Ocean spaces cannot be well managed without fishers: The Smart Fishery Tracker can help

Los espacios oceánicos no se pueden administrar bien sin pescadores: el Smart Fishery Tracker puede ayudar

Les espaces océaniques ne peuvent pas être bien gérés sans les pêcheurs : le Smart Fishery Tracker peut aider

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ABSTRACT

By all accounts, fishers are on the frontlines of ocean change and should be considered an important ally in ocean monitoring, management, and conservation. Yet, a history of misinformation, broken trust, and unsustainable practices – following decades of subsidies to maximize catch and profit – has dissolved relationships and pitted fishers against other stakeholders, scientists, and decision makers. Today, when the future of fish is uncertain, there is both an urgent call for conservation and a fervent push to grow the ocean economy. For the first time in history, fishers are faced with the possibility of being excluded from their historic fishing grounds. Getting marine spatial planning decisions right is arguably one of the most important challenges of this decade. Through literature reviews, conversations, and analysis of fisheries data, we aimed to understand the contemporary situation of fishers in the role of monitoring and decision making, with the aim of building a system that would enable and empower fishers to be at the forefront of ocean monitoring, management, and conservation. The Smart Fishery Tracker, in the eOceans platform, is a suite of digital tools and real-time analyses that equip fishers and fishing groups with timely, standardized, reproducible, expert-developed insights of their catch and bycatch data, along with other ocean dimensions that interest them. This positions fishers to effectively and efficiently improve their efforts, eliminate the barriers that lead to unreported and unregulated fisheries, and enables fishers to play a critical role in the management and conservation of our ocean.

INTRODUCTION

Throughout history, fishers have been the primary ocean explorers and knowledge holders (Kurlansky 1997; Sahrhage and Lundbeck 2012). For thousands of years, fishers fished without markedly depleting ocean health, but as fish became a commodity – to power global economies – fisheries rapidly expanded (Kurlansky 1997; Lear 1998). While governments subsidized industrialized techniques to maximize exploitation efficiency and profit (Sumaila et al. 2016), they often dismissed local fishers' concerns regarding declining populations (Kurlansky 1997). These concerns have often proved true decades later, necessitating these same governments to reduce quotas and implement moratoriums across diverse species groups with varying degrees of failure and success (Hutchings and Myers 1994; Aron et al. 2000; Dempson et al. 2004; Porch et al. 2006).

Today, the future of fish and overall ocean health is uncertain. After centuries of misuse combined with growing climate change impacts and the fervent push to grow the ocean economy, the ocean and its value to humans are expected to degrade rapidly if business-as-usual continues (Doney et al. 2009; Hoegh-Guldberg 2015; Oliver et al. 2018; Mendenhall et al. 2020). For these reasons, coastal countries are expanding ocean monitoring, management, and conservation strategies to balance ocean health with economic uses (Douvere 2008; Foley et al. 2010). However, getting these decisions right is not trivial.

Fishers comprise one of the most diverse and largest ocean stakeholder/rightsholder groups by number, area they cover, and time spent at sea. They see and touch more of the ocean than any other group. By all accounts, fishers are on the frontlines of ocean change, and, with few exceptions, their lives, livelihoods, and communities depend on fish populations that are abundant. Thus, fishers should be considered an important ally in ocean monitoring, management, and conservation (Gutiérrez et al. 2011). Yet, a history of misinformation, broken trust, and unsustainable practices (Worm et al. 2013; Agnew et al. 2009; Ward-Paige et al. 2013), has dissolved relationships and pitted fishers against other stakeholders, scientists, and decision makers (Pomeroy et al. 2007; Spijkers et al. 2018; Mendenhall et al. 2020).

We aimed to understand the contemporary situation, with the aim of building a process and system that would enable and empower fishers to be at the forefront of ocean monitoring, management, and conservation. The Smart Fishery Tracker is a suite of digital tools and analyses that have been developed in the eOceans platform to provide standardized, reproducible, near real-time catch and bycatch analyses for fishers in any fishery in the world. These tools position fishers to effectively and efficiently monitor ocean change, eliminate the barriers that lead to unreported and unregulated fisheries, and enable them to play a critical role in the management and conservation conversation.

METHODS AND MATERIALS

To design and build the Smart Fishery Tracker, we deployed three approaches. First, we reviewed available materials on fisheries written by scientists, managers, and fishers, including scientific and gray literature and online documentation (e.g., social media, blogs). Second, we casually interviewed fishers, fisheries observers, non-fishers in fishing communities, managers, marine and social scientists, and non-governmental organizations that deal with fisheries. We also attended public events (e.g., conferences, town hall meetings) where fisheries-related regulations were discussed (e.g., marine protected areas, quotes, moratoriums). Our conversations covered 28 countries, but were primarily in Canada, the United States, Australia, New Zealand, and various Caribbean countries. Third, we reviewed commercial fishing logbooks and analyzed large fisheries datasets to understand the value and limitations of the data that are collected by fishers, and worked with the fishers who collected the data to uncover their interests. From these perspectives, we developed a series of analyses that comprise the Smart Fishery Tracker tool.

RESULTS AND DISCUSSION

Overview

Our investigations revealed that fishers are still generally regarded as influential in coastal communities, but that their role is in flux. As discussions evolve about what activities are or will be permitted in the ocean, fishers are faced with the possibility of being excluded from historic fishing grounds for both conservation and economic opportunities (e.g., aquaculture, energy). Fishers are also feeling targeted by increased fisheries monitoring, where they fear their data will be used against them and they object to the invasion of privacy. Some fishing groups have become so distressed by these multi-pronged pressures that they have united within associations/societies to collect and process their own fisheries data to hold government scientists and managers accountable and make sure that their interests are upheld.

The Smart Fishery Tracker

The Smart Fishery Tracker (Fig. 1) was designed to equip fishers and fishing groups with timely, expert-developed analysis of their catch and bycatch data, along with other ocean patterns that interest them (e.g., illegal fishing, invasive species). It uses the eOceans platform (Fig. 2), where fishers and their collaborators interact with the platform in two ways. The first is a mobile application (Fig. 3) where fishers can log their at-sea fishing effort, catch/bycatch, and other observations (e.g., whales, pollution), join projects to automatically share their data for analysis, and review and comment to help co-interpret the results. The second is a web application where projects are launched and managed, and the results are reviewed and discussed. Projects can be created by anyone – fishers, fishing associations, managers, NGOs, scientists, consult-ants, etc. Projects only receive data from the fishers who have joined their project (i.e., it is an opt-in program).

The suite of analyses in the Smart Fishery Tracker combine summary and advanced modeling analysis with graphical and map summaries. The analyses include standardized assessments of catch, bycatch, and catch condition (e.g., size, maturity) using the data that are entered through the mobile application. It also includes analyses of the socioeconomic values of their ocean spaces (e.g., where and when they generally fish so as not to include exact sites) and anthropogenic threats (e.g., pollution, invasive species). These results can be used for

Figure 1. Example analysis from the Smart Fishery Tracker™. Analyses are found in the eOceans® dashboard and includes spatial and temporal trends of catch and bycatch, with reported animal conditions. For demonstration purposes, we show a few of the analyses performed for the Southwest Lobster Science Society, in Canada, using their fisheries data (shared with permission).

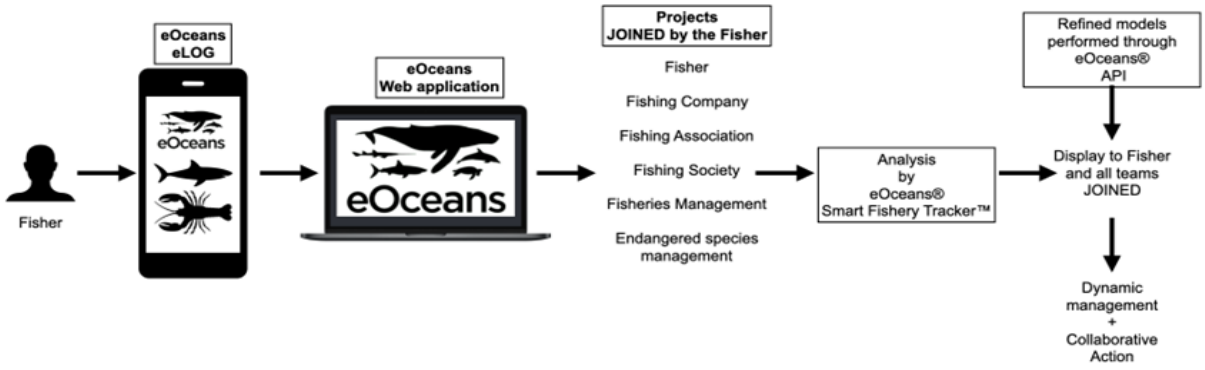

Figure 2. Schematic of data flow in eOceans® Smart Fishery Tracker™. Fishers log catch, bycatch (species, number, condition) and other observations (e.g., whales, ghost gear, illegal fishers) in the mobile application while at sea. These data are saved in the eOceans® platform for their personal access. Data are streamed to supported projects, where they are analyzed and displayed for co-interpretation by project members.

many purposes, from tracking quotas to voluntarily avoiding bycatch hotspots or moving gear that is near endangered species.

Other eOceans platform features that work well with the Smart Fishery Tracker include: Community Channel, where fishers can broadcast interesting observations to their followers; Comments tab, where fishers can comment on the results to help co-interpret their meaning or to improve data quality; Timely Matters Notifications, where a text message can be sent to the team when a specific observation is logged, such as an endangered whale, that enables timely action (e.g., move gear); Data Downloads, which allows raw data to be downloaded for archives and external analysis or sharing (with permission); Data Pipes, where external data sources, such as OBIS and ERDDAP, can piped into a project to extend baselines or to develop more advanced analyses (eg., fish with temperature and fisheries); and other analyses and Trackers, like the MPA Health Tracker or the Blue Economy Tracker, so fishers can easily and seamlessly participate in other dimensions of ocean tracking that matter to them.

Additionally, because unreported and unregulated fishing often gets unfairly lumped in with illegal fishing and other criminal activities (IUU) (Song et al. 2020), the Smart Fishery Tracker may be a solution to effectively ending unreported and unregulated fishing since any fisher, in any fishery, anywhere in the world can now report their catch and use their analyzed data to regulate fisheries, even if voluntarily.

Caveats

For fishers to adopt the Smart Fishery Tracker a few things are needed. The technology will change in the future, but they currently need to use a smartphone, with internet access (e.g., to download the app and upload data), and have an email address to activate their account. Ill-intention fishers, those who supply illegal markets for example, are unlikely to use the system. However, teams that use the Smart Fishery Tracker decide who can join and contribute to their project. Additionally, the eOceans platform has deployed various tools to identify and minimize errors, including using the metadata from the phone (e.g., location, date, time), flagging observation outliers, and an in-app field guide to help correctly identify species in the field.

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KEYWORDS: Fisheries; Conservation; Community science; Conservation; Ocean; Biodiversity; Climate change

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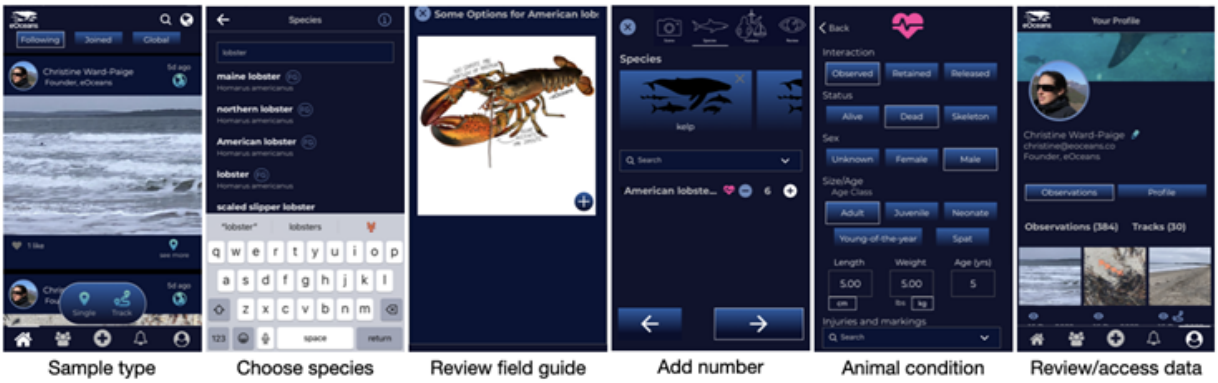

Figure 3. Overview of the key components of the data entry part of the Smart Fishery Tracker™. The mobile app eLOG is used for data input by fishers. It automatically captures location, date, time, and other meta-data and the fisher or observer logs catch, bycatch, and other observations that feed the Smart Fishery Tracker™. The eLOG works offline and has precision of under 5 m.

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