**Table 1**. Indicators and proxies used to characterize social aspects of vulnerability of fisheries cooperatives. References in grey refer to studies that have used that indicator to assess vulnerability in fisheries and to the sources of the data to use to evaluate a given proxy.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Indicator | Proxy | Definition of the proxy | Original scale |
| **Social adaptive capacity** | **Social capital**  Cinner et al., 2013 | Human Development Index  United Nations Development Agency | The human development index of the host country, as defined by the United Nations Development Program. HDI reflects the degree to which life choices are available to people, and opportunities available to act on those choices. | From 0 to 1 |
| Number of cooperative behaviors  Ovando et al., 2013 | The number of cooperative behaviors (from those listed in **Table 1 in SI**) in which the members of the fishery engage. | Count from 0 to 18 |
| Umbrella organization  Ovando et al., 2013 | Whether the fishery represents other smaller fisheries organizations. | Yes = 1, No = 0 |
| **Diversification** | Number of targeted species  Ovando et al., 2013 | The total number of species primarily targeted by the fishery. | Count starting at 1 |
| Multiple gears  Ovando et al., 2013 | Whether the fishery predominantly uses more than one gear type. | Yes = 1, No = 0 |
| **Change anticipation and capacity to change**  Cinner et al., 2013 | MSC certification  Ovando et al., 2013 | Whether the target species has been MSC certified. | Yes = 1, No = 0 |
| Stock assessment  Ovando et al., 2013 | Whether a stock assessment is available for the target species. | Yes = 1, No = 0 |
| **Governmental support to the cooperative** | Number of governmental services  Ovando et al., 2013 | The number of services (from those listed in Table X, SI) that the government of the host country actively provides to the cooperative. | From 0 to 6 |
| Rule of law  The World Bank | The perception of the strength and fairness of the rule of law in the host country, as measured by the rule of law index in the World Bank’s Worldwide Governance Indicators database. | From ~ -2.5 to 2.5 |
| Contract enforcement rank  The World Bank Doing Business Project | The hose nation’s global ranking in strength of contract enforcement, as reflected by the institutions, ease, and cost of enforcing contracts, provided by the World Bank’s Cost of Doing Business dataset. | Rank |
| **Material style of life**  Cinner et al., 2013 | Poverty index (Inverse)  Ovando et al., 2013 | The Human Poverty Index of the host country, as defined by the human performance indicator criteria of the United Nations Development Program. Reflects the percentage of the population without safe water, and children that are underweight. | Continuous from 0 to 1 |
| **Social sensitivity** | **Economic dependence** | Percentage of GDP from fishing  Ovando et al., 2013 | The total amount of a host country’s GDP made up from fishing. | 0 to 100% |
| **Food dependence** | Subsistence fishing  Ovando et al., 2013 | Whether the catch is used for subsistence | Yes = 1, No = 0 |

**Table 2**. Indicators and proxies used to characterize ecological aspects of vulnerability of fisheries cooperatives. References in grey refer to studies that have used that indicator to assess vulnerability in fisheries and to the sources of the data to use to evaluate a given proxy.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Component | Indicator | Proxy | Definition of the proxy | Original scale |
| **Ecological sensitivity** | **Sea temperature vulnerability** | Sea temperature vulnerability score  Halpern et al., 2007 | Score built considering experts’ opinion on scale, frequency, functional impact, resistance, recovery time and certainty of the effects of changes in sea temperature on a given marine ecosystem. | Continuous from 0 to 4 (increasing vulnerability) |
| **Overfishing** | Recorded fishery closure  Ovando et al., 2013 | Whether the fishery has been closed at some point since 1960. | Yes = 1, No = 0 |
| **Species susceptibility**  Cinner et al., 2013 | Species vulnerability to climate change index  Jones and Cheung, 2017 | Index that integrates information on species’ biological and ecological traits to characterize its vulnerability to impacts of climate change. | Discrete from 0 to 100 |
| **Ecological exposure** | **Sea surface temperature change**  Blasiak et al., 2017 | Sea surface temperature projected anomalies  NASA | The difference between mean maximum SST observed for the 2006 - 2015 period and maximum SST in 2050. |  |
| **Ecological recovery potential** | **Habitat recovery potential** | Inverse of ecosystem’s recovery time score  Halpern et al., 2007 | Average time of ecosystem’s recovery according to experts’ opinion across different anthropogenic stressors. | Continuous from 0 to 4 (increasing in years) |
| **Managed fishery** | Open access (Inverse)  Ovando et al., 2013 | The fishery is essentially unregulated, allowing anyone to enter the fishery and catch as much as they desire. | Yes = 1, No = 0 |

**Table 1 in SI.** List of potential cooperative behaviors (from Ovando et al., 2013)

|  |  |
| --- | --- |
| **Cooperative Behavior** | **Description** |
| Marketing Marketing | Cooperation to collectively market or brand catch |
| Profit Sharing Profit\_Sharing | Pooling system to distribute proceeds from fishing among fishery members |
| Coordinated Harvesting co\_harvest | Coordination of fishing strategy among fishery members |
| Cooperative Administration Cooperative\_Administration | The cooperative engages in voluntarily development of on-shore cooperative administration. Examples would include division of the group into fishers, accountants, managers, etc, and the creation of bylaws (formal or informal) to manage these institutions (e.g. rules regarding the entry of new members). |
| Catch Limits Cooperative\_TAC | Implementation of self-imposed catch limits above and beyond any similar governmental restrictions |
| Gear Restrictions Cooperative\_Gear\_Restrictions | Implementation of gear restrictions, e.g. the prohibition of dynamite, beyond any similar governmental regulations |
| Size Limit Cooperative\_Size\_Limit | Implementation of self-imposed size limits above and beyond any similar governmental regulations |
| Gear Sharing Gear\_sharing | Collective ownership or use of fishing gear, such as boats, nets, or landing facilities |
| Direct Enforcement Direct\_Enforcement | Collective action to physically enforce fishery regulations, for example organization of patrols |
| Codified Penalties Codified\_Penalties | Collectively determined set of defined penalties for infractions of fishery regulations |
| Temporal Restrictions Temporal\_No\_Take | Voluntary cessation or restriction of fishing activities for the fishery as a whole, or for a defined spatial region, for a given period of time |
| Spatial Marine Protected Areas Spatial\_No\_Take | Voluntary closure or restriction of spatially defined portions of the fishery |
| Restocking Restocking | Collective action to restock the fishery, for example through the seeding of juveniles |
| Habitat Restoration Habitat\_Restoration | Voluntary efforts to restore fishery habitat, for example planting of mangroves |
| Gear Shift Gear\_Shift | Collective choice to switch to more environmentally friendly gear types |
| By-catch avoidance By\_catch\_avoidance | Cooperative actions to reduce by-catch above and beyond any government stipulations |
| Research Support Research\_support | Cooperative support of fishery research activities, such as data collection or science funding |
| Information sharing Information\_sharing | Cooperative information sharing consists of organized collective behavior by fishers to share information relevant to fishing activities. Examples include sharing knowledge of fishery conditions or location of productive fishing grounds. |

**Table 2 in SI.** List of potential governmental services to the cooperative (from Ovando et al., 2013)

|  |  |
| --- | --- |
| **Governmental Support Service** | **Description** |
| Legal protection/standing legal\_protection\_\_standing | The government provides legal protection and standing to the cooperative. A legal challenge to the cooperative’s right to operate in a fishery would most likely be held up in a court of law. |
| Enforcement Enforcement\_ | The government provides support for enforcement, in the form of enforcement agents, or enforceable penalties for violations of cooperative rules. For example, the government enforces fines for fishers found to be violating the recognized rules of the cooperative. |
| Financial services Financial\_Services | The government provides financial support to the cooperative. For example, the government provides grants to fund research or equipment purchases for the cooperative, or provides tax benefits, loans, loan guarantees, or subsidies to the cooperative. |
| Voluntary regulations Support\_of\_Voluntary\_Regs | Whether the government provides support for the voluntary regulations set by the fishing cooperative. |
| Information support Information\_support | The government provides means for disseminating or collecting information relevant to the success of the cooperative. For example, the government provides researchers or catch logging databases. |
| Conditions for cooperative existence Conditions\_for\_cooperative\_exist | The government has stipulations or benchmarks in place that the cooperative must satisfy in order to retain its right to operate in the fishery. |