect data, and lack of capacity to process and analyze data. He explained how Rare works with communities around the world to overcome these obstacles.

Mr. Stoyle's presentation largely focused on two of Rare's fisheries management tools, OurFish and FishMAT. OurFish is a mobile app that helps collect catch data and is designed specifically for fish buyers and traders, providing detailed financial information to better manage income and expenditures. This provides an important incentive for fish buyers to use the app. FishMAT, on the other hand, is a data analysis tool that can help assess small-scale fisheries, visualize data, track key performance indicators, interpret data, and provide science-backed recommendations for fisheries managers. FishMAT uses data from a variety of sources, including data obtained through OurFish. Additional tools and data dashboards can be found on Rare's public facing data portal.

E. Skylight: Use of the Tool for Maritime Domain Awareness in Trinidad and Tobago *by*
Lt. Cdr. Daniel Castagne, Trinidad and Tobago Coast Guard

Lt. Cdr. Daniel Castagne described the Trinidad and Tobago Coast Guard's experience using the tool Skylight to combat IUU fishing and ensure compliance. Developed by the Allen Institute for AI, Skylight aggregates various data sources – including satellite, Automatic Identification System transmissions, and vessel data – to visualize vessel activity. It then uses artificial intelligence and machine learning to detect IUU fishing events, track illegal activity hotspots, identify offending vessels, and generate alerts. Skylight can be customized to designate specific areas, such as marine protected areas, entry into which would generate an alert.

Lt. Cdr. Castagne explained that Skylight has helped the Coast Guard build maritime domain awareness and collect information about specific trends, zones, and vessels of interest. The Coast Guard's goal is to use this information to streamline operations and launch targeted operations that will result in successful prosecutions.

F. **Marine Manager: Advancing Spatial Management through Innovative Technology Portal** *by* Annie Mejaes, *Product Manager,* Global Fishing Watch

Annie Mejaes explained that Global Fishing Watch (GFW) uses satellite technology, machine learning, and data visualization to support sustainable use of oceans and reduce IUU fishing. GFW has created several free and open data tools that are complementary to Skylight. For example, the open access GFW Map visualizes near real-time data about vessels and fishing activities, as well as historical data going back to 2012.

The Marine Manager tool adds an interactive component to this map. Users can create a site workspace, upload and download datasets, filter data by data sources or various environmental layers, search for specific vessels, and turn on personalized reference layers, such as exclusive economic zones. The Marine Manager is designed to run on mid-level computers with relatively low data consumption. Ms. Mejaes explained that this tool can be used to evaluate whether vessels are fishing, detect transshipment, and detect dark targets. Marine Manager is one of five open-access fisheries tools developed by GFW, which can help fisheries managers address IUU fishing.

G. **Use of Technologies and Data Analytical Tools for Fisheries Management in Barbados: The DigiFish Initiative** *by* Dr. Shelly-Ann Cox, *Chief Fisheries Officer,* Fisheries Division, Barbados Ministry of Environment and National Beautification, Green and Blue Economy

Dr. Shelly-Ann Cox introduced the DigiFish Initiative of the Barbados Fisheries Division. The purpose of the DigiFish Initiative is to promote the use of digital technologies and innovative data analytical methods to support the application of the ecosystem approach to fisheries in Barbados. For example, the Barbados Fisheries Division is installing monitoring devices on both small-scale and longline vessels to map fishing effort through space and time. The Barbados Fisheries Division also plans to transform landing sites into intelligent data collection spaces through the use of smart scales. Dr. Cox outlined many other current programs and future directions of the DigiFish Initiative, including visualizing catch-per-unit effort, implementing a pay-per-use vessel insurance scheme, and enhancing and digitalizing the data collection process.

V.   Questions & Answers

Throughout the seven wonderful presentations from the event's speakers, audience participants submitted questions, and panel participants provided their responses. Audience participants were particularly interested in learning more about CRFM's Fisheries Manager Tool. The discussion touched on how environmental and biological data are integrated into the platform, how the platform might navigate national data protection laws, and how the Fisheries Manager may be compatible with other platforms, such as FAO's Calipseo tool.

The discussion also covered various other aspects of data tools. For example, a few participants asked questions about possible barriers to implementation of a regional database. In response, speakers mentioned that countries may be hesitant to transition to a new data collection system, especially if they are focusing on maintaining the human resources and capacity necessary for their current system. There were also questions about how the data tools discussed may be integrated into traceability platforms to prove the catch's origin and promote sustainability of the harvested seafood. Dr. Cox, for example, shared that through Barbados' DigiFish Initiative, they have already integrated their cellular and satellite vessel monitoring systems with traceability platforms that generate QR codes that can be scanned to determine catch location, type of gear used, and other relevant information.

VI.   Resource List

Below is a list of resources mentioned during the virtual event:

> ➢ CRFM and Iceland's collaboration on prospective Fisheries Manager tool.
> ➢ Dr. Krista Sherman's research papers: (1) Understanding and managing fish populations: keeping the toolbox fit for purpose (Journal of Fish Biology, 2018), and (2) Contemporary and emerging fisheries in The Bahamas—Conservation and management challenges, achievements and future directions (Fisheries Management and Ecology, 2018).
> ➢ The Nature Conservancy's FishPath Tool, Process, and Network.
> ➢ Rare's OurFish, Fisheries Management Assessment tool (FishMAT), and Public Data Portal.
> ➢ Allen Institute for AI's Skylight.
> ➢ Global Fishing Watch's Map and Marine Manager portal.
> ➢ Barbados Fisheries Division's DigiFish Initiative.
> ➢ FAO's Calipseo tool.