THINGS THAT MATTER: INSIGHTS FROM STRUCTURED OBJECTIVES INTO THE OPERATIONALIZATION AND EVALUATION OF SUSTAINABLE FISHERIES

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ABSTRACT

Objectives reflect values that matter to decision-makers, but can be challenging to articulate. This is particularly true in resource management contexts where high uncertainty amplifies the complexity of satisfying multiple conflicting objectives in an acceptable manner. Structured decision-making recommends structuring objectives into networks to assist with choosing management actions among a suite of alternatives. Here, I used content analysis (where words or concepts are identified in qualitative data, like text) to identify and structure objectives according to implicit relationships among them. Objectives were taken from Canadian laws, policies and plans for sustainable fisheries management. Resulting networks were then compared to the explicit objective structures in integrated fisheries management plans. There was a relatively high level of coherence and multiple connections between different axes of sustainability. Plans typically layered and then connected objectives to management actions regardless of the terms used to describe them. Implicit relationships among objectives may reflect the conceptual model(s) that would have informed law, policy or plan development. Networks can provide a scaffolding with which to compare how jurisdictions choose to fix means or ends objectives into law, pre-operationalize objectives, and evaluate sustainable fisheries performance. Structuring objectives helps to identify circumstances where it may be useful to base decisions on means objectives as proxies for hard-to-define ends, while also clarifying assumptions at play when that choice is made. Operational guidance for setting objectives in resource management contexts could

benefit by recommending approaches to structuring objectives, in addition to aiming for measurable and time-bound objectives.

GENERAL SUMMARY

People make decisions about what actions to take in order to achieve their objectives, but it can be hard to express objectives in a way that makes it easier to decide what to do. One approach to help decision-makers is to organize or structure objectives into networks, where achieving "means" objectives helps to accomplish the ultimate goals of decision-makers, termed "ends" objectives. Here, I identified objectives related to sustainable fisheries management in Canadian laws, policies and management plans. I then structured the objectives into networks and compared these networks to the way management plans describe their objectives. Most documents shared the same objectives for fisheries sustainability, and many also recognized that achieving these objectives was interconnected. Regardless of what management plans called their objectives, plans tended to break out objectives from ends to means until they could be connected to management actions. It may be helpful to include information about structuring objectives into operational guidance for resource management.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

The management of natural resources, including fisheries, is a process that involves iteratively making decisions in situations involving a high degree of uncertainty about the true state of the resource and multiple, value-based and usually conflicting goals (Conroy and Peterson 2013, Gregory et al. 2012). In all cases, decisions are made in order to achieve objectives - thus, a complete set of objectives identifies the values that matter to decision-makers. Without clear objectives, management choices and governance processes for shared stewardship may be ineffective, the ability of scientific experts to provide advice in support of decision-making may be limited, and more generally the evaluation of management actions and plans may be precluded.

Despite this critical role, objectives are often challenging for decision-makers to articulate across many fields and contexts. It is often easier to think about decisions as being a choice among alternative actions than it is about how to best achieve what matters most (*alternative-focused thinking* versus *value-focused thinking*; Keeney 1992), even though the latter approach may facilitate a broader array of alternatives for consideration than might otherwise be identified at the start. Where values can be identified, they are more likely to be expressed conceptually or qualitatively than in ways that facilitate specific, or quantitative, evaluation. A lack of specificity is a common critique of resource management objectives, e.g., objectives may be considered vague or broad (Rice and Rochet 2005, Smith 1994), insufficiently associated with quantifiable

measures of performance (Jamieson et al. 2001), or failing to be time-bound (Office of the Auditor General of Canada 2016).

Perhaps to mitigate the risk of inadequate advice, guidance and policies for decision-makers may emphasize the need for making objectives measurable. Marine or fisheries management guidelines may stipulate that objectives be "SMART" (specific, measurable, achievable, realistic and time-bound; Cormier and Elliott 2017, DFO 2013b), a concept borrowed from business management (Doran 1981), or that they must comprise a reference point, probability and timeframe (DFO 2013c). Some jurisdictions aim to directly provide pre-operationalized objectives (complete with targets, limits, timeframes and/or desired probabilities; Marentette and Kronlund 2020), or aim to facilitate the development of conceptual models, e.g., via DPSIR (driver-pressure-state-impact-response; Rice and Rochet 2005) or Pathways of Effects (Government of Canada, 2012), to help the objective-setting process in practice. These tools can help ensure that fisheries objectives found in domestic or international legislation, such as achieving optimum utilization or maintaining stocks at levels capable of producing maximum sustainable yield (both found in the 1995 United Nations Fish Stocks Agreement) are met. Challenges are increased in participatory decision-making scenarios where values underlying specific objectives can conflict, or carry different weights, in terms of importance even within the same stakeholder group (Pascoe et al. 2009, Pascoe et al. 2013). In some cases, resource interests may pre-emptively seek to reject inclusion of objectives that do not align with their values or with their conceptual or "mental" models

of system dynamics (Conroy and Peterson 2013, Verweij and Van Densen 2010), or to select indicators of resource states whose values happen to align with desired management alternatives (Rice and Rochet 2005).

Objectives for fisheries and aquatic resource management are often grouped into categories of *conceptual* (general but often vague statements, which can be broadly agreed upon as desirable) versus *operational* (specific, practical or direct statements against which performance may be more easily measured). The term *unpacking* is often used in these fields to refer collectively to the deductive or top-down process of identifying conceptual objectives, using a hierarchical approach to fully specify or break down those objectives into their components, and then operationalizing them (O'Boyle and Jamieson 2006, Sainsbury and Sumaila 2003, Sloan et al. 2014). *Operationality*, however, is itself a concept that requires further specification before it can be realized. In part, it concerns measurability; measurable objectives are needed to support effective decision-making, including evaluation. There is also utility in understanding the perceived or apparent causal relationships among objectives, and the consequences that the assumptions underlying these relationships have for evaluating whether management actions are aimed to achieve what matters most. The assumptions may reflect decision-makers' conceptual models of the system they manage, including perceptions of the controllability and reversibility of impacts on system attributes, and where important trade-offs lie between conflicting objectives. Relationships among objectives are also

fundamental for operationalizing management decisions (de la Mare 2005, Garcia 2003, Gavaris 2009).

Here I perform content analysis (Babbie 2010) to first identify and then structure a wide range of objectives expressed in Canadian laws, policies and plans for sustainable fisheries management. Content analysis, a research tool where words or concepts are systematically identified in qualitative data, like text, is increasingly being used to understand objectives and their implications in resource management and conservation policies (e.g., marine protected areas, Dalton et al. 2015; aquaculture, Ertör and Ortega-Cerdà 2017; fisheries, Farmery et al. 2019; and marine ranching, Yu and Wang 2020). *Structuring objectives* (identifying and specifying the values that need to be included as objectives and the relationships among them) is part of establishing a *decision context* (i.e., what alternatives are appropriate to consider, by whom, when and how) in structured decision-making, an approach explored in various resource management decision contexts including fisheries (Clemen 1996, Conroy and Peterson 2013, Gregory et al. 2012, Keeney 1992). In structuring objectives, the focus is first on understanding *roles* that objectives may play in a decision-making process. Later, attention extends to determining which objective *attributes* (also called *performance metrics;* Keeney 1992) may be expressed quantitatively, making objectives measurable (Gregory et al. 2012; Table 1). Here I invoke the concept of structuring objectives for the purposes of policy analysis, both within a Canadian context and to compare Canadian objectives to international examples. My analysis focused on elements of sustainability typically

clustered into axes of ecological, institutional, social, cultural and economic values (Stephenson et al. 2019). I explored the implicit means-ends relationships among objectives found in polices and plans, using an inductive approach. Inductive content analysis uses a process of abstraction to reduce and group concepts, categories and themes that emerge from raw data. I then compared the resulting means-ends structures to the explicit ways that objectives are categorized and layered in fisheries management plans. In recognition of the qualitative way in which values are expressed in law, policy and management plans, I adopted here a somewhat simpler and more inclusive definition of an *objective*: a concise statement about what matters to decision-makers and resource interests, typically with a noun and a verb ("increase," "reduce," "minimize," "maintain," "promote"), although in the absence of consensus around the verb, the desired directionality of the thing valued should be clear (Gregory et al. 2012).

2. METHODS

Terminology

Conventions for describing the measurability and/or roles of objectives (e.g., aspirational, broad, conceptual, explicit, operational, etc.), the relationships among objectives (e.g., networks, frameworks, hierarchies, trees, etc.) and other aspects of either objectives or their associated performance metrics (e.g., attributes, components, dimensions, characteristics, etc.) can vary widely among resource management contexts (DFO 2013a, Keeney 1992, O'Boyle and Jamieson 2006, Sainsbury and Sumaila 2003). This can

make the study of objectives more challenging. Here I employed structured decision-making terminology for objective roles and relationships (Table 1, Figure 1). Relationships among objectives can be expressed in two forms: as hierarchies, or as networks, and both may be important in a given decision context (Figure 2). Together, hierarchies and networks can help to identify and supply missing information for both *hidden* (unspecified) and s*tranded* (lacking means) objectives, helping to open up more management choices, although objectives that are unaffected or out of scope for a given decision may be excluded in practice (Clemen 1996, Conroy and Peterson 2013, Keeney 1992). They also set the stage for construction of conceptual models such as *influence diagrams* and *decision networks* (Conroy and Peterson 2013, Gregory et al. 2012). It is important to note that objective roles are not fixed. The same objective may perform different roles in different decision contexts, or even within the same network – serving as a means for some objectives, and an end for others (Figure 1; Keeney 1992). Regardless of role, the same objective can be also expressed either qualitatively, *sensu* O'Boyle and Jamieson 2006 (e.g., "keep fishing mortality [*F*] moderate", "maintain healthy fish stocks") or quantitatively ("maintain $F<F_{\text{reference}}$ with 95% probability each year over the next 10 years," "maintain spawning stock biomass $B > B_{\text{reference}}$ every year", respectively), while still serving the same role in a given context.

Content Analysis

I examined 82 key documents pertaining to federal fisheries management in Canada, namely three laws (the *Fisheries Act*, the *Oceans Act*, the *Species at Risk Act*), 27 policies

Table 1: Structured decision-making terminology for objectives and relationships among objectives that are used in this study. See also Figure 1. Adapted from Clemen 1996, Conroy and Peterson 2013, Gregory et al. 2012, and Keeney 1992.

Term	Definition
Attribute	Some indicator or aspect which can be used to evaluate the degree to which an objective is achieved; can also be used as a synonym for performance metric.
Ends Objective	*Ends objectives* represent the essential values appropriate to the scale of a particular decision– in other words, the values they represent are impacted by alternatives under consideration, and the answer to "why is this important?" that conveys the reason a decision is being made. The concluding ends objective of the sequence for a given decision context can be termed a *fundamental objective*.
Hidden Objective	Objectives that have not been explicitly specified, but are important to a given decision context, and which may be revealed by structuring objectives into networks and/or hierarchies.
Means Objective	*Means objectives* represent the answer to "how is this end objective accomplished?" for a given ends objective. In the middle of a network sequence, means objectives for one objective may themselves be ends objectives for others.
Stranded Objective	Objectives that have been explicitly specified and may be affected by a given decision context, but which do not have means objectives and/or management actions identified for it.
Strategic Objective	*Strategic objectives* represent core values that apply across most or all decisions made by an individual or an organization. As such, they may be expressed quite qualitatively.
Decision Networks	*Decision networks* are conceptual models where candidate management alternatives are connected to means objectives in a means-ends objectives network.
Influence Diagrams	*Influence diagrams* (also called *effects networks* or *impact pathways*) are graphical decision models (i.e., conceptual models) that connect a means-ends objectives network with outside factors that can also influence whether objectives are achieved.
Means-Ends Objectives Network	*Means-ends objectives networks* identify relationships among objectives based on cause-and-effect linkages. While objectives towards the "ends" portion of the network provide the answer to "why does this matter?" for means, objectives towards the "means" portion increasingly refine answers to "how is this accomplished?" that might be asked for desired ends.
Objectives Hierarchy	An *objectives hierarchy* progressively breaks down a complex or generalized concept into one or more specific lower-level objectives and/or attributes. Collectively, the hierarchy helps specify (explain or describe) what is meant by higher-level objectives.

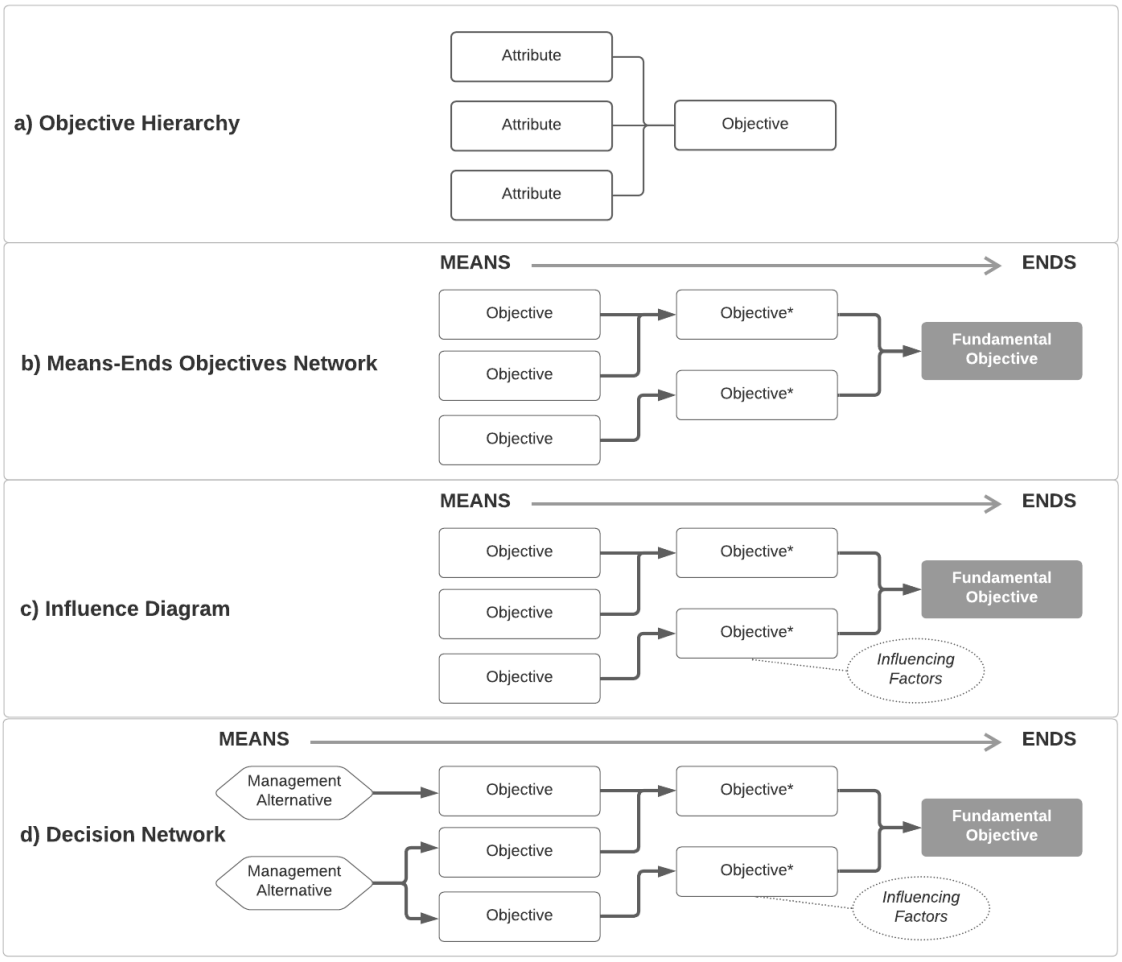

Figure 1: A visualization of a) an objective hierarchy decomposes a more complex objective into specific attributes from which to develop performance metrics, while b) a means-ends network connects objectives with arrows to demonstrate cause-and-effect relationships. Although they represent different concepts, networks and hierarchies may be usefully combined to support decision-making (see Figure 2). The ultimate end objective for a given decision context can be termed a fundamental objective, while an asterisk (*) denotes objectives that serve both ends and means roles, depending on perspective. c) Influence diagrams add in external factors (and uncertainties) that may influence the achievement of certain objectives but are currently outside of management control, while d) decision networks connect objectives to management alternatives.

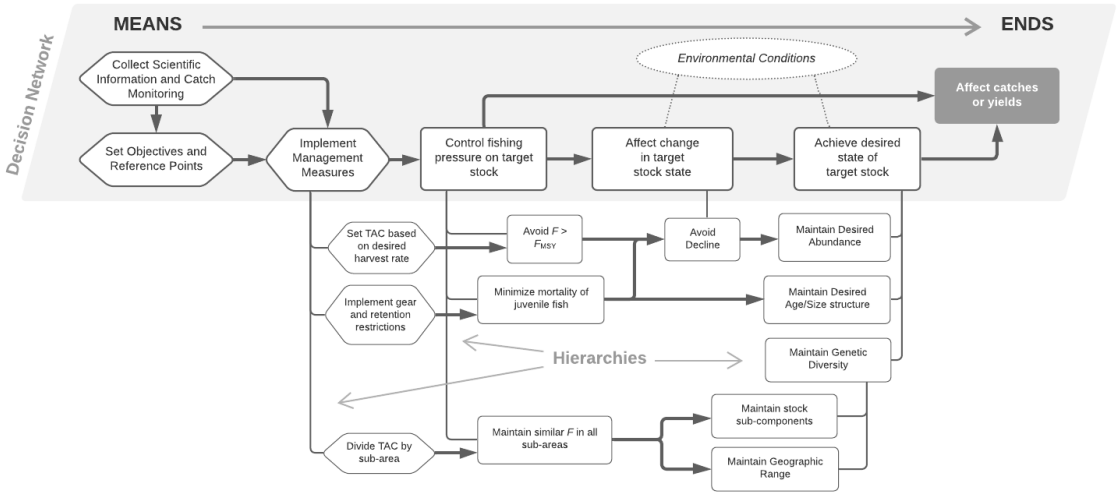

Figure 2: In practice, both hierarchies and networks play useful roles in supporting decisions. A generic decision network is presented that might reflect a traditional "single-species" fisheries management context with a fundamental objective of promoting desired catches (arranged along a horizontal grey plane). Three of these generic objectives (relating to desired states of target stocks, controlling fishing pressure, and implementing management measures) are further specified into objectives for attributes of interest by means of hierarchies. More-specified objectives can be more readily connected to specific management actions, and in later steps made fully measurable. Shapes, colours, arrows and lines are employed in this figure as for Figure 1.

including those in the Sustainable Fisheries Framework (SFF; 11 documents), other fisheries management policies (ten documents), and Oceans and Marine Protected Areas (MPA) policies (six documents), and 52 integrated fisheries management plans (IFMPs; see the Appendix for the full list). Collectively, these documents represented the three primary pieces of legislation pertaining to fisheries and oceans management in Canada, all published policies, and the majority of plans published online on the Fisheries and Oceans Canada website (https://dfo-mpo.gc.ca/index-eng.html) as of August 2020; a minority of IFMPs (n = 7) were screened out for containing too few objective categories (see below).

Relevant sentences and paragraphs (*quotes*) that were inferred to contain objectives (nouns representing something to be achieved or avoided) were selected, and keywords and phrases (*codes*) attached. Documents were reviewed and coded three times by the same analyst to ensure consistency and to iteratively condense the number of codes applied. Codes were grouped by subject matter. Grouping permitted the detection of code presence/absence or frequencies of mention by document type, and code co-occurrences (the number of incidences across all or a subset of documents where two codes were applied to the same quote). Coding of laws and policies focused on identifying statements containing valued elements of sustainability, such as ecological, institutional, social, cultural or economic values, management actions to achieve those objectives, and values that were more cross-cutting (such as "sustainable use" itself). A set of 79 codes formed the basis of the analysis (Table 2; see Appendix, Table S9 for quoted examples). Additional codes were used as devices to track descriptive terms or attributes for these objectives, or to compress objectives into fewer groups to enable broad comparisons, as needed. The analysis excluded sections of technical content and detail in laws and policies (e.g., regulatory requirements or specifics of management processes). While items of value may be expressed or inherent in such content, particularly for management actions, they were at too fine a scale for this analysis.

Most law and policy quotes were lengthier statements that received multiple codes. Objectives quoted from IFMPs tended to be shorter, but still referenced multiple values that each received a code. For example, "keep fishing mortality moderate" and "promote

Table 2: The set of 79 codes derived from all examined laws, policies and plans, most of which were compressed into 16 categories by which Integrated Fisheries Management Plan (IFMP) objective layers and categories were analyzed. The 16 categories were further binned into management actions, overall means or overall ends for a forced comparison to strengthen contrasts (means or ends indicated in parentheses after each code name). Redundancy is defined as the mean number of times each code was applied per IFMP; objective codes that were mentioned at least once, on average, per IFMP are highlighted in bold and with grey shading for emphasis (n = 13). F = fishing mortality, SEC = socio-economic and cultural.

Categories	Codes	Redundancy (IFMPs)
Management Actions		
Decision Inputs	Legal or Policy Instruments	0.8
	Decision-Making Approaches	0.8
	Catch, Fishery or Other Monitoring	**2.5**
	Traditional or Local Knowledge	0.2
	Scientific Information	**2.2**
	Evaluation of Measures, Plans or Practices	0.4
	Socio-economic Studies	--
	Make Information Available	0.3
Support for Decision-Making Processes	Education and Training	0.2
	Consultations and Meetings	0.6
	Governance Processes and Mechanisms	0.9
	Build Institutional Capacity	--
	Support Participant Initiatives	0.1
Decision Outputs	**Fishery Measures and Plans**	**7.9**
	Objectives and Reference Points	0.4
	SEC Measures and Plans	**2.7**
	Enforcement Tools and Actions	0.9
	Best Practices and Standards	0.3
Institutional Axis		
	Unresolvable Institutional Objectives	--
Considerations for Decisions (overall means)	Environmental Conditions	0.1
	Ecological Relationships	0.5
	Cumulative Effects	0.1
	Habitat Functions	0.5
	Uncertainty	0.1
	SEC or Institutional Factors	0.2
	Considering Trade-offs	0.5
Contributing Institutional Elements (overall means)	Public Awareness	0.2
	Foster Stewardship Ethic	--
	Promote Responsible Practices	0.7
	Compliance of Resource Users	0.8
	Good Governance (Shared Stewardship)	**3.8**
Ecological Axis		
	Target Stock Dynamics	0.2
	Other Species Dynamics	--
Direct Interactions (overall means)	**Bycatch Species F / Catch**	**1.0**
	Fishing Effort	0.1
	Target Stock F	**1.7**
	Target Stock Catch	0.1
	Other Interaction	0.2
	Habitat Interaction / Contact	0.6

Categories	Codes	Redundancy (IFMPs)
States: Other Ecosystem Components (overall means)	Bycatch Species State Change	0.2
	Bycatch Species State	0.2
	Other Species State Change	0.6
	Other Species States	0.1
	Habitat State Change	0.8
	Habitat State	0.4
States: Target Stocks (overall means)	Target Stock State Change	0.7
	Target Stock State	**2.4**
States: Ecosystems (overall ends)	**Ecosystem State Change**	**1.1**
	Ecosystem State	**1.3**
Socio-economic and Cultural Axes		
	Unresolvable Social, Economic or Cultural Objectives	0.7
Access and Allocation (overall means)	Industry Capacity or Structure	0.2
	Food, Social and Ceremonial Fisheries	0.7
	Indigenous Capacity to Participate	0.2
	Recreational Fisheries	0.5
	Other Access and Allocation of Resources	0.3
	Desired Opportunities to Fish (including profits)	**1.2**
	Development / New Opportunities	0.4
	Reduce Conflict Among Participants	0.2
	Create Incentives for Participants	--
Other Contributing Economic Elements (overall means)	Promote Innovation	0.1
	Promote Eco-certification / Other Market Initiatives	0.3
	Promote Catch / Product Quality	0.2
	Promote Market Access	0.2
	Promote Diversification	--
	Support Other Fisheries, Non-Harvesting Sectors, Aquaculture or Other Industries	0.5
Other Contributing Socio-Cultural Elements (overall means)	Safe Working Environments	0.4
	Cultural Heritage and Identity	0.1
	Food Security	0.1
	Health and Well-being	--
	Employment and Income	0.1
Community Prosperity (overall ends)	Community Prosperity	0.2
Industry Prosperity and Viability (overall ends)	**Industry Prosperity and Viability**	**1.8**
General Ends Objectives		
	Benefits to Humanity	0.1
	Intergenerational Equity	0.1
	Sovereignty and Security	--
Respect Rights and Obligations (overall ends)	**Respect Indigenous and Treaty Rights**	**1.1**
	Other Legal or International Obligations	0.4
Conservation and Sustainable Use (overall ends)	Conservation	0.6
	Sustainable Use / Development	**1.5**

stock growth" would be IFMP objectives containing only one value (fishing mortality [*F*], and change in stock biomass, that would be coded respectively as "Target Stock *F*" and "Target Stock Change [growth]",), whereas "develop a HCR to keep fishing mortality moderate" and "promote stock growth by keeping fishing mortality moderate" are objectives that each contain two coded values, one serving as a means to attain the second. Once coding was completed, quotes from laws, policies and IFMPs containing such implicit information on cause-effect relationships among values were extracted, and network fragments were identified (see Appendix). To continue with the above example, objectives to "develop a HCR to keep fishing mortality moderate" and "promote stock growth by keeping fishing mortality moderate" would be expressed as network fragments of "Measure [HCR] → Target Stock *F*," and "Target Stock *F* → Target Stock Change [growth]," respectively (see Figure 2 for more examples). Fragments acquired in this way were grouped by topic to support the assembly of a set of presumptive, partial decision networks for axes of sustainability, each consisting of a) a means-ends objectives network, b) external factors influencing the achievement of objectives, and c) management actions to meet the objectives.

Of the 59 IFMPs that were publicly available on Fisheries and Oceans Canada (DFO)'s website in August 2020, 52 contained at least two discernable categories or hierarchical layers of objectives and so their objectives (n = 1515) were carried forward for further analysis (Table S10). IFMP objectives were also sometimes labeled by subject matter (e.g., conservation, compliance, shared stewardship, etc.), but these subject labels were

not used in my study as they did not necessarily denote a form of hierarchical or network-like relationship among different objectives. Objectives from least one IFMP were available from each of DFO's seven administrative regions, and objectives from a further four IFMPs were applicable to stocks across multiple regions.

To help ensure consistency, coding of IFMP objectives was restricted to IFMP subsections entitled "Objectives," "Strategies" and "Performance Evaluation" in the main body of each document, although precise subsection headings varied and not all plans had all subsections. Where possible, I focused on coding clear statements understood to represent objectives (e.g., sentences or phrases that were labeled, numbered, or bulleted). Some IFMPs contained only paragraphs in these subsections, in which case the intent of the statements to represent objectives was inferred from the context (e.g., it contained a verb indicating preferred directionality and a noun reflecting an element of sustainability, or it contained a self-identifying phrase indicating it was objective, etc.). An exception to this was made to include statements categorized as "Tactics" (sometimes labeled "Tactical Objectives", or also labeled as "Short-term Objectives", etc.), and similar categorical terms such as "Management Approaches" or "Management Measures." This choice was made to reflect the stylistic spectrum of expression that ranged from clear statement of an objective (verb + noun), such as "develop a harvest control rule [HCR]," "use total allowable catch [TAC] to control fishing mortality" or "avoid fishing in area X" to management alternatives, e.g., "HCR", "TAC", "closed area." This spectrum of expression varied both among and within plans.

Implicit versus Explicit Objective Structures in Management Plans

Objectives within IFMPs were frequently labeled according to temporal (long-term and short term), spatial (national, regional or fishery-specific) or other categories (e.g., management approaches, strategies, or tactics). Objectives were also generally presented in the document with or without labels (and sometimes more than one label each) in a nested, hierarchical or otherwise layered fashion (e.g., physically layered in table or bullet/sub-bullet formatting, or with descriptive text that indicated some objectives were subordinate to, or contributed to, other objectives). I explored whether these explicit categories or layers of objectives echoed means-ends relationships in the decision networks developed above, in order to determine to what extent cause-and-effect linkages are used in operational documents. Here, the unit of analysis was at the level of each IFMP objective, not each IFMP or each fishery to which that objective applied. In setting the unit of analysis at the objective level, I assumed that each IFMP represented a distinct management context, such that the one or more fisheries managed by a given IFMP were not independent, and that it would not be appropriate to weight objectives by the number of fisheries to which they were applied. While the same or very similar text was often used for certain objectives in multiple IFMPs within and even across regions, no two IFMPs had entirely identical objectives, nor did they apply identical categorical labels or layer positions to them. Thus, it was not feasible to weight objectives by the number of IFMPs that used them, and each IFMP objective (and its labels and layered relationships with other objectives) could only be evaluated *in situ*.

In order to facilitate comparisons among IFMP objectives by category and by layer, the majority of the original set of 79 coded objectives was condensed to 16 categories, each of which could be assigned to a single role as means or ends but which still permitted comparisons among and within axes of sustainability. The 16 codes were further compressed to three (Management Actions, Overall Means, and Overall Ends) to enhance means-ends contrasts among groups of IMFP objectives (Table 2). Where possible, each IFMP objective was assigned tracking codes for each categorical label and each layer from first (highest level) up to fifth (lowest level). Code *co-occurrences* were used to semi-quantitatively evaluate the relative extent to which each category or layer represented various means or ends objectives, treating each objective as a unit of analysis. Co-occurrences are expressed as percentages of the time each objective category was linked to each code, and because any given objective can contain more than one code, co-occurrences are not exclusive and percentages can sum to well over 100%. For example, if objectives categorized as "Specific" always contained codes for "fishery measures," and also included a code for an objective of "sustainable use" half the time, the resulting co-occurrences ("Specific" – "fishery measures", and "Specific" – "sustainable use") would be 100% and 50%, respectively.

3. RESULTS

Overview

A total of 1073 quotes were identified across 30 law and policy documents; a further 1515 objectives were identified across 52 IFMPs. Valued elements were grouped into five major categories based on emergent themes:

1. **Management actions**;
2. **Institutional;**
3. **Ecological,** and
4. **Socio-economic and cultural** (SEC) axes of sustainability, and;
5. **General ends objectives** that showed complex relationships cutting across axes and to management actions.

While shared objectives connected all axes, and social, economic and cultural values may individually be distinct, social, economic and cultural objectives were compressed into a single group as relationships among them were particularly inter-connected.

All laws, policies and IFMPs contained objectives classed in every major category. Redundancy (multiple mentions) of objectives, which is normally not a desirable attribute for decision-making and possibly reflective of repetitive text within and across documents, can also be used as a measure of the preferred areas of focus (Table 3).

Table 3: Redundancy, or the mean number of times objectives were mentioned per document by the type of document (law, policy or management plan), which provides a relative indicator of the preferred areas of focus. Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Areas of Focus	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Management Actions	19.7	20.2	16.2	41.3	17.1
Institutional Axis	4.0	5.7	14.0	21.0	5.3
Ecological Axis	15.3	20.2	9.8	18.8	8.0
Socio-economic and Cultural Axis	3.0	6.1	12.2	13.3	6.0
General Ends Objectives	7.0	8.1	9.4	17.5	3.3

Objectives pertaining to the ecological axis of sustainability were mentioned often and broadly, but to a lesser extent in other (non-SFF) fisheries policies. Oceans and MPA and other fisheries policies also notably contained more frequent mentions of institutional and social, economic and cultural objectives than other document types. Within IMFPs, plans more frequently mentioned objectives pertaining to management actions than to axes of sustainability.

From the laws, policies and IFMPs, 246 quotes were extracted that expressed cause-and-effect relationships among objectives. These quotes in turn yielded 269 network fragments (see the Appendix for the full list). Not all fragments proved equally informative for the purpose of constructing decision networks. Twenty percent of these network fragments contained the idea of means contributing to ends but were too broad

to be useful for network construction (e.g., "Scientific Information" → "Sustainable Use"); another 20% were consistent with the general direction of networks for ecological and socio-economic and cultural axes, but missed key intermediate relationships (e.g., "Measures" → "Target Stock States" instead of "Measures" → "Target Stock F"), and 1% of fragments were not used because the causal directions were not consistent with the majority (e.g., "Ecosystem State" → "Decision-Making Approaches" instead of the reverse). Nonetheless, 51 of the 269 fragments yielded key relationships among ecological objectives, 44 for institutional objectives, and 43 for socio-economic and cultural objectives. A further 19 fragments highlighted relationships among objectives that connected the axes. Most key relationships came from IFMPs (31%), SFF policies (30%, particularly CP6, CP7 and CP10) and other fisheries policies (26%, particularly CP14 and CP15; see Appendix, Table S7, for the full citations). Fragments from Oceans and MPA policies (7%) and laws (6%) tended to be broader in nature and were overall less informative regarding precise relationships among objectives. Across all sources, fragments with key relationships were used to develop partial decision networks for the institutional, ecological, and socio-economic and cultural axes of sustainability for fisheries decision-making (Figures 3—5).

Management Actions

Management actions were commonly valued and expressed as objectives. They could be roughly divided into actions that go into making decisions (*decision inputs*, such as obtaining scientific information, performing catch monitoring, or incorporating

traditional or local knowledge), actions that provide *support for decision processes* (such as implementing governance mechanisms, providing education and training, and making information accessible) and actions that represent the products of those decisions (*decision outputs*, such as implementing management measures, performing enforcement actions, and developing objectives or reference points). Some management actions classed here as inputs, such as using legal or policy instruments, or evaluating management measures, might also be considered outputs of decision-making processes in their own right, but are classed here as decision inputs based on their value in contributing to subsequent decisions. A desire to obtain or use scientific information (research, monitoring surveys, advice, etc.), establish governance mechanisms or processes, and implement measures or plans were frequently expressed across all document types (Appendix, Table S12). Among policy instruments, SFF and Oceans and MPA policies more frequently mentioned desired decision-making approaches, objectives and reference points. Within decision-making approaches, SFF policies mentioned the precautionary approach most often, while Oceans policies emphasized an integrated approach, and other fisheries policies mentioned integrated, precautionary and ecosystem approaches at similar rates (Appendix, Table S13).

Institutional Axis of Sustainability

Many documents and IFMPs noted important influencing factors that appeared to be treated as if they were outside of the decision-makers' immediate control (e.g., outside of the decision context for single-species fisheries management). Such factors were paired

with the phrase “consider” or “take into account,” which did not indicate a preferred directionality that was considered characteristic of an objective (verb + noun) – rather, it was the act of considering them that was inferred to be desirable, and thus I considered them to be part of the institutional axis. These considerations included the cumulative effects of multiple human activities, the importance of habitat function (often generalized as its uniqueness or significance), ecological relationships among species such as between predators and prey, environmental conditions affecting species, other social, cultural, economic or institutional influences, and uncertainty. Beyond influencing factors which might predominantly affect ecological axis elements, all documents noted multiple, potentially conflicting objectives for decisions related to sustainable (or “best”) use of resources, suggesting that trade-offs would need to be made. Such considerations were raised frequently in all policies (Appendix, Table S14).

When arranged into a decision network, the institutional axis was structured heavily around desirable management actions to be undertaken or completed. Desired characteristics of various institutional elements were commonly articulated as adjectives (Table 4). While the products of any governance process (here termed *decision outputs*) constitute management actions that serve as means by which to achieve objectives in other axes of sustainability (Figure 3), the analysis of network fragments revealed that cause-and-effect relationships for institutional objectives are often reciprocal, with objective pairs often serving as both ends and means for each other. This included a widely recognized objective to achieve a state of good governance or shared stewardship

Table 4: Common desired characteristics linked to institutional objectives for decision inputs, processes, outputs and governance, across all document types. Terms are presented in relative order of the frequency of occurrence.

	Desirable Characteristics of Institutional Axis Objectives
Good Decision Inputs	Accurate, complete, reliable, or dependable; Best available; Timely
Good Decision-making Processes	Inclusive and open; Cooperative and collaborative; Transparent; Effective; Clear; Consistent or integrated with other processes; Supported by participants; Has effective communication; Efficient; Feasible; Just, equitable or fair
Good Decision Outputs	Stable and predictable; Effective; Consistent or integrated with other decisions; Flexible; Supported by participants; Clear; Feasible; Just, equitable or fair; Timely; Transparent
Good Governance	Cooperative and collaborative; Stable and predictable; Transparent; Effective; Accountable

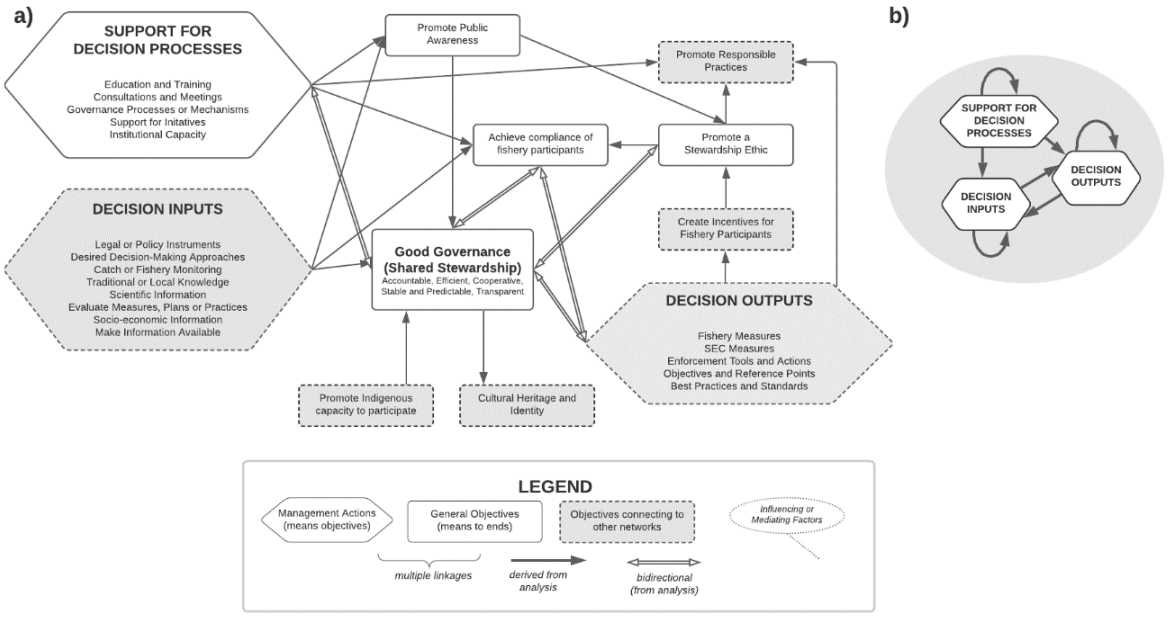

Figure 3: a) Partial decision network for the institutional axis of sustainability, consisting of a means-ends objective network coupled to management actions, grouped broadly as Decision Inputs, Support for Decision Processes, and Decision Outputs. Black arrows denote cause-and-effect relationships among objectives derived from an examination of implicit network fragments in policy and management plan quotes. Multiple objective pairs appeared to serve reciprocally as both means and ends, resulting in many bidirectional connections. Similarly, cause-and-effect relationships among management actions (b) were often reflexive or reciprocal.

(Appendix, Table S15), which is viewed as both the cause and the effect of compliance of resource users, and of taking desirable management actions such as decision outputs and support provided for decision processes. As a result, no consistent or "classical" means-to-ends decision network structure emerged for the institutional objectives examined here.

Beyond decision inputs, outputs and responsible fishing pratices, which all connected to other axes of sustainability, the decision network for the institutional axis was also connected to that of the socio-economic and cultural axes by means of incentives for participants in the fishery, promoting the capacity of Indigenous groups to participate in the fishery, and objectives to maintain cultural heritage and identity.

Ecological Axis of Sustainability

Objectives related to the ecological axis of sustainability were often accompanied by cause-and-effect language. As a result, objectives in the ecological axis most readily lent themselves to means-ends structuring, to which influencing factors of interest to decision-makers and management alternatives could be connected to form a generalized partial decision network (Figure 4; Appendix,
Table S16). Objectives addressed target stocks, non-target (bycatch) species, other associated or dependent species, and habitats. Collectively, these objectives were expressed as contributing towards an ends objective of achieving a desirable ecosystem state. Management actions (and responsible fishing practices) serve as means to control

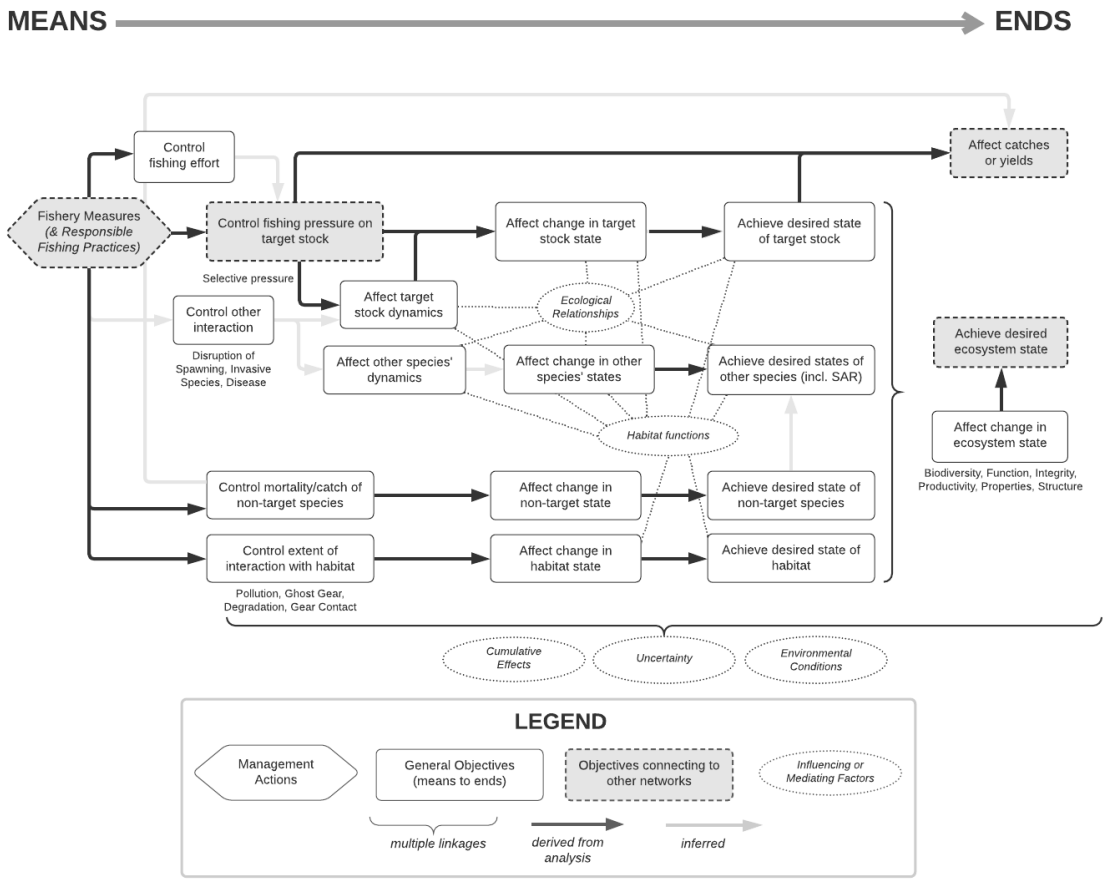

Figure 4: Partial decision network for the ecological axis of sustainability, consisting of a means-ends objective network coupled to management actions, and associated influencing factors. The network splits into streams of objectives: target stocks, non-target (bycatch) stocks, other associated or dependent stocks, and habitat. Collectively, these objectives contribute to achieving an overall ends objective of a desirable ecosystem state. Relative positioning of contributing elements along the means-ends axis should be understood as approximate given the number of connections among elements. Black arrows denote connections derived from an examination of implicit work fragments; grey arrows indicate inferred relationships.

or affect the extent of *direct interactions* of the fishery with ecological elements (e.g., fishing mortality, other disturbances, or the degree of interaction with habitat). Management control of direct interactions with ecological elements was commonly recognized as a means by which to affect change or induce a response in the states of ecological elements of interest (e.g., declines or increases, including rebuilding or

restoration), and these changes collectively determine whether a desired state of the ecological elements is achieved.

Specific desired attributes of target stocks, habitats and ecosystems were identified in many instances (biodiversity, productivity, integrity, abundance, genetic diversity, etc). Adjectives that describe desirable and undesirable states of valued elements or their attributes also varied but were typically qualitative in nature. Only occasionally were target stock states or fishing mortalities expressed in a way that lent itself to quantification (e.g., by status zones, in relation to some reference level or limit, etc.; Table 5).

Socio-Economic and Cultural Axes of Sustainability

Numerous interconnected objectives related to social, economic or cultural values emerged from the analysis. The largest subset of these clustered around providing (or alternatively, limiting) access to the resource and the resulting array of benefits arising from that access in support of prosperous industries and/or the well-being of communities of which they were a part (Figure 5a, Appendix, Table S17). Apart from connecting to the institutional axis via providing incentives, objectives around access and allocation connect to the ecological axis via the effects of industry capacity on the fishing pressure exerted on target stocks, and the many varied benefits arising from catching fish that serve as means to achieving industry and community prosperity (specific attributes that were of interest for industries and communities are presented in Table 6). A second subset of social, economic and cultural objectives focused more on a general desire to

Table 5: Common attributes (i.e., that could be linked to performance metrics); and desired characteristics of states associated with ecological objectives for target stocks, the fishing pressure exerted upon target stocks, habitats and ecosystems. Terms are presented in relative order of the frequency of occurrence.

	Attributes of Interest	**Desirable (Undesirable) Characteristics**
Target Stocks	Abundance; Distribution or range; Stock components; Genetic diversity; Recruitment; Productivity; Biomass; Life history characteristics; Spawners Migration routes	Being conserved or protected; Being rebuilt, recovered or restored; Healthy; Trajectory or change (growth, decline); Sustainable; Described by Zone; Being depleted; Serious harm; In relation to a Reference level; Capable of being harvested
Target Catch or Fishing Mortality	--	Kept moderate; Sustainable; In relation to a Reference level; Minimized; Within limits; In relation to maximum sustainable yield; Avoid high; Kept cautious
Habitats	Unique or particular habitats in relation to their function; Diversity of types; Productivity; Properties; Water Quality	Being conserved or protected; Being rebuilt, recovered or restored; Avoid degradation, damage or destruction; Avoid unacceptable changes; Serious harm
Ecosystems	Biodiversity; Productivity; Function; Structure; Integrity; Processes; Trophic Relationships	Healthy; Being conserved or protected; Avoid unacceptable changes; Avoid adverse effects

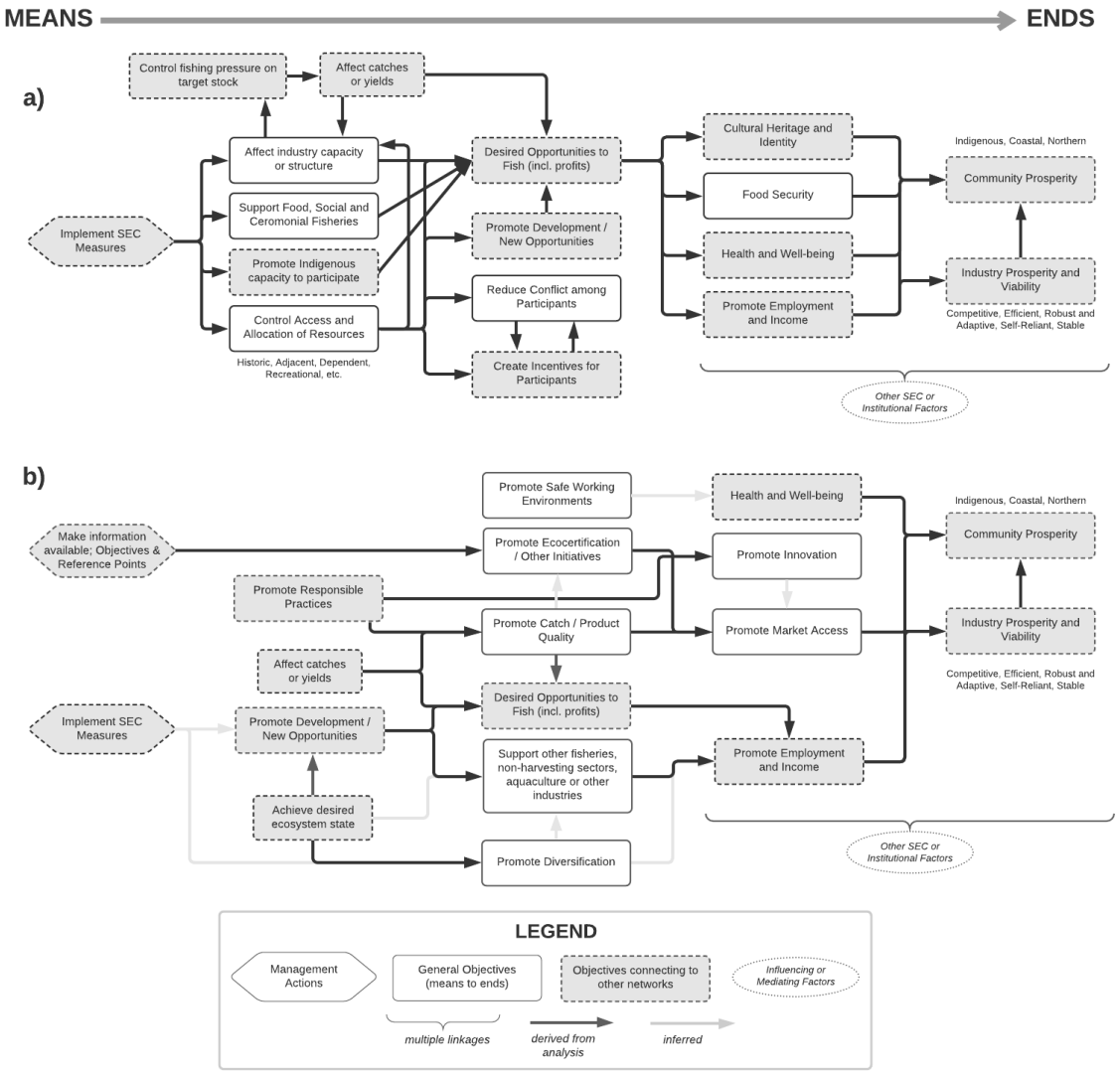

Figure 5: Partial decision networks for varying social, cultural and ecological axes of sustainability consisting of a means-ends objective network coupled to management actions, and associated influencing factors. a) objectives related to the distribution of access and benefits (access and allocation) connecting to socio-cultural objectives promoting fundamental objectives related to industry and community prosperity. b) Objectives related to other economic elements that promote diversification and competitiveness also contribute to industry and community prosperity. Relative positioning of contributing elements along the means-ends axis, and the number of connections among them, should be understood as both partial and approximate. Black arrows denote connections derived from an examination of implicit work fragments; grey arrows indicate inferred relationships.

Table 6: Common desired characteristics or specific attributes of interest for various socio-economic and cultural objectives. Terms are presented in relative order of the frequency of occurrence.

	Desirable Characteristics or Specific Attributes of Interest
Industry Prosperity and Viability	Self-reliance; Robustness and adaptability to change; Stable or able to plan for the long-term; Competitive; Efficient
Community Prosperity	Coastal, Indigenous, Northern
Non-harvesting sectors and Industries	Aquaculture; Other fisheries; Other industries; Processing and non-harvesting sectors
Control Access and Allocation	Adjacency; Dependent communities; Historical access or current access; Inshore Fleet; Recreational Fishing; New Entrants

promote competitive industries via maintaining or increasing market access, and fostering diversification of industry to benefit communities, both within and outside of wild capture fisheries themselves. This network connected to the institutional and ecological axes via responsible fishing practices, and the ecological axis by means of achieving high catch quality, and new opportunities for development that arise from achieving desired ecosystem states (Figure 5b).

General Ends and Unresolvable Objectives

The decision networks descrbed above help to not only understand relationships among axes, but to place other objectives that can be considered more general ends objectives into context. Institutional values represent a distinct axis of sustainability (Stephenson et al. 2019), but network fragments suggest that the institutional axis itself can be thought of as a means to achieving objectives in the ecological axis of sustainability. More broadly, axes of sustainability are perceived to have several reciprocal cause-and-effect relationships with each other (Figure 6a).

Objectives with complex or cross-cutting connections that could not be easily placed into networks, despite their sometimes broadly "institutional" theme, included sustainable use, respect for Indigenous and treaty rights, meeting other international or legal obligations, intergenerational equity, benefits to humanity, and sovereignty and security. Beyond this, relatively unspecified objectives for achieving conservation (considered here to be a high-level ecological objective distinct from sustainable use and with its own history in international fora, although often phrased together with sustainability; Garcia et al. 2014, Rice et al. 2014), and otherwise unresolvable institutional and socio-economic and cultural objectives were also identified. In IFMPs, unresolvable socio-economic and cultural objectives, such as mentions of "socio-economic interests" or "values," were fairly common (at a rate of 0.7 objectives per plan; Table 2) but could not be confidently classed into means or ends and were excluded from more detailed analyses of IFMP objectives.

An examination of network fragments found in law, policy and management plans suggested that means by which these "general ends" objectives were to be achieved ranged widely, from an array of different management actions, to achieving a variety of other objectives from other axes of sustainability or other general ends objectives (Figure 6b). Achieving conservation, sustainable use and respect for Indigenous and treaty rights, were the three most commonly found "general ends" objectives (Appendix, Table S11).

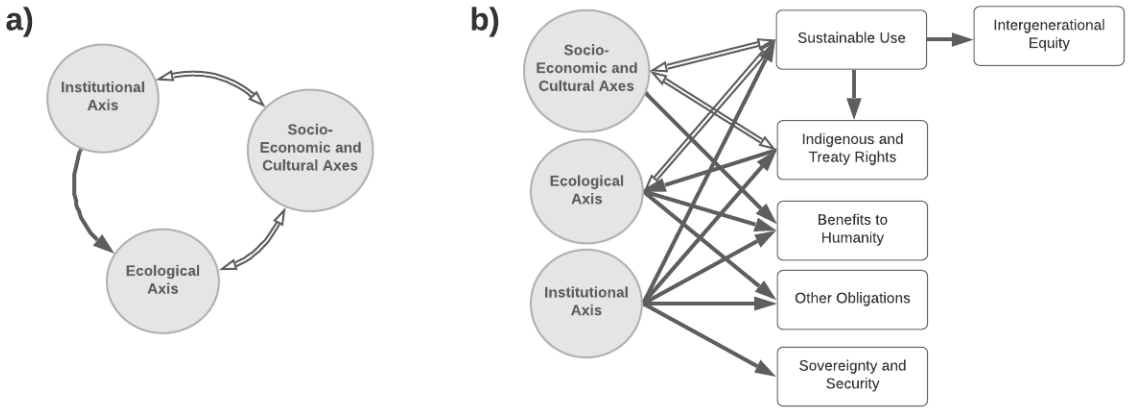

Figure 6: a) Partial decision networks constructed for institutional, ecological, and socio-economic and cultural axes of sustainability suggest that the institutional axis is a means to achieve ecological objectives (solid arrow), and that otherwise, reciprocal means-ends relationships exist between axes (double-headed arrows). b) Means-ends relationships among objectives classed as general ends objectives, many of which are products of objectives in other axes of sustainability, or each other.

Means and Ends in Explicit Objective Structures of Management Plans

Among IFMPs, there were regional patterns in objective wording (with many shared objectives), the number of objective layers, and the categorical labels used to describe objectives. Categorical labels were generally not exclusive to one region only, with the exception of spatial labels used in the Pacific region, and "overarching" and "tactic" being most common in the Maritimes region (see Appendix, Table S10).

Seventeen category labels for objectives were identified in IFMPs; however, five of these terms were rare and therefore I excluded them from categorical analyses ("Medium-Term", n = 3 objectives; "Global", n = 11, "Goal", n = 6, "Issue", n = 6, "Priority", n = 3). Of the remaining categories, spatial and temporal considerations both appeared to reflect differing emphases on ends versus means (Figure 7). More specifically, objectives

applicable over larger spatial scales (e.g., national) and longer timescales tended to be associated more often with ends objectives, while those associated with finer spatio-temporal scales (e.g., regional, fishery-level, or short-term) tended towards means. Most other category labels showed strong associations with either ends ("Overarching Objective") or means ("Specific," "Strategy", "Tactic", "Management Approaches or Measures"). Long-term objectives, however, and those with an otherwise unspecified label of "Objective" were more flexibly associated with both means and ends. The category of "Tactic," in particular, was almost always associated with decision outputs (90%).

IFMPs could also be grouped by the number of objective layers they contained, regardless of what categorical terms were used to describe them. Groups of IFMPs were established that had two (n = 22 IFMPs), three (n = 17), four (n = 10) or five (n = 3) layers. Within each IFMP group, lower level (2^{nd} to 5^{th} layer) objectives were associated with means, while the highest level (1^{st}) objectives were associated more strongly with ends (Figure 8). Notably, increasingly lower-level objectives were associated more and more strongly with management actions comprising decision outputs (establishing management measures, objectives, reference points, enforcement tools, and best practices and standards).

Thirty-nine IFMPs described indicators of performance with or without pairing them to objectives. The most commonly included indicators were for catch monitoring,

Figure 7: An evaluation of the extent to which categorical labels attached to objectives in integrated fisheries management plans (IFMPs) are found to reflect means or ends objectives (including objectives for management actions) for topics under various axes of sustainability. Objective categories are clustered by spatial, temporal or other considerations. Quantities (%) represent co-occurrences (the percentage of times where a code for an objective of category X was associated with a code for an objective under sustainability axis topic Y), with higher values and darker squares indicating increasing emphasis. Co-occurrences are not exclusive (can sum to > 100%), as objectives in IFMPs frequently expressed multiple values that each received their own code. Results for objectives in each topic or axis that are considered to represent ends are outlined in black (compressed as Overall Ends in the lower portion of the figure), while those that are considered to represent means are not outlined (compressed as Overall Means below). Values for n indicate the number of objectives in each category.

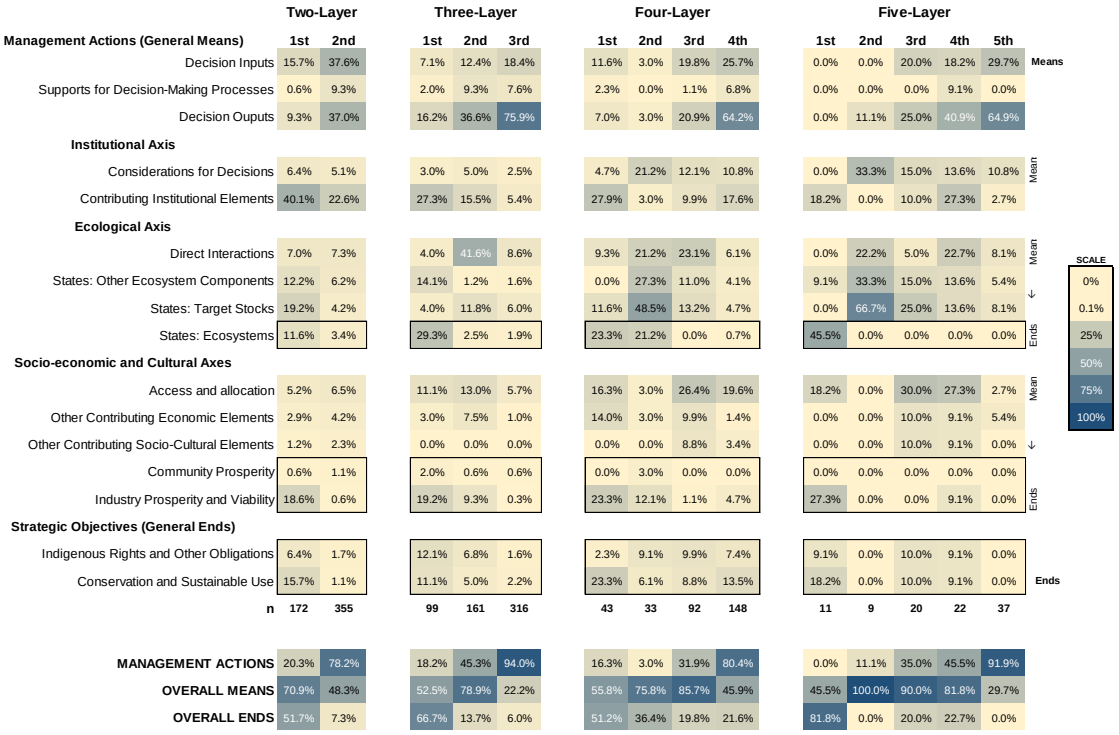

Figure 8: An evaluation of the extent to which the layer in which objectives in integrated fisheries management plans (IFMPs) are found to reflect means or ends objectives (including objectives for management actions) for topics under various axes of sustainability. Layers are grouped according to whether the source IFMP had two, three, four or five layers. Quantities (%) represent co-occurrences (the percentage of times where an objective of category X was associated with a code for topic Y), with higher values and darker squares indicating increasing emphasis. Co-occurrences are not exclusive (can sum to > 100%) as objectives in IFMPs are statements that can express multiple values. Results for objectives in each topic that are considered to represent ends are outlined in black (compressed as Overall Ends in the lower portion of the figure), while those that are considered to represent means are not outlined (compressed as Overall Means below). Values for n indicate the number of objectives in each layer.

participation of interests in decision-making, the collection of scientific information or participation of interests in decision-making, the collection of scientific information or provision of advice, a review of decisions and actions taken, enforcement activity, and meetings or communications undertaken (n = 17—22 IMFPs each; Appendix, Figure S11). Fifteen IFMPs identified Canada's *Sustainability Survey for Fisheries* (DFO 2020) as the vehicle by which fishery performance was evaluated.

4. DISCUSSION

Networks Augment Insights into Canadian Conceptions of Fisheries Sustainability

My analyses build upon previous examinations of sustainable fisheries objectives in Canadian contexts, completed in an interdisciplinary fashion through the Canadian Fisheries Research Network (CFRN, Angel et al. 2019, Stephenson et al. 2019), and a review of objectives from a subset of 17 IFMPs that informed the CFRN work (Paul and Stephenson 2020). The latter indicated wide coverage of the ecological axis of sustainability, industry viability and prosperity, and Indigenous rights in IFMPs, but a relative lack of social or economic objectives pertaining to communities, employment, and other social and cultural considerations. More generally, CFRN's Project 1.1 aimed to develop an operational framework consistent of core fisheries sustainability objectives derived from policies and international commitments. These objectives were linked to candidate performance indicators, to both demonstrate measurability (Stephenson et al.

2018) and help guide incremental improvement of existing management plans over time (Stephenson et al. 2019).

To this body of work is now added an examination of both implicit and explicit causal relationships among objectives, and a generic set of decision networks, that provide further insight not only into what is most valued, but how those values are intended to be achieved, what is and is not inside the fisheries decision context, and the interconnectivity among axes of sustainability. The results suggest that considering means-ends relationships among objectives, ultimately connecting objectives to management actions (de la Mare 2005, Gavaris 2009), is not only useful, it is operationally widespread regardless of the language that is used to describe this process. Despite deriving from different methods and source documents (e.g., content analysis performed by one analyst, versus a discussion and consensus-based approach with a wider group of academic, government and industry representatives), the results here are consistent with the major axes of sustainability identified in the CFRN framework, notably finding similarities to core elements in CFRN's checklist (Stephenson et al. 2019). Different decision contexts, in policy analysis as well as in management, will lead to unique sets of structured objectives, but the consistency found in objectives from both studies reflects a relatively high level of both horizontal and vertical coherency in Canadian fisheries management plans and associated instruments (*sensu* Farmery et al. 2019; likely to be expected given a single jurisdiction). The results here also show the utility of considering both top-down objectives *hierarchies* that seek to fully specify

complex objectives into clearer, more measurable, more "practical" attributes (a common approach to identifying or analyzing objectives and finding performance metrics; Angel et al. 2019, Brooks et al 2015, O'Boyle and Jamieson 2006, Pascoe et al. 2013), and means-ends objectives *networks* (Figure 1; Clemen 1996, Conroy and Peterson 2013). For example, ecosystem productivity, biodiversity and integrity can be thought of as core elements of the ecological axis of the CFRN framework (Stephenson et al. 2019). Objectives regarding these same ecosystem attributes were common in my study, and also reflected that regardless of ecosystem attribute, ends objectives for ecosystem states were sought through some combination of meeting means objectives and ultimately management actions aimed at target stocks, non-target and other associated or dependent species, and/or habitat (and in some cases, all of those elements at once; e.g., MPAs; Garcia 2003).

Networks Suggest Commonalities in Underlying Conceptual Models

Participants in decision-making processes employ, explicitly or not, one or more conceptual models of the system being managed that inform the selection of objectives, external influencing factors that must be taken into account, and potential management actions that could be taken (Conroy and Peterson 2013). Generalized decision networks were developed here as policy analysis tools, inducing means-ends relationships from text to derive network fragments that themselves can be viewed as traces of conceptual models "left behind" by document author(s). While these fragments were developed here from one analysis by one analyst (and thus likely reflective of my own conceptual

models), the frequency with which consistent objectives and consistent network fragments could be identified is suggestive of high-level commonalities in conceptual models that might have underlain the thinking of authors working towards these plans, policies and laws. It is important to note, however, that these commonalities may be partially attributed to repeated text and objectives shared among documents. Repetition might be expected in documents for a single jurisdiction and these documents should not be viewed as independent expressions of values. Further, the networks are necessarily partial, in that not every important relationship among objectives in a given decision context may have been clearly articulated. The networks are also highly generalized in order to facilitate comparisons among disparate documents and therefore should not be understood to be definitive of the actual conceptual models. Finally, it should not be concluded that every participant in the development of management plans, policies or laws shared the same values or the same conceptual model (in fact, the opposite may be more likely; e.g., Verweij and Van Densen 2010).

Recognizing the role of conceptual models in the development of not only management plans, but also legal and policy instruments can confer benefits. Similar to Bayesian belief networks, such tools can promote shared understanding of management problems, such as where objectives conflict and trade-offs must be made, and can be used for strategic decision support and planning (Benson and Stephenson 2018). Explicit use of conceptual models may help resolve complexities in marine policies in a cost-effective fashion (Cormier et al. 2019), permitting greater integration, distinguishing mandates of

various organizations, reducing potential redundancies, or identifying under-addressed topics (i.e., a lack of coherence, found in some jurisdictions; Farmery et al. 2019).

As policy analysis tools, generalized decision networks can provide a scaffolding for comparisons of objectives across jurisdictions as well as within. For example, while there are broad similarities across most fisheries-targeted legislation from a simple single-species perspective, Canada's *Fisheries Act* does not contain objectives pertaining to catch (ends) or to fishing pressure (means), and places greater emphasis on achieving management actions such as setting reference points (Figure 9). Networks further provide a basis for comparison as to where jurisdictions seek to foster consistency, facilitate implementation or otherwise constrain decision-making by pre-operationalizing objectives. This can occur by jurisdictions choosing to mandate or suggest specific reference points (e.g., limits or targets based on F_{MSY}, B_0, $B_{MSY,}$ etc.), specific timeframes, or allowable risk tolerances (e.g., a percent range). While such pre-operationalized objectives are normally presented with respect to fishing pressure (means) or stock states (ends), they can also be for directional changes in stock states, such as objectives for rebuilding stocks from undesirable depleted states, or in Canada's case, short-term preventable declines (DFO 2009, Marentette and Kronlund 2020).

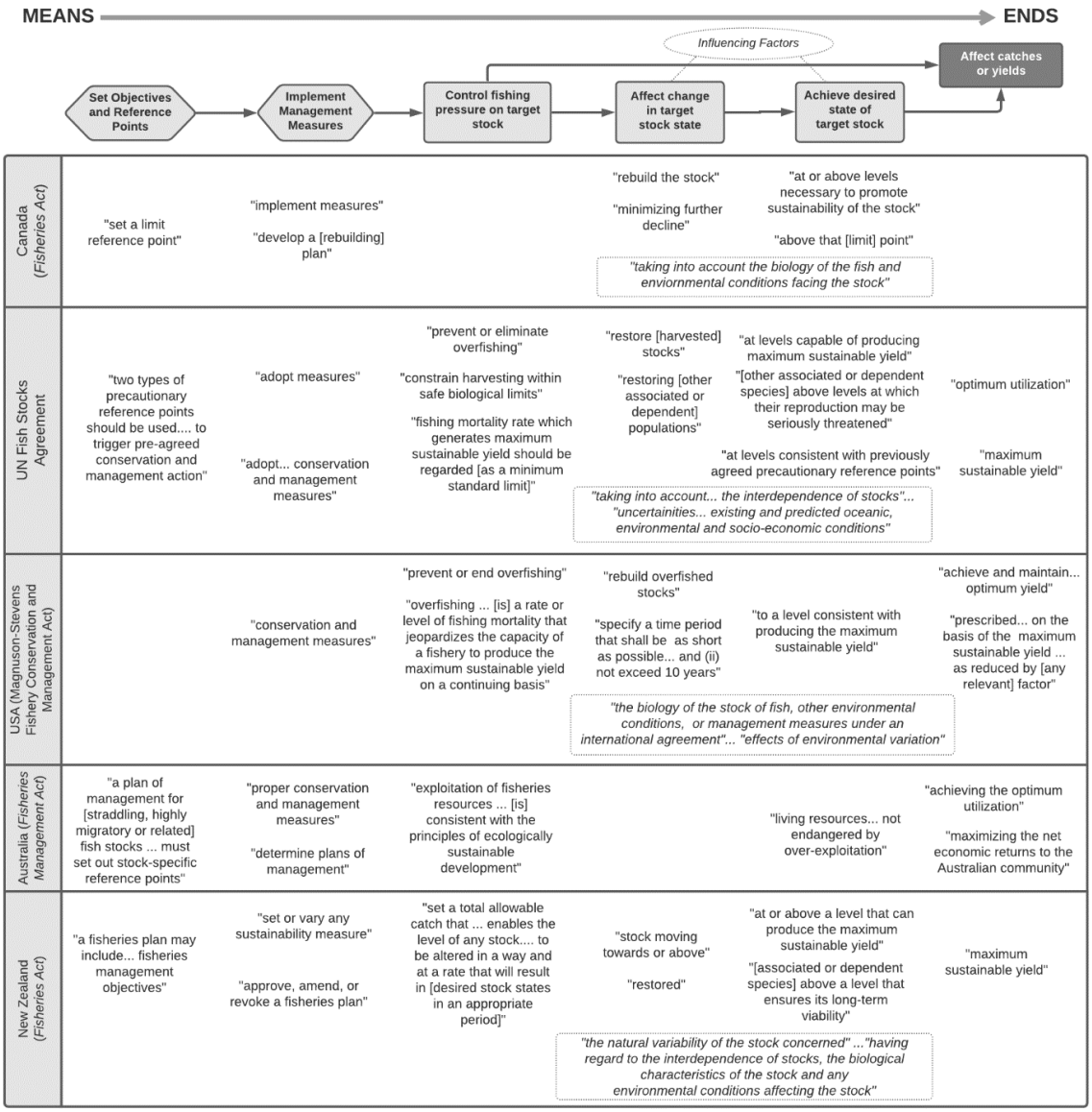

Figure 9: An examination of single-species fisheries management objectives in both Canadian law and legislation for other jurisdictions, mapped against a framework of a partial decision network. Quotations from Canada's Fisheries Act *(section 6) show where legislative constraints on fisheries objectives have been placed, emphasizing management actions (reference points, measures, rebuilding plans) and desired stock states but not fishing pressure or catches; external influencing factors that may affect these objectives are also acknowledged.*

Means and Ends Help "Unpack" Operationality

Existing guidance for setting fisheries objectives for IFMPs in Canada indicates that objectives should be "SMART," recommends consideration and synergies with other policies, processes and plans in setting objectives, and further recommends classifying objectives into *long-term* (defined there as not limited to the duration of the plan), and *short-term* (specific to the duration of the plan, and which support the long-term objectives; DFO 2013b). The "SMART" approach, long-term/short-term and conceptual/ operational dichotomies, and other lists of desirable objective qualities found in the field of decision analysis (e.g., Keeney 1992) are all schemes with which to describe what makes an objective useful in practice. *Operationality* carries connotations of measurability, and as shown here, an increasing focus on causality – working with means as opposed to ends, where the link between taking a management action and the effect of that action is more certain. My analysis of layered objectives within IFMPs shows that objectives appear to be specified in layers from ends to means until they are linked to management actions regardless of either measurability or what other categories (temporal, spatial, etc.) are used to describe those layers. An ability to clearly connect management actions to objectives is a key aspect of operationality (de la Mare 2005, Gavaris 2009), and is fundamental to structuring objectives in decision analysis.

Can these "axes of operationality" even be separated - are means not inherently more measurable than ends? Management actions, in particular, are highly measurable, in a binary sense of being present or absent. In fact, in the absence of clear indicators for

ambiguous higher-order objectives (e.g., target stock or ecosystem states), policy performance evaluation can default to examining whether management actions such as rules and procedures were followed (Rainey and Jung 2015). Nonetheless I suggest that it remains important to consider the concepts and implications of measurability and causality separately. First, nearly all objectives identified in this study were expressed qualitatively regardless of where they fell on the means-ends spectrum, so a given means objective may not always be more measurable than their corresponding ends. Second, relying on measurable means objectives as the basis for decisions in place of ends may be a pragmatic and beneficial choice in the face of high uncertainty, but there can be costs to doing so as well – and these costs inform how an evaluation of evidence of fisheries sustainability can be approached.

Means, Ends and Evidence for Success in Sustainability

Aquatic resource management occurs in the context of complex socio-ecological systems that can drive decisions towards meeting means objectives because their attributes are more readily measured. For example, objectives for protected areas may specify targets for extent of area protected (means), rather than the ecosystem states (ends) achieved by those areas (Rice et al. 2014). Risk assessments for impacts of human activities on sensitive benthic habitat may focus on the extent of interaction or the fishery footprint (means), and not habitat states (ends), as any impact to the habitat may be presumed to be deleterious (DFO 2019). In a similar vein, pragmatic mismatches often occur between proposed performance metrics for various ends objectives aiming to achieve

sustainability. Collections of candidate objectives and performance indicators, aimed to facilitate the identification of fisheries sustainability objectives in real-world contexts (e.g., Brooks et al. 2015, Stephenson et al. 2019), suggest that many proposed sustainability indicators are natural performance metrics (*sensu* Keeney 1992) for means objectives. For example, an ends objective of maximizing cultural, recreational and lifestyle benefits from a fishery might be paired with indicators for levels of fisher satisfaction, suggesting a hidden means objective of maximizing fisher satisfaction, or with indicators for the number of fishers planning to leave the fishery (suggesting a hidden means objective of minimizing departures; Brooks et al. 2015). Attribute substitution of means for ends may be a common heuristic when ends objectives are complex or vague, but its pragmatic benefits will result in management actions more likely to achieve ends when the underlying assumptions are explicitly recognized (Smith and Bahill 2010).

Achieving means objectives as a proxy for achieving ends is sometimes sought even within relatively simpler traditional single-species fisheries management approaches. Both the Marine Stewardship Council (MSC 2018) and the Food and Agriculture Organization's process for evaluating sustainability indicator 14.4.1 (fish stocks sustainability; Ye et al. 2011) accept estimates of fishing mortality in relation to F_{MSY} (means) for data-poor stocks where biomass in relation to B_{MSY} (ends) cannot be estimated. In the same vein, Goti-Aralucea and others (2018) note that European fishery management regulations have moved from biomass (ends) objectives to more

"manageable" fishing mortality (means) objectives, in part because fishing mortality is more directly linked to management measures, whereas stock states in biomass are indirectly connected and thus increasingly subject to other factors outside of management control.

It remains important, however, to focus on measurability as facilitating but not constraining decision-making. Keeney (1992) differentiated between *value-focused thinking* as emphasizing what options achieve what matters most to decision-makers, and *alternative-focused thinking* as being a choice among pre-conceived management options. To this could be added *data-focused thinking*; valuing only what can be measured, and imposing limits on decision-making until something can be measured. An excessive focus on measurable objectives, for example, can lead to the precautionary paradox, where precautionary approaches to fisheries management cannot be applied in cases of data poverty because performance metrics for ends objectives of desired stock states, or even management actions such as setting reference points, cannot be measured in traditional ways (Cadrin and Pastoors 2008). Recognizing that these management actions are means to an end can open up non-traditional alternatives, including many data-poor approaches, that can be used to achieve the same end (Bentley and Stokes 2009). Similarly, it could also lead to unnecessary delays in implementing ecosystem approach to management paradigms until more ecosystem information is collected (de la Mare 2005, Murawski 2007).

Substituting or relying upon the achievement of measurable means objectives as proxies for ends requires assumptions about the cause-and-effect linkages between means and ends, and uncertainty around mechanisms of those linkages may be high. When decisions focus on means, the assumption (conscious or not; Smith and Bahill 2010) is that the higher-level end objective is suitably satisfied by achieving one or more means (de la Mare 2005). This can be an advantage, such as where fundamental objectives prove hard to specify (e.g., ecosystem integrity; Link 2002, Wicklum and Davies 1995) and demonstrably meeting measurable means objectives (e.g., maintaining acceptable levels of fishing mortality on target stocks) can contribute significantly towards achieving them (Rice and Mace 2014). Use of conceptual models and/or the evaluation of cause-and-effect linkages between means and ends objectives may make some of these choices more explicit, or help to identify additional measurable objectives useful in a given decision context. They can also foster awareness of gaps between what can be measured and what matters most (and therefore help to identify where to invest limited resources in additional data collection that could most benefit decision-making; Hansen and Jones 2008). This is yet another "axis of operationality" – reasonableness. Is it reasonable to collect the information to evaluate whether the objective is achieved, given the time and effort required (Keeney 1992)?

The selection of suitably operational objectives from means-ends objectives networks should not be seen as a zero-sum process. Identifying both ends and means objectives and associated performance metrics may confer operational benefits. Conservation

objectives for "states" (ends objectives) and "pressures" (means objectives; *sensu* DPSIR and similar models), may hold different levels of significance or utility for managers versus other participants and both may be usefully incorporated (DFO 2008). Within management plans, including ends ("conceptual") objectives help ensure consistency with overarching policy or legislation (Sloan et al. 2014). Naturally, systems of fisheries sustainability indicators used to evaluate fishery performance for whole jurisdictions (or across jurisdictions) often report on performance metrics for stock states, a common ends objective highlighted in legislation (Hilborn and Stokes 2010). In some cases, these systems include a wider array of other indicators for increasingly means-based objectives such as changes in stock states, fishing pressure, or management actions, such as Canada's *Sustainability Survey for Fisheries* (DFO 2020, Figure 10). Including an evaluation of performance against means as well as ends objectives better enables problems with management measures to be detected (Cormier and Elliott 2017).

Pairing appropriate performance metrics to both means and ends objectives becomes especially important with complex concepts such as "sustainable use" that involve reconciling numerous disparate and conflicting objectives under multiple axes. For example, jurisdictional sustainability "report cards" tend to be relatively weak on evaluating catches or yields, using indicators of catches primarily where natural metrics or reference points for objectives to control fishing pressure are absent (e.g., Canada, United States; Figure 10). This occurs despite the fact that obtaining satisfactory catches from a socio-economic point of view can be considered the fundamental objective of a

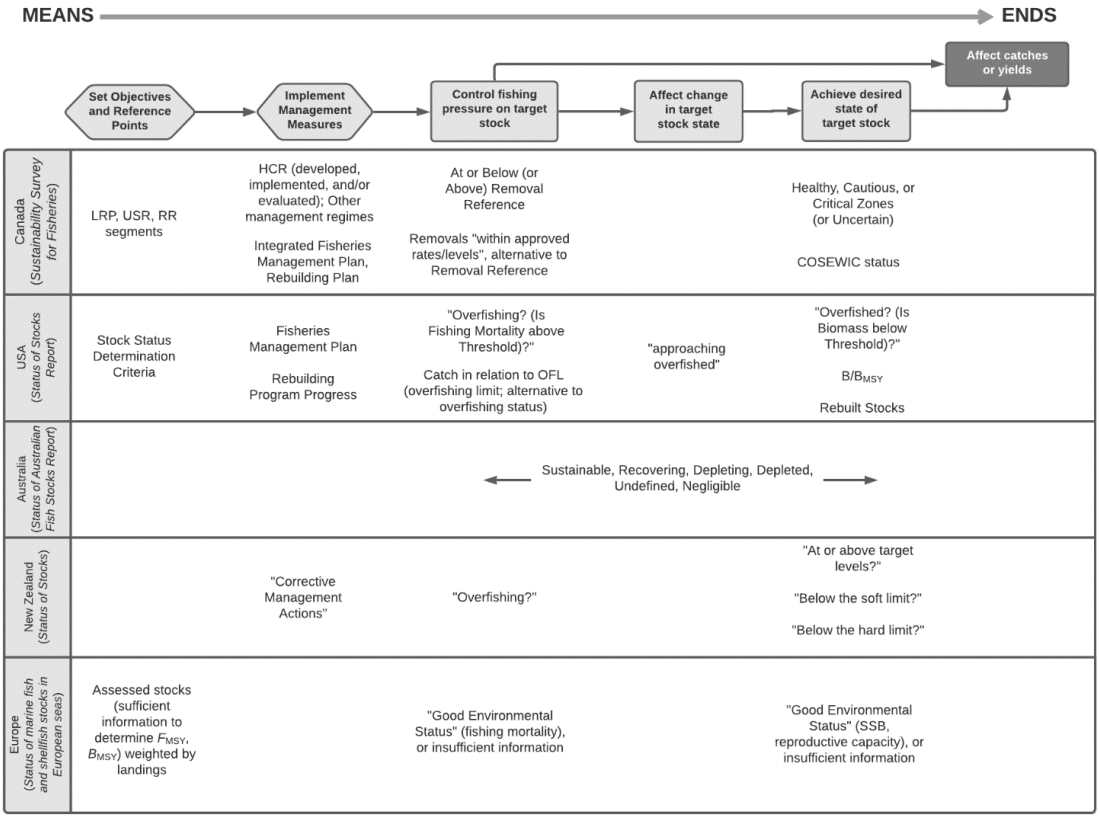

Figure 10: A comparison of systems of performance metrics used in whole-jurisdictional "report cards" for fisheries sustainability in Canada, the United States of America (USA), Australia, New Zealand, and for the European Union. Components of Canada's Sustainability Survey for Fisheries (DFO 2020) show that fishery performance in Canada, like other nations, is evaluated by performance metrics corresponding to multiple means and ends objectives in this single-species decision network, as well as other indicators (e.g., bycatch) pertinent to the ecological axis of sustainability that not represented here. In this comparison, all systems employ performance metrics for fishing mortality. Fishing mortality, along with catches or removals remaining within approved levels, can be an attribute for a means objective of controlling fishing pressure. All systems also report on stock status (often in biomass, or comparable attributes for an ends objective of a desired stock state). An examination of performance metrics for single-species fisheries management objectives in Canada and other jurisdictions against a framework provided by a partial decision network. No jurisdiction appears to evaluate whether a fundamental objective for desirable catches or yields have been achieved in relation to defined socio-economic objectives. COSEWIC = Committee on the Status of Endangered Wildlife in Canada. HCR = harvest control rule. LRP = limit reference point. RR = removal reference. SSB = spawning stock biomass. USR = upper stock reference.

single-species fisheries management decision network (Figure 2) and a major connecting objective between the ecological axis of sustainability with other axes in a fisheries management decision context (Figure 4). A comparison of yields as a fraction of maximum sustainable yield (Hilborn 2019) or adjusted to give more weight to larger, more economically significant stocks (Hilborn 2020) can provide different perspectives on fishery performance at the jurisdictional scale that may also convey important information to decision-makers.

5. CONCLUSION

In this study I identified a wide range of objectives that reflect largely coherent conceptions of sustainable fisheries within a selection of laws, policies and management plans in a single jurisdiction. I then structured the objectives, creating generalized partial decision networks as policy analysis tools to see what operationalization of objectives might mean in practice. Networks help to retrospectively interpret how relationships among objectives, influencing factors and management actions may have been conceived in the conceptual models of participants involved in the production of each document. They also facilitate comparisons among jurisdictions, such as where objectives are constrained or pre-operationalized, and how evidence for success is evaluated. Means objectives are widespread and use of means objectives in addition to ends allows for a more direct connection to management measures as well as potentially improved measurability. Relying on means objectives as proxies for ends carries benefits as well as costs, and concepts from decision analysis such as structuring objectives into means-ends

networks could be usefully considered by resource managers in setting operational objectives.

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APPENDIX

Introduction

The following sections identify and provide references for the documents (laws, policies and integrated fisheries management plans) reviewed in this study, the codes for sustainability objectives that were employed in the content analysis, summary statistics for each document and group of documents, the use of a generalized network for single-species fisheries management to compare Canada to other jurisdictions, and the identification of implicit objective network fragments, which were assembled into generalized decision networks for several axes of fisheries sustainability.

Laws and Policies Reviewed

Table S7: The list of three Canadian laws and 27 policies pertinent to sustainable fisheries that were examined in this study. Each document is accompanied by a code by which it was referred to in the course of the study.

Document	Name	
Canadian Legislation		
CL1	*Fisheries Act* (R.S.C., 1985, c. F-14)	
CL2	*Oceans Act* (S.C. 1996, c. 31)	
CL3	*Species at Risk Act* (S.C. 2002, c. 29)	
Canadian Sustainable Fisheries Framework Policies		
CP1	Sustainable Fisheries Framework	DFO 2020
CP2	Policy on New Fisheries for Forage Species	DFO 2009a
CP3	Policy on Managing Bycatch	DFO 2013a
CP4	Guidance on implementation of the Policy on Managing Bycatch	DFO 2019b
CP5	Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas	DFO 2009b
CP6	A Fishery Decision-Making Framework Incorporating the Precautionary Approach	DFO 2009c
CP7	Guidance for the development of rebuilding plans under the Precautionary Approach Framework: Growing stocks out of the critical zone	DFO 2013b
CP8	Ecological Risk Assessment Framework (ERAF) for Coldwater Corals and Sponge Dominated Communities	DFO 2019a
CP9	Fishery Monitoring Policy	DFO 2019c
CP10	Canada's Policy for Conservation of Wild Pacific Salmon	DFO 2005
CP11	Canada's Wild Atlantic Salmon Conservation Policy	DFO 2018a
Other Canadian Fisheries Policies		
CP12	New Emerging Fisheries Policy	DFO 2008
CP13	Aboriginal Fisheries Strategy	DFO 2012
CP14	An Integrated Aboriginal Policy Framework	DFO 2007
CP15	Atlantic Fisheries Policy Review – A policy Framework for the Management of Fisheries on Canada's Atlantic Coast	DFO 2004

Document	Name	
CP16	New Access Framework	DFO 2002
CP17	Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fisheries Policy	DFO 2010
CP18	Policy on Issuing Licences to Companies	DFO 2017a
CP19	Fisheries Act Section 10: National Policy for Allocating Fish for Financing Purposes	DFO 2018b
CP20	Recreational Fisheries in Canada: An Operational Policy Framework	DFO 2001
CP21	Canadian Code of Conduct for Responsible Fishing Operations	DFO 1998
Canadian Oceans Management Policies		
CP22	Canada's Oceans Strategy	DFO 2017b
CP23	Canada's Oceans Strategy: Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada	DFO 2016
CP24	National Framework for Canada's Network of Marine Protected Areas	DFO 2017c
CP25	Canada's Federal Marine Protected Areas Strategy	DFO 2017d
CP26	National Framework for Establishing and Managing Marine Protected Areas	DFO 1999b
CP27	Marine Protected Area Policy	DFO 1999a

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IFMPs Reviewed

Table S8: The list of Canadian Integrated Fisheries Management Plans (IFMPs) that were examined in this study. Each document is accompanied by a code by which it was referred to in the study. Of the 59 IFMPs available online from the Fisheries and Oceans Canada website in August 2020, 52 contained at least two layers of objectives and were carried forward for further analysis.

Document	Name
Central and Arctic Region	
IFMP01	Atlantic Walrus in the Nunavut Settlement Area
IFMP02	Cambridge Bay Arctic Char Commercial Fishery – Effective 2014
IFMP03	Greenland Halibut - Northwest Atlantic Fisheries Organization Subarea 0 - 2019
IFMP04	Integrated Fisheries Management Plans for Narwhal in the Nunavut Settlement Area
IFMP05	Northern and Striped Shrimp (Shrimp Fishing Areas 0, 1, 4-7, the Eastern and Western Assessment Zones and North Atlantic Fisheries Organization (NAFO) Division (3M)
Gulf Region	
IFMP06	Lobster in the Southern Gulf of St. Lawrence (Lobster Fishing Areas 23, 24, 25, 26A, 26B)
Maritimes Region	
IFMP08	Elver Integrated Fisheries Management Plan (Evergreen) Maritimes Region
IFMP09	Canadian Atlantic Herring (*Clupea harengus*) - SWNS (Southwest Nova Scotia) Rebuilding Plan – Atlantic Canada 2013

Document	Name
IFMP10	Inshore Scallop – Maritimes Region - 2015
IFMP11	Offshore Lobster and Jonah Crab – Maritimes Region
IFMP12	Lobster Fishing Areas 27-38 Integrated Fisheries Management Plan
IFMP13	Offshore Scallop – Maritimes Region
IFMP14	Shrimp (*Pandalus borealis*) - Scotian Shelf - as of 2013
IFMP15	Eastern Nova Scotia and 4X Snow Crab (*Chionoecetes opillio*) - Effective as of 2013
IFMP16	4VWX5 Groundfish – Maritimes Region
IFMP17	Canadian Atlantic Bluefin Tuna – NAFO Fishing Areas 3KLNOP, 4RSTVWX and 5YZ - 2017
Newfoundland and Labrador Region	
IFMP18	American Lobster – Lobster Fishing Area 3-14C
IFMP19	Capelin (*Mallotus villosus*) Newfoundland and Labrador Region Divisions 2+3 (Capelin Fishing Areas 1-11)
IFMP20	Capelin (*Mallotus villosus*) - NAFO (North Atlantic Fisheries Organization) Divisions 4RST (Capelin Fishing Areas 12-16)
IFMP21	Groundfish - NAFO (North Atlantic Fisheries Organization) Division 3Ps – Updated 2016
IFMP22	Groundfish Newfoundland and Labrador Region NAFO Subarea 2 + Divisions 3KLMNO
IFMP23	Herring – Newfoundland and Labrador Region 4R3Pn – Effective 2017
IFMP24	Herring – Newfoundland and Labrador Region 2+3 (Herring Fishing Areas 1-11)
IFMP25	Scallop – Newfoundland and Labrador Region
IFMP26	Sea Urchin (*Stronglyocentrotus droebachiensis*) – Newfoundland and Labrador Region
IFMP27	Sea Cucumber – Newfoundland and Labrador Region 3Ps
IFMP28	Snow Crab – Newfoundland and Labrador Region
IFMP29	Yellowtail Flounder (*Limanda ferruginea*) - NAFO Divisions 3LNO – As of December 2012
Pacific Region	
IFMP30	Groundfish Pacific Region 2019 Integrated Fisheries Management Plan
IFMP31	Pacific Sardine (*Sardinops sagax*), Pacific Region 2018 to 2021 Integrated Fisheries Management Plan
IFMP32	Albacore Tuna - Pacific Region 2019 to 2020 Integrated Fisheries Management Plan
IFMP33	Crab by Trap – Pacific Region, April 1, 2020 to March 31, 2021
IFMP34	Fraser River Eulachon 2020: Integrated Fisheries Management Plan
IFMP35	Euphausiid - Pacific Region 2018 to 2022 Integrated Fisheries Management Plan
IFMP36	Integrated Fisheries Management Plan: Geoduck and horse clam - Pacific Region, 2020/2021
IFMP37	Pacific Region Integrated Fisheries Management Plan: Intertidal Clams – January 1, 2019 to December 31, 2021
IFMP38	Pacific Herring 2018: Integrated Fisheries Management Plan
IFMP39	Integrated Fisheries Management Plan: Pacific Oyster (*Crassostrea gigas*) – Pacific Region, 2020
IFMP40	Integrated Fisheries Management Plan: Prawn and Shrimp (*Pandalus* spp.) by Trap – Pacific Region (2020)
IFMP42	Scallop by Trawl - Pacific Region 2020 to 2021 Integrated Fisheries Management Plan
IFMP43	Integrated fisheries management plan: Sea Cucumber (*Apostichopus californicus*) by Dive – Pacific Region (2019)
IFMP44	Integrated Fisheries Management Plan - Green Sea Urchin – Pacific Region 2018 to 2021
IFMP45	Red Sea Urchin by Dive - Pacific Region, 2020 to 2021 Integrated Fisheries Management Plan

Document	Name
IFMP46	Shrimp Trawl, Pacific Region 2020 to 2021 Integrated Fisheries Management Plan
Quebec Region	
IFMP51	Northern Shrimp - Areas 8,9,10,12 (Estuary and Gulf of St. Lawrence)
IFMP53	Lobster Fishery - Areas 19, 20 and 21
IFMP54	Snow Crab - Estuary and Northern Gulf of St. Lawrence Inshore Areas (12A, 12B, 12C, 13, 14, 15, 16, 16A and 17)
IFMP55	Atlantic Herring Division 4S (Herring Fishing Area 15)
Multiple Regions	
IFMP56	Atlantic Mackerel – Effective 2007
IFMP57	2011-2015 Integrated Fisheries Management Plan for Atlantic Seals
IFMP58	Canadian Atlantic Swordfish and other Tunas
IFMP59	Offshore Clam – Maritimes and Newfoundland and Labrador Regions

Code List and Examples

Table S9: The list of 79 codes employed for objectives under multiple axes of sustainability, with examples of how those objectives were expressed in laws (CLx), policies (CPx), or Integrated Fisheries Management Plans (IFMPs).

Codes	Examples
Management actions (n = 18)	
Decision Inputs (n = 8)	
Legal or Policy Instruments	CP1: "new and evolving fisheries management policies" CP15: "modernize the policy framework"
Decision-making Approaches	CP1: "establishes a precautionary approach … and provides the basis for an ecosystem approach"
Catch, Fishery or other Monitoring	CP2: "extensive and reliable monitoring" CP4: "timely and reliable information on catch"
Traditional or Local Knowledge	CP14: "access the knowledge, wisdom and skills of Aboriginal people"
Scientific Information	CP12: "analysis of data generated and provision of advice" CP15: "sound scientific advice"
Evaluate Measures or Practices	CP4: "evaluated and reviewed periodically" CP15: "evaluating new harvest opportunities and technologies"
Socio-economic Study	CP12: "determine… if markets exist" CP7: "inclusion of a cost-benefit analysis"
Information Made Accessible	CP7: "valuable source of information" CP21: "assist in the dissemination of information"
Support for Decision-Making Processes (n = 5)	
Education and Training	CP13: "improve the fisheries management skills" CP21: "education and training programs" CP23: "promoting ongoing education"
Consultations and Meetings	CP14: "obligations to consult" CL1: "Minister may consult with any provincial government"
Governance Mechanisms or Processes	CP12: "partnership arrangements" CP15: "fisheries decision-making processes"
Provide Support for Initiatives	CP23: "public outreach and ocean stewardship initiatives" CL3: "stewardship activities… should be supported"

Codes	Examples
Build Institutional Capacity	CP14: "Building DFO's capacity to serve Aboriginal groups…" CP23: "investments of time, resources and effort"
Decision Outputs (n = 5)	
Best practices and standards	CP12: "establish conservation standards" CP15: "develop codes of conduct"
Fishery Measures or Plans	CP12: "precautionary management strategies" CP15: "establish required conservation measures"
Enforcement Tools or Actions	CP2: "enforcement must be adequate" CP15: "enforcing measures and rules"
Objectives and Reference Points	CP15: "develop, adopt and respect… reference levels" CP15: "entails setting a limit reference point"
Measures or Plans for Social, Economic or Cultural (SEC) Purposes	CP15: "access and allocation decision-making" CP15: "stable and predictable harvest shares"
Institutional Axis (n = 13)	
Unresolvable Institutional Objectives	CP23: "governance issues" CP25: "governance…objectives"
Considerations for Decisions (n =7)	
Cumulative Effects	CP3: "understanding of the cumulative effects" CP9: "risk from all fisheries that interact with the stock"
Ecological Relationships	CP2: "requirements of predators" CP15: "inter-species relationships… must be taken into account"
Environmental Conditions	CP2: "recognize natural variability… and the many factors which may affect them" CP15: "consideration to environmental conditions"
Habitat Functions	CP5: "habitats that are particularly sensitive" CP15: "interdependences between species and their habitats"
Uncertainty	CP2: "recognize the natural variability" CP5: "consider the implications of uncertainties"
Social, Economic, Cultural or Institutional Factors	CP23: "plans may include more than one province…international boundaries" CP23: "planning must accommodate the capacity in local communities
Trade-offs	CP12: "diversify fisheries and increase economic returns while ensuring conservation" CP14: "taking into account the need for conservation… and the interests of other Canadians"
Contributing Institutional Elements (n = 5)	
Public Awareness	CP20, CP21: "promote public awareness"
Foster Stewardship Ethic	CP15: "promote a conservation ethic" CP16: "promote values of local stewardship"
Promote Responsible Practices	CP13: "more selective fishing" CP15: "responsible harvesting operations"
Compliance of Resource Users	CP12: "users are accountable for compliance" CP15: "ensure compliance"
Good governance (shared stewardship)	CP12: "increased Aboriginal participation in the management of fisheries" CP15: "commits governments to work together"

Codes	Examples
	CP14: “a respectful and mutually beneficial relationship with Aboriginal groups” CP15: “shared stewardship”
Ecological Axis (n = 18)	
Target Stocks (n = 6)	
Target Fishing Effort	CP7: “restrict the amount or intensity of inputs used to harvest fish” IFMP05: “controlling fishing effort”
Target Stock F	CP15: “levels of harvesting mortality” CP15: “acceptable levels of risk in the current exploitation”
Target Stock Catch	CP15: “decisions about… how much to harvest” CP15: “decreases in lucrative landings”
Target Stock Dynamics	CP2: “year-class strengths” CP7: “life history characteristics … reduce potential growth rates”
Target Stock Change	CP6: “recognize a declining stock status” CP6: “promote stock growth”
Target Stock State	CP12: “ensuring conservation of the stocks” CP12: “healthy and abundant fishery resources”
Other Species (n = 4)	
Other Interaction	IFMP08: “control introduction and proliferation of disease” IFMP08: “minimize… transmission of invasive species”
Other Species Dynamics	CL1: “results in the death of fish” CP2: “growth rates… of ecologically dependent marine predators”
Other Species Change	CP12: “potential impact … on associated or dependent species” CP15: “foster the… recovery of species at risk”
Other Species States	CP2: “conservation of other species with depend on the forage species for food” CP27: “conserve and protect marine… species”
Non-target or Bycatch Species (n = 3)	
Bycatch Species F/Catch	CP2: “must… bycatch be controlled” CP21: “minimize bycatch”
Bycatch Species Change	CP2: “how bycatch affects impacted populations” CP2: “minimize risk of changes to species’ abundances”
Bycatch Species State	CP2: “maintenance of… bycatch… species within the bounds of natural fluctuations” CP4: “minimize risk of … serious or irreversible harm to bycatch species”
Habitat (n = 3)	
Habitat Interaction / Contact	CP12: “potential … interaction of any new fishery or gear... on habitat” CP21: “lost fishing gear”
Habitat Change	CP15: “minimize negative impacts … on marine habitat” CP15: “support recovery of… fish habitat”
Habitat State	CP1: “protect… fisheries habitats” CP15: “long-term viability of… habitats”
Fundamental Ecological Objective: Ecosystem (n = 2)	
Ecosystem Change	CP21: “reduce adverse impacts on the… ecosystems”

Codes	Examples
	CP5: “impacts of fishing on these ecosystems”
Ecosystem State	CP1: “protect biodiversity” CP15: “safe, healthy, productive… ecosystems”
Socio-Economic and Cultural Axes (n = 23)	
Unresolvable Social, Economic or Cultural Objectives	CP13: “other uses of the resource” CP14: “values, objectives and priorities of Canadians”, “socio-economic aspirations” CP15: “socio-economic interests”
Access and Allocation of Resources (n = 9)	
Industry Capacity or Structure	CP2: “harvesting capacity should not be allowed to increase” CP15: “many fleets are still simply too large”
Food, Social and Ceremonial Fisheries	CP2: “fisheries for food, social and ceremonial purposes have priority status” CP13: “right to fish for food, social and ceremonial purposes”
Indigenous Capacity to Participate	CP12: “applications by Aboriginal communities will be given special consideration” CP14: “facilitating Aboriginal participation in fisheries”
Recreational Harvesting	CP15: “legitimacy and importance of… recreational fishers”
Other Access and Allocation of Resources	CP15: “fisheries-dependent communities” CP15: “maintaining an independent…inshore fleet”
Desired Opportunities to Fish (including Profits)	CP14: “sustainable commercial fisheries… opportunities” CP15: “low profitability”… “improve the … profitability”… “future opportunities”
New Opportunities / Development	CP12: “development of new fisheries” CP14: “increase in economic opportunities” CP15: “evaluating new harvest opportunities”
Reduce Conflict	CP14: “ensure harmony prevails” CP15: “resolve conflicts over best use”
Create Incentives	CP7: “secure access rights… more willing to bear the current costs” CP15: “resource users must…be given assurance that they will benefit”… “positive incentives are required”
Other Contributing Economic Elements (n = 6)	
Promote Innovation	CP15: “use of innovative, responsible fishing practices” CP15: “encourage innovative and diversified fisheries”
Promote Eco-certification and other Market Initiatives	IFMP03: “support increased market access initiatives such as eco-certification” IMFP04: “improve tusk traceability”
Promote Catch / Product Quality	CP15: “quality of fish products” CP21: “maintain the quality of the catch”
Promote Market Access	CP15: “able to compete in international markets” CP15: “meet market demands”
Promote Diversification	CP12: “diversify fisheries” CP15: “opportunities for economic diversification”
Support Other Fisheries, non-harvesting sectors, aquaculture or other industries	CP15: “legitimacy and importance of… aquaculturists” CP16: “stability of employment in the processing sector” CP23: “affecting fisheries, aquaculture, environment, transportation, oil and gas”
Other Contributing Socio-cultural Elements (n = 5)	
Safe Work Environments	CP15: “safe… waters”

Codes	Examples
	CP21: "safeguard a healthy environment for crew members"
Cultural Heritage and Identity	CP15: "historic and continued importance… on the Atlantic Coast" CP24: "special importance for cultural heritage"
Food Security	CP3: "threaten… food security in some areas" IFMP01: "promote… programs aimed at food safety"
Health and Well-being	CP14: "well-being" CP20: "quality of life"
Employment and Income	CP13: "enhanced fisheries-related job opportunities and income" CP25: "opportunities for… employment"
Fundamental Socio-economic and Cultural Objectives (n = 2)	
Industry Prosperity and Viability	CP12: "economic viability of a fishery enterprise" CP14: "strengthened economic viability" CP15: "fisheries… self-reliant, viable"
Community Prosperity	CP13: "self-sufficiency of Aboriginal communities" CP15: "well-being of coastal communities"
General Ends Objectives (n =7)	
Conservation (general ecological)	CP1: "support conservation" CP12: "conservation will not be compromised"
Sustainable Use	CP12: "realizing the sustainable use of fisheries resources" CP10: "managing fisheries for sustainable benefits" CP23: "fostering sustainable development"
Indigenous and Treaty Rights	CP12: "in a manner consistent with Sparrow and subsequent court decisions" CP15: "in a manner consistent with the constitutional protection provided to Aboriginal and treaty rights"
Other Legal or International Obligations	CP15: "enforcing measures and rules established by international bodies" CP20: "respect the federal government's obligations and responsibilities"
Benefits to Humanity	CP15: "for the benefit of all Canadians" CP11: "provide the desired benefits to Canadians"
Intergenerational Equity	CP15: "for present and future generations" CP21: "meet the needs and aspirations of present and future generations of fish harvesters"
Sovereignty and Security	CP12: "uphold Canada's sovereignty" CP22: "ensure its sovereignty and security"

Summary Statistics and Results

*Table S10: Integrated Fisheries Management Plans (IFMPs) from different administrative regions within Fisheries and Oceans Canada showed regional consistencies in terms used as well as the number of layers of objectives employed, but overlaps among groups existed. Categorical terms or layers used by at least half the IFMPs in that region are in **bold and underlined**.*

IFMPs by Region	n	Categorical Labels (number of IFMPs employing them)	Number of Layers (number of IFMPs employing them)
Central and Arctic Region	5	**Long-term (5), Short-term (5),** Strategic (1), Management Approach/Measure (1)	**Two-layer (4),** Three-layer (1)
Gulf Region	1	Long-term, Medium-Term, Short-term	Three-layer
Maritimes Region	9	**Strategic (9), Tactical (9), Overarching (8), Long-term (5),** Short-term (2), Objective (2), Management Approach/Measure (1)	**Three-layer (6),** Four-layer (2), Five-layer (1)
National Capital Region	1	Long-term, Short-term	Two-layer
Newfoundland and Labrador Region	12	**Objective (8), Strategy (8), Long-term (7), Short-term (6),** Management Approach/measure (3), Issue (1)	**Two-layer (9),** Three-layer (3)
Quebec Region	4	**Objective (3),** Global (2), Specific (1)	Two-layer (4)
Pacific Region	16	**National (14), Regional (14), Fishery (specific) (14), Fishery (broad) (10),** Goal (6), Management Approach/Measure (4), Long-term (3), Short-term (3), Objective (1), Priority (1)	Two-layer (1), Three-layer (5), **Four-layer (8),** Five-layer (2)
Apply to Multiple Regions	4	**Long-term (3), Overarching (2), Objective (2),** Management Approach / Measure (1), Short-term (1), Strategic (1), Tactic (1)	**Two-layer (3),** Three-layer (1)

Table S11: Mean number of objectives mentioned per document by the type of document (law, policy or management plan) by general ends objective. Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence. SEC = Socio-economic and cultural objectives.

General Ends	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Conservation	2.3	3.4	4.2	7.7	0.6
Unresolved Institutional	--	--	--	0.3	--
Unresolved SEC	2.0	3.5	2.3	6.3	1.5
Sustainable Use / Development	1.0	2.7	4.2	5.7	1.5
Respect Indigenous & Treaty Rights	2.7	2.1	2.9	1.8	1.1
Other Legal or International Obligations	1.0	1.0	0.3	2.7	0.4
Benefits to Humanity	0.3	0.7	0.5	1.2	0.1
Intergenerational Equity	0.3	0.8	0.9	1.8	0.1
Sovereignty and Security	--	---	0.1	0.8	---

Table S12: Mean number of objectives mentioned per document by the type of document (law, policy or management plan) for management actions. Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Management Actions	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Decision Inputs					
Legal or Policy Instruments	2.0	1.5	2.4	2.7	0.8
Decision-Making Approaches	3.0	6.1	1.5	6.0	0.8
Catch, Fishery or other Monitoring	--	3.0	0.6	2.3	2.5
Traditional or Local Knowledge	2.0	0.6	0.7	2.5	0.2
Scientific Information	3.0	3.2	2.0	6.2	2.2
Evaluation of Measures	--	2.3	0.7	2.7	0.4
Socio-economic Study	--	0.4	0.2	1.2	0.0

Management Actions	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Information Made Accessible	1.0	0.6	0.2	1.7	0.3
Support for Decision-Making Processes					
Education and Training	0.3	--	0.7	1.8	0.2
Consultations and Meetings	2.0	0.5	0.8	1.0	0.6
Governance Mechanisms and Processes	2.0	2.7	4.4	11.8	0.9
Build Institutional Capacity	--	--	0.1	0.8	--
Provide Support for Initiatives	0.3	--	0.1	1.0	0.1
Decision Outputs					
Enforcement Tools Actions	--	0.5	0.6	1.0	0.9
Best Practices and Standards	2.0	1.2	1.2	0.7	0.3
Measures or Plans	9.7	9.5	2.7	15.8	7.9
Objectives and Reference Points	1.7	3.8	0.9	4.3	0.4
Measures / Plans (socio-economic & cultural)	--	0.4	3.6	0.3	2.7

Table S13: Mean number of objectives mentioned per document for decision-making approaches, by the type of document (law, policy or management plan). Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Decision-Making Approaches	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Adaptive Management	--	0.1	--	0.7	--
De-centralized Approach	--	--	0.3	0.2	--
Ecosystem Approach	1.3	1.1	0.5	2.8	0.2
Integrated Approach	0.7	0.2	0.5	7.5	--
Precautionary Approach	1.7	2.3	0.6	2.8	0.7

Table S14: Mean number of mentions per document for influencing factors or other considerations to be taken into account by the type of document (law, policy or management plan). Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Considerations for Decisions (To Take into Account)	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Cumulative Effects	0.3	0.3	--	2.8	0.1
Ecological Relationships Among Species	1.0	1.8	0.3	--	0.5
Environmental Conditions	1.0	1.5	0.4	1.0	0.1
Habitat Function or Uniqueness	4.0	1.7	0.2	2.8	0.5
Uncertainty	0.3	2.1	0.1	0.8	0.1
Social, Cultural, Economic or Institutional Factors	--	--	0.2	0.7	0.2
Consider Trade-offs Among Competing Objectives	2.3	4.6	3.0	5.8	0.5

Table S15: Mean number of mentions per document for institutional axis objectives by the type of document (law, policy or management plan). Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Institutional Axis	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Contributing Institutional Elements					
Compliance of Resource Users	0.7	1.0	0.8	0.8	0.8
Foster Stewardship Ethic	0.3	--	0.9	0.8	--
Good Governance (Shared Stewardship)	3.0	4.5	11.7	18.2	3.8
Public Awareness	0.3	0.0	0.5	3.5	0.2
Responsible Fishing Practices	--	0.6	2.2	0.3	0.7

Table S16: Mean number of mentions per document for ecological axis objectives by the type of document (law, policy or management plan). Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Ecological Axis	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Direct Interactions					
Bycatch Species F/Catch	0.3	2.0	0.3	--	1.0
Fishing Effort	0.3	0.1	--	--	0.1
Target Stock F	1.3	1.8	0.8	0.2	1.7
Target Catch	0.3	1.3	0.2	--	0.1
Other Interaction	1.7	--	0.1	0.2	0.2
Habitat Interaction / Contact	2.0	0.5	0.8	1.0	0.6
States of Other Ecosystem Components					
Bycatch Species Change	--	0.6	--	--	0.2
Bycatch Species State	0.3	0.6	0.2	--	0.2
Habitat Change	3.3	1.4	0.8	0.8	0.8
Habitat State	5.3	3.8	1.3	2.5	0.4
Other Species Dynamics	1.3	0.3	--	0.7	--
Other Species Change	2.0	0.7	0.5	0.2	0.6
Other Species States	6.3	1.5	0.5	1.7	0.1
States of Target Stocks					
Target Stock Dynamics	--	0.5	--	0.3	0.2
Target Stock Change	2.0	5.1	0.9	0.2	0.7
Target Stock State	5.7	11.0	4.2	2.7	2.4
Ends Objective (States: Ecosystems)					
Ecosystem Change	0.3	0.4	0.2	0.3	1.1
Ecosystem State	3.0	3.3	1.8	11.3	1.3

Table S17: Mean number of mentions per document for socio-economic and cultural objectives by the type of document (law, policy or management plan). Results from integrated fisheries management plans (IFMPs) are presented separately, reflecting that only a small section of each IFMP was reviewed for objectives. MPA = Marine Protected Area. Darker grey shading is added to denote presence/absence.

Socio-Economic and Cultural Axes	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Access and Allocation					
Industry Capacity and Structure	--	0.4	0.5	--	0.2
Food, Social and Ceremonial Fisheries	--	0.7	0.7	0.7	0.7
Increase Indigenous Capacity to Participate	--	--	1.3	--	0.2
Control Access (Other Coastal Concerns)	0.3	0.1	1.8	0.3	0.3
Recreational Harvesting	0.3	0.3	1.1	0.7	0.5
Provide Incentives	--	0.1	0.7	--	--
Reduce Conflict	--	0.2	0.8	2.0	0.2
Desired Opportunities to fish (and profits)	0.3	1.2	1.8	1.8	1.2
New Opportunities / Development	--	0.5	1.6	1.5	0.4
Other Contributing Economic Elements					
Catch / Product Quality	--	0.2	0.3	--	0.2
Eco-certification / Other Market initiatives	--	0.1	--	--	0.3
Promote Innovation	--	--	0.6	0.5	0.1
Promote Market Access	--	0.1	0.4	0.3	0.2
Other Fisheries, Sectors or Marine Industries	0.3	0.4	1.0	1.5	0.5
Promote Diversification	0.3	--	0.9	1.0	0.0
Other Socio-Cultural Elements					
Employment and Income	--	0.1	0.4	0.2	0.1
Safe Working Environments	--	--	0.4	0.7	0.4
Cultural Heritage and Identity	0.7	0.2	0.1	1.3	0.1
Food Security	--	0.1	--	--	0.1

Socio-Economic and Cultural Axes	Laws (n = 3)	Sustainable Fisheries Framework (n = 11)	Other Fisheries Policies (n = 10)	Oceans and MPA Policies (n = 6)	Objectives in IFMPs (n = 52)
Health and Wellbeing	--	0.2	0.3	0.7	--
Ends Objectives					
Industry Prosperity and Viability	--	0.5	3.7	0.3	1.8
Community Prosperity	0.3	0.3	3.4	2.8	0.2

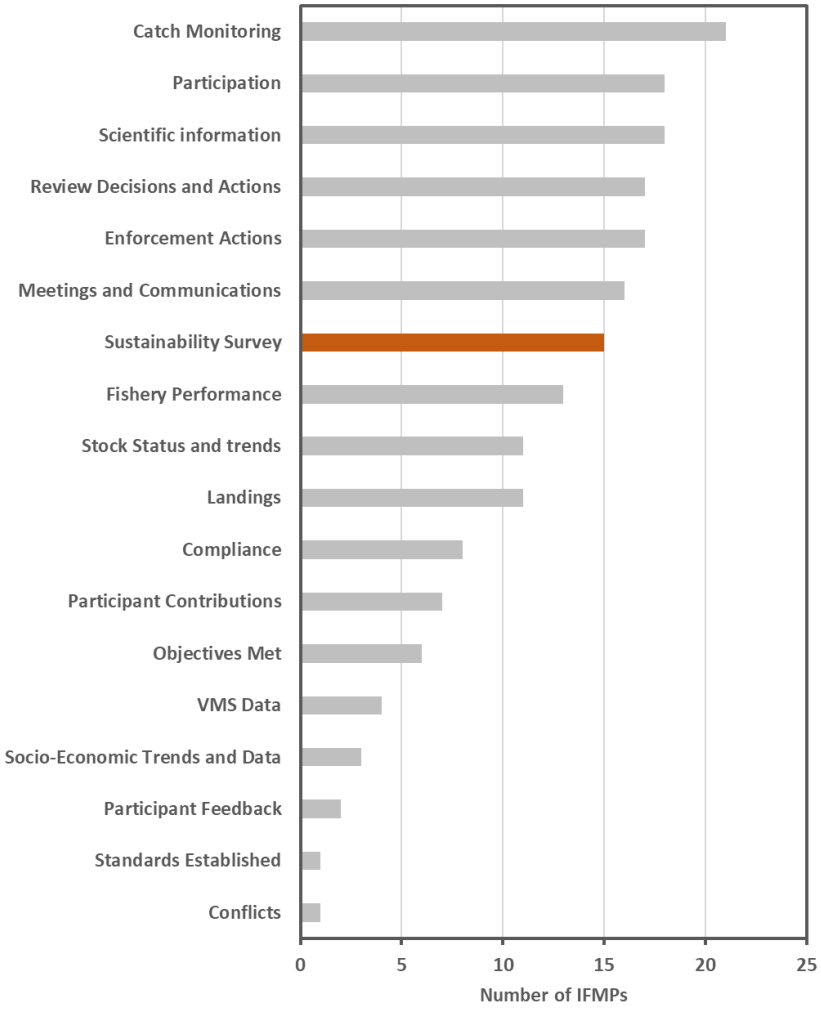

Figure S11: Indicators provided for evaluation of Integrated Fisheries Management Plan (IFMP) performance by the number of IFMPs identifying them. Overall, 39 IFMPs of 52 contained such indicators. Fifteen IFMPs mentioned performance evaluation via DFO's Sustainability Survey for Fisheries, a jurisdiction-level sustainability "report card" (DFO 2020), which is highlighted in orange.

Summary Information for Implicit Network Fragments

Table S18: Quotes from laws, policies and Integrated Fisheries Management Plans (IFMPs) were isolated, and 269 network fragments were generated from implied relationships among sustainability elements. These in turn were used to create partial decision networks. Fragments were classified according to whether they provided specific, key cause-and-effect linkages among objectives for the ecological (ECL), institutional (IST) or socio-economic and cultural (SEC) axes of sustainability; whether they corresponded generally to the partial decision networks constructed from the fragments; whether they provided information on objectives that formed a clear nexus between networks for different axes; whether they indicated relationships among management actions (MA); whether they were too broad to be informative; or whether they were not used because the relationships were in conflict with the partial decision networks. Non-zero fragment counts are highlighted with grey shading for emphasis. MPA = Marine Protected Area. SFF = Sustainable Fisheries Framework.

Fragment Type	Laws (n= 19)	SFF Policies (n= 73)	Other Fisheries Policies (n= 61)	Oceans and MPA Policies (n =32)	IFMPs (n= 84)	Total % (n= 269)
ECL Key linkages	8	25	7	0	11	19%
ECL General direction	5	12	4	5	13	14%
IST Key linkages	1	13	9	7	14	16%
IST General direction	0	0	0	1	0	0%
SEC Key linkages	0	6	17	3	17	16%
SEC General direction	0	2	9	2	3	6%
ECL-SEC Nexus	0	1	2	2	5	4%
IST- SEC Nexus	0	2	6	0	1	3%
Within MA	1	13	1	1	11	10%
Broad	4	11	14	11	13	20%
Not Used	0	1	0	1	0	1%

Table S19: Percentage of the 151 key relationships derived from network fragments of laws, policies and Integrated Fisheries Management Plans (IFMPs). Non-zero fragment counts are highlighted with grey shading for emphasis.

% of Key Relationships from Fragments	Laws (n = 19)	Sustainable Fisheries Framework (n = 73)	Other Fisheries Policies (n = 61)	Oceans and MPA Policies (n = 32)	Objectives in IFMPs (n = 85)
Institutional Axis	2%	30%	20%	16%	32%
Ecological Axis	16%	49%	14%	0%	22%
Socio-economic and Cultural Axis	0%	14%	40%	7%	40%
Connections Among Axes (Nexus)	0%	16%	42%	5%	32%
Total Key Relationships	6%	30%	26%	7%	31%

Table S20: Cause-and-effect relationships of objectives classed as "General Ends", as inferred from implicit network fragments found in Canadian laws, policies and Integrated Fisheries Management Plans. SEC = socio-economic and cultural axis of sustainability.

General Ends Objectives	Information from Implicit Network Fragments
Sustainable Use / Development	**Contributing means:** • *Decision Inputs* (Scientific Information, Legal or Policy Instruments, Catch Monitoring, Good decision-making approaches [EA]) • *Support for Decision Processes* (Governance Mechanisms, Information made accessible) • *Decision Outputs* (Measures) • *Ecological Axis* (Control Fishing Effort, Control Bycatch F/catch, Bycatch and Target Species States, Ecosystem Change/State) • *SEC Axis* (Reduce Conflict, Incentives for Participants) • *Institutional Axis* (Promote stewardship ethic, promote responsible practices) **Contributes to ends:** • *SEC Axis* (Community Prosperity, Industry prosperity and viability) • *Ecological Axis* (Target Stock States) • *Other General Ends Objectives* (intergenerational equity, Indigenous and treaty rights)
Indigenous and Treaty Rights	**Contributing means:** • *Support for Decision Processes* (Governance Mechanisms, Build institutional capacity, education and training) • *Decision Outputs* (Measures, SEC Measures) • *SEC Axis* (Food, Social and Ceremonial Fisheries) • *Institutional Axis* (Good governance/shared stewardship) • *Other General Ends Objectives* (sustainable use) **Contributes to ends:** • *SEC Axis* (Community Prosperity, Industry prosperity and viability) • *Ecological Axis* (Target Stock States)
Other Legal or International Obligations	**Contributing means:** • *Decision Inputs* (Legal or Policy Instruments, Good decision-making approaches [PA]) • *Support for Decision Processes* (Build institutional capacity) • *Decision Outputs* (Reference Points, Enforcement Actions) • *Ecological Axis* (Bycatch F/catch, Habitat Change/State, Ecosystem Change/State)
Benefits to Humanity	**Contributing means:** • *Ecological Axis* (Target Stock Change/States, Habitat State, Ecosystem State) • *SEC Axis* (Diversification, Desired Opportunities and Profits, Community Prosperity) • *Institutional Axis* (Good Governance/Shared Stewardship)

General Ends Objectives	Information from Implicit Network Fragments
Intergenerational Equity	**Contributing means:** • *Ecological Axis* (Target Stock States, Habitat State, Ecosystem State) • *Other General Ends Objectives* (sustainable use)
Sovereignty and Security	**Contributing means:** • *Institutional Axis* (Good governance/shared stewardship)

Implicit Network Fragments

In this section, quotes from laws, policies and IFMPs were isolated, and network fragments were generated from implied relationships among sustainability elements. These fragments informed the creation of partial decision networks for various axes of sustainability, and the identification of general ends objectives. Fragments are classified by type (e.g., key linkage, broad, or consistent with the general direction of a partial decision network constructed for particular axis of sustainability). ECL = ecological axis; IST = institutional axis; SEC = socio-economic and cultural axis. Bold and underlining of text is used for emphasis.

	CL1 Fisheries Act	***Fragment***
1	6.1 (1) In the management of fisheries, the Minister shall implement **measures** to maintain **major fish stocks** at or above the level necessary to promote the sustainability of the stock, **taking into account** the biology of the fish and the environmental conditions affecting the stock.	
	Measures → Target Stock State [sustainable] Influence of: Ecological Factors, Ecological Relationships	*Gen. direction (ECL)*
2	(2) If the Minister is of the opinion that it is not feasible or appropriate, for cultural reasons or because of adverse socio-economic impacts, to implement the measures referred to in subsection (1), the Minister shall set a **limit reference point** and implement **measures** to maintain the **fish stock** above that point, **taking into account** the biology of the fish and the environmental conditions affecting the stock.	
	(Reference Points, Measures) → Target Stock State [within limits] Influence of: Ecological Factors, Ecological Relationships	*Gen. direction (ECL)*
3	6.2 (1) If a major fish stock has declined to or below its limit reference point, the Minister shall develop a **plan** to **rebuild** the stock **above that point** in the affected area**, taking into account** the biology of the fish and the environmental conditions affecting the stock, and implement it within the period provided for in the plan.	
	Measures → **Target Stock Change [rebuild] → Target Stock State [within limits]** Influence of: Ecological Factors, Ecological Relationships	**Key linkage (ECL)**
4	(5) In the management of fisheries, if the Minister is of the opinion that the **loss or degradation of the stock's fish habitat** has contributed to the **stock's decline**, he or she shall take into account whether there are measures in place aimed at restoring that fish habitat.	
	Measures → **Habitat Change [loss, degradation/damage] → Target Stock Change [decline]** [inferred] Influence of: Habitat function	**Key linkage (ECL)**

	CL1 Fisheries Act	*Fragment*
5	(9) The Minister shall, as soon as feasible, prepare a fish habitat restoration **plan** for an ecologically significant area, if he or she is of the opinion that fish **habitat restoration** in that ecologically significant area is required in order to meet any prescribed objectives for the conservation and protection of **fish and fish habitat**.	
	Measures → **Habitat Change [restore] → (Habitat State, Target Stock State, Other Species State [conserved protected])** [inferred] Influence of: Habitat function	**Key linkage (ECL)**
6	(a) the contribution to the **productivity** of relevant fisheries by the **fish or fish habitat** that is likely to be affected; (**Other Species State, Habitat State, Target Stock State) → Ecosystem State** [system productivity]	**Key linkage (ECL)**

	CL2 Oceans Act	*Fragment*
1	WHEREAS Canada promotes the **understanding** of oceans, ocean processes, marine resources and marine ecosystems to foster the **sustainable development** of the oceans and their resources;	
	Scientific Information → Sustainable Use	Broad
2	WHEREAS Canada holds that conservation, based on an **ecosystem approach**, is of fundamental importance to maintaining biological diversity and productivity in the **marine environment**; WHEREAS Canada promotes the wide application of the **precautionary approach** to the conservation, management and exploitation of marine resources in order to protect these resources and preserve the **marine environment**;	
	Good Approaches [EA] → Ecosystem State [biodiversity, system productivity]	Broad
	Good Approaches [PA] → Ecosystem State [conserved protected, preserved]	Broad
3	WHEREAS Canada recognizes that the oceans and their resources offer significant opportunities for **economic diversification** and the generation of wealth for the **benefit of all Canadians**, and in particular for **coastal communities**;	
	(Promote Diversification, Desired Opportunities) → (Community Prosperity, Benefits to Humanity)	*Gen. direction (SEC)*

	CL2 Oceans Act	*Fragment*
4	35 (1) A **marine protected area** is an area of the sea that forms part of the internal waters of Canada, the territorial sea of Canada or the exclusive economic zone of Canada and has been designated under this section or section 35.1 for special protection for one or more of the following reasons: (a) the conservation and protection **of commercial and non-commercial fishery resources**, including marine mammals, and their **habitats**; (b) the conservation and protection of endangered or threatened **marine species**, and their **habitats**; (c) the conservation and protection of **unique habitats**; (d) the conservation and protection of **marine areas** of high biodiversity or biological productivity; (e) the conservation and protection of any other **marine resource or habitat** as is necessary to fulfil the mandate of the Minister; and (f) the conservation and protection of **marine areas** for the purpose of maintaining ecological integrity.	
	Measures [MPA] → (Habitat State, Target Stock State, Other Species State, Ecosystem State [conserved protected] [biodiversity, system productivity, integrity]) [inferred] Influence of: Habitat Function	*Gen. direction (ECL)*

	CL3 Species at Risk Act	*Fragment*
1	the Government of Canada is committed to conserving **biological diversity** and to the principle that, if there are threats of **serious or irreversible damage** to a wildlife species, cost-effective **measures** to prevent the **reduction** or **loss of the species** should not be postponed for a lack of full scientific certainty,	
	Measures [cost-effective] → (**Other Species/Target Change [reduction, serious harm]) → (Other Species/ Target Stock State [loss, serious harm]) → Ecosystem State [Biodiversity]**	**Key linkage (ECL)**
2	Canadian wildlife species and ecosystems are also part of the world's heritage and the Government of Canada has ratified the United Nations Convention on the Conservation of Biological Diversity, providing legal protection for species at risk, will complement **existing legislation** and will, in part, **meet Canada's commitments** under that Convention,	
	Legal or Policy Instruments → Legal or International Obligations	Broad
3	the conservation efforts of individual Canadians and communities should be **encouraged and supported**, **stewardship** activities contributing to the **conservation of wildlife species** and their **habitat** should be supported to prevent species from becoming at risk,	
	Foster Stewardship Ethic → Good Governance [stewardship] → (Other Species State, Target Species State [conserved protected, threatened/at risk], Habitat State [conserved protected])	**Key linkage (IST)**
4	community **knowledge** and interests, including socio-economic interests, should be considered in developing and implementing recovery **measures**,	
	Traditional or Local Knowledge → Measures Consider Trade-offs	**Within MA**
5	the **habitat** of species at risk is key to their **conservation**,	

	CL3 Species at Risk Act	*Fragment*
	Habitat State → (Other Species/ Target Stock State [conserved protected])	**Key linkage (ECL)**
6	**knowledge** of wildlife species and ecosystems is critical to their **conservation**,	
	Scientific Information → (Other Species/ Target Stock State [conserved protected])	*Gen. direction (ECL)*
7	Canada's **protected areas,** especially national parks, are vital to the **protection** and **recovery** of species at risk,	
	Measures [MPA] → (**Other Species/Target Change [recovery]) → (Other Species/ Target Stock State [conserved protected])**	**Key linkage (ECL)**
8	6 The purposes of **this Act** are to prevent **wildlife species** from being extirpated or becoming extinct, to provide for the **recovery of wildlife species** that are extirpated, endangered or threatened as a result of human activity and to manage **species** of special concern to prevent them from becoming endangered or threatened.	
	Legal or Policy Instruments → (**Other Species/Target Change [recover]) → (Other Species/ Target Stock State [extinction or loss, threatened/at risk])**	**Key linkage (ECL)**

	CP1 Sustainable Fisheries Framework	*Fragment*
1	We've adopted **policies** that use **precautionary approaches** and support the adoption of **ecosystem approaches** into fisheries management **decisions**. They help us to: keep our **fish stocks** healthy; protect **biodiversity** and fisheries **habitats**; make sure our fisheries remain **productive**	
	Good Approaches [PA, EA] → **Legal or Policy Instruments → Measures**	**Within MA**
	Legal or Policy Instruments → (Target Stock State [healthy], Ecosystem State [biodiversity, system productivity, conserved protected], Habitat State [conserved protected])	*Gen. direction (ECL)*

	CP2 Policy on New Fisheries for Forage Species	*Fragment*
1	Correspondingly, **conducting fisheries** in ways that **maximize knowledge** gained as the fishery is prosecuted, increases the ability to determine the likelihood that the other objectives can be achieved.	
	Industry Prosperity and Viability [Efficiency] → Scientific Information	***Not used***
2	4.3 - Where biomasses are used as **target and limit reference points** of forage stocks, they should ensure both that **future recruitment of the target species is not impaired**, and that **food supply** for closely linked or **ecologically dependent marine predators** is not depleted.	
	Reference points → (Target Stock State [recruitment], Other Species Dynamics[prey]) Influence of: Ecological Relationships	*Gen. direction (ECL)*

	CP2 Policy on New Fisheries for Forage Species	*Fragment*
3	4.4 - Consistent with the **Precautionary Approach**, **harvests** of forage species should ensure that there is a high probability of not violating reference points, and that there are pre-agreed **harvest control rules** which allow swift and effective reduction of **harvest (including closures)** if the probability of **violating a reference point** is unacceptably high.	
	Good Approaches [PA] → Measures [HCR] → (Target Catch, Target Stock F [reference level], Target Stock State [reference level])	*Gen. direction (ECL)* **Within MA**
4	4.7 - **Harvesting capacity** should not be allowed to increase in ways which are difficult to reverse, during periods when a forage **species is more abundant** than the long-term average condition.	
	Target Stock State [abundance, reference level] → Industry Capacity and Structure	*Gen. direction (SEC)*
5	When **harvests** must be reduced to ensure the **role of the forage species in the ecosystem is not placed at risk**, aboriginal fisheries for **food, social and ceremonial purposes have priority status**.	
	Target Stock Catch → (Ecosystem State [Ecological Relationships])	*Gen. direction (ECL)*
	FSC Fisheries → Desired Profits and Opportunities	**Key linkage (SEC)**
6	5.2.1 Consistent with the **precautionary approach**, there should be clearly identified conservation (limit) **reference points** and associated **harvest control rules**, for measurable properties of both the forage species (see 5.1.1) and some dependent marine predators (see 5.1.2). The reference points should ensure that fisheries do not reduce the **forage species** to levels where either its productivity or the productivity of **predators on it** would be reduced.	
	Good approaches [PA] → (Measures [HCR], Reference Points)) → **Target Stock State [stock productivity] → Other Species State [stock productivity]** Influence of: Ecological Relationships	**Key linkage (ECL)** **Within MA**
7	5.2.2 For the **reference points** and **harvest control rules** to be able to ensure **conservation** is achieved, **monitoring** and **enforcement** must be adequate to ensure high **compliance** with the management plan occurs, and is seen to occur.	
	(Catch Monitoring, Enforcement Actions) → Compliance of Resource Users → (Measures [HCR], Reference Points) → Target Stock State [conserved protected]	**Key linkage (IST)**
8	5.2.4 Management **plans** for fisheries on forage species should include explicit provisions to ensure that fisheries do not unduly lead to **local depletions of the forage species** for time scales long enough to have **consequences for predators**.	
	Measures → **Target Stock State [local depletion] → Other Species Response/Impact** Influence of: Ecological Relationships	**Key linkage (ECL)**

	CP2 Policy on New Fisheries for Forage Species	*Fragment*
9	Harvesting **Plans** must include **measures** designed to detect and manage **bycatch of non-target species**, whether of commercial value or not. When distributions of forage species are near-shore or offshore but near-bottom, management **plans** must also ensure that fishing operations do not **degrade habitat quality**.	
	Measures → (Habitat Change [degradation damage, quality], **Bycatch Species F / Catch**)	**Key linkage (ECL)**

	CP3 Policy on Managing Bycatch	*Fragment*
1	Despite the Code, there is growing concern internationally that **levels of bycatch mortality** from fishing threaten the long-term **sustainability of many fisheries**, the maintenance of **biodiversity**, and even **food security** in some areas.	
	Bycatch Species F/ Catch → (Ecosystem State [biodiversity], Sustainable Use, Food Security)	Broad
2	The SFF (Sustainable Fisheries Framework) is comprised of **policies** and tools designed to help ensure that Canada's **fisheries are environmentally sustainable**, while supporting **economic prosperity**. The SFF (Sustainable Fisheries Framework) also establishes the policy basis for implementing an **ecosystem approach** to fisheries management. An understanding of the **cumulative effects** of fisheries bycatch and the effective management of those effects are fundamental components of an ecosystem approach to management.	
	Legal or Policy Instruments → (Sustainable Use, Industry Prosperity / Viability)	Broad
	Legal or Policy Instruments → Good Approaches [EA] Influence of: Cumulative Effects	**Within MA**

	CP4 Guidance on Implementation of the Policy on Managing Bycatch	*Fragment*
1	Appropriate analyses should be undertaken to determine how **bycatch affects** impacted **populations and ecosystems**, to identify **levels of fishing mortality** that will support **conservation and sustainable use of those populations,** to **evaluate** the effectiveness of bycatch management measures, to improve **transparency** and to **improve DFO's (Fisheries and Oceans Canada) ability to report** on the sustainability of the fisheries under its management.	
	Scientific Information → **Bycatch Species F/ Catch → (Bycatch Species Change → Bycatch Species State [conserved protected],** Ecosystem Change) → (Sustainable Use) Evaluate measures Good Governance [transparency, effective communication]	**Key linkage (ECL)**
2	further species-specific, semi-quantitative and/or qualitative techniques, approaches and tools may need to be developed for **evaluating** whether or not **bycatch rates and magnitudes** are low enough to be sustainable and avoid **serious harm to the bycatch species**.	
	Evaluation of Measures / Plans → Bycatch Species F / catch [sustainable] -> Bycatch Species States [serious harm]	*Gen. direction (ECL)*

	CP4 Guidance on Implementation of the Policy on Managing Bycatch	*Fragment*
3	The bycatch must be removed from the gear and may need to be **sorted from the retained catch** before being returned to the water. This activity takes time and may also damage gear. It is **rational for a harvester to try to minimize the capture** of these unwanted species or specimens where doing so does not unduly affect the **profitability** of the fishing activity. This includes minimizing the probability of interactions with marine mammals, migratory birds and sea turtles.	
	Responsible Practices → Bycatch Species F/Catch [minimize, discarding and waste] -> Catch / Product Quality → Desired Profits and Opportunities	**Key linkage (ECL)** **Key linkage (SEC)**
4	An overall objective of this policy is to minimize the risk of fisheries causing serious or irreversible harm to bycatch species (retained and non-retained). For a bycatch species that a harvester is authorized to retain, the objective will be met by **properly managing** the harvest of the species so as **not to exceed the established harvest levels**.	
	Compliance of Resource Users → Measures → Bycatch Species F/Catch [within limits] → Bycatch Species State [serious harm]	**Key linkage (IST)** **Key linkage (ECL)**

	CP5 Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas	*Fragment*
1	Consistent with the Food and Agricultural Organization Code of Conduct for Responsible Fishing, DFO (Fisheries and Oceans Canada) will continue to promote **responsible fishing** that helps to **reduce by-catch** and **mitigate impacts to habitat** anywhere it's biologically justified and cost effective. Canada is also **committed**, under UN Resolution 61/105, to provide enhanced **protection to marine habitats** that are particularly **sensitive**.	
	Measures [cost-effective] → Responsible Practices → (Bycatch F/Catch [reduction], Habitat Change) → Legal or international Obligations	**Key linkage (IST)** **Key linkage (ECL)**
	Measures → Habitat State [conserved protected] → Legal or international Obligations Influence of: Habitat Functions	Broad
2	To avoid **serious or irreversible harm to sensitive benthic habitat, species and communities** and otherwise address impacts to benthic habitat, communities and species, this policy uses the following process: 1. Assemble and map existing **data and information** that would help determine the extent and location of benthic habitat types, features, communities and species; including whether the benthic features (communities, species and habitat) situated in areas where fishing activities are occurring or being proposed are important from an ecological and biological perspective; 2. Assemble and map existing information and **data on the fishing activity**; 3. Based on all available information, and using the Ecological Risk Analysis Framework, assess the risk that the activity is likely to cause harm to the benthic habitat, communities and species, and particularly if such harm is likely to be serious or irreversible; 4. Determine whether management measures are needed, and **implement such management measures**; and, 5. **Monitor and evaluate the effectiveness of the management measure** and determine whether changes are required to the management measures following this evaluation.(	

	CP5 Policy for Managing the Impacts of Fishing on Sensitive Benthic Areas	*Fragment*
	(Scientific Information, Catch or Fishery Monitoring, Evaluation of Measures) → Measures → (Habitat State, Other Species State, Target Stock State, Ecosystem State [community, serious harm])	*Gen. direction (ECL)* **Within MA**

	CP6 A Fishery Decision-Making Framework Incorporating the Precautionary Approach	*Fragment*
1	The United Nations Agreement on Straddling and Highly Migratory Fish Stocks (UNFA), which came into force in 2001, **commits** Canada to use the **PA (Precautionary Approach)** in managing straddling stocks as well as, in effect, domestic stocks.	
	Good Approaches [PA] → Legal or International Obligations	Broad
2	The LRP (Limit Reference Point) represents the **stock status** below which **serious harm** is occurring to the stock. At this stock status level, there may also be resultant **impacts to the ecosystem**, **associated species** and a long-term **loss of fishing opportunities**	
	Target Stock State [serious harm] → (Other Species Change, Ecosystem Change, Desired Profits and Opportunities)	*Gen. direction (ECL)*
3	the USR (Upper Stock Reference Point) is the stock level threshold below which **removals** must be progressively reduced in order to **avoid reaching the LRP** (Limit Reference Point). For this reason, under this framework, the USR (Upper Stock Reference Point), at minimum, must be set at an appropriate distance above the LRP (Limit Reference Point) to provide sufficient opportunity for the management system to recognize a **declining stock status** and sufficient time for management actions to have effect	
	Target Catch → Target Stock Change → Target Stock State	**Key linkage (ECL)**
	Reference Point → Measures	**Within MA**
4	A **TRP** (Target Reference Point) is a **required element under UNFA** and in the FAO guidance on the application of the PA (Precautionary Approach), as well as **ecocertification standards based on it**, such those of the Marine Stewardship Council and may also be desireable in other situations.	
	Reference point → (Eco-certification, Legal or international Obligations)	**Key linkage (SEC)**
5	The pre-agreed **harvest decision rules and management actions** should vary in relation to the reference points, and be designed to **achieve the desired outcome** by affecting the **removal rate**	
	Measures [HCR] → Target Stock F → Target Stock State	**Key linkage (ECL)**

	CP6 A Fishery Decision-Making Framework Incorporating the Precautionary Approach	*Fragment*
6	When a stock is in the critical zone, **management actions** must **promote stock growth** and **removals** by all human sources must be kept to the lowest possible level. In the critical zone**, management actions** must **promote stock growth** and **removals** from all sources must be kept to the lowest possible level until the **stock has cleared this zone.**	
	Measures → Target Stock F [minimize] → Target Stock Change [growth] → Target Stock State [Zone]	**Key linkage (ECL)**
7	To be successful, the **utilization of this decision-making framework** generally and its application to the specific fisheries needs to be done **in concert with the fishing participants**, to which it is applied, and with engagement of others with an interest, including Provinces, Territories, Aboriginal people, wildlife management boards (as authorized under a land claims agreement), processors and others. If effectively implemented in this way, this approach will facilitate the **stable and predictable business environment** in the fishery that participants seek, while at the same time contributing to **sustainability**	
	Governance Mechanisms → (Good Governance [participatory DM, stable and predictable], Sustainable Use)	**Key linkage (IST)**
8	In fact, **decision rules** we are seeking to establish are only **likely to hold** if they are **developed in concert with its participants**.	
	Good Governance → Compliance of Resource Users → Measures [outputs: supported by participants]	**Key linkage (IST)**
9	**Harvest rate** (taking into account all sources of removals) should progressively decrease from the established maximum and should **promote stock rebuilding** to the **Healthy Zone**	
	Target Stock F → Target Stock Change [rebuild] → Target Stock State [Zone]	**Key linkage (ECL)**

	CP7 Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework: Growing Stocks out of the Critical Zone	*Fragment*
1	**Reducing ambiguity in objectives** and milestones by defining such components will improve **accountability and transparency** around **achieving them**. Like the short-term objectives, **defining explicit targets**, timeframes and probabilities for long-term objectives, to the extent possible, will **reduce ambiguity** and assist in **performance reviews.**	
	Objectives [inputs: clear] → (Good Governance [accountability, transparency], Evaluation of Measures)	**Key linkage (IST) Within MA**

	CP7 Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework: Growing Stocks out of the Critical Zone	*Fragment*
2	Despite the challenges, it is beneficial to the overall long-term **health of the stock** and the **ecosystem** as a whole if such goals are incorporated into the long-term **objectives** for the stock, and supported through short-term objectives.	
	Objectives → (Target stock state, Ecosystem State [health])	*Gen. direction (ECL)*
3	In some cases, however, the **rebuilding of a stock** above the LRP (Limit Reference Point) may only be possible over a longer timeframe (i.e., greater than 1.5-2 generations). This would include situations where **life history characteristics** of the stock in question reduce potential growth rates, when **current productivity regimes** are not favourable for stock growth, or for stocks that are so severely depleted that growth above the LRP (Limit Reference Point) would only be possible over many generations.	
	Target Stock Dynamics [life history] → Target Stock Change [rebuild, growth] → Target Stock State [within limits] Influence of: Ecological Factors	**Key linkage (ECL)**
4	If harvesters could secure **access rights** to the fishery of the future, they might be **more willing** to bear the **current costs** (Hammer et. al., 2010).	
	Access → Incentives for Participants → Measures [outputs: supported by participants]	**Key linkage (SEC) Nexus (SEC-IST)**
5	Various **environmental conditions** (e.g. temperature, salinity) will impact the **rebuilding dynamics** of a stock by affecting life history characteristics, such as fecundity, growth and general productivity. **Environmental conditions** will also influence **predator and prey abundance**, which in turn impacts a **stocks' overall health and recruitment**. Environmental conditions which are favourable for the species in question are generally associated with **improved recruitment and rebuilding opportunities,** while less favourable conditions may lessen rebuilding success.	
	Target Stock Dynamics [life history, recruitment] → Target Stock Change [rebuilding] Influence of: Ecological Factors, Ecological Relationships	**Key linkage (ECL)**
6	Excessive **fishing pressure** can have **evolutionary effects** on a stock, resulting in genetic-based changes to **life history characteristics** such as growth, size-at maturity, age-at-maturity and overall behavioural/reproductive traits. Indeed, rapid evolutionary effects may occur and have been demonstrated for collapsing stocks. **Rebuilding** to the o**riginal state** in terms of genetic and phenotypic stock structure can be extremely slow (i.e. much slower than that required to rebuild stock biomass alone).	
	Target Stock F → Target Stock Dynamics [life history] → Target Stock Change [rebuild] → Target Stock State [reference level, stock structure]	**Key linkage (ECL)**

	CP7 Guidance for the Development of Rebuilding Plans under the Precautionary Approach Framework: Growing Stocks out of the Critical Zone	*Fragment*
7	As such, **rebuilding efforts** may be accompanied by the **restructuring** of the fishery itself, and include a mechanism for **managing fishing capacity** to reduce susceptibility to overexploitation. In many cases, a rebuilt fishery may rely on **higher product value, lower product volume** and reduced **competition** between harvesters in order to achieve greater **profitability and sustainability.**	
	SEC Measures → (Industry Capacity and Structure) → Target Stock F	**Key linkage (SEC)** **Nexus (SEC-ECL)**
	(Catch / Product Quality, Reduce Conflict) → Industry Prosperity and Viability	*Gen. direction (SEC)*
8	Clearly stated **objectives** are an essential element of any rebuilding plan, and direct the development of specific rebuilding **measures**. Well developed objectives help ensure requests for scientific advice are clear and that fisheries managers have the information needed to inform decision making.	
	Objectives → Measures	**Within MA**

	CP8 Ecological Risk Assessment Framework (ERAF) for Coldwater Corals and Sponge Dominated Communities	*Fragment*
1	This ERAF outlines a **process** for identifying the level of ecological risk of fishing activity and its impacts on sensitive benthic areas in the marine environment. This process will be a central component in the efforts by Fisheries and Oceans Canada (DFO) to **manage fisheries** in a manner that mitigates the **impacts of fishing activity on sensitive benthic areas** or **avoids impacts of fishing** that are likely to cause **serious or irreversible harm to sensitive marine habitat, communities and species.** Consequence describes the anticipated degree of impact on the significant benthic areas resulting from an overlap between it and the fishing footprint of the gear type.	
	Governance Mechanism/Process → Measures → Habitat Interaction/Contact → Habitat Change → (Habitat State, Target Stock State, Other Species State [serious harm], Ecosystem State [community]) Influence of: Habitat functions	**Key linkage (ECL)** **Within MA**
2	All management **measures** implemented should be monitored to determine the **effectiveness** of the measures in place, as well has to gather additional data and information which may be used to **improve** on management techniques.	
	Evaluation of Measures → Measures	**Within MA**

	CP9 Fishery Monitoring Policy	*Fragment*
1	Robust **fishery monitoring information** is essential for stock assessment and to effectively implement **management measures** such as target and bycatch limits, quotas and closed areas. Nationally and internationally there is an increased focus on improving **fishery monitoring** to support the implementation of an **ecosystem approach** to fisheries management. Both of these policies require monitoring of all fisheries catching or intercepting a stock / population in order to **account for total fishing removals.**	
	Catch Monitoring [input: accurate reliable, complete] → (Measures / Plans, Good Approaches [EA])	**Within MA**
2	To have **dependable, timely and accessible fishery information** necessary to help ensure that Canadian fisheries are managed to support the **sustainable harvest** of aquatic species to have **dependable, timely and accessible fishery information** necessary to carry out **enforcement** activities to ensure **compliance** with the Fisheries Act, the Oceans Act, the Species at Risk Act and their associated regulations	
	(Catch Monitoring [accurate reliable, timely], Information Made accessible) → Sustainable Use	Broad
	(Catch Monitoring [accurate reliable, timely], Information Made accessible) → Enforcement Actions → Compliance of Resource Users	**Key linkage (IST) Within MA**
3	To put in **place fishery monitoring** that is adequate to **conserve fish stocks** / populations and **manage fishery removals sustainably**, we must understand the conservation **risk an individual fishery poses to a stock/population** and the risk from **all fisheries that interact with the stock/population.**	
	Catch and Fishery Monitoring → Measures → Target F [sustainable] → Target Stock Change → Target Stock State [conserved protected] Influence of: Cumulative effects	**Key linkage (ECL) Within MA**

	CP10 Canada's Policy for Conservation of Wild Pacific Salmon	*Fragment*
1	The goal of the Wild Salmon Policy is to **restore** and **maintain healthy and diverse salmon populations** and their **habitats** for the benefit and enjoyment of the **people of Canada in perpetuity.**	
	(**Target Stock/Habitat Change [restore]) → (Target/Habitat State [healthy, diversity of types])** → (Benefits to Humanity, Intergenerational Equity)	**Key linkage (ECL)**
2	Resource management **processes and decisions** will honour Canada's **obligations to First Nations.**	
	(Governance Mechanisms, Measures)→ Indigenous and Treaty Rights	Broad
3	Where monitoring indicates **low levels of abundance, or deterioration in the distribution of the spawning components of a CU,** a full range of **management actions** to **reverse declines** – including habitat, enhancement, and harvest measures – will be considered and an appropriate response implemented.	

	CP10 Canada's Policy for Conservation of Wild Pacific Salmon	*Fragment*
	Measures → **Target Stock Change [decline]→ Target Stock State [abundance, distribution range, stock components]**	**Key linkage (ECL)**
4	This policy will foster a **healthy, diverse, and abundant salmon resource** for **future generations** of Canadians. It will support **sustainable fisheries** to meet the **needs of First Nations** and contribute to the current and future **prosperity of Canadians**.	
	Target Stock State [health, abundance, diversity of types] → Benefits to Humanity	Broad
	Sustainable Use → (Indigenous and Treaty Rights, Benefits to Humanity)	Broad
5	The challenge for habitat managers is to **regulate** social and economic activities to **avoid or mitigate adverse impacts on fish habitat**, in cooperation with First Nations, Provincial, Territorial, and local governments. The new management approach needs to meet this challenge more effectively and maintain **habitat and ecosystem integrity** for the long-term **health of Pacific salmon populations**.	
	Good Governance [Participatory Decision-making] → Measures → Habitat Change	**Key linkage (IST)**
	(Habitat State, Ecosystem State [integrity]) **→ Target Stock State [health]**	**Key linkage (ECL)**
6	The protection of biodiversity, and understanding the broader implications of this term, is also essential to implementation and success of this policy. The **biodiversity associated with Pacific salmon populations** will influence the **quality and productivity of the salmon's ecosystems** and **local habitats**, and determines the **biological background** influencing **salmon diversity and their adaptability**.	
	Target Stock State [genetic diversity, diversity of types] → (Habitat State, **Ecosystem State [quality, system productivity])** Target stock state [natural evolution] Influence of: Environmental Conditions, Ecological Relationships, Habitat Function	**Key linkage (ECL)**
7	Within the last decade, various **measures** have been implemented to advance the **conservation of Pacific salmon**. For example, the **commercial fishing fleet was reduced**, Canada and the United States renewed the **Pacific Salmon Treaty**, and **selective harvesting practices** have been developed and adopted.	
	SEC Measures → Industry Capacity and Structure	**Key linkage (SEC)**
	(Responsible Practices, SEC Measures, Legal or Policy Instruments) → Target stock state [conserved protected]	*Gen. direction (ECL)*
8	**Sustainable fisheries** to meet the **needs of First Nations** and contribute to the current and future prosperity of **all Canadians;**	
	Sustainable Use → (Indigenous and Treaty Rights, Benefits to Humanity)	Broad

	CP10 Canada's Policy for Conservation of Wild Pacific Salmon	*Fragment*
9	To safeguard the **long-term viability of wild Pacific salmon** in natural surroundings, the Department will strive to maintain **healthy populations in diverse habitats**. The **health and long-term well-being of wild Pacific salmon** is inextricably linked to the availability of diverse and productive freshwater, coastal, and marine **habitats**.	
	Habitat State [diversity of types, system productivity] → Target Stock State [health, viability]	**Key linkage (ECL)**
10	Identifying, **protecting, restoring** and rehabilitating aquatic **habitats** are critical to maintaining their **integrity** and sustaining **ecosystems**.	
	Habitat Change [rebuild] → Habitat State [integrity, conserved protected] → Ecosystem State [sustainable]	**Key linkage (ECL)**
11	Success in **protecting and restoring habitat** demands a **cooperative and collaborative** approach among the various levels of government so that land and water use activities and **decisions** better support the needs of salmon. One such coordinating structure is the Pacific Council of Fisheries and Aquaculture Ministers and its subsidiary work groups. The council and the work groups can provide an organizational arrangement within which information can be shared and cooperative work developed and coordinated. Collaborative approaches such as this optimize the use of our collective resources.	
	Governance Mechanisms / Processes [efficient] → Good Governance [Participatory Decision-Making] → Measures	**Key linkage (IST)**
12	First Nations, harvesters, environmental groups, and community interests in the resource need to be **engaged directly** in these **processes,** and in the determination of the most appropriate management **actions.** Individual and community involvement in salmon management decision-making, in turn, will **sustain the social and cultural ties** between people and salmon. These ties will ultimately lead to the **more successful implementation of conservation plans** and the **better protection of wild salmon**.	
	Governance Mechanisms/Processes → (Good Governance [Participatory Decision-Making] → Cultural Heritage and Identity) **→ Measures [outputs: supported by participants]** → Target Stock State [conserved protected]	**Key linkage (IST) Nexus (IST-SEC)**
13	The maintenance of **sound, productive salmon habitat** in both fresh water and the marine environment depends on **good scientific information**, timely **measures** to prevent **habitat disruption**, and **compliance** with regulatory directives.	
	(Scientific Information, (Measures (outputs: timely)) → Habitat Change [disruption])	*Gen. direction (ECL)*
	Compliance of Resource Users) → Habitat State [sound, system productivity]	Broad

	CP10 Canada's Policy for Conservation of Wild Pacific Salmon	*Fragment*
14	**Together** with the Province of British Columbia and other partners, DFO will promote the design, implementation, and maintenance of a linked, collaborative **system** to increase **access to information** on fish habitat status.	
	(Governance Mechanism, Information Made Accessible) → Good Governance [Participatory Decision-Making]	**Key linkage (IST)**
15	The WSP will have limited ability to directly protect salmon from climate change, but the policy's premise – to protect diversity and their habitats – is critical to allowing Pacific salmon to adapt to future changes. By maintaining the **genetic diversity of wild salmon and the integrity of their habitat and ecosystems**, the WSP will help ensure viable wild **salmon populations in the future**. At the same time, while salmon adjust to these **pressures**, managers could **expect productivity and allowable catches to decline**.	
	Legal or policy instrument → (Target stock State [genetic diversity], Habitat State, Ecosystem State [integrity])→ Target Stock state [viable]	*Gen. direction (ECL)*
	Target Stock Dynamics → Target Stock Catch Influence of: Ecological Factors	*Gen. direction (ECL)*

	CP11 Canada's Wild Atlantic Salmon Conservation Policy	*Fragment*
1	The Government of Canada recognizes that **action** is required to **arrest the decline** and to **rebuild wild Atlantic salmon populations** and **maintain their genetic diversity** in order to provide the desired **benefits to Canadians**. This policy sets the stage for various levels of government, Indigenous communities and non-governmental stakeholders to **work together** and in so doing contribute through **shared stewardship** to the **conservation of wild Atlantic salmon.**	
	Measures → **Target Stock Change [rebuild] → Target Stock State [genetic diversity]** → Benefits to Humanity	**Key linkage (ECL)**
	Good Governance [Shared Stewardship, participatory decision-making] → Target Stock State [conserved protected]	Broad
2	**Conservation** is the protection, maintenance, and rehabilitation of salmon **populations,** their genetic diversity, and their **ecosystem**s in order to **sustain biodiversity** and the continuance of evolutionary and **natural production processes.**	
	Target Stock State [conserved protected, maintained, rebuilt, genetic diversity] → Ecosystem State (biodiversity, processes, natural evolution)	**Key linkage (ECL)**
3	**Sustainable use and benefits** is defined as the **use** of the Atlantic salmon resource in a way that does not lead to **its long-term decline**, thereby ensuring that the needs and aspirations of **future generations** can be met.	
	Target Stock F → Target Stock Change [decline] → Sustainable Use → Intergenerational Equity	**Key linkage (ECL)**

	CP11 Canada's Wild Atlantic Salmon Conservation Policy	*Fragment*
4	To garner trust and **public support**, management **decisions** will seek to accommodate a wide range of interests in the resource; and will be based on meaningful **input with clear and consistent rules and procedures**. Furthermore, resource management **decisions** will be exercised in a way that is consistent with the principle of **shared responsibility** between the Government of Canada, provincial and territorial governments, First Nations, Indigenous organizations, and other stakeholders.	
	(Good Governance [Participation of Interests in DM, shared stewardship], Governance Mechanisms / Processes (clear, consistent)) → Measures/Plans (supported by interests)	**Key linkage (IST) Within MA**
5	In this context, the **promotion** of and **compliance** with management measures is most effective when the users of the resource **are directly involved in the development and implementation of the measures**, including monitoring for compliance.	
	Good Governance [participatory Decision-Making] → Compliance of Resource Users	**Key linkage (IST)**

	CP12 New Emerging Fisheries Policy	*Fragment*
1	**New fisheries** should contribute positively to the **economical viability** of a fishery enterprise on an ongoing basis.	
	New Opportunities / Development → Industry Prosperity and Viability	*Gen. direction (SEC)*
2	"Healthy and abundant **fishery resources** supporting **sustainable uses**."	
	Target Stock State [health, abundant] → Sustainable Use	Broad
3	The potential **impact or interaction** of any new fishery or gear on **associated or dependent species**, fishing or gear type and on **habitat** will be assessed.	
	(Habitat Interaction / Contact, Other Interaction) → (Habitat Change, Other Species Change)	**Key linkage (ECL)**
4	Users, through **partnership arrangements**, will **participate** more in the management of the fishery	
	Governance Mechanisms / Processes → Good Governance [Participatory Decision-Making]	**Key linkage (IST)**
5	The objective of this stage is to determine whether **a species/stock** can sustain a **commercially viable operation** and to collect biological data in order to build a preliminary database on stock abundance and distribution.	
	Scientific Information → Target Stock State [capable of being harvested] → Industry Prosperity and Viability	Broad

	CP13 Aboriginal Fisheries Strategy
1	None.

	CP14 An Integrated Aboriginal Policy Framework	*Fragment*
1	5. Contribute to the broader Government of Canada objective of greater economic development for First Nations by assisting with **greater access to economic opportunities,** such as commercial fishing.	
	SEC Measures → New Opportunities / Development	**Key linkage (SEC)**
2	Supporting **healthy and prosperous Aboriginal communities** through: building and supporting strong, stable **relationships**; working in a way that **upholds the honour of the Crown**; and **facilitating Aboriginal participation in fisheries** and aquaculture and a**ssociated economic opportunities** and in the **management of aquatic resources**.	
	(Good Governance [Indigenous-Government Relationship, Participatory Decision-making], Indigenous and Treaty Rights) → Community Prosperity	Broad
	Increase Indigenous capacity → Desired Profits and Opportunities → Community Prosperity	**Key linkage (SEC)**
3	Building and supporting strong, stable **relationships** - by maintaining and improving **working relationships with Aboriginal people** through fostering an internal culture and external climate of mutual understanding and **respect.**	
	Governance Processes [respectfulness] → Good Governance [government-Indigenous Relationship]	**Key linkage (IST)**
4	7. **Building DFO (Fisheries and Oceans Canada)'s capacity** to serve Aboriginal groups - providing organizational and staff capacity to **serve Aboriginal groups** and respond to emerging issues through **organizational and training initiatives.**	
	(Build Institutional Capacity, Education and Training) → Indigenous and Treaty Rights	Broad
5	There are Aboriginal groups who are seeking greater **access to economic opportunities** from aquatic resources as a **potential driver for economic development** in their communities; more stability in **food, social and ceremonial (FSC (Food, Social and Ceremonial)) fisheries**; a greater **role in the aquatic resource and oceans management decisions that affect them**; and a **greater role in stewardship**, including stock assessment, oceans and habitat management, conservation and protection, and recovery strategy development and implementation.	
	(New Opportunities / Development, FSC Fisheries) → Community Prosperity [Indigenous] Good Governance [Shared Stewardship, Participatory Decision-making]	*Gen. direction (SEC)*
6	Many Aboriginal groups assert an Aboriginal right to fish for FSC (Food, Social and Ceremonial) purposes. Many also assert that Aboriginal rights of self-government extend to many aspects of the management of aquatic resources and that they have **Aboriginal rights to wider management and protection of these resources.**	
	Good Governance [Shared Stewardship / Co-management] → Indigenous and Treaty Rights	Broad

	CP14 An Integrated Aboriginal Policy Framework	*Fragment*
7	DFO (Fisheries and Oceans Canada)'s Aboriginal programs are designed to strengthen the **relationship** between the federal government and Aboriginal groups and communities by **supporting integration in the commercial fishery** and the development of scientific, technical and administrative capacity of Aboriginal groups. This allows them to more effectively manage their activities around aquatic resources and oceans management and to participate in the multilateral decision-making and advisory processes used to manage aquatic resources and ocean spaces.	
	SEC Measures→ Increase Indigenous Capacity) → Good Governance [Participatory decision-making, Indigenous-Government Relationship]	**Key linkage (SEC)**
8	**access** to fisheries resources to address **asserted rights** and **socio-economic aspirations**; annual agreements to secure an **orderly fishery** and increase **stability**; and increased Aboriginal participation in fisheries co-management.	
	SEC Measures → (Indigenous and Treaty Rights, **New Opportunities / Development**) Good Governance [Shared Stewardship / Co-management, orderliness, stability]	**Key linkage (SEC)**
9	The key outcomes of these programs include benefits to: industry through better integrated commercial fisheries with improved a**ccountability and more certainty**, which supports improved **economic viability**; Aboriginal communities in the form of enhanced fisheries related job opportunities and income and increased capacity building and greater involvement in management; and Canadians, with more certainty and stability.	
	Good Governance [accountability, stability, integrated/consistency] → Industry Prosperity / Viability	Broad
	(Good Governance [Participation of Interests in DM], Increased Indigenous Capacity, **Employment and Income) → Community Prosperity [indigenous]**	**Key linkage (SEC)**
10	The initiative provides for **greater certainty and stability around fisheries access and allocation**, as well as **enhanced monitoring, reporting and enforcement**, in support of strengthened **economic viability** and **fisheries resource sustainability**.	
	(Catch/Fishery Monitoring, Enforcement Tools/ Actions, SEC Measures [outputs: stable, predictable]) → (Industry Prosperity / Viability, Target Stock State[sustainable])	Broad

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
1	**The interjurisdictional agreement** commits governments to work together to maintain ecologically sustainable **fisheries resources and habitats**, and to develop ecologically sustainable and **economically viable fisheries** and **aquaculture industries**.	

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
	Good Governance [participatory Decision-Making] → (Habitat State, Target Stock State, Industry Prosperity / Viability, Other Sectors)	Broad
2	As well, current levels of harvesting mortality for shellfish are undesirably high in some areas, and **decreases in the lucrative landings** of shellfish are evident in some instances.	
	Target Catch → Desired Profits and Opportunities	**Nexus (ECL-SEC)**
3	The problem of **excess participation** can cause **low profitability** in many fisheries and is compounded by the **lack of alternate economic opportunities** in some regions. This can result in situations where **communities are excessively dependent** on the fisheries for their survival and are **unable to weather the effects of a sudden reduction in fisheries resources.**	
	Industry Capacity → Desired Profits and Opportunities → (Industry Prosperity and Viability [robust, adaptive], Community Prosperity [dependent])	**Key linkage (SEC)**
4	A **downturn in the fisheries** can therefore lead to **conflict among resource users**, pressure to compromise conservation objectives and **recurring demands for increased access** at the expense of other resource users. In several fisheries, the department has designed a complex **regulatory system** with associated high management **costs** to better control fishing activities. However, these rules are increasingly difficult to **enforce** and often, fishers and others raise concerns over inadequate **monitoring** and limited **compliance.**	
	Industry Capacity → (Reduce Conflict, Desired Opportunities ← Catches or Yields)	**Key linkage (SEC)** **Nexus (ECL-SEC)**
	(**Enforcement Tools, Fishery Monitoring [feasible, cost-effective, effective]) → Compliance of Resource Users**	**Key linkage (IST)**
5	Strengthening **incentives** to support conservation can also be expected to advance **self- reliance among resource users**, both now and in the future. As resource users **become more involved in decision making** and assume certain fisheries management responsibilities, they will become more **accountable for their actions** and for the environmental and economic sustainability of the Atlantic fisheries.	
	Incentives for Participants → Industry Prosperity and Viability [self-reliant] (Good Governance [accountability, participatory decision-making], Sustainable Use)	*Gen. direction (SEC)*
6	Ongoing uncertainty about **access** to fisheries resources and allocation of harvesting opportunities undermines the department's efforts to develop conservation incentives. If resource users do not have a reasonable degree of certainty that they will share in future returns arising from their conservation efforts, they will have limited **incentive** to **support conservation.**	

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
	SEC Measures → **Incentives for Participants → Measures** [outputs: supported by participants])	**Nexus (SEC-IST)**
7	Conservation and sustainable use of resources and habitat must be the overarching, and indeed the fundamental, objective for fisheries management on Canada's Atlantic coast. Conservation is essential if fisheries are to be self-reliant, viable and capable of contributing to the economic and social base of coastal communities over the long term.	
	Industry Prosperity and Viability [self-reliant] → Community Prosperity [coastal] → (Conservation, Sustainable Use)	**Key linkage (SEC)**
8	Participants in decision-making **processe**s must **work together** to determine acceptable levels of risk in the current **exploitation** of a resource for social, economic and cultural benefits, and to develop the measures required to **protect the resource and its habitat**.	
	Governance Mechanisms / Processes → Good Governance [Participatory Decision-Making] → Measures / Plans → (Target Stock F → Target Stock State, Habitat State [conserved protected])	**Key linkage (IST) Key linkage (ECL)**
9	This risk management framework will focus on achieving conservation objectives compatible with sustainable use, by: establishing **reference points** that are linked to key stock and ecosystem indicators, such as the **size and productivity of the resource**; and, implementing resource use **strategies** in relation to these reference points that will scale **levels of use** to stock condition in a manner that will avoid **undesirable outcomes**.	
	(**Reference Points, Measures / Plans) → Target Stock F** → Target Stock State [abundance, productivity]	**Key linkage (ECL)**
10	Applying **precaution** to the management of Canadian fisheries entails setting a limit **reference point,** and if this limit is approached, implementing increasingly restrictive resource use **strategie**s.	
	Reference points → Good Approaches [PA]	**Within MA**
	Measures / Plans → Target Stock Change	*Gen. direction (ECL)*
11	continuing development of recovery **strategies** to foster the **protection and recovery** of species at risk; using oceans management **measures,** including Marine Protected Areas, to protect the most vulnerable **habitats and areas of biological importance**;	
	Measures / Plans → **Other Species Change[recovery] → Other Species States[protected]**	**Key linkage (ECL)**
	Measures / Plans [MPAs] → Habitat State Account for: Habitat functions	*Gen. direction (ECL)*
12	**promoting fishing technologies and practices** that maintain **spawning potential**, ensure all **age groups** are appropriately represented in the catch, protect **genetic diversity** within stocks and populations, and minimize negative **impacts on other marine resources and on marine habitats**	

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
	Responsible Practices → (Habitat Change, Other Species Change, Target Stock State [reproductive potential, life history, genetic diversity])	*Gen. direction (ECL)*
13	Conservation measures and rules alone, however, will not lead to **compliance**. **Positive incentives are required to reinforce rules and measures**. These incentives must be adopted to **support behaviour** that **fosters the conservation objectives** and they must encourage resource users to go beyond mere compliance with the rules	
	Incentives for Participants → Foster Stewardship Ethic → (Compliance of Resource Users, Responsible Practices)	**Nexus (SEC-IST) Key linkage (IST)**
14	The well-being of coastal **communities** is a **collective responsibility** and cannot rest exclusively on the actions of Fisheries and Oceans Canada.	
	Good Governance [shared stewardship] → Community Prosperity [coastal]	Broad
15	Canada recognizes that the oceans and their resources offer significant opportunities for economic **diversification** and **the generation of wealth** for the benefit of all Canadians, and in particular for **coastal communities**.	
	(Promote Diversification, Opportunities to Fish / Profit) → Community Prosperity [coastal]	*Gen. direction (SEC)*
16	Regarding the fisheries, Fisheries and Oceans Canada can best contribute to the well-being of **coastal communities** by promoting **the sustainable use** of fisheries resources through respect for **conservation principles**	
	(Conservation/Ecological Axis, Sustainable Use) → Community Prosperity [coastal]	Broad
17	there will be **no increase** in the number of enterprises consistent with existing licensing policy; … **maintaining the geographic distribution of economic opportunities** within a **diverse fleet structure**;	
	Access [Historical Access Current System] → (Industry Capacity and Structure, Diversification)	*Gen. direction (SEC)*
18	**Responsible fishing** projects also contribute to the development of **new technologies**, creation of research networks, expansion of harvesting methods to improve species selectivity and **improvements in energy-efficient fishing methods**.	
	Responsible practices → Promote Innovation → Industry Prosperity/ Viability [efficient]	**Nexus (SEC-IST)**
19	**Collaboration** is needed to foster a **forward-looking and well-organized fisheries sector** able to **compete in international markets.**	
	Good Governance [participatory Decision-making] → Industry Prosperity/ Viability [competitive]	Broad
20	To reduce their **vulnerability to natural fluctuations** in resource availability and to variations in market conditions, commercial licence holders are expected to **diversify their operations** while respecting conservation objectives and the need to control harvesting capacity.	

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
	Diversification → Industry Prosperity/ Viability [robust, adaptive]	*Gen. direction (SEC)*
21	streamlining rules and regulations or adjusting harvesting and management practices to **meet market demands** for a reliable and dependable supply of **fresh and processed fish products.**	
	Catch / Product Quality → Market Access	**Key linkage (SEC)**
22	Within commercial fisheries, too often **disputes about access and allocation** create **instability** that undermines the **integrity** of fisheries management and jeopardizes efforts to achieve **sustainable use** and **self-reliance**. If resource managers must be preoccupied with the reallocation of finite resource shares, an understandable response from resource users and others will be to expend their energy on obtaining the greatest possible share.	
	SEC Measures → Access and Allocation → Reduce Conflict among Users → (Good Governance [stability, effectiveness], Sustainable Use, Industry prosperity/viability [self-reliant])	**Key linkage (SEC)**
23	More importantly, these **dispute**s, if at all extensive, create great **uncertainty** in the minds of resource users about future harvest opportunities. As emphasized earlier, such uncertainty **undermines attempts to cultivate a conservation ethic**. Such an ethic is a fundamental pre-requisite for the development of **effective shared stewardship**	
	Reduce Conflict among Users → Incentives → Stewardship Ethic → Good Governance [Shared Stewardship, Stable, Effectiveness]	**Key linkage (SEC)** **Nexus (SEC-IST)** **Key linkage (IST)**
24	Increasing **opportunities for participation** by local or fleet-level commercial licence holders in allocation decision making will make **allocation processes more transparent** and their **outcomes more understandable and acceptable**. As a consequence, commercial harvesters will have greater **incentives to support the sustainable use** of their fisheries, that is, they will have developed a **stronger conservation ethic**. In addition, they will be able to focus their efforts on achieving **economic viability,** rather than on competing for a larger share of the resource.	
	Good Governance [participatory Decision-making] → Governance Processes [transparent] → SEC Measures [outputs: supported by participants] → (**Incentives for Participants**, Stewardship Ethic) → (**Reduce Conflict**, Industry Prosperity/ Viability) → Sustainable Use	**Key linkage (IST)** **Key linkage (SEC)** **Nexus (IST-SEC)** **Within MA**
25	Fisheries and Oceans Canada believes that enabling resource users and others to play a **greater role in decision making**, and thus to take greater responsibility for resource management decisions and their outcomes, will **further a conservation ethic** and enable stakeholders to take greater control of their **economic and social well-being**.	
	Good Governance [Participatory Decision-making] → (Stewardship Ethic, Industry Prosperity/ Viability [self-reliant], Health and Well-being)	**Key linkage (IST)**

	CP15 Atlantic Fisheries Policy Review – A Policy Framework for the Management of Fisheries on Canada's Atlantic Coast	*Fragment*
26	Atlantic Canada is endowed with a continental shelf that provides valuable and abundant fisheries resources that, if properly managed, will provide sustainable economic opportunity for generations to come. Despite having weathered a difficult period of adjustment and restructuring, the **fisheries** continue to be an important contributor to **employment, income and economic opportunity.**	
	Desired Opportunities to Fish → Employment and Income → Industry Prosperity and Viability	**Key linkage (SEC)**

	CP16 New Access Framework	*Fragment*
1	Priority of **access** should be granted to those who are closest to the fishery resource in question. The adjacency criterion is based on the explicit premise that those coastal fishing communities and fishers in closest proximity to a given fishery should gain the greatest benefit from it, and on the implicit assumption that access based on adjacency will promote **values of local stewardship** and **local economic development.**	
	SEC Measures → Access [Adjacent Communities] → (Stewardship Ethic, Community Prosperity)	**Key linkage (SEC)**
2	Priority of **access** should be granted to fishers who have historically participated in and relied upon a particular fishery, including those who developed the fishery. Depending on the nature and history of the fishery, the requisite period of dependence can vary from a few years to many decades. The historic dependence criterion is based on the premise that fishers who have historically fished a particular stock should enjoy privileged access to that resource, to ensure their continued **economic stability and viability,** as well as that of the **coastal communities** from which they come.	
	Access [Historical Access / Current System] → (Industry Prosperity / Viability, Community Prosperity)	*Gen. direction (SEC)*
3	At a broader level, **economic viability** looks to factors such as relative economic return and value-added to the fishery, as well as at **stability of employment** in the **processing sector** and economic benefits to dependent **coastal communities.**	
	(**Industry Prosperity / Viability,** Non-Harvesting Sectors**, Employment) → Community Prosperity**	**Key linkage (SEC)**

	CP17 Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fisheries Policy	*Fragment*
1	As Canada's Minister of Fisheries and Oceans, I believe strongly that an **independent inshore commercial fishing fleet** is an important element of an **economically prosperous Atlantic Canada.**	
	Access [Inshore Fleet] → Community Prosperity	*Gen. direction (SEC)*

	CP17 Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fisheries Policy	*Fragment*
2	The PIIFCAF (Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fisheries) Policy is part of Fisheries and Ocean's comprehensive approach to enhance the economic prosperity of fishers and fleets through the Fisheries Renewal initiative. This approach is based on promoting **stability, predictability and transparency in fisheries management decision-making.**	
	Governance processes [stable, predictable, transparent] → Industry Prosperity / Viability	Broad
3	The goal of the PIIFCAF (Preserving the Independence of the Inshore Fleet in Canada's Atlantic Fisheries) Policy is to strengthen the Owner-Operator and Fleet Separation **Policies** to ensure that inshore fish harvesters remain independent, and that the **benefits of fishing licences flow** to the fisher and to **Atlantic coastal communities**.	
	Policy Instrument → Access [Inshore Fleet] → Opportunities to Fish/Profit → Community Prosperity	**Key linkage (SEC)**

	CP18 Policy on Issuing Licences to Companies
1	None.

	CP19 Fisheries Act Section 10: National Policy for Allocating Fish for Financing Purposes
1	None.

	CP20 Recreational Fisheries in Canada: An Operational Policy Framework	*Fragment*
1	**Recreational fishing** makes a valuable contribution to both the **quality of life** and the **economic development of our communities.** The Department's resource management policies must consider **access for recreational purposes.**	
	Access [Recreational Fishing] → (Health and Well-being, Community Prosperity)	*Gen. direction (SEC)*
2	2. Fisheries and Oceans is responsible for providing **sustainable recreational harvesting opportunities** as part of integrated management plans consistent with its policies.	
	SEC Measures → Access [Recreational Fishing] → Desired Profits and Opportunities	**Key linkage (SEC)**

	CP21 Canadian Code of Conduct for Responsible Fishing Operations	*Fragment*
1	Implementation of the **Code** will contribute directly to the **conservation of stocks** and the protection of the aquatic **environment** for **present and future generations** of Canadians.	

	CP21 Canadian Code of Conduct for Responsible Fishing Operations	*Fragment*
	Best Practices and Standards → (Target Stock State, Ecosystem State [conserved, protected]) → Intergenerational Equity	Broad
2	For the purposes of this Code, sustainability is understood to mean the **harvesting of a stock** in such a way, and at a rate, that **does not threaten** the **health** of the stock, or **inhibit its recovery** if it has previously been in decline, thereby maintaining its **potential** to meet the needs and aspirations of **present and future generations** of fish harvesters.	
	Target Stock F → Target Stock Change → Target Stock State → Intergenerational Equity	**Key linkage (ECL)**
3	Establish fisheries **policies** in full consultation with management and other regulatory agencies to ensure **conservation of fish resources and protection of the environment**.	
	Good Governance [participation of Interests in DM] → Policy Instruments → (Target Stock State, Ecosystem State [conserved, protected])	Broad
4	Develop protocols (including, when practical and appropriate, the **use of selective fishing gears and practices**) regarding the **catch of non-targeted resources** which jeopardize the **health of the stocks**.	
	Responsible Practices → Bycatch Species F/Catch → Bycatch Species State	**Key linkage (ECL)**
5	Guideline #2.3 Ensure **fishing activities** are not conducted in a fashion that would **endanger fish stocks** or the **environment.**	
	Responsible Practices → (Target Stock State, Ecosystem State)	*Gen. direction (ECL)*
6	Employ **fishing practices** that minimize the **risk of gear loss.**	
	Responsible Practices → Habitat Interaction [Ghost Gear]	**Key linkage (ECL)**
7	Assist in the development of and participate in **education and training** programs that emphasize **responsible fishing** and **sustainable development practices**.	
	Education and Training → Responsible Practices → Sustainable Development	**Key linkage (IST)**

	CP22 Canada's Oceans Strategy	*Fragment*
1	First, the federal government will develop, support and promote activities to establish institutional **governance mechanisms** to enhance **coordinated, collaborative oceans management** across the federal government and with other levels of government.	
	Governance Mechanisms → Good Governance[collaboration]	**Key linkage (IST)**
2	As they are also the backbone of the **global transportation system**, **safe and secure navigable waters** are critical to the effective functioning of **Canada's national economy**.	

	CP22 Canada's Oceans Strategy	*Fragment*
	<u>Safe Working Environments → Non-Fishing Industries→ Community Prosperity</u>	**Key linkage (SEC)**
3	Oceans are facing severe environmental threats from **over-exploitation**, **pollution** from land-based and sea-based activities and the **alteration and destruction of habitats** and **ecosystems**. The **health of oceans** is affected by sewage and pollutant discharge in marine waters, excessive growth of marine plant life, **alien species introduction** and **changes to hydrology and sediment flow**.	
	(Target Stock F [overexploitation], Habitat interaction / contact [pollution, water quality], Habitat Change [destruction], Other Interaction [AIS]) → Ecosystem State[health]	*Gen. direction (ECL)*
4	Canada promotes the u**nderstanding** of oceans, ocean processes, marine resources and marine ecosystems to foster the **sustainable development** of the oceans and their resources;	
	Scientific Information → Sustainable Use	Broad
5	Canada's Oceans Strategy aims to promote the development of **private / public partnerships and standards** that will support existing and emerging ocean industries, and ensure the **conservation and sustainability of ocean resources**.	
	(Best Practices and Standards, Good Governance [participatory Decision-Making]) → Ecosystem State (Conserved protected, sustainable)	Broad
6	the application of conservation measures necessary to maintain biological diversity and productivity of the marine environment, including the establishment of marine protected areas;	
	Measures [MPA] → Ecosystem State [biodiversity, system productivity]	*Gen. direction (ECL)*
7	The broadly defined stewardship responsibility is designed to ensure that resources of the oceans are managed wisely, respect the stated principles, and protect oceans for the benefit and enjoyment of future generations.	
	Good Governance [shared Stewardship] → Ecosystem State [conserved protected] → Benefits to Humanity	Broad
8	By **influencing international priorities, decisions and processes**, Canada can help ensure its **sovereignty and security**, sustainable **ocean resources**, and support social and economic interests.	
	Good Governance [participatory Decision-making] → (Sovereignty and Security, Ecosystem State [sustainable])	Broad
9	Integrated Management establishes **advisory bodies** that consider both the **conservation and protection of ecosystems**, while at the same time providing **opportunities** for creating wealth in oceans- related **economies and communities.**	
	Governance Mechanisms → (Ecosystem State [conserved protected], Desired Profits and Opportunities) → (Industry Prosperity/Viability, Community Prosperity)	Broad

	CP22 Canada's Oceans Strategy	***Fragment***
10	Support economic **diversification** in **coastal communities** to ensure participation within the larger oceans economy;	
	Promote Diversification → Community Prosperity	*Gen. direction (SEC)*
11	Promote national and **international collaboration** to prevent illegal activity and **enforce** national and international **obligations;**	
	Good Governance [Participatory Decision-making] → Enforcement Actions → Legal or International Obligations	**Key linkage (IST)**
12	Provide **capacity** for effective implementation of ocean management regimes such as the **United Nations Convention on the Law of the Sea**;	
	Build institutional capacity → Legal or International Obligations	Broad

	CP23 Canada's Oceans Strategy: Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada	***Fragment***
1	It also recognizes the **significant opportunities** offered by the oceans and their resources for **economic diversification** and the generation of wealth for the benefit of all Canadians, particularly those in **coastal communities.**	
	(Promote Diversification, Desired Opportunities to Fish/Profit) → Community Prosperity → Benefits to Humanity	*Gen. direction (SEC)*
2	For **all Canadians and for the welfare of the planet**, there must be long-term **measures** to protect the integrity and biodiversity of the **marine environment**. As stewards of marine waters, Canada must strive to protect the ocean environment from growing pressures on ecosystems.	
	Measures → Ecosystem State [integrity, biodiversity] → Benefits to Humanity Influence of: Cumulative Effects	Broad
3	Conservation, based on an **ecosystem approach**, is of fundamental importance to maintaining biological diversity and productivity in our **marine environment.**	
	Good Approaches [EA] → Ecosystem State [biodiversity, system productivity]	Broad
4	Integrated Management will support **diversified,** balanced economic development of oceans and coastal waters by protecting their **health, preserving their biodiversity and maintaining their productivity.**	
	Good Approaches [IA] → **Ecosystem State [biodiversity, system productivity, health] → (Promote Diversification, New Opportunities / Dev't)**	**Nexus (ECL-SEC)**
5	Once adopted, Integrated Management will create **opportunities** for wealth generation through protecting critical marine **environments** and promoting sustainability of coastal and marine **ecosystems.**	

	CP23 Canada's Oceans Strategy: Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada	*Fragment*
	Good Approaches [IA] → **Ecosystem State [conserved protected, sustainable] → New Opportunities / Dev't → Opportunities to Fish / Profit**	**Nexus (ECL-SEC) Key linkage (SEC)**
6	Where information gathering and compilation can best be accomplished by community organizations or other partners, Fisheries and Oceans Canada may facilitate their efforts by **providing expertise and access to suitable databases**. **Fostering ocean stewardship** can also be achieved by promoting ongoing **education, research, improved access to information** and specific on the ground activities.	
	(Information made accessible, Education and Training, **Good Governance [Participatory Decision-making)) → Stewardship Ethic**	**Key linkage (IST)**

	CP24 National Framework for Canada's Network of Marine Protected Areas	*Fragment*
1	The important role of marine protected area **networks in protecting marine biodiversity is reflected in a number of** national and **international commitments** he vision for Canada's national network of marine protected areas is: An ecologically comprehensive, resilient, and representative national network of **marine protected areas** that protects the biological diversity and health of the **marine environment** for **present and future generations**.	
	Measures [MPA] → Ecosystem State [biodiversity, health] → (Intergenerational Equity, Legal or International Obligations)	Broad
2	With respect to ecological benefits, networks of **marine protected areas** can contribute by: • Protecting examples of all types of **biodiversity (both species and ecosystems);** • Helping to maintain the **natural range of species**; • Facilitating the protection of unique, endemic, rare, and threatened species over a **fragmented habitat**; • Enabling adequate mixing of the gene pool to **maintain natural genetic characteristics** of the population; and • Facilitating the protection of **ecological processes** essential for ecosystem functioning, such as **spawning and nursery habitats and large-scale processes** (e.g., gene flow, genetic variation and connectivity), which promote an **ecosystem-based approach to management.**	
	Measures [MPA] → (Ecosystem State [biodiversity], Target/Other Species States [genetic diversity, distribution range, conserved protected, at risk], Habitat State) → Good Approaches [EA] Influence of: Habitat functions	***Not used***
3	There are also a number of social and economic benefits which can result from the establishment of a network of **MPA**s, such as: • **Sustained fisheries**; • Enhanced r**ecreation** opportunities; • Promotion of **cultural heritage**; • Enhanced planning of ocean uses, including regional coordination; • Increased **support** for marine conservation; • More effective **outreach and education**; and • Enhanced **research and monitoring opportunities.**	

	CP24 National Framework for Canada's Network of Marine Protected Areas	***Fragment***
	Measures [MPA] → (Sustainable Use, Recreational Harvesting, Cultural Heritage and Identity, Public Awareness, Education and Training, Scientific Information)	Broad
4	Education: an area that offers an exceptional opportunity to inform the public about the value of protecting the marine environment or to enhance awareness of particular natural and cultural features or phenomena (e.g., through outreach programs, visitor centres).	
	Education and Training → Public Awareness → Foster Stewardship Ethic	**Key linkage (IST)**

	CP25 Canada's Federal Marine Protected Areas Strategy	***Fragment***
1	Oceans Act **Marine Protected Areas** established to protect and conserve important fish and marine mammal **habitats,** endangered marine **species**, **unique features** and **areas** of high biological productivity or biodiversity.	
	Measures [MPA] → (Ecosystem State [biodiversity, system productivity], Target/Other Species States and Habitat State [conserved protected]) Influence of: Habitat Function	*Gen. direction (ECL)*
2	This Federal Marine Protected Areas Strategy helps set the foundation for developing a **marine protected areas** network in Canada and aims to increase the ecological **effectiveness** and **connectivity** between individual marine protected areas in an effort to conserve and protect the structure and function of **marine ecosystems.** Establishing a network of **marine protected areas** within this planning context will increase the **effectiveness** and health of both individual marine protected areas and the network by ensuring that surrounding areas are managed in **a consistent manner**.	
	Measures [MPA, effective, consistent/integrated] → (Ecosystem State [structure, function, health])	*Gen. direction (ECL)*
3	**Mechanisms** for gathering of information, increasing **public awareness**, conducting research, and **ensuring participation** of those with an interest or role to play in marine protected areas planning and management will be established to improve **collaboration and cooperation amongst partners**	
	(Governance Mechanism, Public Awareness) → Good Governance (cooperation, participatory decision-making]	**Key linkage (IST)**

	CP25 Canada's Federal Marine Protected Areas Strategy	*Fragment*
4	Enhance **collaboration** for management and monitoring of marine protected areas. Develop site specific **collaborative** models including the: – Development of management **plans** that link marine protected area objectives and other conservation objectives (e.g. species at risk, fisheries, biodiversity, unique ecosystems); – Exploration of options **for working with Aboriginal Peoples** on marine protected area issues; – Development of a **science** and **traditional ecological knowledge** program; and – Development of common **public education and awareness** programs.• Conclude **collaborative management arrangements** on individual **MPAs,** including with Aboriginal groups.• Work together to identify **targets and indicators** (ecological, socio-economic, and government) to **evaluate the effectiveness** of marine protected areas and the network.• Conduct joint or complimentary **enforcement** activities, where possible.	
	(Good governance [participatory Decision-making], Education and Training, Public Awareness, Traditional and Local Knowledge, Scientific Information) → (Measures [MPAs], Objectives, Evaluation of Measures, Enforcement Actions, Good Governance [cooperation])	*Gen. direction (IST)*
5	**Increase awareness**, understanding and participation of Canadians in the marine protected areas network. • Establish an **MPA research program** (natural and social science considerations). • Launch an internet based geo-referenced MPA mapping system. • Develop common **MPA communications and public outreach tools** to **increase awareness** of marine issues and enhance Canadian marine literacy. • Develop **widely accepted definitions of key legislative and policy concepts** common to all federal marine protected area programs (i.e., ecological sustainable use, ecosystem-based management, precautionary approach).	
	(Information Made Accessible, Scientific Information) → Public Awareness	**Key linkage (IST)**
6	In some cases, coastal protected areas may provide **tourism benefits** to **local communities,** including opportunities for either **employment** or volunteer work.	
	Other Industries → Employment and Income → Community Prosperity	**Key linkage (SEC)**

	CP26 National Framework for Establishing and Managing Marine Protected Areas	*Fragment*
1	Effective **education** and **stakeholder support** can **reduce enforcement requirements** by: encouraging **participation** by interested parties, creating an understanding that leads to better **compliance**, providing **a forum**, through the partnering arrangements, for addressing concerns	
	(Education and Training, Support for Initiatives) → (Governance Mechanism, Good Governance [participatory Decision-making]) → Compliance of Resource Users	**Key linkage (IST) Within MA**

	CP26 National Framework for Establishing and Managing Marine Protected Areas	*Fragment*
2	Each MPA will be **evaluated periodically**, with input from the public, to determine whether it is fulfilling its purposes. If not, **changes may be recommended** to MPA regulations or management plans.	
	Evaluation of Measures → Measures [MPA]	**Within MA**

	CP27 Marine Protected Area Policy	*Fragment*
1	Achieving **sustainability** in the harvest of living ocean resources ultimately depends on **healthy, productive ecosystems**.	
	Ecosystem State [healthy, system productivity] → Sustainable Use	Broad
2	By **coordinating** the policies, programs and prospective sites amongst the different federal agencies, the **integrity and health of Canada's estuarine, coastal and marine waters** will be better maintained.	
	Measures [outputs: consistent] → Ecosystem state [health, integrity]	*Gen. direction (ECL)*

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
1 (similar to 2, 3)	Maintain **vital, healthy walrus stocks** and populations through **sustainable use** and **effective fishery management** consistent with the wildlife harvesting and management provisions under the **Nunavut Agreement.** (Sustainable Use, Indigenous and Treaty Rights, Good Governance [effective]) → Target stock state [healthy]	Broad
1	Support **effective fisheries management** through a defined **compliance program.** **Enforcement Tools → Good Governance [effective]**	**Key linkage (IST)**
1	Develop **training** materials for Inuit harvesters to **maximize harvest and minimize losses**. **Education and Training → Responsible Practices**	**Key linkage (IST)**
2	Support strategies to **increase feasibility** of commercial operations at more distant river locations **Access → New Opportunities / Development**	**Key linkage (SEC)**
2	**Maintain** and conserve local and **traditional fishing activities** and areas. **Desired Opportunities → Cultural Heritage and Identity**	**Key linkage (SEC)**
2 (similar to 3, 5)	Promote **fishing practices** that avoid or mitigate **impact on bycatch species**. Responsible Practices → Bycatch Change	*Gen. direction (ECL)*

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
2	Promote compliance through education and shared stewardship. Work closely with local and territorial wildlife officers. Promote compliance through increased presence, monitoring, and surveillance activities. **(Education, Good Governance, Enforcement Actions) → Compliance of Resource Users**	**Key linkage (IST)**
2	Improve the accuracy and completeness of **reporting bycatch** to **improve understanding of species** interactions and **management.** **Catch Monitoring [accurate, reliable] → (Scientific Information, Measures)**	**Within MA**
2	**Support initiatives** to optimize community-based **processing** and **employment** capacity. Support for Initiatives → (Other Industries, Employment and Income)	Broad
3	Support **effective fishery management** through reliable, timely and accessible **fishery information**. **Catch Monitoring [accurate, reliable] → Good Governance [effective]**	**Key linkage (IST)**
3	Support increased **market access** initiatives such as **eco-certification.** **Eco-certification → Market Access**	**Key linkage (SEC)**
3	Promote **fishing practices** that maximize **quality of the catch** thereby minimizing discards. **Responsible Practices → Catch/Product Quality**	**Nexus (IST-SEC)**
3 (similar to 5, 27, 28)	Promote **fishing practices** that avoid or mitigate **impacts on sensitive benthic habitats**. Responsible Practices → Habitat Change [sensitive]	*Gen. direction (ECL)*
4	Increase public awareness of the importance of narwhal **subsistence** to Inuit for **community cohesion, nutrition, and well-being**. **Opportunities [from FSC] → (Cultural Heritage, Food Security, Health and Well-Being)**	**Key linkage (SEC)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
5 (similar to 27, 28)	Within specified resource management constraints, to promote a **harvest level** that stabilizes **industry infrastructure** and **meets marketing requirements**, in the pursuit of **economic viability** objectives for the shrimp sector. **Catches → Industry Capacity and Structure** **Catches → Catch product quality → Market Access → Industry Prosperity and Viability**	**Nexus (ECL-SEC)** **Nexus (ECL-SEC)** **Key linkage (SEC)**
5 (similar to 21, 28, 29)	Utilize a **precautionary approach framework** when **setting exploitation rates** for the directed Fisheries. **Good Approaches [PA] → (Measures, Objectives/Ref Pts) → Target Stock F**	**Within MA** **Key linkage (ECL)**
5	At NAFO, for the Flemish Cap (3M) and 3L shrimp fisheries, to promote a TAC and quotas management scheme, or otherwise **controlling fishing effort** to achieve a sustainable fishery **Measures → Fishing Effort** → Sustainable Use	**Key linkage (ECL)**
6	The long-term objective is to ensure the **reproductive potential of the stock** is preserved by **implementing all of the elements** of the **Precautionary approach**. Initially, the focus will be on establishing biological reference points to define various states of the stock. **Good Approaches [PA] → (Measures, Objectives/Ref Pts) →** Target Stock State [reproductive potential]	**Within MA**
6	The short-term objective is **to minimize incidental catches** by ensuring that **trap configuration** allows for the **escape of undersized lo**bster and includes an effective biodegradable escape mechanism. **Measures → (Bycatch F, Target Stock F[undersized])**	**Key linkage (ECL)**
6	The medium term objectives are: o to **stabilize access** to the resource over longer periods to allow industry stakeholders to develop **long-term business plans**; o work with those fleets interested to facilitate fleet restructuring. SEC Measures [stable, predictable] → Industry Prosperity [Able to Plan Long-term]	*Gen. direction (SEC)*
8	Provide **access** for **food, social and ceremonial** purposes. - FSC (Food, Social and Ceremonial) **licences** are provided for large eels **SEC Measures → FSC Fisheries**	**Key linkage (SEC)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
8 (similar to 9, 10, 11, 12, 13, 14, 15, 16)	Do not cause unacceptable **reduction in productivity** so that components can play their role in the functioning of the **ecosystem**. **Ecosystem Response Impact [system productivity] → Ecosystem State [function]**	**Key linkage (ECL)**
8 (similar to 9, 10, 11, 12, 13, 14, 15, 16)	Do not cause unacceptable **reduction in biodiversity** in order to preserve the structure and natural resilience of the **ecosystem**. **Ecosystem Response Impact [biodiversity] → Ecosystem State [structure, resilience]**	**Key linkage (ECL)**
8 (similar to 9, 10, 11, 12, 13, 14, 15, 16)	Do not cause unacceptable **modification to habitat** in order to safeguard both physical and chemical properties of the **ecosystem**. Habitat Response Impact → Ecosystem State [properties]	*Gen. direction (ECL)*
8	Support **capacity reduction** in the adult eel fishery to reduce overall eel **mortality** **Industry Capacity and Structure → Target Stock F**	**Nexus (SEC-ECL)**
8	Distribute population component **mortality** in relation to component biomass, such that the standing **stocks** of American Eel in all suitable rivers are maintained Target Stock F [distribution range] → Target Stock State [components]	*Gen. direction (ECL)*
9	Keep **fishing mortality** of Southwest Nova Scotia / Bay of Fundy Herring moderate by using the following **references and risk tolerances**: […] (**Measures,** Objectives/Ref Pts**) → Target Stock F[moderate]**	**Key linkage (ECL)**
10	Keep **fishing mortality** of scallops moderate in SFA (Scallop fishing area) 29 West: Maintain current levels of exploitation and fishing patterns with respect to habitat suitability areas for minimal change in **biomass levels** Target Stock F [distribution range] → Target Stock State [biomass]	*Gen. direction (ECL)*
11	To **harvest at a conservative, sustainable level**, based on **sound scientific advice** that will continue to **protect the offshore lobster and Jonah crab resources;** Scientific Information→ Target Stock F [conservative, sustainable] → Target Stock State [protected]	*Gen. direction (ECL)*

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
11	to **harvest** at a level that will continue to **protect the adjacent inshore lobster stocks that may be biologically linked to the offshore stock(s);** Target Stock F → (Target Stock State [components] → Associated Fisheries)	*Gen. direction (ECL)*
15	Support **Certification** for sustainability - **Provision of data**, where available **Make Information Accessible → Eco-certification**	**Key linkage (SEC)**
17	Ensure the charter boat fishery **is monitored** to ensure **consistent application of the guidelines** **Catch Monitoring → Compliance of Resource Users**	**Key linkage (IST)**
17	Continue to **monitor** the **impact of the fishery on bycatch species** including sharks, marine mammals and sea turtles. Scientific Information → Bycatch Species Change	*Gen. direction (ECL)*
17	Continue to **work with harvesters** to **maximize the return** on **every fish harvested.** Good Governance [participatory DM] → **Catch Quality → Desired Profits and Opportunities**	**Key linkage (SEC)**
17	Provide conditions to allow the charter boat fishery to continue to **develop** into an **economically prosperous venture.** New Opportunities/Dev't → Industry Prosperity/Viability	*Gen. direction (SEC)*
17	**Work with ICCAT contracting parties** to negotiate **additional fishing opportunities** using **inter-country transfers.** **Good Governance [participatory DM] → SEC Measures** → Desired Profits and Opportunities	**Key linkage (IST)**
17	Implement **measure** to address **safety at sea** concerns. **SEC Measures → Safe Working Environments**	**Key linkage (SEC)**
17 (similar to 18, 23,25)	achieve **high compliance rates** through effective monitoring and compliance **programs** **Enforcement Tools → Compliance of Resource Users**	**Key linkage (IST)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
19 (similar to 20, 24, 26, 27)	Given the importance of capelin in the food web and for the ecosystem, conservation and the long- term sustainability of capelin is one of DFO (Fisheries and Oceans Canada)'s most important objectives. It is vital that the stock grow and provide benefits for all stakeholders in the short and long-term. As such, DFO (Fisheries and Oceans Canada) will **work with all stakeholders** to ensure this objective is achieved and that the **capelin stock** allows for an **economically viable and self-reliant fishery.** Good Governance [participatory DM] → Target Stock State → Industry Prosperity/Viability	Broad
19 (similar to 20, 24,26)	**Harvest levels** will be set that allow the **stock to grow** and achieve a **higher TAC** (Total Allowable Catch) than current levels. Consideration will be given to the level of recruitment in this stock. Furthermore, the capelin fishery will be managed such that catches are not concentrated in a manner that would result in **high exploitation rates** on any of the **stock components**. **<u>Target Stock F → Target Stock Change</u>** → **<u>Target Catch → Desired Profits and Opportunities</u>** Target Stock F → Target Stock State [components]	**Key linkage (ECL) Nexus (ECL-SEC)** *Gen. direction (ECL)*
19 (similar to 20, 24, 26, 27)	The **sustainability of capelin as a species** within **the food web** (as both a prey species and consumer) will strengthen the long-term **health of the ecosystem**. Target Stock State [sustainability] → Ecosystem State [health] ACT Ecological Relationships	*Gen. direction (ECL)*
19 (similar to 20, 22, 23, 24, 26, 27)	To **conserve the capelin resource** to **provide commercial sustainability** to fish harvesters Target Stock State [conserved] → Sustainable Use	Broad
19 (similar to 20, 21, 22, 23, 24, 25, 26, 27, 28)	To mitigate the **impacts on other species, habitat and the ecosystem** where capelin fishing occurs, protecting **biodiversity and ecosystem structure and function** (Other species change, Habitat Change, Ecosystem Change) → Ecosystem State [biodiversity, structure, function]	*Gen. direction (ECL)*

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
19 (similar to 5, 20, 21, 22, 23,24, 26, 27, 28)	To employ effective **monitoring** and surveillance **tools** and mechanisms that ensure **compliance with conservation measures** and provide scientists with appropriate information and **basic data required to manage** the capelin fishery (**Enforcement Tools, Catch Monitoring) → (Compliance of Resource Users, Measures / Plans)**	**Key linkage (IST) Within MA**
19, (similar to 20, 21, 22, 23, 24, 26, 27, 28)	Establish an effective **consultative process** for resource users to **participate in decision-making** process. **Governance Mechanism [effective] → Good Governance [participatory DM]**	**Key linkage (IST)**
21 (similar to 5)	To promote cost-effective **harvesting strategies** that ensures **compliance** with management and conservation measures **Measures/Plans [cost-effective] → Compliance of Resource Users**	**Key linkage (IST)**
21 (similar to 28, 29)	**Control fishing mortality** by **setting annual TAC** (Total Allowable Catch), or other limitations, taking into account the impact of the fisheries in the ecosystem where appropriate. **Measures/Plans → Target Stock F**	**Key linkage (ECL)**
21	To promote at the Canada-France Advisory **Committee annual meeting**, where applicable to the stock, a **Total Allowable Catch** (TAC (Total Allowable Catch)) to achieve a **sustainable groundfish Fisheries.** **Governance Mechanism → Measures/Plans** → Sustainable Use	**Within MA**
21	Use key departmental criteria of **adjacency**, **historical dependence**, and **economic dependency** and **land claims obligations** when considering new **allocations**. **SEC Measures → (Control Access [adjacent, dependent, historical],** Indigenous/Treaty Rights)	**Key linkage (SEC)**
21	Ensure **compliance** with management measures intended to foster an **orderly fishery**. **Compliance of Resource Users → Good Governance (Orderly)**	**Key linkage (IST)**
23	enhance the spring and fall spawning **components** of the 4R herring stock so that allocations, **landings and total value** of the resource can reach their full potential **Target Stock State[components] → Catches Yields → Desired Opportunities and profits**	**Key linkage (ECL) Nexus (ECL-SEC)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
27	To develop an **ecologically-based management regime** for a **sustainable fishery** through a better **understanding** of stock dynamics of the resource. **Scientific Information → Good Approaches [EA]** → Sustainable Use	**Within MA**
27	Aboriginal **access and allocations** are maintained and **opportunities for additional access** are addressed. **Access and Allocation → New Opportunities for Development**	**Key linkage (SEC)**
28	To facilitate an **orderly** and productive fishery through **maximizing benefits within the industry, adjacent communities** and the Province. **Industry, Community Prosperity → Good Governance**	Broad
28	**Minimize other sources** of fishery induced mortality by**: Minimize fishing activity** during times of peak soft-shell to avoid discard mortality. **Promote proper handling practices** and minimizing the by-catch of crab in other fisheries; and Introducing **disincentives** to high-grading as well as appropriate **monitoring and enforcement measures** (Catch monitoring, enforcement tools, incentives, measures, responsible practices) → Target Stock F	Broad
28	Maximize **yield per recruit** through the **avoidance** of soft-shell crab**.** **Target stock F → Target stock Catch**	**Key linkage (ECL)**
28	**Management decisions** are made through the annual harvest planning **process**. **Governance mechanisms → Measures**	**Within MA**
31 (similar to 32, 36, 37, 39, 40, 42, 43, 44, 45)	Manage fisheries to **provide opportunities** for **economic prosperity** Desired Profits and Opportunities → Industry Prosperity and Viability	*Gen. direction (SEC)*

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
31 (similar to 32, 33, 34, 38)	The overall goal of Fisheries Management in the Pacific Region is the **conservation of Canada's fisheries resources** to ensure **sustainable resource utilization** and generate **economic prosperity**, accomplished through **close collaboration** with resource users and stakeholders based on shared stewardship consistent with **treaty and Indigenous rights**, providing First Nations with **priority access** to the resource for **FSC purposes** after conservation. Target Stock State → (Sustainable Use, Industry Prosperity and Viability) (Participatory DM, Indigenous and Treaty Rights) → Industry Prosperity and Viability **SEC Measures → Food, Social and Ceremonial Fisheries** → Indigenous and Treaty Rights	Broad Broad **Key linkage (SEC)**
31 (similar to 32, 38)	An open and transparent **consultation process** will be maintained for management issues related to the Pacific sardine fishery, including the annual **development of an IFMP**, **long-term direction** of the fishery, and to **increase information** posted on the DFO consultation website to allow for wide review of all relevant material. **Governance Mechanism [open, transparent] → (Measures / Plans, Objectives, Make Information Accessible)**	**Within MA**
31 (similar to 32, 39)	DFO will continue to **work collaboratively** with First Nations to provide **opportunities** to harvest fish for **food, social, and ceremonial (FSC) purposes**, in a manner consistent with the Sparrow Decision (SCC 1990) and for treaty and Indigenous commercial fisheries. Good Governance [participatory DM] → **FSC Fisheries → Desired Opportunities**	**Key linkage (SEC)**
31 (similar to 32, 33, 38)	DFO will DFO will **work collaboratively** with commercial fishery participants to: • Provide reasonable **fishing opportunities** in a manner that ensures long-term **sustainability of the resource**. • **Monitor** fish stocks and fish harvest to develop knowledge of the stock. Good Governance [participatory DM] → (Desired Opportunities, Target Stock State [sustainable], Catch monitoring)	Broad
31 (similar to 32, 36, 37, 38, 39, 40, 42, 43, 44, 45, 46)	DFO will continue to provide **opportunities** for **a recreational fishery** for sardine. **Recreational Harvesting → Desired Opportunities**	**Key linkage (SEC)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
32 (similar to 33, 34, 38)	Base management **decisions** on the best available **scientific information** **Scientific Information [best available] → Measures**	**Within MA**
33 (similar to 32, 38, 43)	Provide **stability and predictability** in fisheries management and **improved governance** through an open and transparent consultation **process** **Governance Mechanism [open, transparent] → Good Governance [stable, predictable]**	**Key linkage (IST)**
33 (similar to 36, 37, 39, 40, 42, 43, 44, 45, 46)	To develop **fishing plans** and co-operative research programs which will contribute to **improving the knowledge base** and understanding of the resource; **Measures/Plans → Scientific Information**	**Within MA**
33 (similar to 31, 32, 34, 36, 37, 39, 40, 42, 43, 44, 45, 46)	To ensure **conservation and protection of invertebrate stocks** and their **habitat** through the application of **scientific management** principles applied in a risk averse and **precautionary** manner based on the **best scientific advice** available. (Scientific information [best available], Good Approaches [PA]) → (Target Stock/Habitat State [conserved, protected])	Broad
34	The objective of the current Eulachon fishery is to respond to conservation concerns with Fraser River Eulachon stocks and introduce **measure**s to allow for stock **rebuilding** Measures → Target Stock Change [rebuild]	*Gen. direction (ECL)*
35	A **better understanding** of the influence of varying exploitation rates on the resilience of local populations in years of poor survival (caused mostly by climate and predator effects on euphausiids) may be needed to **support new policies** developed under the Sustainable Fisheries Framework. **Scientific information → Legal or Policy Instruments**	**Within MA**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
38	The Department's objectives undertaking of this process is to provide transparent **decision making**, and choosing the best performing **management procedures** for Pacific Herring. Additionally, the Department aims to facilitate **collaboration**, as well as fulfill many of the other objectives listed in section 5.3, including **sustainable harvest**, Indigenous **FSC access**, and **economic opportunities**. To date, the initiative has included the development of **Limit Reference Points** (LRPs) and a first cycle of **MSE simulation evaluations** for the SOG and WCVI major stock assessment areas. Governance Mechanism[transparent] → (Measures, Scientific Information, Reference Points, Good Governance [collaboration], FSC Fisheries, Desired Opportunities, Sustainable Use)	Broad
40 (similar to 42, 43, 45)	First Nations involvement in the commercial fishery is a shared goal between DFO and Aboriginal people. **First Nation participation** in the commercial fisheries is being addressed through DFO Aboriginal fisheries **programs.** **SEC Measures → Promote Indigenous Capacity**	**Key linkage (SEC)**
46	To consider **opportunity for the development** of the **aquaculture** industry **New Opportunities/Dev't → Other Industries [aquaculture]**	**Key linkage (SEC)**
53	5.3.1 Develop a **comprehensive approach involving all fishing industry participants** to **reduce illicit activity.** **Good Governance [participatory DM] → Compliance of Resource Users**	**Key linkage (IST)**
53	5.5.5 **Educate the non-Aboriginal population** on the importance of the **food, social and ceremonial** fishery. Public Awareness → FSC Fishery	Broad
54	Collect information from **local knowledge** via established **communication network** and take this knowledge into account in **scientific processes**. **Governance Mechanism → Traditional or Local Knowledge → Scientific Information**	**Within MA**
57	Ensure **engagement of seal harvesters** in the development and implementation of plan **objectives**. **Good Governance [participatory DM] → Objectives**	**Key linkage (IST)**
57 (similar to 4)	Socio-Cultural: increase public awareness of the importance of sealing to Inuit and Atlantic Canadians for **community cohesion, nutrition, and well-being**. (**Cultural Identity, Food Security, Health and Well-being) → Community Prosperity**	**Key linkage (SEC)**

IFMP No.	*Objective Network Fragments from IFMPs*	*Fragment*
58 (and similar therein)	Keep **fishing mortality** of North Atlantic swordfish moderate **by setting a TAC** (Total Allowable Catch) (13,700t in 2012) with a high probability of **maintaining stock levels that would produce MSY** (Maximum Sustainable Yield), with greater than 50% probability. **Measures → Target Stock F[moderate]** → Target Stock State [MSY]	**Key linkage (ECL)**
59	Increase certainty that **harvesting** occurs at an optimum sustainable level to ensure the long- term viability of the **resource**, Target Stock F [sustainable] → Target Stock State [viable]	*Gen. direction (ECL)*
59	Enhance industry's **level of participation** in the management of this resource to **benefit Canadians** Good Governance [participatory DM] → Benefits to Humanity	Broad