CONTRIBUTION 3.10

Digitizing the Vessel Inspection Process in Barbados

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Abstract

Barbados is known the world over for unique vessel designs that promote a rich fishing culture. In 2022, the registered fishing fleet was estimated at 1,156 vessels which range from small open rowboats (less than 6m) that fish at nearshore reefs, to well-equipped inboard-engine powered longliners (over 22m) that target tunas and swordfish as far as 200 miles offshore and beyond. The vessel inspectorate maintains a vessel registry and conducts inspections to determine compliance with prescribed safety standards and guidelines. In recent years, an average of 150 inspections are completed every quarter using hard copy forms that provide a checklist to ensure that vessels are seaworthy and outfitted with the required machinery and equipment. The inspection form includes several data fields that require a tedious data entry process and manual reporting. Ultimately, this gives an opportunity to review the inspection process and create an electronic form to support a new era of digital transformation.

A recent collaboration with the Fisheries Division of Dominica supported the digitization and improvement of the vessel inspection form using KoboToolbox. This platform supports powerful and intuitive data collection tools to support an expedited process of inspection. The e-form integrates pick lists to support efficient data collection, validation to ensure that the data collected is appropriate, and skip logic which enables the inspector to focus on the requirements for that specific scenario. In addition, it allows for many types of information to be captured, including photos and videos which are automatically linked to the traditional text and numeric data. The time between data collection and data availability for review, analysis and reporting is significantly reduced. Further developments include testing the interoperability with the vessel registry and the creation of R statistical programming scripts to support efficient and standardised data analysis and the automation of reports.

KEYWORDS: Digital technologies, vessel inspections, KoboToolbox, automation, R statistical programming

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1. INTRODUCTION

Barbados is well known for unique vessel designs that promote a rich fishing culture. Fishing vessels are often featured in local art and photography and can be viewed as a cultural icon. The bajan fishing fleet has been described as the cumulative expression of elements of fisheries (Willoughby and Cecil 2001). The fleet evolved from inshore sailboats to offshore deep-sea vessels, but there are still remnants of old boat styles in use today.

In 2022, the registered fishing fleet was estimated at 1,156 vessels which range from small open rowboats (less than 6m) that fish at nearshore reefs, to well-equipped inboard-engine powered longliners (over 22m) that target tunas and swordfish as far as 200 miles offshore and beyond.

A two-tiered system is used to classify local fishing vessels. Vessels are first classified by length as class 1 [less than 6 m], class 2 [greater than 6 m but less than 12 m] and class 3 [greater than 12 m]. Each length class is also sub-divided into types: **moses, dayboats/launches, iceboats and longliners** based on their physical structure or the type of gear carried (Barbados Fisheries Division, 2003).

Moses (approx. 734). Moses are open boats (Figure 1) 3-6 m in length; constructed of either wood or glass reinforced plastic [GRP]; propelled either by oars or 10-40 hp outboard engines; used primarily for reef and coastal fisheries. Gear commonly used includes hand and trolling lines, fish traps and cast nets. Moses may also be used as tenders to bigger vessels and for transporting seine nets and diving gear.

Dayboats/Launches (approx. 189). Dayboats are mostly wooden vessels 6-12 m in length fitted with a cabin (Figure 1); propelled by inboard diesel engines from 10-180 hp; used primarily for harvesting flyingfish and large pelagics on day trips; carry navigation, communication, and safety equipment. Gear commonly used includes hand and trolling lines, gill nets and hoop nets. Also used for tending set nets and transporting divers.

Iceboats (approx. 183). Iceboats (Figure 1) are characterised by being fitted with insulated ice holds; carry a cabin; usually greater than 12 m in length; propelled by inboard diesel engines; carry navigation, communication, and safety equipment; used primarily for harvesting flyingfish and large pelagics on trips of 5-10 days. Gear commonly used includes hand and trolling lines, gill nets and hoop nets.

Longliners (approx. 50). Longliners (Figure 1) are greater than 12 m in length; fitted with insulated ice holds; propelled by inboard diesel engines; carry navigation, communication, and safety equipment; used primarily for fishing tunas and swordfish, with a by-catch of large pelagics, on trips usually of 12-28 days. Pelagic longline gear is the mainly used, but some may carry all of the other gear associated with iceboats.

Figure 1. Fishing vessels illustrated: Moses and launch (left), Iceboat (middle) and Longliner (right)

Inspection protocols

The vessel inspectorate maintains a vessel registry and conducts inspections to determine compliance with prescribed safety standards and guidelines. Section 31, CAP 391 of the Fisheries Act (1993) mandates that all Barbados fishing vessels involved in commercial fishing activity are to be inspected annually. Vessels operating without a valid Certificate of Inspection (Figure 2), risk the safety of their crew. It is an offence under the Fisheries Act to operate a local fishing vessel that is not registered under the provisions of CAP 391. This offence carries a fine of up to five thousand dollars (BBD$5,000).

Clients are encouraged to make bookings of inspections not less than 2 working days prior to the requested date. This will be subject to the Inspection Schedule outlined in Table 1 below.

Table 1. Inspection Schedule

Monday	Tuesday	Wednesday	Thursday	Friday
Areas North of Bridgetown - Shallow Draught to Stroud Bay	Bridgetown Fishing Complex	Areas South of Bridgetown - Careenage to Silver Sands	East Coast of the Island - Foul Bay to Tent Bay	Reserved

Types of inspections

Pre-Inspection
This inspection is conducted to establish that the vessel being presented is suitable for commercial fishing and to allow the Chief Fisheries Officer to advise the owner(s) on what would be required to satisfy the Prescribed Standard of a Full Inspection.

Annual Inspection / Full Inspection
Section 31, CAP 391 of the Fisheries Act requires that all vessels to be used for commercial fishing activity are to be inspected annually. Inspection Decals are only valid for 12 months; hence each commercial fishing vessel is required to be inspected on a yearly basis.

Spot Inspections
By law any Fisheries Inspector, Authorised Officer, Coast Guard Officer, and Police may stop, board and inspect a fishing vessel at any time to ensure it complies with Prescribed Standards, has a valid Inspection Decal and that the vessel and its equipment are properly maintained.

Vessels to be Constructed / Altered
People seeking to construct, alter or convert a vessel to be used for commercial fishing, or boat owners seeking to make structural changes to a registered fishing vessel, must obtain permission from the Chief Fisheries Officer (CFO). Failure to get permission could result in the vessel not being registered under the Fisheries Act CAP 391, and it is an offence under the Fisheries Act carrying a fine of up to five thousand dollars (BBD$5,000).

The owner, agent, or master (captain) must be present during the inspection and all equipment as prescribed by CFO must be present on-board the vessel at the time of the inspection. No ice/fish is to be on board the vessel at the time of the inspection.

During the inspection, the vessel inspector will check the Electrical System, Propulsion System, Engine & Steering Systems, Safety Equipment, Navigation & Electronic Equipment, Emergency Supplies, Lights, Vessel's Sanitation, Cabin Arrangements, Condition of the Hull, Vessel Markings etc.

An Inspection Decal will be issued by the Fisheries Division once the vessel passes inspection. The decal must be collected by the Owner or Agent. If the requirements are not satisfied a Notice of Non-Compliance will be issued by the Inspector to the Owner, Agent or Master. The notice will state the areas of non-compliance and it will specify the number of days allotted for the deficiencies to be rectified.

Figure 2. Vessel Inspection Certificate / Decal

In recent years, an average of 150 inspections are completed every quarter using hard copy forms that provide a checklist to ensure that vessels are seaworthy and outfitted with the required machinery and equipment. The inspection form includes several data fields that require a tedious data entry process and manual reporting. Ultimately, this gives an opportunity to review the inspection process and create an electronic form to support a new era of digital transformation to support effective fisheries management (Bradley et al. 2019).

2. METHODOLOGY

A recent collaboration with the Fisheries Division, Dominica supported the digitization and improvement of the local vessel inspection form using KoboToolbox. This process (Figure 3) began with a review and critical analysis of the existing form (Figure 4). Examples of vessel inspection forms used in other countries were reviewed to support the analysis. The design of the existing form was largely based on collecting details on the vessel, determining sea worthiness and the presence of safety equipment on board. In addition, the hull structure, water integrity and other fixtures were evaluated. Checks were also made to the rudder and steering, propeller and shaft engine and electrical fixtures. The form had been revised three times before to improve the efficiency of vessel inspection operations. From the review it was determined that the form, while comprehensive, could be improved to capture areas related to the integrity of the insulated ice box that had implications for ensuring fish quality and supporting cold chain management. Furthermore, other important data fields related to the presence of equipment such as vessel monitoring system devices or AIS, solar powered battery chargers and onboard Wi-Fi hot spots.

Data entry from the form entails a manual process of inputting information into a Microsoft Access database. Only important data fields are digitised to support the reporting process. The opportunity to support detailed analyses to determine trends and potentially assess mechanical and electrical issues that may affect the fishing vessel fleet was explored. After a review of digital data collection tools and platforms, KoboToolbox was selected based on its powerful and intuitive data collection tools to support an expedited process of inspection.

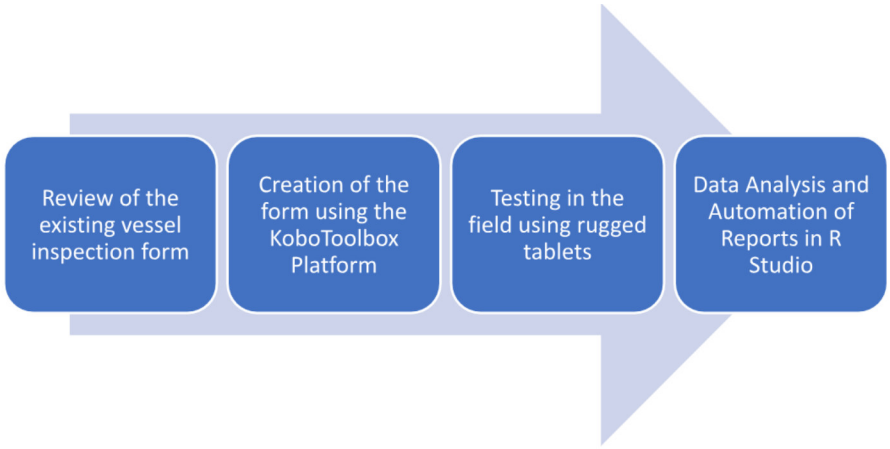

Figure 3. Collaborative process

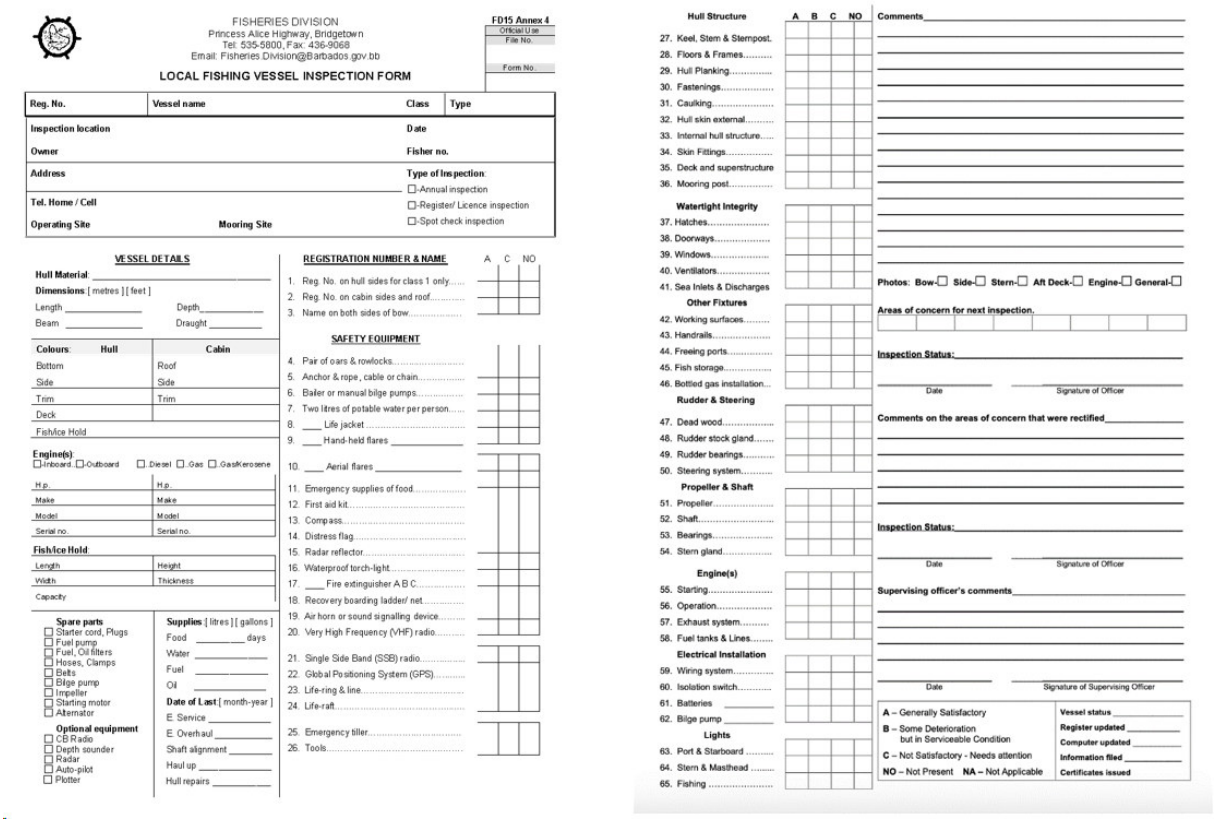

Figure 4. Local Fishing Vessel Inspection form

The draft e-form was piloted using rugged tablets in the field to test the functionality and ease of data entry. The photograph and video feature of the form was also tested to check the quality of the photos in recording specific features of the vessel. Testing began in June and is expected to continue until the end of 2023.

3. RESULTS

The KoboToolbox platform supported the design and development of a digital form and a comprehensive framework for data analysis. The e-form (Figure 5) integrates pick lists to support efficient data collection, validation to ensure that the data collected is appropriate, and skip logic which enables the inspector to focus on the requirements for that specific scenario. In addition, it allows for many types of information to be captured, including photos and videos which are automatically linked to the traditional text and numeric data. The time between data collection and data availability for review, analysis and reporting is significantly reduced.

The first section of the e-form allows the locations of the inspections to be georeferenced. Inspections typically are done at the major fish landing sites, but some inspections are conducted at the homes of boat owners. Mapping the locations of inspections may be useful for planning and distributing work among vessel inspectors to increase the efficiency of operations.

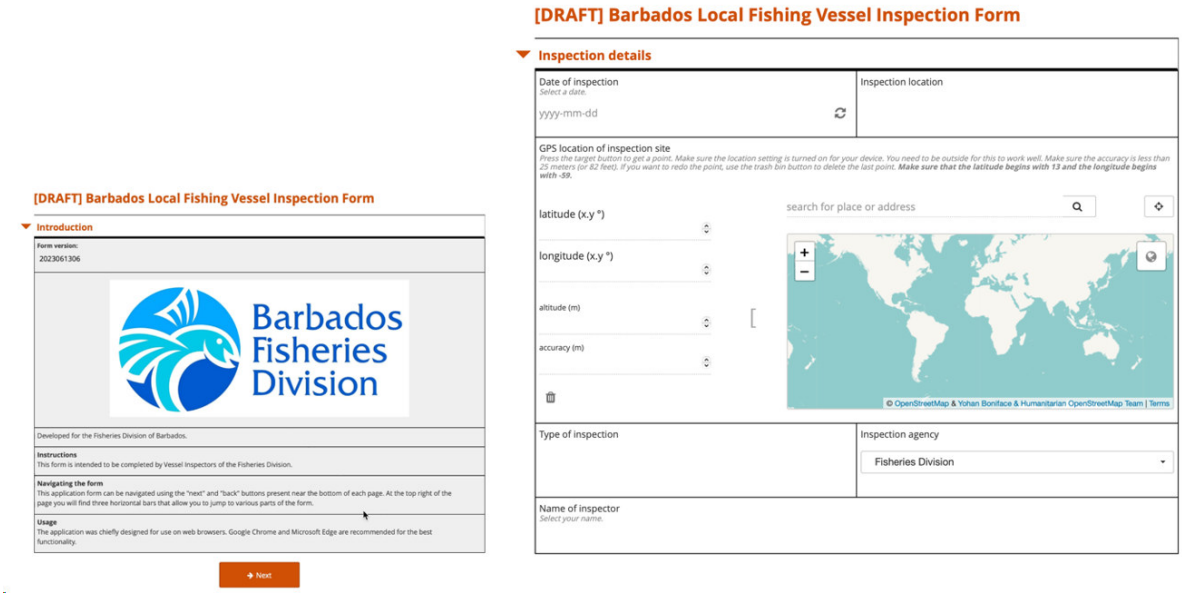

Figure 5. Local fishing vessel inspection e-form

The section on vessel details integrates a pick list based on the information stored in the vessel registry. Inspectors would just need to enter a few letters from the boat name or registration number and all the relevant information will show up in the fields (Figure 4). There is also an option to update information such as the owners or crew members to ensure that the registry is up to date.

Figure 6. Vessel details section of the e-form

The other sections of the e-form are designed to validate information being entered and prompt inspectors to required fields that need to be completed. The additional functionality of the form that allows for photographs and videos of the vessel at inspection to be automatically linked to the traditional text and numeric data will support effective database management. Currently photos are taken with a camera then uploaded to folders on the server and not linked to the data collected at the time of inspection.

Like the existing form, comments, and notes on areas of concern can be added to support the inspection status. The last section allows inspectors to sign off on their entry before submitting the data. The form allows data to be stored until a Wi-Fi connection is available to upload the information to the online server.

4. DISCUSSION

The collaborative development process between the two Fisheries Divisions created a platform for the exchange of experiences and ideas to propel innovation. Several lessons learned in the process including the integration of elements to meet international standards, have supported the creation of a comprehensive e-form that will improve the efficiency of the vessel inspectorate in Barbados and promote safety. The resulting e-form is dynamic and can be adapted to address emerging issues, if need be, in the future.

Next steps include the continuation of testing in the field with the rugged tablets until the end of December 2023. Upgrades to the database to create relational connections between landing statistics will be implemented along the same timeline.

The ongoing vessel remarking exercise of the fishing fleet to international standards will promote the issuing of updated inspection decals with new registration numbers starting with 8P, Barbados' international call sign.

Further developments include the installation of a new server to support the testing of the interoperability with the vessel registry and the creation of R statistical programming scripts to support efficient and standardised data analysis and the automation of reports. A summary of reports generated in R studio can be uploaded to the website to inform stakeholders on the number of quarterly and annual inspections and common trends observed.

This project is a demonstration of the benefits of using digital technologies to promote the advancement of internal procedures, decrease operational inefficiencies, and support the creation of data driven solutions that can engage fisheries stakeholders in decision making processes. Addressing key challenges by way of the global digital transformation of the fisheries sector will meet several sustainable development goals of the United Nations tailored around the application of disruptive technology (Rowan 2023).

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