

UNIVERSIDAD AUTÓNOMA DE BAJA CALIFORNIA
INSTITUTO DE INVESTIGACIONES OCEANOLÓGICAS



**EVALUACIÓN DEL CAMBIO DE LA RESILIENCIA EN SISTEMAS
SOCIOECOLÓGICOS PESQUEROS IMPLEMENTANDO PROYECTOS
DE MEJORA PESQUERA**

T E S I S

**QUE PARA CUBRIR PARCIALMENTE LOS REQUISITOS NECESARIOS PARA
OBTENER EL GRADO DE**

DOCTOR EN MEDIO AMBIENTE Y DESARROLLO

PRESENTA

ANTONIO GÓMEZ GÓMEZ

Ensenada, Baja California, México. Junio de 2024

Resumen

El manejo de recursos naturales basado en la resiliencia se ha convertido en una herramienta indispensable para ayudar a los sistemas socioecológicos a incrementar su capacidad de adaptación a perturbaciones. El enfoque de resiliencia reconoce la naturaleza dinámica de los sistemas socioecológicos que se enfrentan a un mundo en constante transformación con todo tipo de eventos inesperados, desde eventos climáticos extremos a shocks en mercados internacionales. Las pesquerías, como sistemas socioecológicos, no son ajenas a estos desafíos. Los Proyectos de Mejora Pesquera (FIP, por sus siglas en inglés) han surgido como una herramienta prometedora para impulsar el manejo sostenible de las pesquerías en Latinoamérica y el Caribe (LAC). Sin embargo, poca atención se ha tomado en conocer cómo estos proyectos impactan sobre la resiliencia socioecológica de las pesquerías. Esta tesis explora en profundidad ese tema; está compuesta por un capítulo introductorio, dos capítulos en formato artículo científico, y un cuarto que trata de una valoración general del modelo FIP.

El primer capítulo ofrece una evaluación general de los FIP en la región LAC, analizando sus características principales, los desafíos que enfrentan en relación al estándar de pesquerías del *Marine Stewardship Council* y las acciones implementadas y resultados obtenidos hasta el momento para promover la sostenibilidad de las pesquerías. Se destaca la diversidad en características de los FIP en la región, reflejo de la diversidad de las pesquerías en la LAC, así como los retos principales, como la información limitada, indeterminación del estado de las poblaciones explotadas, establecimiento de estrategias y reglas de control de captura y mejorar el manejo específico de cada una de las pesquerías. Entre sus actividades principales se encuentra la recopilación de datos y la participación de las diferentes partes interesadas en reuniones que buscan cambiar las prácticas de pesca y aspectos del manejo pesquero.

El segundo capítulo examina el papel de los FIP, como intervención en el manejo pesquero, en promover cambios en la resiliencia socioecológica de las pesquerías en LAC. Se analizó cómo los FIP modifican los siete principios de resiliencia socioecológica establecidos por Biggs et al. (2012), utilizando tres casos de estudios en la región. Los resultados indican que los FIP tienen un impacto positivo en algunos principios de la resiliencia, como en la ampliación de la participación, el fomento del aprendizaje y la gestión de la conectividad. Sin embargo, para el resto de principios su impacto fue muy limitado. Además, se identificaron las motivaciones de las diferentes partes interesadas en participar en sus respectivos FIP, donde actores de la cadena de suministro expresaron motivos relacionados con incentivos de mercado, mientras que el resto de actores expresaron motivaciones diversas, como la oportunidad de mejorar el manejo o la necesidad de hacer un uso sostenible de los recursos naturales.

En conjunto, la tesis concluye que los FIP son una herramienta valiosa para mejorar el desempeño ambiental de las pesquerías en LAC. Sin embargo, su eficacia varía y se deben considerar sus limitaciones. Los FIP ayudan a promover algunos de los principios de resiliencia, pero estos proyectos no son suficientes para promover la resiliencia general de las pesquerías, mejorando todos los principios. Esto sugiere la necesidad de complementar estos proyectos con otras estrategias que conjuntamente ayuden a mejorar la resiliencia socioecológica de las pesquerías en general. Se recomienda más investigación para comprender en profundidad el impacto a largo plazo de los FIP en

el manejo pesquero de LAC, ayudar a determinar las condiciones más adecuadas para su implementación exitosa, y comparar con otras estrategias que promuevan la resiliencia de sistemas socioecológicos.

Abstract

Resilience-based natural resource management has become an indispensable tool to help social-ecological systems increase their adaptive capacity to disturbances. The resilience approach recognizes the dynamic nature of social-ecological systems that face a constantly changing world with all kinds of unexpected events, from extreme weather events to shocks in international markets. Fisheries, as social-ecological systems, are no stranger to these challenges. Fishery Improvement Projects (FIPs) have emerged as a promising tool to promote sustainable fisheries management in Latin America and the Caribbean (LAC). However, little attention has been paid to how these projects impact the social-ecological resilience of fisheries. This thesis explores this topic in depth and is composed of an introductory chapter, two chapters in scientific article format and a fourth that deals with a review of the FIP model.

The first chapter provides a general assessment of FIPs in the LAC region, analyzing their main characteristics, the challenges they face concerning the Marine Stewardship Council fisheries standard, and the actions implemented and results obtained so far to promote fisheries sustainability. The diversity in characteristics of the FIPs in the region is highlighted, reflecting the diversity of the fisheries in the LAC, as well as the main challenges, such as limited information, indetermination of the status of exploited populations, the establishment of harvest control rules and harvest strategies and improving the fisheries specific management. Its main activities include data collection and stakeholder participation in meetings that seek to change fishing practices and management.

The second chapter examines the FIP's role as a fisheries management intervention in promoting changes in fisheries' social-ecological resilience in LAC. It analyzed how FIPs modify the seven principles of social-ecological resilience established by Biggs et al. (2012), using three case studies in the region. The results indicate that FIPs positively impact some resilience principles, such as broadening participation, fostering learning, and managing connectivity. However, the rest of the principles had limited impact. In addition, the motivations of the different stakeholders to participate in their respective FIPs were identified, where supply chain actors expressed motives related to market incentives. In contrast, the other stakeholders expressed diverse motivations, such as improving management and sustainability.

Overall, the thesis concludes that FIPs are a valuable tool for improving the environmental performance of fisheries in LAC. However, their effectiveness varies, and their limitations should be considered. FIPs helped promote some of the resilience principles, but these projects are insufficient to promote the overall resilience of fisheries by improving all the principles. This suggests the need to complement FIPs with other strategies that help improve fisheries' socioecological resilience in general. Further research is recommended to understand the long-term impact of FIPs on fisheries management in LAC, to help determine the most appropriate conditions for their successful implementation, and to compare with other strategies that promote the resilience of social-ecological systems.

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Dedicatoria

Caminante, son tus huellas
el camino y nada más;
Caminante, no hay camino,
se hace camino al andar.
Al andar se hace el camino,
y al volver la vista atrás
se ve la senda que nunca
se ha de volver a pisar.
Caminante no hay camino
sino estelas en la mar.

(Caminante, no hay camino, de *Antonio Machado* en *Proverbios y cantares XXIX*)

A mí familia y amig@s,
muchísimas gracias por todo el amor compartido,
y hacerme la persona que soy.

Agradecimientos

Quisiera agradecer al Programa de Doctorado Medio Ambiente y Desarrollo, al IIO y a la UABC por brindarme la oportunidad de realizar mi tesis doctoral y contribuir a mi formación.

Al Consejo Nacional de Humanidades, Ciencia y Tecnología (CONAHCYT) por el apoyo económico.

A mis directores, Luis y Gabriela, por la oportunidad de realizar el doctorado y por todo el aprendizaje durante estos años. En especial a Luis, muchísimas gracias por todo el tiempo, ideas y paciencia.

A los miembros de mi comité de tesis, Anne, Georges y Andrés por toda la ayuda, retroalimentación y tiempo dedicado, sin duda este trabajo mejoró gracias a ustedes.

A tod@s los miembros del Malpica lab por acompañarme en las reuniones, y el apoyo cuando lo necesitaba.

A tod@s l@s compañer@s del doctorado por hacer más llevaderos los días de trabajo, aunque nos tocó empezar durante la COVID, fue genial interactuar finalmente en persona.

A mis amig@s, por todos los momentos compartidos y los que quedan por disfrutar.

A mi familia del otro lado del charco por todo su apoyo y cariño. En especial a mi padre y madre, por todo el buen trabajo hecho para hacerme la persona que soy. Deseo poder seguir sus pasos y guiar los pasos de mis hijos tan bien como ellos hicieron conmigo. Estoy profundamente agradecido y orgulloso de ellos.

A mi nueva familia, sin duda Fer y Anto (y el que viene de camino), son lo más preciado que la fortuna me pudo dar. Fer, sabes que sin tu cariño y paciencia yo no sería yo.

Finalmente, quiero agradecer profundamente a México, por recibirme con los brazos abiertos, por enseñarme tanto, por darme una familia, tan buenos amigos, por sus mares, sus montañas y sus gentes, sus lugares inolvidables, y por lo que todavía me queda de aprender y conocer.

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Captítulo 1. Introducción

Sistemas socioecológicos

A nivel global, los ecosistemas están siendo alterados por actividades humanas a un ritmo y extensión nunca visto en la historia. En especial aquellos ecosistemas de donde se pueden extraer recursos para el uso humano se encuentran en peligro de sobreexplotación, y/o impactados severamente por la acción humana [1–3]. Además, todos los ecosistemas se encuentran sometidos a los impactos del cambio climático. Este escenario global cambiante nos obliga repensar las relaciones entre sociedad y medio ambiente [4].

Los sistemas relacionados con la explotación de recursos naturales se pueden considerar como sistemas socioecológicos (SES, por sus siglas en inglés) [5]. Un SES es la combinación de un sistema ambiental y uno social, donde la combinación resulta en un nuevo sistema, cuyo funcionamiento se encuentra determinado por la interacción y procesos de retroalimentación entre los diferentes componentes [6]. En los SES se pueden identificar cuatro subsistemas, el subsistema recurso (pesquería), unidad recurso (especies/especie explotada), gobernanza (organizaciones, normas y reglas que regulan la pesquería) y los usuarios (pescadores) [5]. Las pesquerías (refiriéndose a todo el SES del que forman parte) son un buen ejemplo de SES puesto que son un sistema social y otro biofísico conectados entre sí con una clara y alta dependencia de uno o varios recursos naturales que sostienen la actividad pesquera.

El marco conceptual de SES puede aplicarse para analizar pesquerías. El enfoque de los SES es holístico, puesto que no se enfoca en entender detalladamente cada una de las partes, sino en como los componentes contribuyen a la dinámica de todo el sistema [5]. Ostrom [5] presenta un marco general para analizar la sustentabilidad de los SES, que será revisado por McGinnis & Ostrom [7] para ajustar el listado de atributos relevantes para el subsistema de gobernanza. La **¡Error! No se encuentra el origen de la referencia.** ejemplifica los procesos de interacción y retroalimentación entre los diferentes subsistemas de un SES. En el caso específico de pesquerías, este marco es tomando en Basurto [8] donde identifican los atributos de segundo a quinto nivel para pesquerías artesanales bentónicas, usando varios casos de estudios de México y Chile para comprender qué atributos ayudaron al manejo sustentables de algunas de las pesquerías.

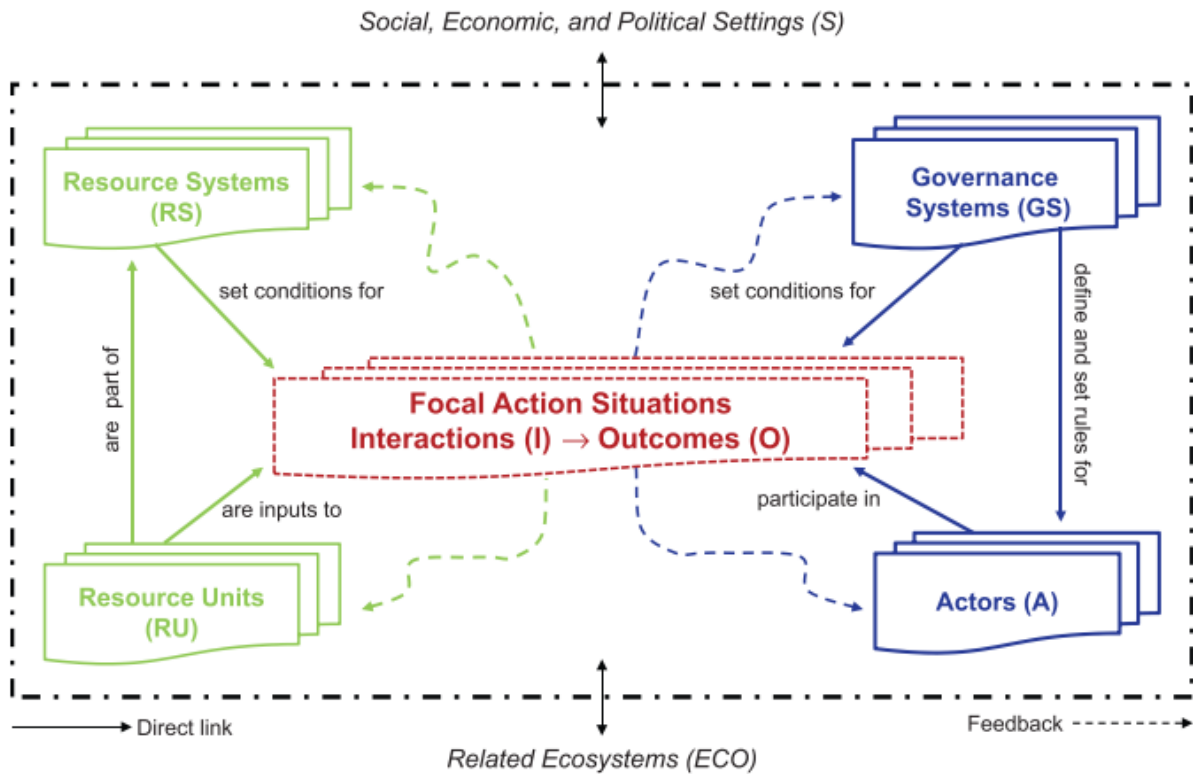


Figura 1. Marco conceptual revisado para los SES con componentes de múltiples niveles. Los recuadros detrás de cada subsistema (Recurso, Unidad, Gobernanza y Actores) indican los diferentes niveles de variables. El cuadro central es donde las acciones tienen lugar como inputs y son transformadas por las acciones de los actores en resultados u outputs. Las flechas discontinuas indican la retroalimentación de las acciones sobre cada uno de los niveles de los subsistemas. La línea de puntos y rayas que rodea los elementos interiores de la figura indica el SES de estudio, que está influenciado por factores exógenos como ecosistemas y el contexto socio-económico-político que pueden afectar cualquier componente del SES. Fuente: [9].

Resiliencia

El concepto de resiliencia ha evolucionado en las últimas décadas. La Resiliencia (como concepto) surge del campo de la ecología para entender la capacidad de los ecosistemas, con diferentes estados de equilibrio, de resistir en su estado original a perturbaciones [10]. Holling [10] define la resiliencia ecológica como “la magnitud de perturbación que un sistema puede absorber antes de cambiar a un régimen o sistema alternativo”. Del campo de la ecología evoluciona el concepto y se integra en numerosos campos llegando a los SES donde la resiliencia puede ser definida como la capacidad de un sistema para absorber perturbaciones y reorganizarse mientras experimenta cambios para conservar esencialmente la misma función, estructura y retroalimentaciones y, por lo tanto, la identidad, es decir, la capacidad de cambiar para mantener la identidad [11,12]. Así, la resiliencia socioecológica (SER) se puede definir como la capacidad de un sistema socioecológico para absorber, adaptarse y reorganizarse frente a perturbaciones, manteniendo esencialmente su identidad y funciones básicas [13]. La resiliencia por lo tanto es un concepto dinámico que se centra en cómo persistir con el cambio y/o cómo evolucionar con el cambio [14]. Así, mejorar la resiliencia de los SES puede ayudar a manejar la complejidad y la incertidumbre [15].

El marco conceptual de SES puede aplicarse para analizar pesquerías. El enfoque de los SES es holístico, puesto que no se enfoca en entender detalladamente cada una de las partes, sino en como los componentes contribuyen a la dinámica de todo el sistema [4]. El enfoque de resiliencia reconoce la complejidad e interconectividad de los sistemas socioecológicos, enfatizando la capacidad de estos sistemas para absorber, adaptarse y reorganizarse frente a perturbaciones [13]. En el contexto del manejo de recursos naturales, la resiliencia implica la capacidad de mantener la productividad, la biodiversidad y los servicios ecosistémicos de los ecosistemas, a la vez que se asegura el bienestar de las comunidades que dependen de ellos [16].

En el contexto actual, caracterizado por cambios ambientales y sociales sin precedentes, la gestión sostenible de los recursos naturales se ha vuelto imperativa. Las pesquerías, como sistemas socioecológicos complejos, enfrentan múltiples desafíos que amenazan su viabilidad a largo plazo. En este sentido, el concepto de resiliencia ha cobrado relevancia en el manejo pesquero, ofreciendo un marco conceptual para abordar la incertidumbre y la adaptación a perturbaciones [11,12]. Los enfoques de manejo basados en la resiliencia enfatizan la comprensión de las interconexiones entre los componentes ecológicos y sociales de las pesquerías, promoviendo estrategias de manejo que fortalezcan la SER [17]. Estos enfoques reconocen la dinámica compleja y cambiante de los sistemas pesqueros, y buscan identificar puntos de apalancamiento que permitan aumentar la capacidad de adaptación y transformación ante perturbaciones [18]. El enfoque de resiliencia, reconoce que la incertidumbre y el cambio son inherentes a los sistemas naturales y sociales, y busca desarrollar estrategias de manejo que permitan a estos sistemas navegar por la incertidumbre y adaptarse a nuevas condiciones. En este sentido, el concepto de resiliencia ha cobrado relevancia en el manejo de recursos naturales, ofreciendo un marco conceptual para abordar la incertidumbre y la adaptación a perturbaciones [11,12]. Este enfoque contrasta con los enfoques tradicionales de manejo, que a menudo han tratado de controlar y estabilizar los sistemas socioecológicos, ignorando su capacidad natural para adaptarse y cambiar.

Existen estudios sobre cómo identificar indicadores y medir la resiliencia de SES. Biggs [16] revisan la literatura para destacar los principios para mejorar la resiliencia de los SES para enfrentar perturbaciones, destacando siete principios generales. Estos principios son i) mantenimiento de la diversidad y redundancia, ii) manejo de conectividad; iii) manejo de estresores (slow variables) y retroalimentaciones; iv) fomentar la comprensión de los SES como sistemas adaptativos complejos.; v) fomentar el aprendizaje y la experimentación; vi) ampliar la participación; y vii) promover sistemas de gobernanza policéntricos. Salomon [19] toman estos principios teóricos y los ponen en práctica para evaluar cómo la resiliencia cambia en el SES asociado a la pesquería de arenque en el noroeste de Canadá a lo largo de tres regímenes de gobernanza (Tabla 1). La presencia combinada de varios de estos atributos ayuda a aumentar la resiliencia de los SES. Quinlan [20] analizan diferentes formas de evaluar y medir la resiliencia que han surgido en la última década.

Tabla 1. Principios e indicadores utilizados para evaluar el cambio en la resiliencia en el SES del arenque del Pacífico de la costa central de Canadá (Fuente: Salomen et al., 2019).

Resilience principle	Metrics specific to herring SES
Maintain diversity and redundancy	Marine species and habitat diversity Species response diversity Diversity of perspectives Diversity of livelihoods Diversity in herring size structure Diversity in herring spawning season dates
Manage connectivity	Degree of information sharing
Manage slow variables and feedbacks	Understanding of gradual changes Decisions updated with new information Ability of managers to respond to key changes
Foster complex adaptive thinking	Willingness to embrace change Preparedness to cope with unexpected events
Encourage learning	Innovation and willingness to experiment Sharing of scientific resources
Broaden participation	Level of participation Level of trust Level of cooperation
Promote polycentric governance	Use of Indigenous knowledge and stewardship protocols Distribution of power in decision-making Accountability Indigenous authority to access herring Willingness for conflict resolution

Otros estudios aportan ejemplos de indicadores para evaluar los SES. Leslie [21] operacionalizan los SES, dando ejemplos de indicadores, para evaluar el grado de sustentabilidad de las comunidades costeras de Baja California Sur, México. Silva [22] estudian el grado de resiliencia de los SES de comunidades costeras vinculadas a reservas marinas en Brasil, desarrollando varios indicadores. Gutiérrez [23] destacan los factores de liderazgo y capital social como clave para el éxito el manejo sustentable de pesquerías.

Pesquerías, Eco-certificaciones y Proyectos de Mejora Pesquera

Las pesquerías son una actividad socioeconómicamente relevante a nivel mundial. Alrededor de 50 millones de personas se dedican a la pesca como actividad económica principal, siendo las pesquerías artesanales y/o de pequeña escala (PPE) las que emplean a la mayoría del sector [24]. Las pesquerías tienen ante sí numerosos retos para alcanzar la sostenibilidad, como la sobreexplotación de los recursos, pesca ilegal, no regulada o declarada, manejo deficiente entre otros [25–28]. Las pesquerías juegan un papel destacado en la persecución de los objetivos de la agenda 2030 de Naciones Unidas, en especial en el objetivo 14: “Conservar y utilizar de forma sostenible los océanos, los mares y los recursos marinos para el desarrollo sostenible”[29]. Las pesquerías son un buen ejemplo de SES puesto que son un sistema social y otro biofísico conectados entre sí con una clara y alta dependencia de uno y/o varios recursos naturales que sostienen la actividad pesquera.

Uno de los esquemas de manejo sostenible de pesquerías más prometedores son las eco-certificaciones. Las eco-certificaciones, son un instrumento de mercado que otorga un reconocimiento a una compañía y/o producto por haber alcanzado un cierto estándar medioambiental [30], a la vez que informan al consumidor sobre los criterios de sostenibilidad seguidos en el producto [31]. Estos instrumentos han sido reconocidos por la Organización Mundial de Comercio como instrumentos de política ambiental [32].

La eco-certificación del Marine Stewardship Council (MSC) es líder en pesquerías a nivel internacional. El MSC ha certificado a 338 pesquerías, y 45 se encuentran en proceso, correspondiendo al 14% de las capturas globales [33]. El estándar del MSC se basa en tres principios: i) Sostenibilidad del stock de la especie objetivo de la pesca (especie); ii) Minimizar los impactos en especies no objetivos y los hábitats asociados a la pesquería (ecosistema); iii) Manejo eficaz de la pesquería (gobernanza) [34]. Cabe destacar que en la creación del estándar del MSC se omitió la consideración de temas sociales para centrarse más eficientemente en la parte ambiental [35]. Además, el estándar se enfoca en el eslabón de captura de la pesquería. El estándar del MSC no es prescriptivo, es decir, no cuenta con una ruta general o específica para alcanzarse, esto complica a muchas pesquerías, en particular a las pesquerías ribereñas acceder a él ya que no cuentan con las capacidades para generar la planeación estratégica que se requiere para alcanzarlo.

A pesar de la proliferación de las eco-certificaciones, existe una controversia sobre sus beneficios y limitaciones. Por ejemplo, la implementación del estándar del MSC mejora la sostenibilidad de las pesquerías [36–38]. También permite el acceso a nuevos mercados, aumento del capital político y fortalecimiento de las estructuras organizativas [30,35,39,40]. Sin embargo, existen limitaciones como los altos costos asociados a la certificación, falta de familiaridad con los programas de certificación, excesiva burocracia, falta de apoyo gubernamental y la incapacidad de solucionar dificultades sociales [30,35,39,40]. En muchos casos la poca conciencia ambiental en el mercado objetivo puede dificultar el incentivo de un posible precio premium, por lo que los productores no logran compensar económicamente los costos de mantener estas certificaciones [31,41]. Ante la ausencia de preferencias de sustentabilidad de los consumidores, y sin subsidios, quizá la certificación no es una herramienta apropiada para las pesquerías, y en especial para las de pequeña escala [42].

Aquellas pesquerías interesadas en contar con la eco-certificación, o que quieran aumentar su desempeño ambiental y que no cumplen con el estándar, deben establecer una serie de acciones que eventualmente les permita cumplirlo. Es en este contexto que surgen los denominados *proyectos de mejora pesquera* (Fishery Improvement Projects, FIP por sus siglas en inglés). Los FIP son una forma de gobernanza liderada por el sector privado que utiliza la fuerza del mercado para impulsar a las pesquerías a reducir sus impactos ambientales [43]. Los FIP se guían por el estándar del MSC, pero dependiendo del tipo de FIP que se quiera implementar no necesariamente conducen a la certificación final del MSC [44,45]; éstos pueden llevar a la pesquería a acceder a otra o a ninguna certificación [46]. La creciente demanda global de productos marinos provenientes de pesquerías

sostenibles ha ocasionado el incremento de FIP, siendo actualmente más 170 a nivel mundial [47], unido a que los FIP se encuentran reconocidos dentro de las políticas de compras de grandes empresas [e.g.: 48,49].

Los FIP han demostrado que son una herramienta útil para mejorar el estado de sostenibilidad de las pesquerías. Los problemas críticos de las especies objetivas mejoran, como la probabilidad de alcanzar mejoras en el manejo en comparación con pesquerías que no se estructuran como un FIP [50]. En general, la presencia de un FIP en una pesquería ayuda a mejorar la comunicación entre las diferentes partes interesadas, la recolección de datos, como también ayuda a desarrollos de planes de manejo y otros cuerpos de manejo, y aumenta el cumplimiento de las normas [51]. Ciertas características hacen que aumente la efectividad de las mejoras dentro de un FIP, como son el tiempo transcurrido desde el inicio de un FIP, la presencia de acuerdos de manejo regionales y cuando la especie objetivo presenta una vulnerabilidad moderada a la pesca [38].

Sin embargo, los FIP presentan algunas limitaciones. Los FIP tienen su fortaleza y debilidad en su diseño en sí. Como forma de gobernanza privada, utiliza la fuerza del mercado como mecanismo para implementar mejoras en las prácticas de sostenibilidad. Esto a su vez hace que acciones que no estén ligadas a una ventaja en el mercado, pueden ser difíciles de poner en marcha, o pesquerías que no están centradas en mercados de exportación, difícilmente puedan aprovechar este impulso para adoptar un FIP [51], dejando a pesquerías de mercados nacionales o regionales sin los incentivos para entrar en estos esquemas de manejo. A su vez, especies que puedan ser substituidas por otras en las grandes cadenas de suministro de pescados y mariscos cuando presenten deficiencias en el estado de sus stocks, pueden ser substituidas por otras poblaciones o especies, debilitando el potencial del FIP para llevar a cabo mejoras en sostenibilidad de la pesquería [51]. Esto deja muy vulnerable a las pesquerías, en especial a las de pequeña escala, ante cambios en el mercado [52]. Además, existen críticas sobre su capacidad para abordar adecuadamente los desafíos relacionados con los derechos humanos y la responsabilidad social [53,54].

En los últimos años ha habido una proliferación de los FIP a escala internacional con el propósito de mejorar la sostenibilidad ambiental de las pesquerías. Sin embargo, no se conoce a profundidad cómo estos instrumentos de mercado podrían estar contribuyendo a aumentar la resiliencia o podrían estar añadiendo un estrés en los SES del cual forman parte, puesto que están centrados en mejorar la sostenibilidad ambiental aprovechando la demanda de productos sostenibles por parte de ciertos mercados.

Comprender a las pesquerías como SES y ayudar a aumentar su resiliencia hará que puedan alcanzar un desarrollo sostenible. Los esquemas de eco-certificación como el MSC, y los FIP se han centrado en el desempeño ambientalmente sostenible de las pesquerías. Sin embargo, las pesquerías se enfrentan

a múltiples problemas que podrían afectar a la sostenibilidad de estas. Se necesita analizar desde un enfoque holístico si estas herramientas de mercado, concretamente en este estudio los FIP, están ayudando a fortalecer el sistema pesquero, es decir, si contribuyendo al aumentar a la resiliencia del sistema, y si no, explorar qué aspectos también se deberían fortalecer para hacerlo. Este trabajo busca contribuir a una comprensión más profunda de la relación entre los FIP y la resiliencia socioecológica en las pesquerías de Latinoamérica, y busca informar el desarrollo de estrategias de manejo más integrales y fortalecer la construcción de sistemas pesqueros más resilientes y sostenibles a largo plazo.

Objetivos

Objetivo general

Evaluar los cambios de la resiliencia de los sistemas socioecológicos pesqueros que llevan a cabo proyectos de mejora pesquera en la región de Latinoamérica y el Caribe.

Objetivos específicos

- i) Realizar una revisión de la contribución los proyectos de mejora pesquera (FIP) al manejo pesquero en la región de Latinoamérica y el Caribe
- ii) Evaluar cómo los FIP modifican los principios de resiliencia en sistemas socioecológicos pesqueros en tres casos de estudios en Latinoamérica y el Caribe.

La tesis está estructurada en cuatro capítulos, el primero introductorio, seguido de dos capítulos que responden a los respectivos objetivos específicos en formato de artículo científico, seguido de un capítulo final de consideraciones del modelo FIP. En el segundo capítulo se analizó la diversidad, desafíos y oportunidades de los Proyectos de Mejora Pesquera en la región de Latinoamérica y el Caribe. El tercer capítulo se analizó como los proyectos de mejora pesquera modifican de forma limitada la resiliencia socioecológica.

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Capítulo 2. Diversity, challenges, and opportunities of Fishery Improvement Projects in the Latin America and the Caribbean region¹

Abstract

Fishery Improvement Projects (FIPs) have become a popular tool to drive sustainable management among fisheries. FIPs, guided by a private sector-led governance structure motivated by market-driven incentives, aim to reduce environmental impacts in fisheries, using the Marine Stewardship Council (MSC) fishery standard as a guide. The Latin America and Caribbean (LAC) region is a FIPs global hotspot. This study provides a comprehensive analysis of FIPs in the LAC region and highlights their potential and limitations in driving fisheries toward sustainability. We used information from the FisheryProgress website to analyze the main characteristics, and challenges concerning the MSC fishery standard, as well as actions, and outputs taken by FIPs. FIPs in this region are diverse, and face similar challenges related to defining stock status, establishing harvest strategies and control rules, and implementing fishery-specific management given limited fisheries information. Data collection and engagement through meetings to modify fishing practices and policies were the most employed actions to address these challenges. Although many FIPs are ongoing, improvements are evident as FIPs advance to later stages. Overall, FIPs are seen as a multi-stakeholder tool that encourages fisheries to enhance their environmental performance in pursuit of sustainability. However, more time is required to ascertain the true extent of their impact. This research offers insights into the main challenges and strategies when implementing FIPs in LAC. Our results should be valuable for stakeholders looking to support sustainable fisheries management through FIPs where fisheries conditions are similar.

Keywords: Fisheries sustainability, fishery management, Latin America, eco certification.

Highlights

- The LAC region has become a global hotspot of Fishery Improvement Projects
- Small-scale fisheries comprise most Fishery Improvement Projects in the LAC region
- The seafood market could be driving sustainable fishery management in the LAC region

¹ A version of this chapter appears as, Gomez-Gomez, A., Malpica-Cruz, L., Montaña-Moctezuma, C. G., Cisneros-Montemayor, A. M., Salomon, A. K., & Seingier, G. (2024). Diversity, challenges, and opportunities of Fishery Improvement Projects in the Latin America and the Caribbean region. *Marine Policy*, 163, 106116. <https://doi.org/10.1016/j.marpol.2024.106116>

- ONGs and industry are key players in developing Fishery Improvement Projects
- FIPs in LAC promote fishery governance and improve environmental performance

Introduction

Private standards and certification schemes have become increasingly popular in the seafood trade. Eco-certifications are market instruments that recognize a company and/or product for having achieved a certain environmental standard [30] while informing consumers about the sustainability criteria followed in its production [31]. The premise is that this will then incentivize environmental and socially responsible practices. One of the most widely recognized eco-certification programs in the seafood industry is the Marine Stewardship Council (MSC), which engages 19% of global marine wild catch [55]. The MSC fishery standard is based on three basic principles: i) sustainable fish stocks; ii) minimizing environmental impacts, and iii) effective management [34].

Fishery Improvement Projects (FIPs) have gained popularity as a model for enhancing fisheries sustainability, despite not being a certification per se. FIPs are defined as *“a multi-stakeholder effort to address challenges in a fishery. These projects use the power of the private sector to incentivize improvements in the fishery and seek to make these changes endure through policy change. FIPs always include goals related to environmental sustainability. In recent years, many FIPs have also begun to address other issues, such as human rights, social responsibility, and even financial sustainability”* [43]. FIPs follow the MSC fishery standard as a guide to improve their environmental performance, but depending on the type of FIP being implemented, they may not necessarily lead to MSC certification [45]. Instead, the improvements the fishery achieves might allow it to apply for another certification schemes (e.g., Fair Trade, MarinTrust Standard, etc.), rating recommendations (e.g., Monterey Bay Aquarium Seafood Watch yellow/green rating recommendations) or choose not to commit to any certification [46]. The incorporation of FIPs into seafood retailers' procurement policies, aimed at sourcing from more sustainable fisheries, has contributed to the popularity of these projects [44,56]. This allows retailers to comply with their sourcing commitments while fisheries in FIPs maintain market access while making improvements[57].

The number of FIPs has increased over the past decade, leading to a formalization of this fishery improvement model [43,46]. The Conservation Alliance for Seafood Solutions (CASS), a coalition of conservation organizations dedicated to promoting sustainable seafood [43], established the FIP

guidelines to assist these projects. These guidelines have undergone several updates (2012, 2015, 2019, 2021, 2022) [58]. In 2016, FisheryProgress (fisheryprogress.org) was launched, becoming the recommended platform by CASS for FIPs to report their work in a standardized, reliable, and credible manner, facilitating project tracking for other stakeholders[43]. In 2023, FisheryProgress boasts 188 active and completed projects worldwide [47]. CASS guidelines outline the requirements that FIPs must meet regarding stakeholder engagement, project objectives, progress tracking, and public reporting [43]. FIPs are required to create a workplan to enhance their environmental performance, based on an initial preassessment utilizing the MSC fishery standard. This workplan identifies environmental challenges, sets goals, establishes time-bound actions, and outlines an associated budget [43]. In addition, CASS guidelines indicate the different stages a FIP should go through. While FIPs were initially established to improve the environmental performance of fisheries, since May 2021, those FIPs published on the FisheryProgress website must also adhere to The FisheryProgress Human Rights and Social Responsibility Policy [47].

FIPs have shown that they are a useful tool to improve fisheries' sustainability, but they have some limitations. In a global review of FIP progress, [50] found that critical problems of target fisheries improve (e.g., stock health, environmental impacts, quality management), as does the likelihood of achieving management improvements compared to fisheries that are not structured as a FIP. In general, the presence of a FIP in a fishery helps to improve communication between different stakeholders, data collection, as well as assisting in the development of management plans and other management bodies, and increases compliance with regulations [51]. However, the FIP model has presented some concerns about its suitability to be implemented by small-scale fisheries (SSF) [52], the focus on middle to high-valuable commodities [51], and being inadequate to address labor abuses and protect workers' rights [54]. The FIP model has also been criticized for providing novel market access without demonstrating real fishery improvements [57]. These potentially serious challenges for implementing FIPs as a way to meet environmental (or social) goals make it necessary to engage in more in-depth research that can highlight contextual evidence to anticipate barriers and possible solutions.

Latin America and the Caribbean (LAC) has become a global FIP hotspot, as FIPs have emerged as a potential solution to address various sustainability challenges with fisheries throughout the region [46]. LAC fisheries are diverse, encompassing a wide range of target species and playing a significant role in the global seafood trade [24]. Despite their importance, LAC fisheries face several challenges

such as limited data, weak governance institutions, as well as issues related to overfishing and ecosystem degradation, especially prevalent in SSF [59]. The LAC region stands out due to the number of ongoing FIPs [46,47] aimed at overcoming some of these challenges. This paper focuses on FIPs implemented in the LAC region and assesses their growth, challenges, performance, and the role of eco-certifications schemes in guiding their development towards environmental sustainability. In the context of the FIPs in the LAC region, we explored the following key questions: What are the primary characteristics of FIPs? What are the main challenges associated with the MSC fishery standard? And what are the key actions and outcomes achieved by FIPs? Answering these questions would help fisheries stakeholders to tailor their approach to meet specific needs and challenges faced by fisheries in the region, thus allowing implementors to design targeted interventions and improvements. Furthermore, understanding the key actions and outcomes achieved by FIPs provides a roadmap for effective implementation strategies and highlights successful approaches that can be replicated in other fisheries.

Methods

To characterize FIPs, we used data from all available FIPs in the Latin American and Caribbean region. To ensure the data was reliable and homogeneous, we consulted the FisheryProgress website (www.fisheryprogress.org), henceforth “FisheryProgress”, given that it has become the website of reference where most FIPs reports their work (i.e., data from 95% of active FIPs worldwide are reported here) [47]. FIPs on this website follow the Conservation Alliance for Seafood Solutions guidelines [43]. They must report updates every six months, provide evidence of their work, update the Performance Indicator (PI) scores based on the Marine Stewardship Council (MSC) Fisheries Standard and provide supporting evidence for score changes every 12 months [43]. To ensure accuracy in the information posted, a committee revises progress and evidence from each FIP before publication on the website, and corrections are made when needed by FIP lead/s. Additionally, all projects listed on FisheryProgress must have workplans, participant agreements, and evidence of improvements publicly available [47]. Since 2016, FisheryProgress has been the main reference for reporting FIP progress; although each FIP has its own action plan, all FIPs report similarly, allowing for comparison among projects [60] or analyzing some of their attributes related to FIP performance [38]. Although FisheryProgress was launched in 2016, some FIPs on the website may have started their projects before.

We retrieved the information from March 10th to April 25th of 2022 from FisheryProgress. We only included FIPs listed in FisheryProgress as “active” or “completed”. We did not include FIPs under an “inactive” or “prospective” status in our analysis given that the available data was limited [47].

To characterize the FIPs in the region, we collected data from FisheryProgress about several attributes such as country, species, fleet type, leading organization, FIP landings, FIP starting date (starting evaluation date), and FIP stage, among other attributes. To assess the level of engagement and commitment to the sustainability of the fishery, we assessed the percentage of the fishery's total landing that each FIP represents. If the FIP includes a large proportion of the overall fishery landings, it would suggest that there is a strong level of support for the sustainability goals of the FIP among the stakeholders involved in the fishery or that the fishery is very highly concentrated into the hands of people interested in engaging with a FIP.

We grouped FIPs by type of commodity: Large pelagics group includes tuna species (eg.: *Thunnus spp.*), mahi-mahi (*Coryphaena hippurus*) and swordfish (*Xiphias gladius*); Finfish group includes several species of whitefish and coastal fishes, such as Ocean Whitefish, Patagonian Toothfish and *Lutjanus spp.*, among others; Squid/Octopus (*Dosidicus gigas*, *Enteroctopus megalochyatus* and *Octopus spp.*); Lobster (*Panulirus spp.*); Crabs (*Callinectes spp.* and *Metacarcinus edwardsii*); Shrimp (eg.: *Xiphopenaeus kroyeri*, *Heterocarpus vicarious*, *Litopenaeus stylirostris*, among others); and Others, an heterogeneous group that includes clams (*Megapitaria squalida*, *Dosinia ponderosa* and *Panopea globosa*), sea urchins (*Mesocentrotus franciscanus*) and anchovy (*Engraulis ringens*).

Typically, FIPs undergo six stages (from 0 to 5). Stage 0: FIP Identification, where the target fishery is identified and a supply chain analysis is performed; stage 1: FIP Development, the fishery performance is evaluated against the MSC fishery standard (this initial evaluation of the fishery and the documentation produced is referred to as “preassessment”, or in some cases, “needs assessment”, referred hereafter throughout the text as “preassessment”) and fishery actors and stakeholders are contacted to participate; stage 2: FIP Launch, where the FIP is publicized indicating project participants, FIP objectives and workplan; stage 3: FIP Implementation, implementing the workplan, progress tracking and reporting, and direction correction if needed; stage 4: Improvements in Fishing Practices or Fishery Management, where FIPs document improvements related to monitoring and/or management, and; stage 5, Improvements in the Water, where FIPs document improvements on the

water, such as reduction on fishing mortality, increase on fish biomass, and/or reduction of bycatch (stage 4 and 5 could be non-sequential) [43]. Therefore, FIPs use the MSC fisheries standard to measure their environmental performance through the project. In our study, FIPs used version 2.01 of the MSC fishery standard, which is based on 28 PIs divided into three principles [34]. Principle 1, sustainable fish stock, to assess the fishery target stock(s) status and the harvest strategy (management) in six different PIs; principle 2, minimizing environmental impacts, to assess the fishery impacts over non-target species, ETP (Endangered, Threatened or Protected species), habitat and the broader ecosystem in 15 PIs; and lastly, principle 3, effective management, to assess the governance and policy framework system and the fishery specific management systems in seven PIs [34]. While principles 1 and 3 are assessed at the stock level, principle 2 is assessed at the FIP fleet level (see MSC fishery standard [34] for definitions on scope and species).

We collected the last PI scores for each available FIP, to compare them with PI scores from the preassessments. In addition, we used the preassessments scores to identify common issues against the MSC fisheries standard performance trends in the region (similar to Álvarez-Flores [61]). We transformed the MSC scoring categories to Benchmarking and Tracking Tool (BMT) scores [62]. By doing this, the MSC score's main categories (≥ 80 , 60-79, and ≤ 60) were transformed into BMT scores (1, 0.5, and 0, respectively). For each FIP, we assigned a BMT index that is simply an average of all BMT scores assigned to each Performance Indicator. The BMT index is a number between 0-1, where values closer to 1 mean that PIs are closer to MSC scores above 80; on the contrary, values close to 0 mean PI scores are below 60 [62]. We used the BMT index to explore differences between preassessments and present FIP performance, specifically, to see if there were differences among fisheries before and at the current FIP stage, among stages (given that the workplan implementation starts at stage 3 and improvements are only expected after this starts, therefore we only compared FIP preassessments to FIP in stages 3, 4, and 5), and among commodities using a non-parametric Kruskal Wallis test. We explored, analyzed, and visualized data using the tidyverse package [63] and ggplot2 package [64] in the open-source R programming environment [65].

Lastly, from each FIP, we identified common fisheries outputs, actions performed, and stakeholders' involvement by assessing the actions progress tab from each FIP profile when task status was completed. We used the coding developed in Crona [51], which is an analytical framework and coding to analyze the main actions and direct outputs performed by each FIP. Similarly to Crona [51], actions were divided into 8 main groups such as data collection, data dialogue, education, rally support,

engagement dialogue in fishery policy or practices and basic dialogue in fishery policy or practices. Outputs were defined as direct achievements in fisheries policy and/or fishery practices. Policy outputs were achievements related to policy and/or regulations, such as changes in laws, fishing regulations, that aim to improve governance. Practice outputs were achievements related to changes in fisheries practices such as gear changes, traceability schemes, or changes in fisheries practices where government was not involved. For variable coding we used the software MAXQDA [66].

Results

General characteristics of FIPs in LAC

Since the initial FIP reported in 2009, we found an exponential increase in new and ongoing reported FIPs until 2020. We found a total of 55 FIPs, 51 actives, and four completed in the region (Figure 2). 46% of all reported FIPs took place in Mexico, being by far the country with more FIPs (25), followed by Peru (4) and Argentina, Chile, Ecuador, and Brazil (3) (Figure 2). We found 11 inactive FIPs in the LAC region (not included in the analysis).

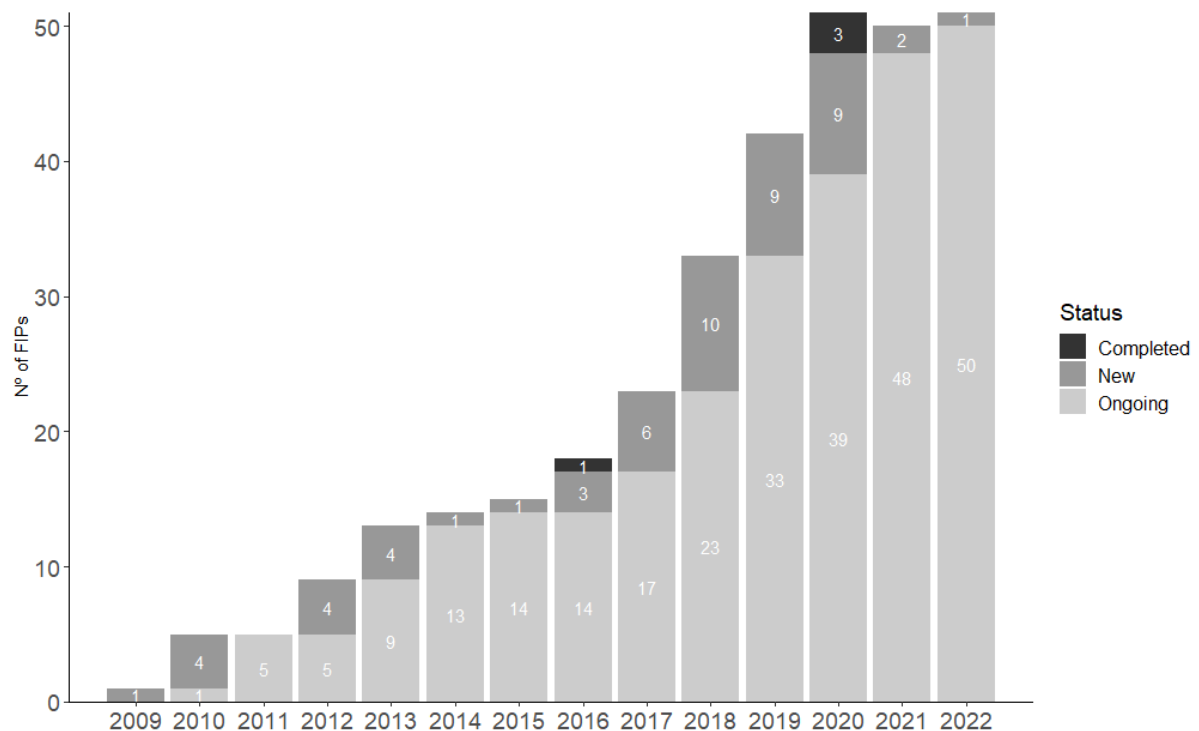


Figure 2. Cumulative number of active or completed Fisheries Improvement Projects (FIPs) in Latin America and the Caribbean from 2009 to 2022 as reported on the FisheryProgress website (www.fisheryprogress.org).



Figure 3. Distribution of Fisheries Improvement Projects (FIPs) in Latin America and the Caribbean region (M represents FIPs shared by several vessel flags; M1: Nicaragua, Panama, Ecuador; M2: Ecuador, Panama, USA, Colombia; M3: Costa Rica, Panama, Ecuador; and M4: Ecuador, El Salvador, Panama).

In the region, FIPs from the small-scale fisheries (SSF) fleets dominated with 30 FIPs in the LAC, followed by industrial fisheries with 15, and FIPs with mixed fleets (industrial and small-scale fleets) were 10 (Figure 4A). 20 FIPs in the region showed improvements in the management of the fishing practices or improvements on the water (corresponding to stages four and five, respectively). Early implementation stages, such as stage three and stage two, were a minor part of all FIPs in the LAC, with seven and four FIPs, respectively (Figure 4B). NGOs led more FIPs in the region than other organizations, with 20 FIPs. Collaborations within NGOs with industry were the second group leading

FIPs with 13 FIPs, followed by industry alone with 9 FIPs (Figure 4C). Commodities differed among fleet type. In SSF, finfish was the commodity on which most FIPs focused (8), followed by crabs (6), lobster (5) and others (5). Large pelagics (8), followed by shrimp (3), were the main commodities for the industrial fleet (Figure 4D).

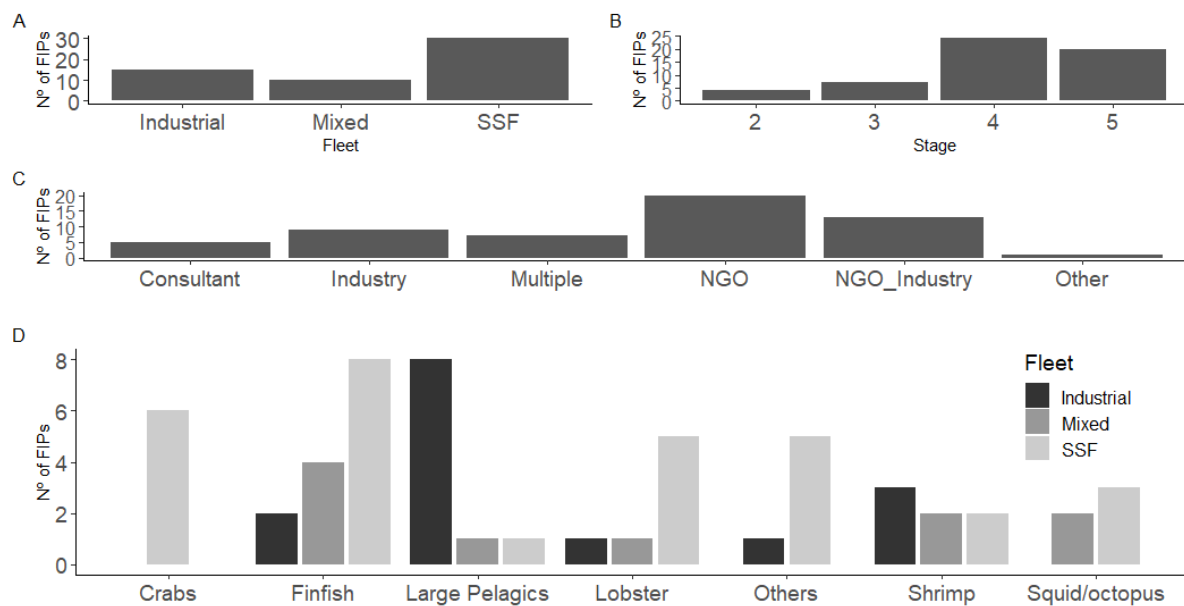


Figure 4. Fisheries Improvement Projects (FIPs) characterization in Latin America and the Caribbean (LAC) region: A: Number of FIPs per type of fleet (SSF: small-scale fisheries; Mixed: a mixed fleet of industrial and small-scale fishery). B: Number of FIPs per stage in the LAC region. 2: FIP launch; 3: FIP implementation; 4: Improvements in Fishing Practices or Management; 5: Improvements on the Water. C: Number of FIPs led by organizations in the LAC region (Multiple means a combination of different stakeholders leading the FIP besides NGO and Industry that has its category). D: Number of FIPs per commodity and type of fleet in the LAC region. Finfish include several species of whitefish and coastal fishes; Large Pelagics include tuna, Mahi-mahi, and swordfish; Others include small pelagics, clams, and sea urchin fisheries.

Landings reported by FIPs, Peru was the country with the highest total landings comprised within FIPs, with a small pelagic FIP (*Engraulis ringens*) reporting 3.85 million tones representing 80% of this fishery in the country, and a Jumbo Squid FIP (*Dosidicus gigas*) reporting over 441 thousand tones representing 100% of this fishery in the country. On the opposite side, the Caribbean spiny lobster FIP in Venezuela and the Isla Natividad ocean whitefish (*Caulolatinus princeps*) FIP in Mexico, reported

both 20 tones, representing 20% and 100% of their reported fishery landings, respectively. Overall, we found 20 FIPs with landings over 70% of the total fishery landings, 13 FIPs with landings between 30-69% of their total fishery landings, and 20 FIPs below 30% of the total fishery landings. We also found two FIPs in Mexico that reported no landings, the Jumbo squid (*Dosidicus gigas*) and Chocolate Clam (*Megapitaria squalida*). The first was due to low resource availability in recent years and, the second was due to a temporal fishery closure to promote recovery. In this analysis, we dismissed 2 FIPs that did not report the total fishery landings, only the FIP landings.

Main challenges with MSC fisheries standards in LAC

We identified several challenges reflected in the FIP Performance Indicator (PI) Scores for LAC, which are based on the MSC fisheries standards (Table 1). Challenges achieving Principle 1, sustainable fish stocks, were related to the stock status, stock rebuilding, harvest strategy and harvest control rules, and tools indicators (1.1.1, 1.1.2, 1.2.1 and 1.2.2). In principle 2, minimizing environmental impacts, challenges were focused on Secondary species (species without points of reference), management strategy and information (2.2.2 and 2.2.3) and endangered, threatened, or protected species outcome (2.3.1). In principle 3, the challenges were related to the Fishery Specific Management System rather than governance and policy, with more scores below 60 related with fishery specific objectives, compliance and enforcement, and monitoring and management performance evaluation indicators (3.2.1, 3.2.3 and 3.2.4). Overall, principles 1 and 3 showed more indicators scoring below 60, while principle 2 showed a higher percentage of PI scoring above 80.

Table 2. Percentage of Fisheries Improvement Projects (FIPs) in Latin America and the Caribbean with Performance Indicator (PI) Scores of ≤60, 60-79, or ≥80. Colors indicate higher (green) or lower (red) mean scores for each PI across all FIPs assessed. Note that the number of FIPs is not always 55, as some PI are not addressed in all the preassessments (e.g., basic FIPs or PI 1.1.2).

MSC Principles		PI	% ≤60	% 60-79	% ≥80	# FIPs
1. Sustainable fish stocks	Outcome	1.1.1	31	48	21	52
		1.1.2	56	30	15	27
	Harvest Strategy (Management)	1.2.1	54	39	7	54
		1.2.2	57	39	4	54
		1.2.3	27	55	18	55
		1.2.4	27	35	38	55
Primary Species	2.1.1	14	14	72	50	
	2.1.2	20	18	62	50	

2. Minimizing environmental impacts	Secondary Species	2.1.3	22	31	47	51
		2.2.1	28	26	45	53
		2.2.2	37	27	37	52
	ETP Species	2.2.3	38	40	23	53
		2.3.1	32	19	49	53
		2.3.2	19	35	46	52
	Habitats	2.3.3	28	49	23	53
		2.4.1	8	30	62	50
		2.4.2	18	20	61	49
	Ecosystems	2.4.3	13	38	50	48
		2.5.1	8	48	44	48
		2.5.2	21	53	26	47
		2.5.3	26	58	16	43
3. Effective management	Governance and Policy	3.1.1	13	13	74	53
		3.1.2	9	30	60	53
		3.1.3	7	19	74	54
	Fishery Specific Management System	3.2.1	37	54	10	52
		3.2.2	29	52	19	52
		3.2.3	42	50	8	52
		3.2.4	36	53	11	47

We found that the mean BMT Index increases as FIPs move from the preassessment stage (i.e., before the FIP formally starts) into current FIP stages (3-5). BMT index values for stages 3 and 4 were not significantly different from preassessments; however, we found significant differences between preassessment BMT index values and FIP stage 5 (Kruskal-Wallis chi-squared = 24.991, df = 5, p-value < 0.05) (Figure 5). There were no differences among the different groups of commodities.

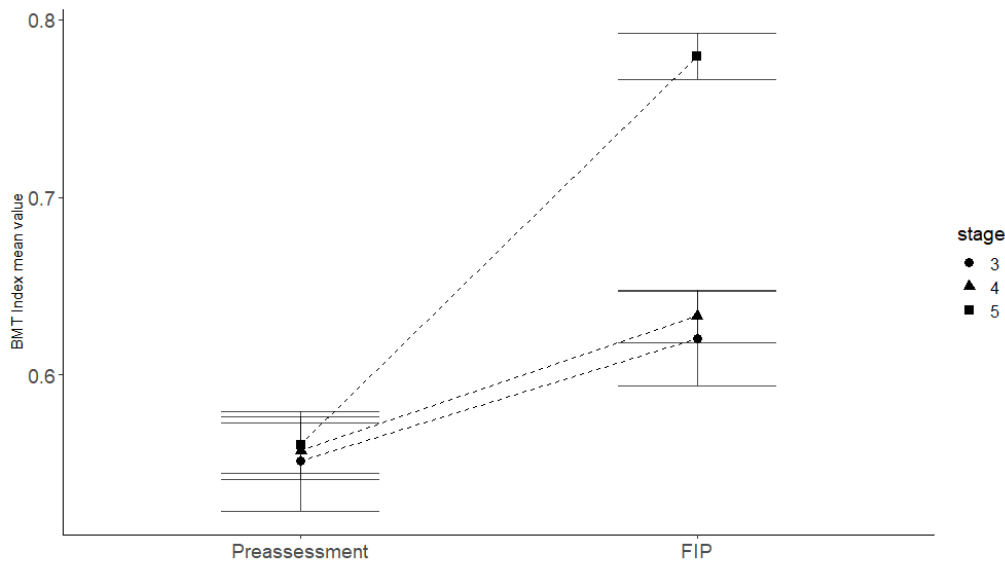


Figure 5. Benchmarking and tracking tool (BMT) index for preassessment and ongoing/completed Fisheries Improvement Projects (FIPs). The BMT index is a number between 0-1, values closer to 1 mean that Performance Indicators move closer to scores above 80. Contrary, values close to 0 mean Performance Indicator scores are below 60 scores. Bars indicate the standard error.

Main actions and outputs performed by FIP in LAC

We reviewed actions and outputs for 43 FIPs. Some FIPs did not yet complete listed tasks given the short time since they had been active. Actions were very similar among fisheries. All FIPs presented data collection, as data for stock assessments and/or species associated with the fishery, data about compliance, and other types of data, as the most common action taken across the FIPs. Data dialogue, in the form of meetings and workshops to discuss data results and/or data needs, was the second most common action indicated, with few exceptions, such as for Large Pelagics and Finfish, where it was ranked as the 3rd most common action (Table 3).

Engagement in practice, meetings, and discussions about gear modifications/selectivity, new ways of reporting catches, and new procedures to reduce bycatch was another action present in all fisheries but crabs (where they have basic dialogue in practice). Engagement in policy was a regular action for FIPs to try to improve the fisheries governance; only crab fisheries did not list it in the top 3 actions taken. Lastly, education, such as training to record data into logbooks, disseminating information, or implementing best practices, was a relevant action, but only in lobster fisheries (Table 3).

All fisheries but crab presented some form of outputs. The most common policy output was some form of fishery management plans. However, there were other types of outcomes that had a secondary relevance, such as creating a new group/committee to help support the governance or some modifications in current fishery laws/rules. New regulations to improve compliance and enforcement were an important outcome in large pelagics, lobster, and other fisheries. Some regulations about limiting access to lobster and shrimp fisheries and establishing quotas (or setting new quotas) in finfish and other fisheries were relevant outputs. Squid/octopus showed no policy outputs (Table 3).

FIPs also showed some outputs regarding changes in fishery practices but were less frequent than policy changes (Table 3). The primary practice output of all fisheries, but those targeting lobster and squid/octopus, was to implement fishery observation strategies, mainly onboard observers' programs but also the use of acoustic instruments that gather data constantly. Another common fishery practice output was the implementation of electronic traceability systems (e.g., via the use of electronic apps), and was implemented in FIPs targeting all commodity groups but finfish, shrimp and other fisheries. Other fishery changes in practices but less recurrently implemented were gear modifications, best practices implementations, and bycatch reduction programs, which were present in finfish, large pelagics, and other commodity fisheries.

Table 3. The top three most common actions reported, and outputs observed in completed Fisheries Improvement Projects (FIPs) across commodity fishery types. Numbers in parenthesis indicate the number of FIPs analyzed in each category (bold). When several actions and/or outputs were ranked the same, we listed them in the same action (1, 2, or 3). Percentages are reported concerning FIPs under each fishery category.

	Large Pelagics (5)	Finfish (12)	Squid / Octopus (4)	Crabs (6)	Lobster (5)	Shrimp (5)	Others (6)
Most common	1. Data collection (100%)	1. Data collection (100%)	1. Data collection (100%)	1. Data collection (100%)	1. Data collection; Engagement in policy (100%)	1. Data collection (80%)	1. Data collection (100%)

	2. Engagement in practice (80%)	2. Engagement in practice (42%)	2. Data dialogue; Basic dialogue policy (75%)	2. Data dialogue (66.7%)	2. Education; data dialogue (67%)	2. Data dialogue (60%)	2. Data dialogue; Engagement policy (67%)
	3. Engagement in policy; data dialogue; basic dialogue in practice (60%)	3. Engagement in policy; data dialogue; Basic dialogue policy (33%)	3. Engagement practice (50%)	3. Basic dialogue practice (50%)	3. Engagement in practice (50%)	3. Engagement practice and policy (40%)	3. Engagement practice; Basic dialogue policy (50%)
Most common outputs	Policy output (60%)	Policy output (42%)	No Policy output	No outputs	Policy output (83%)	Policy output (40%)	Policy output (50%)
	Management plan (60%)	Management plan (33%)			Others (83%)	Management Plan (40%)	Others (50%)
	Others (40%)	Others (25%)			Compliance (17%)	Limited Entry (20%)	Quota (33%)
	Compliance (40%)	Quotas (8%)	Limited Entry (17%)		Others (20%)	Compliance (33%)	
	Practice output (80%)	Practice output (33%)	Practice output (25%)		Practice output (17%)	Practice output (40%)	Practice output (33%)
Observers (60%)	Observers (25%)	Traceability (25%)	Traceability (17%)	Observers (40%)	Observers (33%)		
Others (40%)	Others (25%)				Others (17%)		
Traceability (20%)							

The main stakeholders involved in FIP activities were fishers, government organizations, NGOs, research organizations, the rest of the supply chain and the category “others” (comprised mainly of consultants). Fishers were more engaged in education, data collection and engagement in practice; government in engagement and basic dialogue in policy; NGOs played an important role in all kinds of activities; research organizations and others were engaged in data collection and data dialogue; and supply chain in the engagement of practice. First suppliers and retailers were seemingly absent of FIP

actions, with few exceptions, and in general, supported FIPs (as financial support) rather than undertaking operative activities (Figure 6).

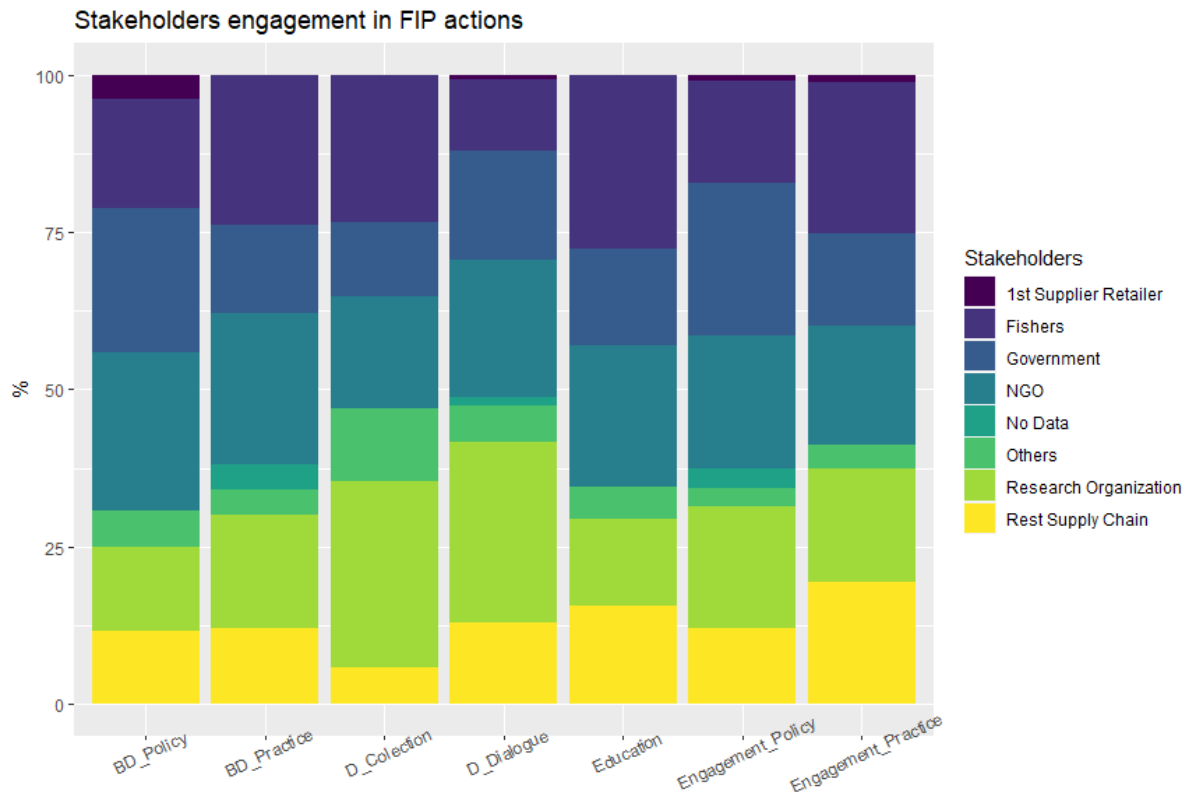


Figure 6. Stakeholders engaged in Fishery Improvement Project actions. All fisheries are represented together (BD_Policy: Basic Dialogue in Fishery Policy; BD_Practices: Basic Dialogue in Fishery Practices; D_Collection: Data Collection; D_Dialogue: Data Dialogue; Engagement_Policy: Engagement Dialogue in Fishery Policy; Engagement_Practice: Engagement Dialogue in Fishery Practices, see results section for more details on the FIP actions).

Discussion

The diversity of FIPs in the LAC region contributes to bridging gaps in fisheries knowledge. FIPs in the LAC region are diverse in the leading organizations, target species, fleet, and implementation, where small-scale fisheries, medium-high value species, NGOs or/and fishing industry leading FIP are the most common FIP in the region. Overall, and based on their own metrics, FIPs showed improvements throughout the region. Besides their diversity, they face common environmental challenges related to performance indicators, such as stock status, stock rebuilding, harvest strategy or indicators related to the fishery's specific management systems. Data collection and engagement meetings to modify

fishing practices were the most common actions performed with FIPs in the region to face those challenges.

General characteristics of FIPs in LAC

Globally, the number of FIPs are growing rapidly. Since 2009, FIPs reported in FisheryProgress in the LAC region have increased. Until the revision date, there were 51 actives, 4 completed, and 11 inactive FIPs in the LAC region, with the LAC and Asia-Pacific regions having the highest number of active FIPs [46,47,51]. FIPs had been implemented before FisheryProgress was launched in 2016. There are several reports of a Fisheries Improvement Project or Program implemented in the region in the 90s in Jamaica [67,68]. However, while a relevant effort towards local fishery sustainability, it is not comparable as it did not follow the MSC standard and guidelines as current FIPs. Other online sources date the first FIPs in the region in 2008 (Argentine hake, *Merluccius hubbsi*, and Argentine hoki, *Macruronus magellanicus*) [69,70]. Mexico stood out by being the country with the most active FIPs in the LAC region. Mexico had 25 out of 55 FIPs in the region, and the second country with the most FIPs was Peru with 4. The demand and international trade for aquatic food have grown in recent decades [24] and FIPs are recognized as sustainable practices (as fisheries in transition to sustainability) by some important retailers in US and Europe (e.g.: [48,49,71] that wish to supply from sustainable seafood sources. Therefore, FIPs allow fisheries to access market opportunities while improving fishery practices [57].

The FIP model was implemented across all types of fishing fleets. Small-scale fisheries (SSF) represented the main fleet type among FIPs in the region. However, we also observed cases where FIP efforts were divided by fleet type (e.g., Argentina and Peru), where there was a FIP focusing on the SSF and another focusing on the industrial fleet for the same species. This situation may reflect a practical way to deal with each fleet's challenges. For example, despite targeting the same resource, stakeholders tend to be more numerous and heterogeneous in SSF, thus a longer and more complicated co-management process would be needed when developing and implementing changes to fishery practices. The widespread adoption of FIPs throughout LAC echoes some concerns that have been raised about expanding the FIP model to SSF in regions riddled with complex social and economic conditions [52], data limited fisheries [42] and high costs to implement management actions [36]. If FIPs in SSF pursue certification, high costs could exceed potential benefits [72–74]. Despite the

concerns related with certification schemes in SSF, the high number of SSFs involved in FIPs may suggest that this sector does not wish to be left behind.

All FIPs go through different stages, where improvements are presented when they reach the final stages. Stages 4 and 5 are where FIP documented any demonstrated improvements, either in policy or management practices or modifications in fishing practices for stage 4, and improvement on the water for stage 5, measured as an increase in scores for MSC performance indicators (PI) on management or information or in outcomes, respectively, based in their workplan implementation [43]. In the LAC region, most FIPs showed improvements, corresponding to stages 4 or 5, although significant differences were observed for FIPs in stage 5 only regarding the preassessments. Normally, PI score improvements occur in the first two years since FIPs were launched [46]. However, time has been identified as an important attribute for showing improvements [38], indicating that some PIs require longer to improve. Despite that going from stage 2 (FIP launch) to stage 3 (FIP implementation) does not require demonstrated improvements, the required stakeholder engagement in FIP workplan activities provides an opportunity for fishery stakeholders (including government agencies) to build trusting relationships [75], and strengthen social capital, a key attribute to ensure fisheries success [23]. Only four of the whole FIPs analyzed were completed, meaning those FIPs “*provided independent verification that they have completed all their objectives or become MSC certified*” [43]. We observed the peak of new FIPs in the region from 2017 to 2020, when 34 new FIPs started. Most FIPs in LAC are rather new, thus additional time is still needed before more FIPs are completed to assess and generalize their improvements or challenges regarding their performance under the MSC fisheries standard.

Organizations leading FIPs varied, but most were led by NGOs, either individually, or together with industry, or collaboratively with multiple stakeholders. The key role NGOs played in developing FIPs was the development of multi-scale governance structures [76], knowledge production and distribution among stakeholders, networking and monitoring capabilities, and lastly, being actors with a generally assumed neutrality among FIP stakeholders, thus adding legitimacy to the FIP [68]. Also, given that the MSC fishery standard is complex, and stakeholders must invest time to fully understand its intricacies, NGOs are capable of speeding up knowledge and education training on sustainability certifications (e.g.: [68,77,78]). Although the FIP model was originally developed and promoted by NGOs [79], since the FIP guidelines were published, new stakeholders have started to lead FIPs [46]. Therefore, the fishery industry has become a FIP main player [46,51]. It seems that FIPs present the

opportunity where NGOs and fishing Industry goals can meet, allowing for the former to promote fishing sustainability, and the latter to obtain access to a wider market portfolio while improving fishery practices [57]. The significant presence of FIPs in Mexico may be attributed to the convergence of goals among diverse stakeholders. Various NGOs, the fishing industry, or a combination of both are spearheading these initiatives throughout the country.

Industrial FIPs appear to be specialized in targeting large pelagics, whereas SSF FIPs exhibit a greater degree of fish species. The industry fleet primarily focuses on large pelagic species, including tuna fisheries. According to CEA [46], there may be an overrepresentation of FIPs concentrated on tuna species, such as the Yellowfin Tuna (*Thunnus albacares*), which is present in several FIPs in the Pacific Ocean. These projects often entail distinct FIPs for different countries, all targeting the same stock, which is managed, for instance, by a regional fisheries management organization, like the Inter-American Tropical Tuna Commission. FIPs operating under regional-level management organizations tend to be associated with greater effectiveness [38], with these organizations primarily collaborating in the sharing of information [80]. However, coordinated actions against other fisheries-associated challenges (e.g., impacts on non-target species, or illegal, unreported, and unregulated fishing), are lacking [80], which could potentially undermine the overall success of all FIPs targeting the same stock. Conversely, SSF FIPs exhibit a more diverse range of targeted commodities, encompassing several middle- to high-value resources [81], which also reflects the multifaceted nature of this type of fleet, interested in multiple resources. Since FIPs serve as market tools, it appears that they are particularly interested in commodities traded on a global scale [51], although some FIPs have begun to focus on regional markets [46].

Low FIP landings in relation to total fishery landings could hinder overall fishery improvements both locally and across the region. For example, we identified 20 FIPs reporting landings that represented less than 30% of total fishery landings, while other 20 FIPs reported landings that represented over 70% of total fishery landings. That difference could be critical when dealing with actions to improve MSC PIs. While the principles of sustainable fish stocks (principle 1) and effective management (principle 3) focus on the stock level (i.e., including all fishing gears and fleets pursuing the stock, not only the FIP fleet), minimizing environmental impacts (principle 2) only focus on the fleet engaged in the FIP [34]. Therefore, promoting positive changes throughout the whole fishery may be more challenging when FIPs target a lower percentage of the total fishery landings. However, FIPs could add new stakeholders in the process and may encourage others to join forces to the project. It is important

to highlight that we retrieved the data directly from the FisheryProgress website, and we believe that sometimes it was not clear what the total fishery landings were referring to (country, regional, or state level). Future assessments will determine the change of landings over time assessed by each FIP (or several FIPs targeting the same stocks) and address whether the actions promoted are having positive impacts and advancing the fishery towards their different sustainability goals.

Main challenges against MSC Fisheries Standard in LAC

By evaluating FIPs against the MSC fishery standard during the initial stages of any FIP, it is possible to identify key environmental challenges that the fishery is facing and develop a workplan to implement actions aimed at improving its condition [43]. In this study, we observed that similar challenges are common across the LAC region. Other studies have highlighted similar challenges, such as weak or no enforcement, deficient data or monitoring systems, vague harvest strategy and rules, and deficient or absent information on stock status across the global south [82] or Mexico [61]. Deficient fishing information systems can lead to poor performance indicator scoring due to the lack of evidence of sustainable performance needed for all FIP development [60]. Further, such data limitations would complicate the development of harvest control rules [83]. The ability of fisheries to produce reliable data has been highlighted as an important constraint to accurately score performance indicators [74,82]. Therefore, FIPs are an opportunity to increase the fishery data capabilities and needs as well as to improve harvest control rules.

We observed improvement regarding the BMT scores along with the development of FIPs. We only observed significant statistical differences in BMT scores in FIPs in stage 5 in relation to their preassessments. The time required to reach each stage can vary widely depending on the specific FIP and the context in which it is being implemented, consequently, project time has been highlighted as a key factor for performance indicator improvements [38]. Overall, improvements were related to stock status and rebuilding, management, compliance, and improvements in principle 2. This is consistent with other studies that have shown significant improvements in FIPs for fisheries with critical problems in management and overfishing scores [50]. Our analysis indicates that FIPs can drive improvements in fisheries sustainability, particularly during the later stages of the project. These results highlight the importance of project time, management, compliance, and rebuilding efforts in achieving positive environmental outcomes.

Fisheries sustainability must be rooted in social, economic, and environmental performance. Fisheries involved in FIPs face several challenges in addition to complying with the MSC fishery standard. While FIPs are not a certification per se, fisheries involved in FIPs deal with challenges similar to those of similar certification schemes, such as activity costs, lack of engagement of key stakeholders, as well as limited local technical knowledge and capacity [36]. In addition, some studies have suggested the need to include socio-economic considerations in FIPs, such as impacts on institutions and people [74], stakeholders' social-ecological dynamics [52,79], and relationships between social capital and performance [84], among others.

Main actions and outputs performed by FIP in LAC

As expected, all FIPs assessed in the LAC region are undertaking activities to improve their environmental performance. Data collection was the most common action across all fisheries, followed by data dialogue, which was similar to the actions reported by Crona [51]. Given that the MSC fishery standard requires data to assess different performance indicators, lack of data, particularly from monitoring or stock assessments, has been highlighted as one of the main constraints to achieve certifications in developing countries [82]. We found that FIPs in LAC region overall presented more engagement to change fishing policy and practices rather than basic dialogue to change fishery policy and practices compared to Crona [51]. This difference could be due to FIP reporting becoming more prevalent since 2016 in FisheryProgress where FIP implementers should bind together activities with performance indicators, thus promoting that dialogues between stakeholders are focused on pursuing changes in fishery practices and/or policy, at least in the LAC region.

Most FIPs showed outputs but were limited to those in later stages. By definition, stages 4 and 5 are stages where there are changes in practices/policy and changes in water [43], respectively. Given that we considered only finished tasks and not incomplete tasks (that may have some outputs), we found the commodities in stages 4 and 5 with no outputs (Crabs with no outputs overall, or Squid/Octopus with no policy outputs), undermined some of the real outputs among FIPs in our analysis. Although we did not analyze implementation time in relation to FIP performance, it has been highlighted as a main factor for FIP success, with more improvement in longer FIPs [38]. In agreement with Crona [51], our results indicate that FIPs in the LAC region are pushing fishery governance forward with the creation and/or modification of new rules and governance bodies as well as implementing changes in fisheries practices to improve their environmental performance.

Each stakeholder contributed to different aspects and at a different level of engagement to the FIP goals and activities. The overall contribution of each stakeholder to the FIP activities in the LAC region, as shown in Figure 5, supports results reported by Crona [51], indicating that FIP stakeholder engagement is often specific. For example, NGOs played an active role in Education activities, given that they usually organize and coordinate these types of activities. Fishers, on the other hand, have a passive role in Education activities. Also, for Data Dialogue, research organizations are active, as they usually present and discuss data (active participation), meanwhile other stakeholders, such as government or fishers, are present as listeners (passive participation). We observed that while supply chain is present in all activities overall, they were more engaged in industrial FIPs, and NGOs were more engaged in SSF FIPs (Appendix A).

Potential contributions of FIPs to fishery management in the LAC region

FIPs are emerging as a valuable tool in fisheries management and governance in Latin America and the Caribbean (LAC). Like other regions in the global south, the LAC region faces several challenges regarding sustainable fisheries management, namely, deficient scientific, monitoring, and management systems [59,82,83]. Our analysis showed that FIPs promote data collection and dialoguing about the needs for effective fisheries management, both for stock assessments and compliance rules. Thus, FIPs strengthen monitoring and information systems by involving stakeholders in data collection, facilitation, and distribution. Another highlight was the need for management improvements. Many FIPs showed some form of policy output (e.g., regarding fishery management, establishment of new management bodies, or limited entry to the fishery) and actions involving dialogue among stakeholders on fisheries policy and management issues. Government agencies play a crucial role in the success of multi-stakeholder efforts, such as FIPs [46,75]; indeed, without new regulations tailored to the needs of the specific fishery, FIPs cannot realize their full potential [51]. Existing FIPs and their associated stakeholders should encourage greater government participation and aim to strengthen or complement official fisheries management strategies as part of FIPs, with the potential to improve systemic-level management [75]. Furthermore, by promoting dialogue, it is expected that FIPs foster personal relationships among key fisheries actors and stakeholders. Such conditions could strengthen trust and allow leadership roles to be established, thereby increasing social capital, a key point to achieve successful fisheries management [23].

In addition, the proliferation of FIPs in LAC has extended the use of the MSC fishery standard as a diagnostic tool [85], at least during the initial assessments. This has enabled to identify and guide necessary fishery improvements to enhance their environmental performance [83,86]. FIPs have expanded the use of this tool in different countries and types of fisheries, which has allowed them to identify critical challenges at the regional level (as in this study) or at the country level [61].

Globally, FIPs are widely recognized by retailers and other stakeholders as effective mechanisms to enhance the sustainability of fisheries [43,57], and retailers incorporate FIPs into their purchasing policies as sustainable practices (e.g., [48,49,71]). Despite that several of the ongoing FIPs in the LAC region are not targeting the MSC certification, by being based on the MSC standard, it is expected that fisheries practices will improve and, if proper follow-up and efforts continue, eventually achieve sustainability [68]. Therefore, this approach has motivated stakeholders to engage in fisheries management and opened up market opportunities [68]. However, given that FIPs focus on fisheries in the process of achieving sustainability, retailers should consider their support to reliable projects for those FIPs demonstrating improvements in the fishery, and acknowledging that certificated fisheries have better performance. Such a cautionary approach must be taken to avoid a race to the bottom regarding sustainability standards [57] and not undermine certification schemes with higher, reliable, and enduring environmental performance [68].

The FIP model should not be taken as a panacea to fisheries' sustainability but rather as a complementary tool along with other fisheries' management approaches. In general, species targeted in FIPs have middle to high market value in global markets and may not be the best management strategy to improve fisheries sustainability for low-value species or species with more regional-national markets discussed by Crona [51], a critical aspect to analyze further given the prevalence of these commodities and market approaches in LAC. Although FIPs are a market base tool [43,57], non-market incentives have shown to be important FIP drivers, e.g., to increase influence in resource management, [68] or personal motivation and responsibility together with the decline of natural resources [79]. Finally, more attention must be paid to alternative drivers that also contribute to sustainability goals.

Further research is needed to understand the full impact of FIPs on fisheries' sustainability. While FIPs show promise, further research is needed to fully understand their impact in the LAC region and other

regions of the globe facing similar fisheries management challenges. The comparison of performance between fisheries undergoing FIPs, and those implementing other management tools, government management capacities [74,82] and preexisting stakeholder relations [74,79] could help to reveal the real impact of FIPs. Additional studies should also be made to determine the impact of recent social responsibility and human rights policy for mitigating labor abuses and guaranteeing labor rights for workers in FIPs [54]. Overall, while FIPs hold the potential to improve sustainable management in the LAC region, they must be approached with caution and complemented with other fisheries management strategies to ensure real progress in fisheries sustainability.

Final conclusions

Fishery Improvement Projects (FIPs) have emerged as a powerful tool for enhancing the sustainability of Latin American and Caribbean (LAC) fisheries. This study revealed FIPs in LAC are diverse, reflecting the region's complex fisheries landscape. However, these projects address similar challenges as deficient data or monitoring systems, vague harvest strategy and rules, deficient information on stock status and weak enforcement. To overcome these challenges, FIP showed data collection, dialogue about data, and stakeholder engagement to change fishery policy and/or practice as main actions within the region. Though primarily driven by market demand for sustainable seafood, FIPs can't undermine existing certification schemes with higher environmental standards. They should be considered complementary tools alongside other management approaches. Moving forward, long-term monitoring, enhanced social and economic considerations, and exploration of alternative drivers are crucial for maximizing FIPs' potential and securing the long-term viability of LAC's fisheries.

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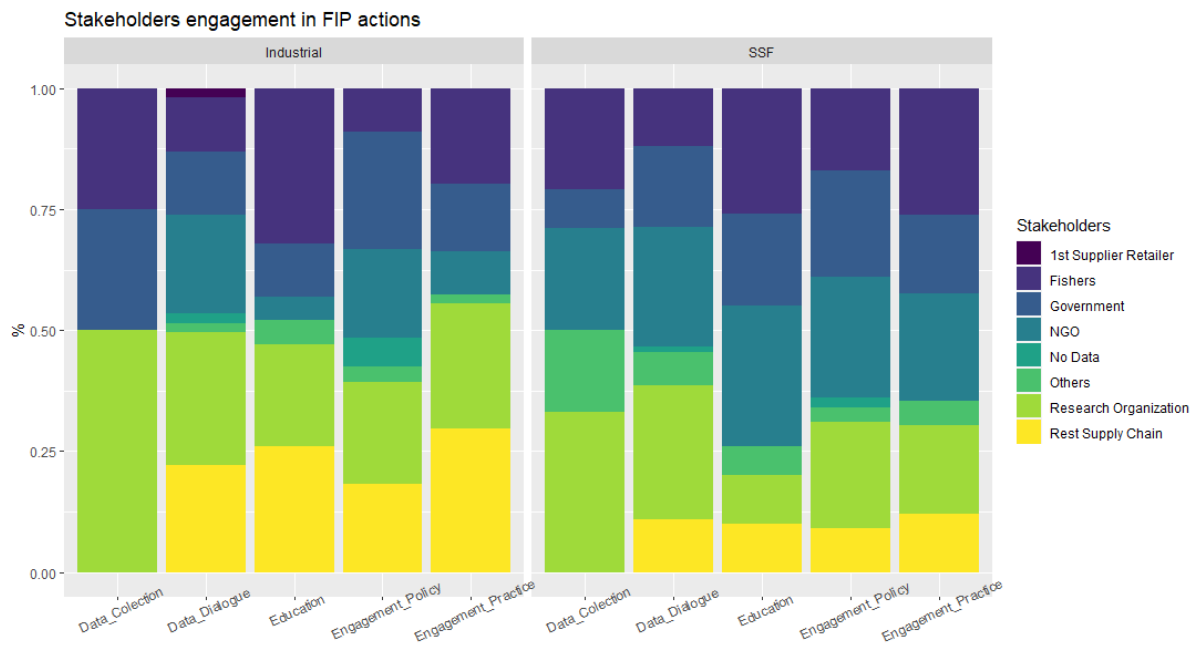
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Appendix

Appendix A. Stakeholders engaged in Fishery Improvement Projects actions, only including industrial fleet FIP (left) and small-scale fleet (right). (Data_Collection: Data Collection; Data_Dialogue: Data

Dialogue; Engagement_Policy: Engagement Dialogue in Fishery Policy; Engagement_Practice: Engagement Dialogue in Fishery Practices).



Capítulo 3. Fishery improvement projects as a management intervention modifying social-ecological resilience in fisheries

Abstract

Enhancing the resilience of fisheries has emerged as a critical concern amid environmental changes and socio-economic pressures. Fishery Improvement Projects (FIPs) are multi-stakeholder initiatives addressing challenges in fisheries, offering a promising strategy to enhance their performance while having market access. This study examines the role of FIPs as a management intervention in enhancing social-ecological resilience within fisheries through three case studies in Latin America. Using the seven principles by Biggs et al., 2012 and adapting the metrics proposed by Salomon et al., 2019, we assessed how resilience was impacted by FIPs, utilizing data from FisheryProgress.org and semi-structured interviews with key stakeholders. The results indicate that FIPs positively impacted certain resilience principles, such as broadening participation, encouraging learning, and managing connectivity. However, other principles, such as managing slow variables and feedbacks, exhibited minimal change. Stakeholder incentives for FIP participation varied, ranging from market access and the will to improve management to the sustainable use of resources. This study highlights how FIPs have limited potential in enhancing the broader resilience of fisheries and the need to complement these projects with other strategies to enhance all resilience principles to promote the long-term sustainability of fisheries as social-ecological systems.

Keywords: Fishery Improvement Projects, Socioecological resilience, fisheries, resilience metrics, assessing resilience.

Introduction

The concept of resilience has become increasingly important in environmental management over recent decades. Unlike traditional management approaches that focus on maintaining a static state, resilience management emphasizes a system's ability to absorb and adapt disturbances while retaining its core functions [11,12]. This is crucial because natural resource systems face a variety of perturbations, including climate change, habitat loss, and overexploitation [87]. Thus, resilience management thinking contributes to sustainability science by integrating ecological and social processes [88] and allows managers to better cope with these changes and ensure the long-term sustainability of resources and system relationships [17].

Resilience assessment is critical for improving natural resource management in social-ecological systems. It provides valuable insights into the dynamics of natural resources, their responses to management interventions, vulnerabilities, and regenerative capacities [16,17,89]. By enhancing resilience, natural resource managers can better cope with anticipated and unexpected changes, ensuring the sustainable use of limited resources and optimizing resource management strategies [17]. Systems related to natural resource exploitation can be considered social-ecological systems (SES) [5]. A SES is a system integrated by an ecological system and a social system, which results in a new indivisible system whose function is determined by the interactions and feedback processes

between its multiple components [6]. The SES approach promotes a holistic understanding of natural systems that considers the interconnectedness of ecological and social systems, ultimately leading to a more sustainable future [90]. Furthermore, enhancing the resilience is vital for meeting present and future societal needs and requires specific governance and management policies [16]. By assessing and measuring social-ecological resilience, opportunities for transforming environmental governance towards sustainability and social justice can be identified [19].

There are fundamental principles that can be used to promote resilience in SES. Fortunately, the established seven policy-relevant principles for promoting resilience in SES [16] offer a practical framework for evaluating this property [19]. These principles are: maintain diversity and redundancy, manage connectivity, manage slow variables and feedbacks, foster an understanding of SES as complex adaptive systems, encourage learning and experimentation, broaden participation, and promote polycentric governance systems [16]; and they provide guidelines for managing and governing SES in a way that promotes resilience. For example, maintaining biodiversity, managing connectivity between habitats, and fostering adaptive governance approaches can all contribute to a more resilient system [19]. Incorporating resilience thinking into natural resource management offers a valuable framework for dealing with complex and uncertain socio-ecological challenges.

Fisheries are prime examples of social-ecological systems (SES), embodying the intricate interplay between human and natural systems [15]. As essential economic activities, they provide sustenance, livelihoods, and cultural value to societies worldwide [91]. However, the resilience of these systems faces several challenges from multiple stressors, including climate change, overfishing, habitat degradation, and a range of socioeconomic issues [11,59,92]. Enhancing the resilience of fisheries emerges as a critical imperative to safeguard their long-term sustainability and well-being.

While the concept of resilience has gained prominence in fisheries management, its operationalization remains a challenge [93]. Despite the relevance of Biggs et al. (2012), this framework has yet to be widely adopted in fisheries research, although many studies indirectly measure some resilience principles [94]. Part of the difficulty in implementing strategies to increase overall resilience is due to the system's complexity, as it requires a comprehensive understanding of which factors enable and which limit resilience [95], which is very complicated as it involves considering multiple stressors simultaneously, where each stressor may be impacting in a complex manner [96]. Salomon et al. (2019) offered a notable example, developing metrics to assess resilience changes across different governance regimes. Their work highlights the importance of identifying and addressing factors that erode or restore resilience attributes, and by pinpointing these leverage points, we can chart strategic pathways towards a more ecologically sustainable and socially just future in fisheries. Therefore, a SES resilience management framework should aim to provide adaptive, and context-specific strategies to cope with systemic uncertainties.

Fishery Improvement Projects (FIPs) have emerged as a promising strategy to enhance the performance of fisheries. FIPs are a multi-stakeholder initiative to address challenges in fisheries using the power of the private sector, usually addressing environmental challenges, although more recently they address socioeconomic issues [43]. FIPs use the Marine Stewardship Council fishery standard as a guide to improve environmental performance [43]. Seafood retailers recognize FIPs within their purchasing policies, which has popularized these projects [44,46], been Latin America one of the regions worldwide with more FIP [47]. FIPs have showed to be good tools for improving environmental problems in fisheries [50], in addition to improving communication between stakeholders, data deficiencies, improvements in management, among others [51]. However, they present some limitations, only for medium-high value resources [51,97]. In addition, there are also criticisms about the suitability to resolve challenges related to human rights and social responsibility [53,54], and some authors have suggested new approaches to FIPs to make it suitable for small scale fisheries [52].

Studies have highlighted the importance of considering fisheries as linked social-ecological systems, emphasizing ecosystem-based and resilience-based approaches to fisheries assessment and management [91,98]. Despite the growing popularity of FIPs, a critical need remains for a deeper understanding of their effectiveness in fostering social-ecological resilience. While FIPs have demonstrated success in improving environmental outcomes, their impact on overall system resilience remains to be seen. This study addresses these gaps by examining the role of FIPs as a management intervention in enhancing social-ecological resilience within fisheries in three different study cases in Latin America. Specifically, we addressed the following questions: i) Do FIPs enhance social-ecological resilience in Latin America? ii) Which resilience metrics are most affected by FIPs? iii) How might FIPs be further improved to magnify their positive effects of SES Resilience?

Methodology

To evaluate whether Fishery Improvement Projects (FIPs), enhance fisheries resilience we first developed 19 metrics following the seven principles that foster resilience in Social-Ecological Systems (SES) (see Biggs et al., 2012). These metrics were adapted from Salomon et al. (2019) and modified based on resilience literature to suit the specific study cases (see Appendix A).

To assess these metrics, we assigned a 5-point scale scoring system, where >3 indicated a positive, 3 no change, and <3 a negative trend, respectively. The scores were determined using information from FisheryProgress.org (November 2023), specifically from performance indicator scores of the Marine Stewardship Council assessments, and responses from key stakeholders during semi-structured interviews (see Appendix A & B). The final score for each metric was the average of scores assigned by different stakeholders when their opinions varied. To ensure that we evaluated the changes specifically due to FIP actions and activities, the information related to the MSC indicators was taken from the change between the pre-assessments (initial report) and the latest available scores for those indicators. Regarding interview questions, throughout the interview, we focused our questions on the before-to-current fishery status, as well as targeted FIP-associated changes, and not about other dynamics. Two interviews were removed to assess the resilience metrics due to the lack of a historical

view of the FIPs (in the Mahi mahi FIP), although those interviewed helped us better understand the context of how the FIP arose in each case.

Our interview explored general FIP overview, FIP impacts on fishery resilience, as well as stakeholder motivations to FIPs participation (see Appendix B for details). Prior to formal interviews, we conducted three informal interviews with the study cases FIP implementers (October to November 2023) to calibrate and standardize our interview to ensure questions were comprehensible to the different stakeholder perspectives. These interviews were also used to refine the questions based on implementers feedback.

Semi-structured interviews with an open-ended format were chosen for this study due to their ability to enhance the accuracy of retrospective reports, as participants are free to express whether they recall specific events or not [99]. The open-ended nature of these interviews allows for flexibility, enabling interviewees to express themselves freely in terms of what they say, how much they share, and how they express it [100]. Additionally, this format offers researchers the opportunity to approach different interviewees in various ways while still addressing the same questions and allows cross-checking and validating information from previous interviews, ensuring the accuracy and reliability of the data collected [101].

From November 2023 to March 2024, we conducted 23 semi-structured interviews via Zoom with stakeholders (Appendix C). Each interview lasted approximately 1-1.5 hours, with some extending up to 2.5 hours. Snowball sampling [102] was utilized to reach key FIP stakeholders. Questions were rephrased as needed to accommodate different stakeholders. All interviews were conducted in Spanish and consent was requested prior the interview.

To analyze interviews, we employed a mixed approach. All interviews were transcribed. Specific questions were used to score resilience metrics, following a deductive method with pre-established scores and for specific questions. We organized the interview by topic, with the anticipated core themes to develop [103,104]. An inductive analysis was conducted for incentive or motivation questions, where codes were developed as ideas emerged from the transcription text. This approach is particularly useful in identifying emerging concepts in data analysis, as it starts with data collection and identifies patterns solely from participant experiences, involving a detailed examination of data [103,105]. We used the software MAXQDA for text analysis.

Study cases

We studied three fishery improvement projects listed on the FisheryProgress.org website from different countries, all comprehensive (their improvements address all MSC indicators) and were to be at least three years old. This is because, after three years, a third party makes a report verifying the status of the FIP [43]. The selected FIPs were: i) Peru Mahi-mahi, (*Coryphaena hippurus*) - longline

(WWF); ii) Costa Rica large pelagics, (Yellowfin Tuna, *Thunnus albacares*; Mahi-mahi, *Coryphaena hippurus*; and Swordfish, *Xiphias gladius*)- longline and green stick; and iii) Mexico Yucatan octopus, common octopus (*Octopus vulgaris*), and red octopus (*Octopus maya*) - drift rod and line (Alianza Por El Pulpo En Yucatan). Hereafter we will refer to these FIPs as Large Pelagics, Mahi-mahi and Octopus FIP, respectively.

Large Pelagics FIP

This commercial fishery targets large pelagic species (Yellowfin Tuna, Mahi-mahi, and, Swordfish) in Costa Rican waters using longlines and green sticks. The fishery operates with approximately 170 vessels, mostly an artisanal fleet with vessels between 6-14 meters, and lands an average annual catch of 4,000 metric tons. The fishery's main problems are overfishing, a need for more data, and bycatch of sharks, rays, turtles, and other marine animals. The objective of the FIP is to make the fishery sustainable according to the Marine Stewardship Council Fisheries Standard and aligned with Sustainable Development Goals [47]. The Costa Rica project arises in the context of the country's collaboration with The Global Sustainable Supply Chains for Marine Commodities (GMC) Project that started in 2016 [106].

Mahi-mahi FIP

This commercial longline fishery targets mahi-mahi in Peruvian waters. The FIP operates with approximately 1,000 vessels, mostly an artisanal fleet with vessels between 6-14 meters, and lands an average annual catch of 50,000 metric tons of mahi-mahi [47]. The objective of the FIP is to move the fishery in a step-wise approach towards meeting the Marine Stewardship Council (MSC) standard to achieve MSC certification [47]. The mahi mahi peru project arises from the WWF-US organization's interest in developing the marine program in Peru, coupled with the importance of the fishery for importing mahi mahi to the USA. In addition, it was in a context where Ecuador was working on a Mahi mahi FIP in search of certification (stakeholder personal communication).

Octopus FIP

This commercial fishery targets octopus, common octopus, and red octopus in the Yucatan Peninsula, Mexico, using drift rods and lines, using small scale and medium fleet. The FIP operates with approximately 200 vessels and lands an average annual catch of 3,350 metric tons of octopus. The objective of the FIP is to enter the MSC full assessment to achieve certification [47]. The octopus FIP project arose in the context of several years of interest on the part of octopus importing companies to promote improvements in the fishery (stakeholder personal communication).

Results

We assessed change in the seven principles that promote resilience in socio-ecological systems for each FIP study case. In all three cases, all FIPs showed an overall increase in resilience; no principle showed a decrease. Overall, Broaden participation, Encourage learning, and Manage connectivity

were the principles that improved the most by FIPs, while Manage slow variables and feedbacks showed minor improvements compared to before the initiation of FIPs (Figure 7 & Appendix D).

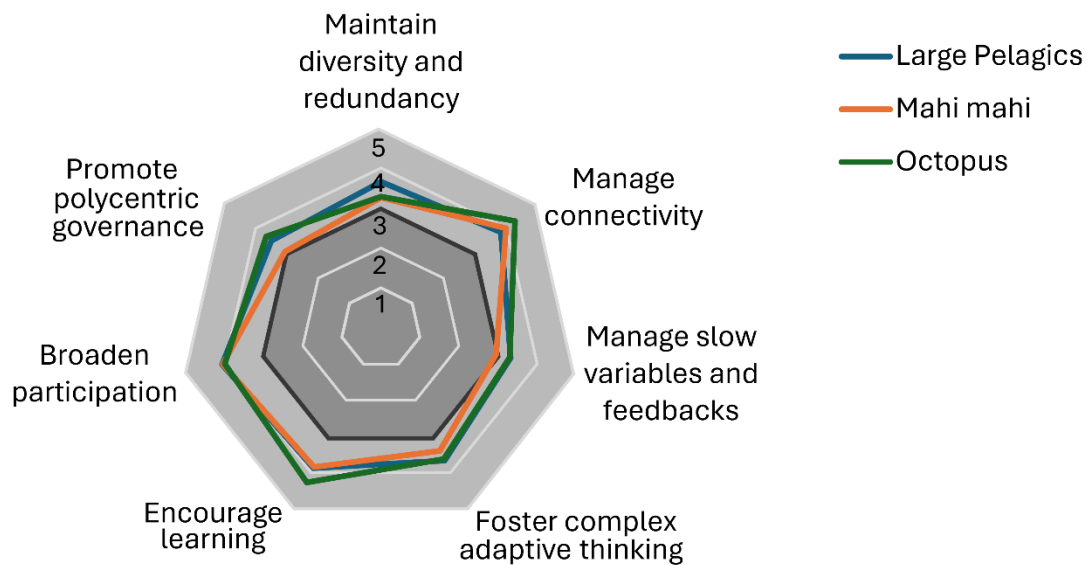


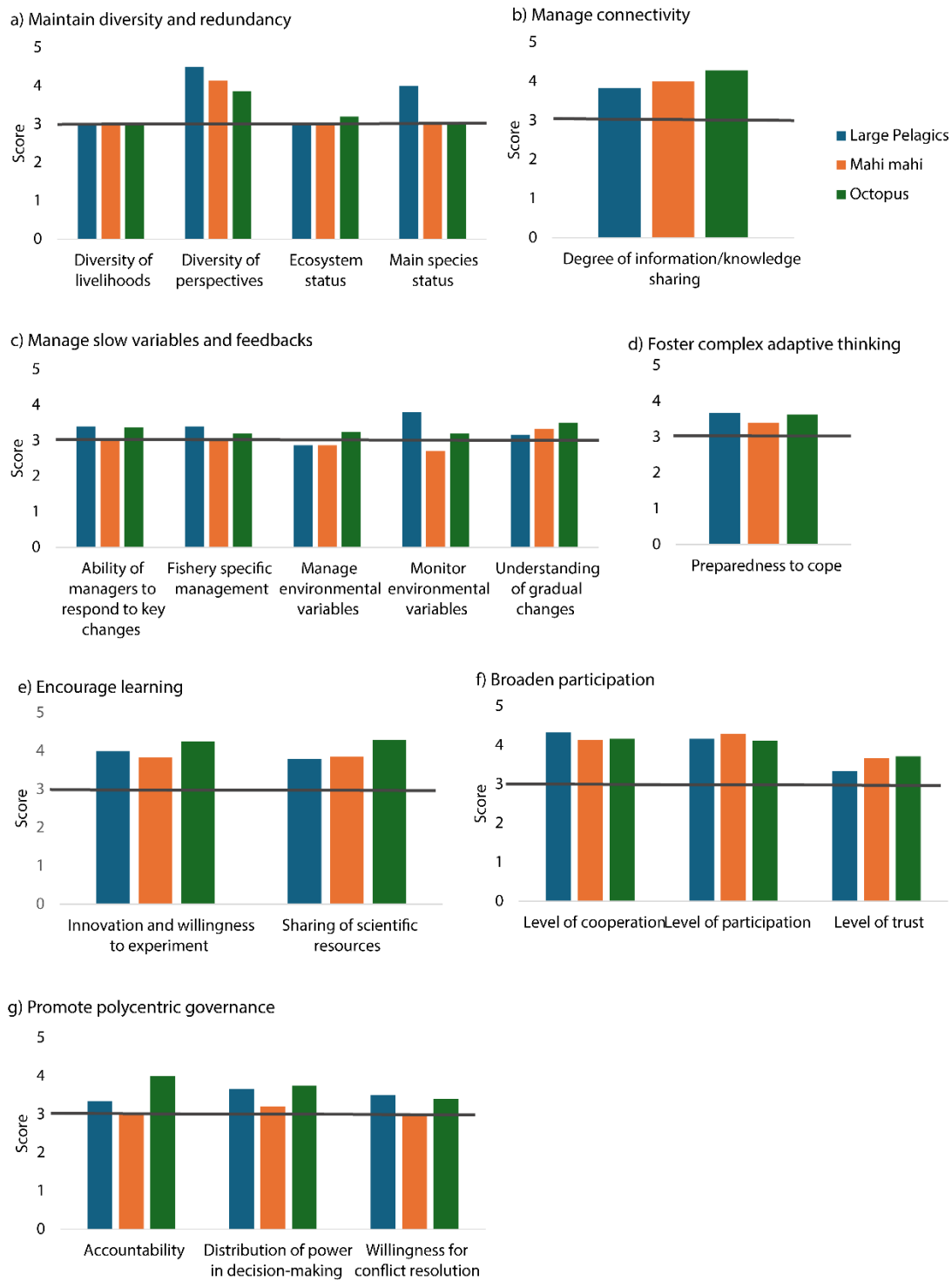
Figure 7. Changes in resilience principles for three Fishery Improvement Projects. Scale: >3 (light grey area) resilience enhanced; 3 no change (solid black line), <3 resilience declined (dark grey area).

We observed an increase in cooperation and participation across all three FIPs, exceeding a score of 4, thus contributing to an enhancement in the resilience principle of Broadening participation. However, an improvement in trust was less pronounced, particularly for the Large Pelagics FIP, which scored 3.3. (Figure 8f). We also found an upward trend in all metrics related to the Encouraging learning principle, with the Octopus FIP showing the biggest improvement, with scores hovering around 4 in all three case studies (Figure 8e). We noted a slight improvement regarding the principle of Fostering complex adaptive thinking, but no FIP surpassed a score of 3.7. The Mahi-mahi FIP had the lowest score of 3.4. (Figure 8d; see Appendix D for more information on metrics values).

Metrics associated to the principle of Maintaining diversity and redundancy were differently affected by each FIP. We found no change in the diversity of livelihood metrics across all FIPs assessed. However, diversity of perspectives increased, with the Large Pelagics FIP showing the most significant change (4.5), and the Octopus FIP showing the least change (3.8). Ecosystem status showed no change for Large Pelagics and Mahi-mahi, but Octopus slightly improved (3.2). The main species status metric improved only in the Large Pelagics FIP (4) (Figure 8a).

We detected an increase in the resilience principle of Managing Connectivity among all three FIPs. The Octopus FIP showed the highest value (4.3) in Managing Connectivity while Large Pelagics the lowest (3.8) (Figure 8b). Metrics contributing to the principle of Managing slow variables and feedbacks, had values close to 3 in general. Notably, the metric for managing environmental variables decreased for

the Large Pelagics and Mahi-mahi FIPs, the only metric assessed to show a decreasing trend (Figure 8c). Finally, for the principle of Promoting polycentric governance, we noted increased accountability for the Octopus FIP. There was also an improvement in Power distribution in decision-making for Octopus and Large Pelagics. The FIP of Large Pelagics showed the highest value (3.5) in the willingness to resolve conflicts (Figure 8g).



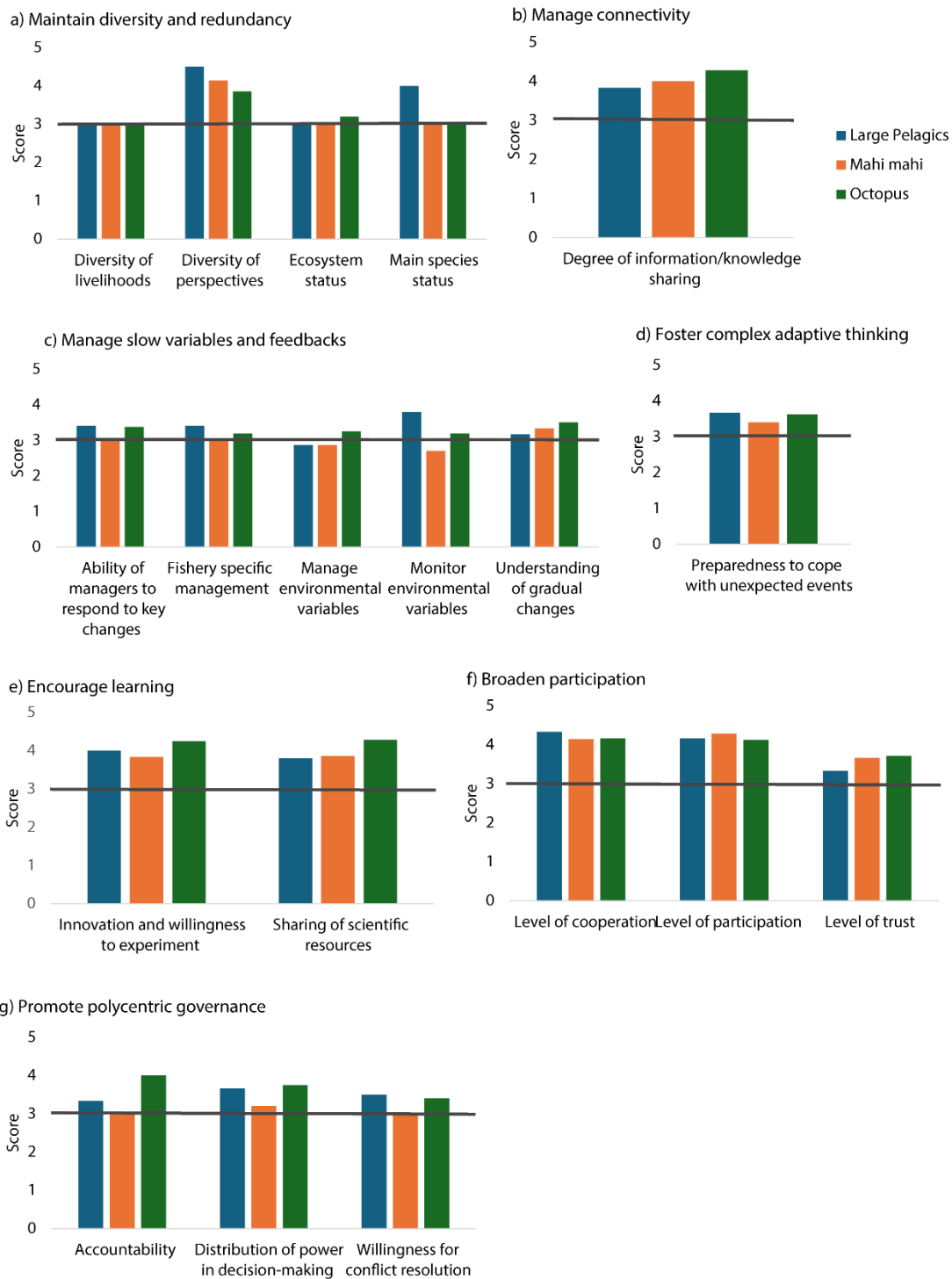


Figure 8. Average scores on specific metrics to assess change in resilience principles in three different fishery improvement projects. Scale: 5 resilience enhanced; 3 no change (solid horizontal line), 1 resilience declined.

The incentives or motivations that led respondents to become involved in the FIP were diverse and differed among respondents. Practitioners with NGOs showed an interest in the sustainable exploitation of marine resources and taking advantage of the market interest. Managers with

government agencies highlighted that part of the FIP objectives were aligned with their work and goals (improve management/fisheries research). Industry practitioners highlighted market pressure and the sustainable use of resources were key motivations to participate in FIPs. Stakeholders involved in export and import activities highlighted the social responsibility of their organizations, client supply chain pressure, and as an economic opportunity to access certain markets (Table 4 & Figure 9). Producers expressed various reasons, from sustainable use of resources, improved management, pressure from the supply chain, and as a potential market. Market issues was the primary interest of producers. Lastly, some producers and government agency managers associated FIPs with a strategy to prevent environmental organizations from lobbying to reduce or close the specific fishing activity.

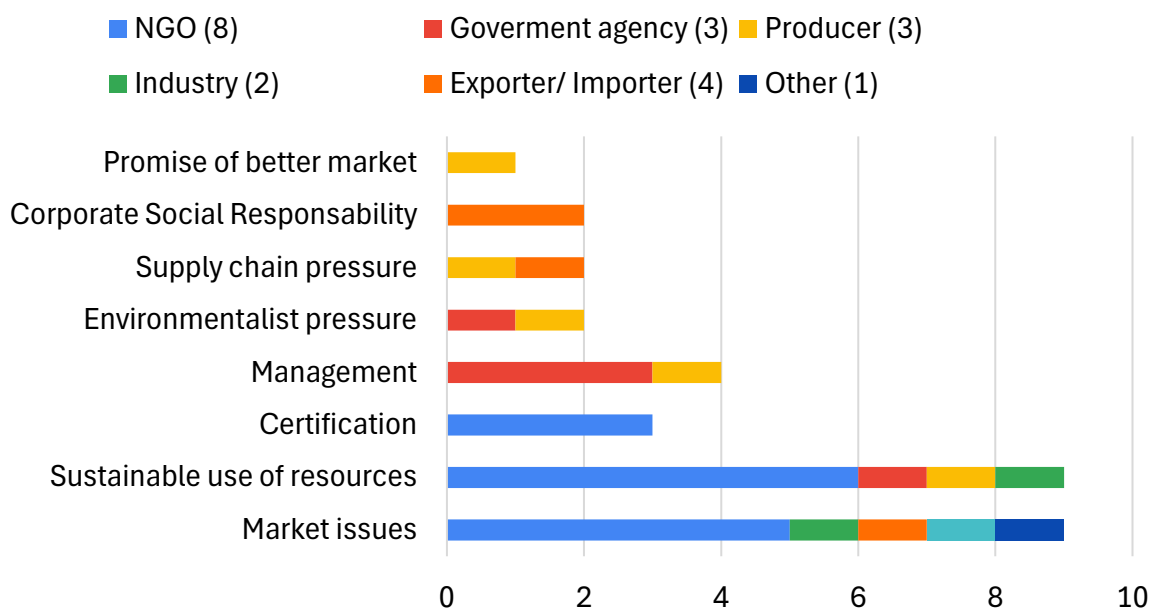


Figure 9. Incentives/motivations to be engage in a Fishery Improvement Project by stakeholder category. NGO: non-government organization staff or NGO alike (hire consultants, playing similar roles); Government agency: agencies working in fisheries research and management; Producer: representative of fishing organization; Industry: Seafood business that buy/process seafood, even owning vessels (do not export/import seafood); Exporter/Importer: Stakeholder working in a seafood company that trade seafood (exporting/importing); Other: any of the previous categories

Table 4. Interviewees quotes indicating incentives and interests to participate in the FIP. Sector: Interviewee sector; n: number of interviewees that provided an answer; Topic: topics of interest coded; quotes: examples of quotes from interviews, some quotes were paraphrased. All quotes are Spanish to English translations.

Sector	n	Topics	Quotes
NGO (8)	3	Certification	"The organization is interested in fisheries certification" (paraphrased). "FIP members [...] want to obtain certification"

	5	Market issues	<p>"There was a lot of interest from major buyers in the United States [...], they were interested and made commitments to source from more sustainable fisheries"</p> <p>"Commercially, it was very convenient for them to be part of a fishery improvement project, because it was already a requirement set by the market, but there was no specific requirement to achieve the certification itself"</p> <p>"[Companies with] several commitments to supply themselves with fishery products from sustainable fisheries"</p>
	6	Sustainable use of resources	<p>"Well, it is a way to take care of the resource so that it can continue to be exploited"</p> <p>"The interest is to promote sustainable fisheries"</p> <p>"We saw that this incentive of using the market to encourage improvements could perhaps have some positive impacts [on the state of the fishery]"</p> <p>"Personal motivation, improve natural resources health" (Paraphrased)</p>
	1	Sustainable use of resources	"The incentive as such is to maintain a fishery over the long term."
<i>Government agency (3)</i>	3	Management	<p>"It is easier to make decisions. Because we move forward together as a group, it is not the institution dictating measures, but participating in the measures, taking actions in the evaluation, in the analysis, in the joint work. So this is a benefit to make it easier to adopt different management measures" (Paraphrased)</p> <p>"Improve management/research is part of my work" (Paraphrased)</p>
	1	Environmental pressure	"So for the NGOs that want to eliminate fisheries, it makes it more difficult for them because we are working together under the framework of a fisheries improvement project that also gives social, economic and environmental benefits."
	1	Market issues	"it's a set of rules to be able to stay in the market."
<i>Industry (2)</i>	1	Sustainable use of resources	"We are not a relevant stakeholder as the exporters, which for them is important for their external clients..., but we still have to support it at the local level even despite nobody demands it to us. We have been conscious of taking care of the seas and sustainability for many years..."
	1	Market access	"The incentive is to have access to that market. In other words, if you want to sell to a supermarket [it is a requirement to meet] in the USA."
	1	Supply chain pressure	"I got involved, motivated by a concern and interest on the part of the market from one of our [FIP] clients."
<i>Exporter/Importer (4)</i>	2	Corporate Social Responsibility	<p>"If you ask me today, why did you get involved? Well, the truth is that we got involved because of social responsibility and there is no other explanation. We do not have a market demand"</p> <p>"Unfortunately, I would say that, well, our effort has not turned into a very big compensation for our company itself, but of course we have other gains, right? For example, we have a [good] company position on corporate social responsibility."</p>

	1	Promise of better market	"First you are going to have a guide to improve and some demands. Demands from markets that are willing to pay extra for that effort, so we started working hard at the FIP from the beginning"
	1	Supply chain pressure	"The commercial side (buyers) say there is a market interested in it (FIP products)."
<i>Producer (3)</i>	1	Improve management	"The fishery could not continue as it was 20 years ago, it was necessary to focus and manage the fishery" (paraphrased).
	1	Environmental pressure	"We were looking at the FIP as a shield, to reduce pressure from some NGOs."
	1	Sustainable use of resources	"We were looking for sustainability between exploitation and conservation, looking for measures or actions to achieve a balance, and that is why we started the FIP. In order to be able to guarantee that over the years we can continue to carry out the fishing activity."
<i>Other (1)</i>	2	Market issues	"What would happen if they really close our borders with the USA? We cannot allow the foreign market to be closed" (Paraphrased). "It has an impact on the market, but it's not to increase sales but to generate some confidence and be able to continue."

Discussion

Enhancing the resilience of fisheries is a critical goal in the face of environmental and socio-economic disturbance. Promoting resilience in fisheries involves understanding and enhancing the capacity of both ecological and social systems to cope with and adapt to various stressors. Fisheries Improvement Projects (FIPs) are a multi-stakeholder effort to address challenges in a fishery [43], intending to bring fisheries to the level required for certification [86]. Recently, alongside the usual MSC principles of achieving sustainable fish stock, minimizing environmental impacts; and effective management [34], FIPs also included social responsibility and human rights policy requirements [47]. In this study, we found that the implementation of these projects in three different fisheries and countries, each with their own social-ecological contexts, has enhanced some of the resilience principles proposed by Biggs [16], primarily broaden participation, encourage learning, and manage connectivity. However, other resilience principles have not been greatly affected by FIPs, such as the Manage slow variables and feedbacks principle. Even though evaluating resilience changes in social-ecological systems can guide changes towards more desirable states, evaluating this multidimensional property remains a challenge [19].

Among the FIPs we studied, we detected positive change among some resilience principles. The "Broaden participation" principle, assessed through cooperation, participation, and trust among different stakeholders, was enhanced in all three cases. Implementing the FIPs' work plans, established after the pre-assessments, likely required numerous activities and meetings to advocate for the FIPs' needs [51,97]. These interactions facilitated stakeholder engagement and collaboration, potentially fostering trust among them. However, as noted in stakeholder communications, "building trust takes time," and the "trust" metric showed minor improvement compared to cooperation and

participation. Trust and connectedness in networks and groups are important for enhancing social capital [107], an essential attribute for fisheries success [23]. Broadening participation enhances fisheries resilience by fostering social capital and strengthening linkages through participatory strategies [16]. This connection is crucial as it influences the resilience of the systems' relationships. Cooperation, participation, and trust among fishery stakeholders are essential for enhancing resilience within fisheries. Furthermore, social capital is considered essential for fostering collective action in managing natural resources [108], such as in small-scale fishery co-management initiatives.

Another principle that was positively impacted by the FIPs we investigated was "Encourage learning" (innovation and willingness to experiment and sharing of scientific resources). While none of the studied FIPs reached the maximum score of 5, there was some experimentation and learning processes implemented. All FIPs showed initial experimentation efforts related to bycatch reduction or new artificial bait techniques. Among fisheries worldwide, innovations such as new gear types, bycatch reduction devices, and restocking programs have been shown to enhance the resilience of fisheries [109–111]. These changes help mitigate the impact of overfishing and contribute to the recovery of fish stocks and biodiversity [109,110]. Additionally, participation and organization within the fishery sector promote collaborative learning, adaptive planning, and increased adaptive capacity [112].

Information and knowledge sharing play a crucial role in improving the resilience of fisheries. The principle of managing connectivity through information and knowledge sharing was enhanced in all cases. The presence of a FIP in a fishery has been shown to improve communication between different stakeholders [51], and FIPs perform an important role in generating and supporting dialogue on fisheries data, changes in fishery practices, and the development of new policies [51,97]. thereby opening the opportunity of information and knowledge sharing. However, information sharing can be limited for stakeholders not engaged in the FIP.

FIPs however do not enhance all resilience principles. The "Manage slow variables and feedbacks" principle showed minimal change from the start of the FIP for all three case studies. We observed a decrease in resilience in the "Manage environmental variables" metric after the initiation of the Mahi-mahi and Large Pelagics FIPs. Those decreases were based on changes in the performance indicators scores related to MSC management of principles of sustainable fishing stocks and minimizing environmental impacts. In the case of the Mahi-mahi FIP, this decrease was due to two main factors. First, the MSC standard was updated during the life of the FIP, and the way performance indicators were evaluated changed, leading to some performance indicators being scored differently. This resulted in a decrease in the overall score. Second, the improved fishery monitoring led to identifying new associated species. This triggered some change in the performance indicators due to the lack of species in that category. In the case of the Large Pelagics FIP, the decrease was due to a change in the assessment of stock status for swordfish (*Xiphias gladius*). The pre-assessment for the FIP highlighted the need to update the stock assessment and incorporate new data from other countries. The 3-year review of the FIP noted that the assessment was a "simple exercise that does not include specific details about the status of the stock" [47]. In addition, the new classification of species for Principle 2

in the Mahi-mahi FIP also contributed to the decrease in the score of the "Monitor environmental variables" metric. However, we believe these decreases were due to how performance indicators were evaluated rather than a fundamental change in resilience.

Furthermore, this principle was scored based on five metrics, three of which were linked to improvements in the performance indicator scores of the MSC standard. In all three cases, the improvements in performance indicator scores were moderate. It is important to note that FIPs are ongoing projects, and time has been identified as a critical factor in improving indicators [38]. FIPs in their final stages are those which show improvements in MSC performance indicators relative to initial state [97]. In general, FIPs improve critical problems regarding target species, environmental impacts, and fishery management [50], and being based on the MSC standard, fisheries practices are expected to improve [68]. Thus, this principle would be expected to be enhanced over the course of a FIP.

Additionally, FIPs start from a previous initial state, which can condition overall relative fishery improvement. For example, the octopus FIP started with relatively good scores in the pre-assessment, so there was little room for improvement, just in a few performance indicators. The Mahi-mahi FIP, on the other hand, had many indicators with low scores, which implies a challenge in making all the management and social reforms for the FIPs, especially in low-income countries [114]. In addition, this principle included two metrics evaluated through interviews, which considered the ability of managers to respond to key changes, there was a slight increase in this ability for Octopus and Large Pelagics (scored 3.4), and understanding of gradual changes was also evaluated, and no significant changes were noted, except for the Octopus FIP (scored of 3.5). It is important to note that the study focused on the change produced by the FIP, not on managers' ability per se. Enhancing our understanding of the interactions between fast and slow variables impacting ecosystem dynamics will improve the ability to detect imminent regime shifts in fisheries and intervene in time to prevent them [115]. In turn, this understanding should provide leverage points for deliberate transformation towards a more sustainable future [19].

Our study highlights the heterogeneity of incentives and interests that drive stakeholder participation in Fisheries Improvement Projects (FIPs). While supply chain stakeholders primarily emphasized market-related incentives, producers exhibited a broader range of motivations, with market incentives receiving less prominent mention. This finding aligns with previous research suggesting that non-market incentives, such as reputational enhancement [116], increased resource control [68,86], and a sense of responsibility following resource decline [79], can play a significant role in fostering collaborative governance processes aimed at improving sustainability. In addition, government agency stakeholders in our study perceived FIPs as "aligned with their work," highlighting the potential of shared incentives to facilitate collective action towards sustainability goals. The voluntary nature of FIP participation necessitates a careful understanding of the diverse incentives that motivate different stakeholder groups.

During our study, the Large Pelagics FIP was classified as inactive on the FisheryProgress website at the request of the FIP itself. This FIP started with the objective of improving its environmental performance in the context of several years working to reduce the impact of bycatch. However, during the process, the new social responsibility and human rights policy requirements were released. These new policy requirements must be met for all FIPs to remain active on the FisheryProgress website. Therefore, stakeholders were concerned because they needed to understand the need to spend their limited resources on social issues when it was not considered a concern or a priority in the context of their country, nor a focus at the FIP onset. This, coupled with the lack of a strategy to raise funds to implement the newly required actions, caused the FIP to pause and is undergoing a reflection on whether to continue.

Fisheries are immersed in broader dynamics that impact socio-ecological systems. Interviewees highlighted that the FIPs, as any fishery, are affected by factors beyond the fisheries. For example, they highlighted the interest of the government after a change in the political color of the central government, showing more interest and involvement in the needs of the FIP (stakeholder personal communication) or how government staff rotation undermined the project effort due to the loss of knowledge and engagement (stakeholder personal communication). Other factors identified by some stakeholders were global trade dynamics and competition with other regions, which can affect how suppliers can source higher or lower quantities depending on their commercial interests rather than efforts to improve the sustainability of the resource. Companies prioritizing sustainable sourcing contribute positively to sustainability through their supply chains [117]. When a commodity can be substituted by another or by another stock source, it can undermine the usefulness of FIPs as a governance improvement tool [51]. Although these insights are valuable for understanding some of the external dynamics that impact fisheries in our study, more studies are needed to understand specifically how they affect different fisheries and how those may undermine FIP initiatives.

FIPs need to be improved, updated and/or complemented to further enhance other resilience dimensions in fisheries. FIPs effectively address environmental challenges in fisheries and incentivize positive changes through market mechanisms [84], and they seem to be effective in doing so [50,51,97]. However, their effectiveness to enhance resilience may be limited, and promoting improvements towards sustainability can vary significantly depending on fishery and project conditions [38]. To enhance resilience in fisheries, requires embracing multiple objectives such as conservation, food security, and livelihoods simultaneously [98] and it is crucial to consider the capacity constraints and social-ecological resilience challenges and dynamics specific to each fishery [57,112]. For example, building social capital through adaptive business arrangements [118], diversifying marine resources accessible to small-scale fishers [119], and increasing flexibility and options within other economic sectors [120] could contribute to the long-term economic sustainability and enhance social-ecological resilience in fisheries and coastal communities, but these type of interventions will be implemented at more local/regional scale rather than fishery level. Furthermore, with the implementation of the recent social responsibility and human rights policy for FIP reporting on FisheryProgress.org, new stakeholders and strategies will need to be implemented to impact fisheries positively. Some authors have raised some concerns that FIPs may not be effective in driving social responsibility improvements in fisheries [53,54], as “effective and enduring solutions must

consider human wellbeing and environmental sustainability in tandem” [27], although more research on these field is need it to really understand the scope of the policy.

For example, Scale mismatches pose a significant constraint. In this study, we focused our work on how implementing FIPs modified fishery-level resilience, and the results showed moderate improvements. It is not easy to enhance resilience without acting at different scales. As mentioned in the previous section, knowing the factors outside the scope of the FIP that impacted the fishery or how to intervene at a more regional/local level can help improve fishery-level resilience. In addition, government agencies in charge of management tend to be centralized institutions with a reductionist view of the management of “their resources”, which are unlikely to be able to solve social-ecological problems [121] that involve interaction with other processes outside their management area, creating mismatches in the management approaches [122]. Another constraint is the knowledge and data available for the whole system (including different scales. Gathering comprehensive social and ecological data across an entire Socio-Ecological System (SES) can be a costly and labor-intensive endeavor, necessitating the incorporation of diverse stakeholders with expertise in various processes and feedback mechanisms. This, combined with the inherent complexity of SES[123], renders the development of accurate and comprehensive resilience models a challenging task.

The study has several limitations, and results should be taken with caution. Firstly, the study was conducted on a limited number of FIPs, which may affect the generalizability of the results to other projects. Secondly, the study used a limited number of metrics to measure resilience, which may have affected the results if other metrics were used. Additionally, some metrics may have been biased due to respondents' perceptions, as they were not direct measurements [19]. Respondents asked to compare the past and present may have been subject to recall bias [124]. However, empirical evidence suggests that recalled information can be highly accurate, even after 50 years [125]. Another possible bias is the more numerous representation of one type of stakeholder, although an attempt was made to have a heterogeneous group of respondents to limit this [126]. Furthermore, resilience is inherently multidimensional, and not all dimensions are likely to affect system resilience equally [19]. Each metric used in the study was considered equally important to system-wide fishery resilience, although this may not be the case. Additionally, not all resilience attributes are directly quantifiable, such as trust and willingness to embrace change, and perceptions of those attributes are often what matter when it comes to governance transformation [127].

In conclusion, fisheries improvement projects offer potential for enhancing social-ecological resilience in fisheries but are not sufficient in supporting social-ecological resilience. The FIP's “effectiveness” for enhancing resilience could be limited by the ability of stakeholders to influence the FIP's needs on government agencies and extend the project impacts throughout the fishery. In addition, FIPs are implemented within specific socio-cultural contexts while influenced by different level dynamics. Understanding the context and dynamics can help complement FIPs with other strategies that enhance broader resilience. Fisheries must be understood as a social-ecological system and any research and management effort should approached from an inter- and transdisciplinary perspective to enhance resilience benefiting the wider social-ecological components.

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Appendix

Appendix A

Table 5. Scoring system used for assessing the variation of the resilience for the three study cases. >3 indicates the resilience have increased in the system in relation to a metric, <3 indicates a loss of resilience, 3 indicates that there was no change. MSC stands by Marine Stewardship Council. PI stands by Performance Indicators. The column source indicates similar approaches in relation the metric.

Principle	Metric	Assessed	Reference	Score definitions
Maintain diversity and redundancy	1. Main specie(s) status	Proportion of change of key challenges related to MSC outcome-based performance indicators in Principle 1 (PIs 1.1.1 and 1.1.2)	[19,38]	5 = All relevant PIs have shown significant improvement in scores, moving from a range of -60 (worst) to +80 (best). 4 = There has been a moderate improvement in PI scores. Scores may have moved from -60 to a range of 60-79, or from 60-79 to +80, or a combination of both across the relevant PIs. 3 = No Change. 2 = There has been a moderate decline in PI scores. Scores may have moved from a range of 60-79 to -60, or from +80 to 60-79, or a combination of both across the relevant PIs. 1 = All relevant PIs have shown a significant decline in scores, moving from a range of +80 to -60.
	2. Ecosystem status	Proportion of change of key challenges related to MSC outcome-based performance indicators in Principle 2: 2.1.1, 2.2.1, 2.3.1, 2.4.1, 2.5.1.	[19,128]	5 = All relevant PIs have shown significant improvement in scores, moving from a range of -60 (worst) to +80 (best). 4 = There has been a moderate improvement in PI scores. Scores may have moved from -60 to a range of 60-79, or from 60-79 to +80, or a combination of both across the relevant PIs. 3 = No Change. 2 = There has been a moderate decline in PI scores. Scores may have moved from a range of 60-79 to -60, or from +80 to 60-79, or a combination of both across the relevant PIs. 1 = All relevant PIs have shown a significant decline in scores, moving from a range of +80 to -60.

3. Diversity of perspectives	<p>Different questions throughout the interview: -How would you consider the variety of perspectives (ex: ideas, views, opinions) that inform decision-making in fishery?</p>	[19,128,129]	<p>5 = The planning and decision-making processes have become truly inclusive. A diverse array of stakeholder interests and perspectives are actively sought out, valued, and incorporated into decision-making. 4 = There has been some progress in incorporating a wider range of perspectives. A limited number of previously excluded stakeholder groups are now involved in the planning and decision-making process. 3 = No significant change. 2 = The diversity of perspectives included in the planning and decision-making process has narrowed. Previously involved stakeholder groups may have been excluded or marginalized. 1 = The planning and decision-making processes have become significantly less inclusive. A diverse array of stakeholder interests and perspectives are now actively excluded or ignored.</p>
4. Diversity of livelihoods/ Income diversity	<p>Different questions throughout the interview: Has the FIP helped to create new livelihood/Income??</p>	[19,128,129]	<p>5 = The FIP has fostered a significant increase in the diversity of livelihoods available to fishery-dependent stakeholder. 4 = There has been some progress in increasing the diversity of livelihoods. A limited range of new income opportunities have been introduced or supported. 3 = No significant change. 2 = The FIP had impacted in the social system experiencing a decrease in the diversity of livelihoods available. Previously existing alternative income opportunities may have diminished. 1 = The social system has seen a significant decrease in the diversity of livelihoods. Fishers are now even more reliant on income directly from the fishery than before the FIP.</p>

Manage connectivity	5. Degree of information / knowledge sharing	Different questions throughout the interview: How connected are the groups involved in the fishery in terms of information/knowledge sharing?	[19,128]	<p>5 = The level of connection and information sharing among fishery stakeholders have increased considerably. Information flows freely across all levels.</p> <p>4 = There has been a positive shift in information sharing among fishery stakeholders. Stakeholders are more willing to share information and collaborate compared to before the FIP.</p> <p>3 = No significant change.</p> <p>2 = Information sharing and collaboration among fishery stakeholders have declined somewhat. Stakeholders may be less willing to share information.</p> <p>1 = Information sharing and collaboration among fishery stakeholders have significantly decreased.</p>
Manage slow variables and feedbacks	6. Understanding of gradual changes	Different questions throughout the interview: How well known are the factors that impact the fishery gradually and/or in the middle/long term?	[16,19,129]	<p>5 = The fishery demonstrates a strong understanding of slow variables (gradual changes) that influence the social-ecological system. These key variables have been effectively identified, analyzed, and incorporated into long-term governance strategies.</p> <p>4 = There is some progress in understanding slow variables. Some key variables have been identified, but their integration into long-term governance may be limited.</p> <p>3 = No significant change.</p> <p>2 = There has been a regression in understanding slow variables. Previously identified variables may have been disregarded or removed from consideration in long-term governance.</p> <p>1 = Despite initial efforts to identify slow variables, they have been removed from consideration in long-term governance.</p>

7. Fishery specific management	Proportion of change of key challenges related to MSC fishery specific management systems performance indicators in Principle 3: 3.2.1, 3.2.2, 3.2.3, 3.2.4.	[16,19]	<p>5 = All relevant PIs have shown significant improvement in scores, moving from a range of -60 (worst) to +80 (best).</p> <p>4 = There has been a moderate improvement in PI scores. Scores may have moved from -60 to a range of 60-79, or from 60-79 to +80, or a combination of both across the relevant PIs.</p> <p>3 = No Change.</p> <p>2 = There has been a moderate decline in PI scores. Scores may have moved from a range of 60-79 to -60, or from +80 to 60-79, or a combination of both across the relevant PIs.</p> <p>1 = All relevant PIs have shown a significant decline in scores, moving from a range of +80 to -60.</p>
8. Ability of managers to respond to key changes	Different questions throughout the interview: How would you consider the impact of the FIP on the ability of managers to respond to important challenges (ecological, economic, & social)?	[19,128,130]	<p>5 = Managers have demonstrated a significant improvement in their ability to respond to key changes in a timely and effective manner.</p> <p>4 = Managers have shown some improvement in their ability to respond to key changes. There may be room for improvement.</p> <p>3 = No significant change.</p> <p>2 = Managers' ability to respond to key changes has somewhat deteriorated.</p> <p>1 = Managers' ability to respond to key changes has significantly worsened.</p>
9. Monitor environmental variables	Proportion of key challenges related to MSC information-related Performance Indicators for Principle 1 and 2: 1.2.3, 2.1.3, 2.2.3, 2.4.3, 2.5.3.	[38]	<p>5 = All relevant PIs have shown significant improvement in scores, moving from a range of -60 (worst) to +80 (best).</p> <p>4 = There has been a moderate improvement in PI scores. Scores may have moved from -60 to a range of 60-79, or from 60-79 to +80, or a combination of both across the relevant PIs.</p> <p>3 = No Change.</p> <p>2 = There has been a moderate decline in PI scores. Scores may have moved from a range of 60-79 to -60, or from +80 to 60-79, or a combination of both across the relevant PIs.</p> <p>1 = All relevant PIs have shown a significant decline in scores, moving from a range of +80 to -60.</p>

10. Manage environmental variables	Proportion of key challenges related to MSC management-related performance indicators for Principle 1 and 2: 1.2.1, 1.2.2, 1.2.4, 2.1.1, 2.2.1, 2.3.1, 2.4.1, 2.5.1.	[38]	<p>5 = All relevant PIs have shown significant improvement in scores, moving from a range of -60 (worst) to +80 (best).</p> <p>4 = There has been a moderate improvement in PI scores. Scores may have moved from -60 to a range of 60-79, or from 60-79 to +80, or a combination of both across the relevant PIs.</p> <p>3 = No Change.</p> <p>2 = There has been a moderate decline in PI scores. Scores may have moved from a range of 60-79 to -60, or from +80 to 60-79, or a combination of both across the relevant PIs.</p> <p>1 = All relevant PIs have shown a significant decline in scores, moving from a range of +80 to -60.</p>	
Foster complex adaptive thinking	11. Preparedness to cope with unexpected events	Different questions throughout the interview: How prepared is the fishery system to cope with unexpected events? Do you consider that the FIP has changed something about that?	[19,128]	<p>5 = Manager ability has improved in a timely manner and has expanded the challenges it faces.</p> <p>4 = Manager ability has improved somewhat, either in time and manner or in the ability to meet challenges.</p> <p>3 = No change.</p> <p>2 = Manager ability has worsen somewhat, either in time and manner or in the ability to meet challenges.</p> <p>1 = Manager ability has definitely worsen.</p>

12. Innovation and willingness to experiment	Different questions throughout the interview: Has the FIP impacted on the innovation (Ex. experimentation) in the fishery?	[19,128,129]	<p>5 = Learning and experimentation have thrived. There is a strong emphasis on piloting innovative solutions, sharing lessons learned, and adapting practices based on evidence.</p> <p>4 = There have been initial efforts towards increased learning and experimentation. Some stakeholders have been exploring new ideas and methods, but these efforts are not be widespread.</p> <p>3 = No significant change.</p> <p>2 = Innovation and experimentation have encountered obstacles.</p> <p>1 = Innovation and experimentation have been actively discouraged.</p>
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Encourage learning	13. Sharing of scientific resources	Different questions throughout the interview: Has the FIP modified the communication and the sharing of scientific resources among fishery stakeholders, including government agencies?	[19,128]	<p>5 = Open and transparent sharing of scientific resources has become the norm for the entire fishery. Regular communication channels are established, facilitating the flow of scientific knowledge between researchers, managers, and all stakeholders.</p> <p>4 = Sharing and communication of scientific resources have improved moderately. There is an increased willingness to share information, particularly among FIP stakeholders.</p> <p>3 = No significant change.</p> <p>2 = Sharing and communication of scientific resources have been discouraged for some fishery stakeholders.</p> <p>1 = Sharing and communication of scientific resources have been discouraged for the entire fishery.</p>
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14. Level of participation	Different questions throughout the interview: Has the FIP modified the level of participation of all users in decision-making?	[19,128]	5 = Participation in fishery management has significantly increased. All major fishery stakeholders are actively involved in decision-making processes. 4 = Participation in fishery management has increased moderately. New stakeholder groups have become involved in the process, contributing to a broader range of voices being heard. 3 = No significant change. 2 = Participation in fishery management has become limited for some stakeholder groups. 1 = Participation in fishery management has become severely limited for most or all fishery stakeholders.	
Broaden participation	15. Level of trust	Different questions throughout the interview: Has the FIP modified the level of trust among fishery stakeholders?	[19,128,129]	5 = Trust has become widespread and strong among all fishery stakeholders. 4 = Trust has grown moderately among some fishery stakeholders. 3 = No significant change. 2 = Trust has eroded among some fishery stakeholders. Previously established trust may be weakening. 1 = Trust has broken down completely among all fishery stakeholders. There is a pervasive sense of distrust and suspicion.
	16. Level of cooperation	Different questions throughout the interview: Has the FIP modified the level of cooperation among fishery stakeholders in general? Has the coordination and cooperation been modified among fishery stakeholder related to the management of the fishery?	[19,128,129]	5 = Cooperation has significantly increased among all fishery stakeholders. A strong social network has been established, and all stakeholders actively collaborate to implement new measures. 4 = Cooperation has increased among some fishery stakeholders. A social network is emerging, and some stakeholders actively collaborate to implement new measures. 3 = No significant change. 2 = Cooperation has decreased among some fishery stakeholders. Existing collaborative efforts have weakened, and communication and trust may be breaking down. 1 = Cooperation has significantly decreased among all fishery stakeholders.

	17. Distribution of power in decision-making	Different questions throughout the interview: Has the FIP modified the distribution of power in decision-making around the fishery?	[19,128]	5 = All stakeholders are actively and empowered involved. 4 = Stakeholder participation in decision-making has increased. Diverse perspectives are valued more than before the FIP. 3 = There have been no significant changes. 2 = The participation of different stakeholders in decision-making has decreased. Fewer opinions are heard than before the FIP. 1 = Power has become even more concentrated in a small group of individuals or entities.
Promote polycentric governance	18. Accountability	Different questions throughout the interview: Has the FIP modified decision makers accountability (following through on responsibilities) in the fishery?	[19]	5 = Managers are now fully transparent in their management and highly committed to accountability. 4 = The accountability of managers has improved. Decisions made and their impact are reported more clearly and timely. 3 = No significant changes. 2 = The accountability mechanism has weakened and/or less information is provided about decisions made. 1 = The lack of accountability mechanisms has been exacerbated.
	19. Willingness for conflict resolution	Different questions throughout the interview: Has the FIP modified the willingness for conflict resolution and negotiation among decision-makers in the fishery?	[19]	5 = A culture of dialogue and collaboration has been fostered and conflicts have been prevented more effectively. 4 = Conflict resolution mechanisms have been strengthened. More agreements have been reached. 3 = No significant changes. 2 = The willingness to solve conflicts has weakened, with less dialogue and fewer agreements than before. 1 = The willingness to solve conflicts has decreased.

Appendix B

Template used for the semi-structured interview. The original script was in Spanish, this is an English translation.

Script to assess resilience metrics.

-Welcome and thank the interviewee,

-Explain the context of the project.

-Before proceeding to the interview, share the statement of ethical principles and informed consent for this interview.

Note: we may not ask all questions to the interviewee depending on their area of expertise or role in the FIP.

Context

-What is your role in the FIP? When did you start your involvement in it?

-What have been the incentives/interests that led you (or your organization) to participate in the FIP?

-How did the FIP start?

Metrics

Keep in mind that we want to see the difference between what happened before the FIP and what is happening now.

Note: Metric numbers are related to the scoring Table 5 in Appendix A.

Participation and governance

-Metric 14: How is and how was the participation of all users in the decision-making process? Is the different stakeholders' opinion consulted and considered (or only half considered)? Have new groups been incorporated? How do you think that the FIP has changed this?

-Metric 15: How would you describe the level of trust between the management organizations and the different stakeholders? Has it changed from before the FIP?

- Metric 16: How do you consider stakeholder cooperation in the decision-making process? Has it changed compared to before the FIP?

Would participation/trust and stakeholder cooperation have changed with the forming of the FIP?

- Metric 17: How is power distributed in the decision-making process? Is there a dominant group? How has the FIP modified this?

-Metric 3: Are the perspectives/interests of the different stakeholders in the fishery considered and incorporated in the decision-making process? How has the FIP modified this?

- Is there general compliance by resource users, i.e., fishers and other stakeholders?

- Metric 19: Willingness to resolve conflicts by resource managers? Is there any negotiation between the parties that may have a conflict? Has the FIP modified anything in this regard?

-Metric 18: Accountability in relation to the management of the fishery. Are the authorities held accountable when they do not comply with what has been established? Has the FIP modified anything in this regard?

What has changed in relation to management since the confirmation of the FIP?

Complex adaptive thinking, learning, and connectivity

- Metric 5: How is fishery information shared, who has access to it, and is it shared among other stakeholders? How well connected are the different stakeholders? How has the FIP modified this?

-Metric 13: Specific to scientific information, is the state of knowledge about the fishery updated? Are workshops held, or is information disseminated in any way? Are government agencies involved?

- Metric 12: Do you know if there have been any pilot tests or studies on innovation in the fishery, changes in fishing gear, or any kind of experimentation in management? Has the FIP contributed to this, or not?

- Metric 11: I wanted to ask you about how you see the fishery in terms of making changes to adapt to disturbances, whether natural or social. Is the monitoring system incorporated into the management system? What is the willingness among stakeholders to integrate changes in fishing practices? Is the fishery prepared to deal with unexpected changes? How has the FIP affected this?

-How did COVID affect the fishery? Did being in the FIP changed anything?

Rephrase the questions/conversation of this section to consider what has changed since the FIP started.

Diversity and Redundancy / Slow Variable Management

-Metric 4: Are there other forms of income within the fishery? That is, other target species for fishers, or other forms of income (other activities)? How has the FIP contributed to modifying this?

-Are the factors that impact/affect the fishery in the medium and long term known? How has the FIP contributed to this?

-Metric 8: Has the FIP modified the ability of managers to respond to the challenges of the fishery? Have new governance structures (formal/informal) been created?

Rephrase the questions/conversation to consider what has changed with the FIP shaping of this section.

Extra

-The FIPs are seen as a market tool, where a more responsible product demand supports these projects to consolidate and move forward.

-What do you think has/is improving thanks to the FIP and as its implementation advances?

-Do you know of or are you aware of any increased demand for the resource due to being in a FIP?
Has there been any change in the price of products due to this?

-Has it caused producers to focus more on this resource?

-Have labor and safety conditions changed, or are they intended to change throughout the project?

Appendix C

Table C1. Relation of interviews per stakeholder category and fishery improvement project. NGO: non-government organization staff or NGO alike (hire consultants, playing similar roles); Government agency: agencies working in fisheries research and management; Producer: representative of fishing organization; Industry: Seafood business that buy/process seafood, even owning vessels (do not export/import seafood); Exporter/Importer: Stakeholder working in a seafood company that trade seafood (exporting/importing); Other: any of the previous categories.

#Interviewer	Category	FIP
1	NGO	Large Pelagics
2	Government agency	Large Pelagics
3	Producer	Large Pelagics
4	Other	Large Pelagics
5	Producer	Large Pelagics
6	Industry	Large Pelagics
7	NGO	Mahi-mahi
8	NGO	Mahi-mahi
9	NGO	Mahi-mahi
10	NGO	Mahi-mahi
11	NGO	Mahi-mahi
12	NGO	Mahi-mahi
13	Exporter/Importer	Mahi-mahi
14	Government agency	Mahi-mahi
15	Exporter/Importer	Mahi-mahi
16	NGO	Octopus
17	NGO	Octopus
18	Producer	Octopus
19	Industry	Octopus
20	NGO	Octopus
21	Government agency	Octopus
22	Exporter/Importer	Octopus
23	Exporter/Importer	Octopus

Appendix D

Table D1. Average scores for resiliencies principles for three study cases.

Principle	Large Pelagics	Mahi mahi	Octopus	Average
Maintain diversity and redundancy	3.7	3.3	3.3	3.4
Manage connectivity	3.8	4.0	4.3	4.1
Manage slow variables and feedbacks	3.3	3.0	3.3	3.2
Foster complex adaptive thinking	3.7	3.4	3.6	3.6
Encourage learning	3.9	3.8	4.3	4.0
Broaden participation	4.1	4.1	4.0	4.0
Promote polycentric governance	3.5	3.1	3.7	3.4

Table D2. Average scores for principles metrics for the three study cases.

Principle: Maintain diversity and redundancy				
Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Diversity of livelihoods	3.0	3.0	3.0	3.0
Diversity of perspectives	4.5	4.1	3.9	4.2
Ecosystem status	3.0	3.0	3.2	3.1
Main species status	4.0	3.0	3.0	3.3
Total general	3.7	3.3	3.3	3.4
Level of cooperation	4.3	4.1	4.2	4.2
Level of participation	4.2	4.3	4.1	4.2
Level of trust	3.3	3.7	3.7	3.6
FIP Mean	4.1	4.1	4.0	4.0

Principle: Manage connectivity				
Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Degree of information/knowledge sharing	3.8	4.0	4.3	4.1
FIP Mean	3.8	4.0	4.3	4.1

Principle: Manage slow variables and feedbacks				
Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Ability of managers to respond to key changes	3.4	3.0	3.4	3.3
Fishery specific management	3.4	3.0	3.2	3.2
Manage environmental variables	2.9	2.9	3.3	3.0
Monitor environmental variables	3.8	2.7	3.2	3.2
Understanding of gradual changes	3.2	3.3	3.5	3.4
FIP Mean	3.3	3.0	3.3	3.2

Principle: Foster complex adaptive thinking				
Metrics	Large Pelagics	Mahi mahi	Octopus	Average

Preparedness to cope with unexpected events	3.7	3.4	3.6	3.6
FIP Mean	3.7	3.4	3.6	3.6

Principle: Encourage learning

Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Innovation and willingness to experiment	4.0	3.8	4.3	4.0
Sharing of scientific resources	3.8	3.9	4.3	4.0
FIP Mean	3.9	3.8	4.3	4.0

Principle: Broaden participation

Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Level of cooperation	4.3	4.1	4.2	4.2
Level of participation	4.2	4.3	4.1	4.2
Level of trust	3.3	3.7	3.7	3.6
FIP Mean	4.1	4.1	4.0	4.0

Principle: Promote polycentric governance

Metrics	Large Pelagics	Mahi mahi	Octopus	Average
Accountability	3.3	3.0	4.0	3.3
Distribution of power in decision-making	3.7	3.2	3.8	3.5
Willingness for conflict resolution	3.5	3.0	3.4	3.3
FIP Mean	3.5	3.1	3.7	3.4

Capítulo 4. Reflexiones del modelo FIP

El siguiente capítulo tratará de una reflexión personal del autor respecto al modelo de los Proyectos de Mejora Pesquera (FIP, por sus siglas en inglés) para promover la sostenibilidad y la resiliencia de las pesquerías en el contexto de Latinoamérica y el Caribe. Esta sección se saldrá del encorsetado formato de artículo científico, y permitirá una reflexión y un lenguaje diferente, basándome en parte del conocimiento compartido a través de las encuestas como el adquirido a lo largo de la tesis.

Proyecto de mejora pesquera

Como vimos a lo largo del estudio los FIP han surgido como una herramienta para mejorar el manejo y promover la sostenibilidad de los recursos pesqueros, aprovechando incentivos de mercado que solicitan este tipo de prácticas. Sin embargo, existen diversas limitaciones y retos asociados a su implementación, así como oportunidades para complementar su enfoque y mejorar su efectividad.

Los FIP han demostrado ser útiles para llenar algunos huecos de información de la actividad pesquera, particularmente en lo que respecta a la recopilación de datos sobre las poblaciones de peces explotadas, otras especies asociadas y el hábitat. Ayudando a poder proponer y/o complementar reglas y estrategias de captura. Esta información puede ser utilizada para desarrollar políticas pesqueras más efectivas y basadas en evidencia.

Además, los FIP pueden contribuir a mejorar el capital social entre organizaciones pesqueras, empresas de la cadena de suministro, organizaciones de la sociedad civil y agencias de gobierno. Puesto que gran parte del trabajo de los FIP estaba relacionado con establecer espacios para tratar cambios en las prácticas, en el manejo y/o discusión sobre los datos necesarios para la pesquería. Así estos espacios fomentan la colaboración y la participación de los diferentes actores, ayudando a fortalecer las relaciones y la confianza entre los diferentes actores involucrados en la pesca. Cabe destacar que estos espacios están limitados generalmente a las partes interesadas que están involucradas en el FIP, y actores importantes de la pesquería podrían no estar incluidos. Idealmente, todos los actores relevantes deberían formar parte del FIP, o organizar el proyecto para que más actores se puedan ir sumando.

Las agencias de gobierno que manejan e investigan los recursos marinos son esenciales para el avance de los FIP. Dependiendo de la voluntad de estas agencias, los proyectos pueden avanzar más rápidamente, o quedarse atascados en los avances (comunicación personal). Antes de empezar un proyecto se debería asegurar que voluntad y/o disposición real existe por parte de estas agencias clave. También deben conocerse los tiempos y las dinámicas internas de las agencias de gobierno, puesto que burocracia interna puede dilatar mucho los procesos. En el caso que no se contara con el apoyo del gobierno, y este fuera necesario para aplicar alguna mejora, se deben buscar vías para establecer relación y poner las necesidades del FIP en la agenda de los manejadores. Aquí la cadena de suministro de la pesquería puede jugar un papel clave para conseguirlo.

La financiación de los FIP a medio y largo plazo es clave para el éxito del proyecto. Si la cadena de suministro está involucrada e interesada en el FIP, esta puede ser una fuente directa de fondos para desarrollar el plan de trabajo. A pesar de esta posibilidad, la filantropía ha impulsado y financiado muchos de los proyectos de la región. Difícilmente, la filantropía pueda apoyar a los numerosos FIP que están surgiendo en la región, y la industria pesquera deberá asumir gran parte de estos gastos.

Para el éxito de los FIP, es necesario abordar varias consideraciones adicionales. En primer lugar, el mercado no parece que pueda dar precio premium para los productos de los FIP, sino que da acceso/mantiene el acceso a ciertos mercados. Además, existe el riesgo de greenwashing, donde las empresas pueden utilizar los FIP como una estrategia de marketing sin realizar mejoras reales. Para evitar esto, se deben establecer mecanismos de supervisión rigurosos, puesto que muchas de las pesquerías de la región difícilmente puedan alcanzar una certificación, y el modelo FIP podría ayudarles a tener una especie de aval ambiental. La equidad también es crucial, asegurando que los beneficios y costos de los FIP se compartan de manera justa entre todos los participantes. Este último punto requiere de más atención, puesto que la mayoría del trabajo se da en los primeros eslabones de la cadena de suministro de productos del mar, pero realmente se desconoce cómo actúa el mercado en la compra y venta de estos productos. También se debe considerar la trazabilidad de los productos, para que efectivamente una empresa que use los FIP de cara a sus compromisos de compra, se surta de ellos.

Por otro lado, la incorporación de la política de responsabilidad social y derechos humanos para aquellos FIP publicados en la web FisheryProgress.org presenta desafíos adicionales, requiriendo la participación de expertos y la colaboración con agencias gubernamentales adicionales. Pero a la vez abre la puerta a mejoras en este aspecto se empiecen a incorporar y poner en la agenda de los proyectos. Estos proyectos no solo deberán buscar la mejora de la sostenibilidad de los recursos, si no también a la mejora de las condiciones laborales basadas en la responsabilidad social y los derechos humanos.

Finalmente, hay que considerar que los FIP son proyectos en proceso, que buscan mejorar la sostenibilidad de los recursos (y son proyectos que duran años incluso llegan a la década), y reconocer que pesquerías certificadas son “mejores” en su desempeño ambiental. La recomendación, coincidiendo con otros autores, sería que las políticas de compra que incluyan FIP, deben priorizar abastecerse de pesquerías certificadas con mejor desempeño ambiental. Así incentivar a las pesquerías a mejorar, y no desincentivar a la ya certificadas.

Enfoque socioecológico

El cambio de visión que implica analizar las pesquerías desde el marco de sistemas socioecológicos aumenta la complejidad, pero supera la visión del manejo tradicional de recursos naturales, abriendo se a todo un sistema integrado de varios componentes naturales y sociales.

Los FIP promovieron la resiliencia en algunos principios, pero como vimos, resultan ser un enfoque limitado para promover la resiliencia socioecológica en general de las pesquerías. Para mejorar la resiliencia en las pesquerías es esencial considerar objetivos múltiples como la conservación, la seguridad alimentaria y los medios de vida, teniendo en cuenta las limitaciones de capacidad y los desafíos de resiliencia socioecológica específicos de cada pesquería. Aunque la investigación se centró en el estudio a nivel de pesquería, las posibles respuestas para mejorar la resiliencia socioecológica, se deberá dar en varios niveles (e.g.: a nivel de pesquería, región, localidad, etc.). La operacionalización del manejo de la resiliencia en la pesca es una tarea compleja y llena de desafíos. Superarlos y aprovechar las oportunidades existentes pueden llevar a los sistemas socioecológicos a mejores estados deseados.

Finalmente, cabe destacar que, aunque los FIP no sean lo suficiente para promover todos los principios de resiliencia, son proyectos que están haciendo que las pesquerías avancen hacia la sostenibilidad. Las pesquerías, como cualquier otro sistema, debe de explorar los recursos de una manera sostenible para no crear problemas ambientales, y/o socioeconómicos a mediano y/o largo plazo. Además, poseen la particularidad que se pueden complementar con otras herramientas y estrategias que podrían dirigirse hacia otros principios de resiliencia. Así merecen la pena implementarlos en las pesquerías que estén interesadas en llevarlos a cabo, puesto que puede contribuir significativamente a la sostenibilidad a largo plazo de las pesquerías y los ecosistemas marinos.

Conclusiones generales

Los FIP han surgido como una poderosa herramienta para mejorar la sostenibilidad de la pesca en la región de América Latina y el Caribe.

Los FIP en esta región son diversos, lo que refleja el complejo panorama pesquero de la región. A pesar de eso, abordan desafíos similares, como datos deficientes, deficiencias en las estrategias de captura, un débil cumplimiento de reglas e información limitada sobre el estado de las poblaciones.

Los FIP parece estar contribuyendo a llenar algunos vacíos en el manejo pesquero en la región, a través de la recopilación de datos, el diálogo sobre los datos y la participación de las partes interesadas para impulsar cambios en la política y las prácticas pesqueras. Pero la participación del gobierno en estos procesos sigue siendo fundamental para el avance de estos.

El mercado de productos del mar podría estar impulsando la gestión pesquera sostenible a través de los FIP en LAC, pero deben considerarse herramientas complementarias junto con los sistemas de certificación existentes con normas medioambientales más estrictas.

El monitoreo a largo plazo, consideraciones socioeconómicas de las pesquerías y la complementación con otros procesos son cruciales para maximizar el potencial de los FIP y garantizar la viabilidad a largo plazo de la pesca en Latinoamérica.

Los FIP mostraron potencial para mejorar la resiliencia del SES de algunos principios, en particular, Ampliar la participación, Fomentar el aprendizaje y Manejar la conectividad, pero no son suficiente para potenciar la resiliencia del todo el SES en su conjunto.

Los FIP deben modificarse y/o complementarse con otras estrategias si desean mejorar otros principios de resiliencia.

La «eficacia» de los FIP para mejorar la resiliencia podría verse limitada por la capacidad de las partes interesadas para influir sobre agencias gubernamentales sobre las necesidades de los FIP y extender los impactos del proyecto a toda la pesquería.

La pesca debe entenderse como un sistema socioecológico para abordar los esfuerzos de manejo en beneficio de todos los componentes de la pesquería ante un mundo cambiante.

La evaluación de la resiliencia de los sistemas socioecológicos es compleja y contexto-dependiente. La aplicación del marco de los principios de resiliencia puede facilitar la evaluación del impacto sobre la resiliencia de las intervenciones de gestión a lo largo de diferentes SES. Pero las intervenciones para potenciar la resiliencia deberán ser adaptadas a los diferentes contextos.