Strategic Framework for Fishery Monitoring and Catch Reporting in the Pacific Fisheries

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Table of Contents

1. Introduction

Faced with a myriad of challenges, including climate change, declining fish stocks, reduced economic viability, an evolving global marketplace, and heightened competition for aquatic resources, Canada's Pacific fisheries are undergoing reform. Demands for sustainable management that considers the larger ecosystem, respects Aboriginal rights, strengthens engagement of resource users in decision-making, and finds solutions to allocate scarce resources are putting pressure on governments and fishery interests alike. In many fisheries, the distrust of reported catch data and inconsistent monitoring has helped to fuel conflicts between harvesting groups.

Reliable, timely and accessible fisheries information is the foundation of sustainable management. While the importance of good catch data is certainly not new to the Pacific Region, the worldwide trend towards sustainable fisheries and supporting management practices is calling for significant improvements in monitoring and reporting. In this environment, it is vital that our fisheries have a consistent approach to determining information requirements and monitoring programs—one that inspires confidence and cooperation among harvesters, global consumers and the Canadian public.

This discussion paper sets out a strategic framework to guide Pacific fishery monitoring and catch reporting into the future. The framework was developed by Fisheries and Oceans Canada (DFO) in consultation with First Nations, commercial and recreational harvesters and other stakeholders. It is intended to serve as one of the tools within the Sustainable Fisheries Framework of DFO's overarching Fisheries Modernization agenda. As such, the purpose of this tool is to provide a common understanding of the importance and need for fisheries monitoring and catch reporting standards. This framework is intended to provide guidance to Pacific Region staff and to all harvesters (Commercial, Recreational, aboriginal food, social and ceremonial (FSC)) on various catch monitoring requirements and the development and application of specific standards. However, DFO recognizes that not all fisheries operate on the same basis or have the same impact therefore a consistent risk-based approach to the development and application of catch monitoring standards in all fisheries is included (see Appendix 2).

While this framework addresses the information requirements for all fisheries, it recognizes the unique basis for FSC fisheries, for which the right to access is constitutionally protected and provided priority over other harvest sectors..

Policy context

Fisheries Modernization is the Department's national initiative to achieve a long-term stable approach to fisheries management decision making, support the conservation and sustainability of fisheries resources and set the context for greater economic prosperity. Central to this initiative is the Sustainable Fisheries Framework (SFF) established in 2009 to consolidate existing and new fisheries sustainable development policies and tools [1]. The SFF embodies a precautionary, ecosystem-based approach to management and seeks to stabilize fishery allocations through defined sharing arrangements between harvesting sectors. This move to clearer allocations or shares both within the commercial fisheries and more generally between harvest sectors in all fisheries, in turn, requires enhanced catch accountability to ensure that all removals are properly considered.

[1] See http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm for a full list of the Sustainable Fisheries Framework tools and policies

Important policies and tools of the evolving SFF include:

A Fishery Decision-Making Framework Incorporating the Precautionary Approach - This policy applies to key harvested fish stocks managed by Fisheries and Oceans Canada; that is, the fish stocks that are the specific and intended targets of a commercial, recreational, or subsistence fishery. It may be applied more broadly to other stocks, if necessary or as circumstances warrant. The Framework requires that a harvest strategy be incorporated into respective fisheries management plans to keep the removal rate moderate when the stock status is healthy, to promote rebuilding when stock status is low, and to ensure a low risk of serious or irreversible harm to the stock. It also requires a rebuilding plan when a stock reaches critical levels.

Integrated Fisheries Management Plans (IFMPs) – IFMPs are the primary tool for balancing the ecosystem, social and economic dimensions of fishery decisions. These plans include arrangements for food, social and ceremonial and treaty fisheries by First Nations, selective harvesting, other regulatory harvest measures and decision-rules and documentation of information requirements and monitoring programs. All of the new SFF policies and tools will be implemented through existing IFMP processes. Fishery managers in collaboration with harvesters and other interests, will address ecosystem and fisheries management risks and monitor progress in meeting associated goals. Various tools (such as internal DFO Fishery Checklists) will be used to collect data and input into transparent performance reporting.

Fishery monitoring and catch reporting requirements must support these and other SFF components—for example, the Policy for Managing the Impacts on Sensitive Benthic Areas, Policy on New Fisheries for Forage Species and the Policy Framework on Managing Bycatch and Discards — as they are finalized and implemented.

"Canada's Policy for Conservation of Wild Pacific Salmon" (WSP) (DFO 2004) has important implications for the application of this Strategic Framework to the monitoring of salmon fisheries. In establishing salmon conservation units (CUs) as a key focus for decision making, specific additional harvest information is required (especially in chinook, coho and sockeye fisheries) to address fisheries encompassing numerous CUs. Furthermore the WSP highlights the importance of understanding and incorporating broader ecosystem values into integrated plans and monitoring performance against objectives over time.

Canada's Selective Fishing Policy also requires greater accountability to ensure identified selective fishing standards and objectives are being achieved (DFO 2001).

Key drivers for change

In recent years, developments at the regional, national and international levels have required the need for better monitoring and reporting:

Sustainability and public confidence – Canadians expect their fisheries to be managed in a precautionary way that conserves the resource and allows sustainable use. They are demanding more transparency and accountability in resource decision-making. Public confidence is increasingly important for the Pacific fisheries, providing a social license to operate in the marine environment where there are many competing uses (Gislason 2007). Building that confidence requires clear evidence, through sound catch reporting data, confirming that fisheries are indeed environmentally, socially and economically responsible.

Co-management – Globally over the past decade, new models of fisheries governance have emerged that recognize local stewardship and shared responsibility for resource decisions. Co-management[2] with First Nations and other fishing interests is a major component of Pacific fisheries reform and DFO is pursuing collaborative strategies through its harvest advisory processes, Aboriginal fisheries initiatives and integrated oceans management (DFO in prep (a)). To succeed, co-management must be backed by high-quality fisheries information that can support greater confidence and mutual trust among harvesters and other participants in decision-making.

Aboriginal rights, treaties and other agreements – The First Nations Food, Social, Ceremonial (FSC) fishery is unique, having developed over many years through a blend of legislation, case law and negotiation. FSC fisheries have priority access to the resource, second only to conservation needs. Evolving Aboriginal rights require accurate and comprehensive monitoring of fisheries to ensure that these rights are respected. Some FSC fisheries are actively changing as the harvesting interests and capacities of First Nations evolve over time. In some cases this contributes to a shift in management risk(s) requiring greater attention to the management and monitoring of these fisheries.

Existing and future First Nations Treaties and other domestic and international obligations, such as the Pacific Salmon Treaty and various UN agreements (e.g., UNEP Convention on Biological Diversity, Straddling Fish Stocks, Highly Migratory Fish Stocks, Maximum Sustainable Yield),[3] also necessitate higher standards of fishery monitoring and catch reporting.

An ecosystem perspective – International commitments (i.e., Food and Agriculture Organization, United Nations General Assembly, The Convention on Biological Diversity), along with the domestic *Oceans Act* and *Species at Risk Act* (SARA), compel the Department to adopt a broader ecosystem-based approach to resource management, of which catch accountability is a significant component. An ecosystem approach to fisheries management looks beyond a single species, sector or activity to examine the cumulative impacts of all human actions on the ecosystem. This means managing fisheries, not just for stock productivity, but also for biodiversity and habitat integrity (DFO 2009a).

The global push for integrated ecosystem-based management is expanding the scope and complexity of monitoring systems. Aside from basic catch and biological sampling data on the target stock, information requirements now encompass bycatch of non-targeted fish, seabirds, sea turtles, and marine mammals; regulated releases and discards of target and non-target species; encounters with species that are not captured; and impacts of the fishing operation on habitats.

Share-based fisheries – To remain viable at a time of increased competition, an increasing number of commercial fisheries around the world are being managed by defined shares or established quotas. In DFO Pacific Region, quota systems have been implemented for the

[2] defined as "a process or arrangement whereby the roles, responsibilities and accountabilities for sustainable fisheries and resource management are shared between DFO, First Nations, other levels of government and stakeholders".

[3] In particular, a series of international agreements have enshrined the use of a precautionary, ecosystem approach to fishery management, including the 1992 *United Nations Convention on Biological Diversity*, 1995 *Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks,* and 2002 Johannesburg commitment to achieve Maximum Sustainable Yield by 2015.

commercial groundfish and roe herring fisheries as well as for several shellfish fisheries (e.g., geoducks).

These management regimes are dependent upon timely and verifiable fisheries data to confirm harvests against catch limits. Indeed, one of the benefits of share-based systems is that they require greater accountability of fisheries through enhanced monitoring and catch reporting enabling greater public confidence and achievement of catch limits and eco-certification standards. Evidence for the Pacific fisheries suggests that, better monitoring and management has contributed to compliance with total catch levels, fleet rationalization and improved economic performance, as well as greater sustainability and conservation (Gislason 2007; Fraser 2008).

Selective fishing - Selective fishing techniques (e.g., fish wheels, traps, weirs, dip-nets) can be used to harvest target fish stocks or species while protecting less productive stocks and/or species of concern. These selective fisheries typically incorporate more intensive monitoring, to determine effectiveness and compliance, bycatch levels and specific release rates. Similarly, mark-selective fisheries allow fishing opportunities for hatchery-raised salmon when a fishery might otherwise be closed to protect wild salmon. These opportunities also have specific information requirements related to rates of coded wire tags (CWT) retrieval and other related information.

Market demands for proof of seafood sustainability and demands for traceability – A changing world marketplace has growing expectations for enhanced accountability on the part of fisheries and seafood suppliers. In particular, retailers, consumer and ENGO demands for proof, in the form of third-party ecocertification or positive assessments by ENGOs, that seafood products come from sustainable fisheries, and the demands for traceability programs to provide assurance about the origin of a product both require more rigorous monitoring and reporting procedures (traceability programs may be developed for various reasons including providing assurance that a product comes from a safe source, from a certified fishery or a legal fishery).

The Pacific halibut, sablefish, hake, dogfish, sockeye and pink salmon, and albacore tuna fisheries have all been certified by the Marine Stewardship Council (MSC). MSC certification of several fisheries (including Pacific sockeye salmon) remains conditional upon demonstrated improvements of catch reporting for both retained and discarded catch. These certification and traceability requirements, in turn, can increase market access and add value for Pacific fishery products.

What is Fishery Monitoring and Catch Reporting?

Fishery monitoring means observing and understanding the fishery and its dynamics (DFO 2002). It includes observation and examination of the catching and landing of fish and any related activities, such as counting vessels, gear and sampling of any fish caught. Monitoring is carried out by harvesters, First Nations and, increasingly, third party observers designated by DFO. Departmental staff including fishery officers, fishery guardians, fishery managers, biologists and scientists also conduct monitoring activities.

Catch reporting means providing information either verbally, in writing or electronically on catch and other essential details related to fishing activity (e.g., location, gear type, etc.). Reporting is performed by harvesters or by fish buyers, off-loaders or designated third party dockside monitors/observers on behalf of harvesters.

Other activities associated with monitoring and reporting include the specification of catch information and biological sampling requirements, auditing of collected data for accuracy and completeness, information management, compliance enforcement of catch reporting regulations and licence conditions, summarizing and analysis of catch and fisheries monitoring data, and communication of catch estimates and other information within DFO and to harvesters and the public.

The current status of monitoring and reporting

Fishery monitoring and catch reporting in the Pacific fisheries has evolved since its inception more than a half-century ago (See for e.g., DFO 2002; Beath et al. 2004; DFO 2009b; DFO 2009c). Today, the level of information gathering ranges from no monitoring in some fisheries (e.g., remote recreational and First Nations shellfish harvesting) to enhanced monitoring programs (as exemplified by the integrated commercial groundfish fishery). The extent and intensity of monitoring requirements varies significantly with the fishery's size and location, particular management risks and information challenges, and other factors.

Over the years, outside reviewers including the Auditor General of Canada and the Pacific Fisheries Resource Conservation Council have identified shortcomings in fishery monitoring and catch reporting. In response, DFO committed to pursue shared accountability and the development of "basic standards for monitoring and reporting" in consultation with all harvesting groups (DFO 1999). In 2002, the Department released a *Pacific Region Fishery Monitoring and Reporting Framework* setting out principles with which to review and improve fishery monitoring and catch reporting systems (DFO 2002). The framework also identified a number of fishery attributes (geographic scope, number of species, fishing power, etc.) for consideration when determining specific monitoring and reporting strategies.

Building on that work, selected measures have been taken to improve monitoring and reporting in various fisheries. Under the pilot Integrated Groundfish Program launched in 2006, full accounting of all catch and 100 per cent at-sea video monitoring was implemented for all commercial

groundfish hook and line and trap vessels.[4] A preliminary review in 2008 of the pilot program found that more timely and comprehensive information on fish catch, including releases, had successfully modernized this fishery subsequently enabling full market access, eco-certification and global recognition of sustainable fisheries management (Fraser 2008).

Other recent monitoring developments include:

- Several commercial invertebrate fisheries, such as Geoduck, Sea Urchins, Sea Cucumber and Euphausiid have operated under 100% Dockside Monitoring Programs for many years. Some dive fishery licence areas also use independent On-Grounds Monitors for additional verification and fishery management tasks. The Crab fishery uses enhanced monitoring to verify vessel and harvesting activity electronically (GPS tracking, hydraulic sensors, video cameras). The Prawn fishery has been testing Vessel Monitoring Systems (VMS) and electronic logs (e-logs) to enable faster, more accurate data reporting and fleet tracking.
- Several commercial demonstration salmon fisheries, such as the Area F troll fishery on the North Coast, have adopted enhanced monitoring to verify all catch in a pilot quota fishery; as well, all gear types have been testing electronic logs (e-logs) to enable faster, more accurate data reporting.
- Some pelagic fisheries including herring food and bait, herring roe, herring special use, herring spawn on kelp and sardine require 100% dockside validation. Herring Food and Bait, and sardine require and at sea observers ranging from 25-100% coverage. These tools as well as hail and vessel logbooks programs are used to meet specific fishery monitoring objectives.
- Customized E-logs have also been piloted by some commercial fleets, sport fishing guides, and lodges and recreational creel surveys have also evolved to include halibut and other groundfish information.
- In FSC fisheries, a new role (Data Management Advisor) to better plan for and coordinate data collection for several First Nations has been successfully piloted; further, catch calendars and customized data systems have been adapted in many communities to collect and forward local catch data.

Despite such improvements, deficiencies remain in information gathering, in terms of coverage of the fisheries, missing or unreliable data (particularly on bycatch and discards), reporting delays and other issues. A preliminary analysis on monitoring and reporting levels of Pacific fisheries including every species group and harvesting sector, identified that there were many fisheries in need of better monitoring and reporting. Consequently, a systematic approach must be applied for determining fishery information requirements and how best to meet them.

[4] This change filled a monitoring and reporting gap for the commercial groundfish fisheries, which already had 100% on-board observer coverage for the trawl fleet and 100% dockside monitoring across all fisheries. Prior to the program, the trap/hook and line fleet was subject to only partial (10 to 15%) on-board observer coverage.

A Look Back at Pacific Fishery Monitoring Programs

Commercial sector: In 1951, catch reporting began for the commercial salmon fisheries with the submission of sales slips generated at time of landing showing the quantity, value and species of the catch. As fisheries developed, this approach became increasingly flawed due to its failure to account for releases/discards, time lags between fishing and catch deliveries, non-compliance and other problems. In 1998, as part of *A New Direction for Canada's Pacific Salmon Fisheries*, logbooks and on-board observers were introduced to address some of these deficiencies. Harvesters record their kept and released catch and report the results by telephone and mail. In addition to fisher-supplied data, for most commercial salmon fisheries trained observers collect detailed data on the harvest and bycatch as well as biological samples (e.g., lengths, weights, tissue for DNA analysis).

The use of at-sea observers in the groundfish fisheries dates back to the late 1980s. Mandatory 100% observer coverage was implemented for the groundfish trawl fleet in 1996. By 1994, most of the fleet also had compulsory dockside monitoring in place, where DFO-approved monitors documented the harvest at designated landing sites. While all groundfish fisheries now require 100% dockside monitoring, this approach is used only periodically in the salmon fisheries, e.g., for the commercial salmon demonstration projects and the lower Fraser River pilot sales fishery.

Other techniques including on-ground hails, charter patrols and aerial over-flights have also been used to provide gear counts, location and timing of fishing and additional information. The recent emergence of video monitoring and electronic vessel tracking systems offers potential cost efficiencies and more timely data reporting.

Recreational sector: From the mid-1950s through the 1970s, DFO estimates of catch and effort in the sport fishery relied on subjective assessments by fishery officers and small-scale creel surveys. The need for greater rigour and consistency led to the launch in 1980 of a major creel survey program focused on salmon for the Strait of Georgia. Since then, creel surveys have been added for other coastal areas and in some freshwater systems, as the scope of recreational fishing has expanded geographically and to include other species. To conduct these surveys, aerial over-flights estimate effort and fishery technicians visit marinas, boat ramps and river locations to interview anglers about their catch and take biological samples where needed.

A risk-based strategic framework

In July 2007, a five-year Pacific Integrated Commercial Fishery Initiative (PICFI) was announced to support environmentally sustainable and economically viable commercial fisheries. Among the PICFI elements were Co-management and Enhanced Accountability Measures to strengthen fishery monitoring, catch reporting and enforcement. This second element promised consistent, transparent standards for monitoring and reporting in the commercial sector, with the proviso that enhanced information requirements would also be needed in the recreational and FSC fisheries (DFO 2007).

Arising from the Integrated Salmon Dialogue Forum, a multi-stakeholder Monitoring and Compliance (M&C) Panel was formed in 2008 to examine ways to improve monitoring, catch reporting and compliance in the salmon fisheries. This independent panel of representatives from

First Nations, commercial, recreational and conservation interests has been working with DFO to "map a better pathway for monitoring and compliance." (Integrated Salmon Dialogue Forum 2011)[5]

Under the PICFI Enhanced Accountability work plan, DFO and the M&C Panel have collaborated on the development of a strategic framework for fishery monitoring and catch reporting. During this time, the Department also prepared some draft interim standards for monitoring and reporting in the commercial salmon fisheries, as well as a discussion paper on First Nation FSC catch monitoring.[6] In addition, work proceeded to define internal accountabilities for fishery monitoring and reporting and to prepare the infrastructure for the better provision and accessing of fisheries data.[7]

The strategic framework outlined below is meant to develop an improved monitoring and reporting system that balances the biological (ecosystem) risks and management requirements for Pacific fisheries. In keeping with the 2002 policy guidance on catch monitoring and reporting, it applies consistent risk assessment criteria to each fishery, but allows for final monitoring and reporting requirements that reflect the fishery's unique characteristics (see Figure 1).

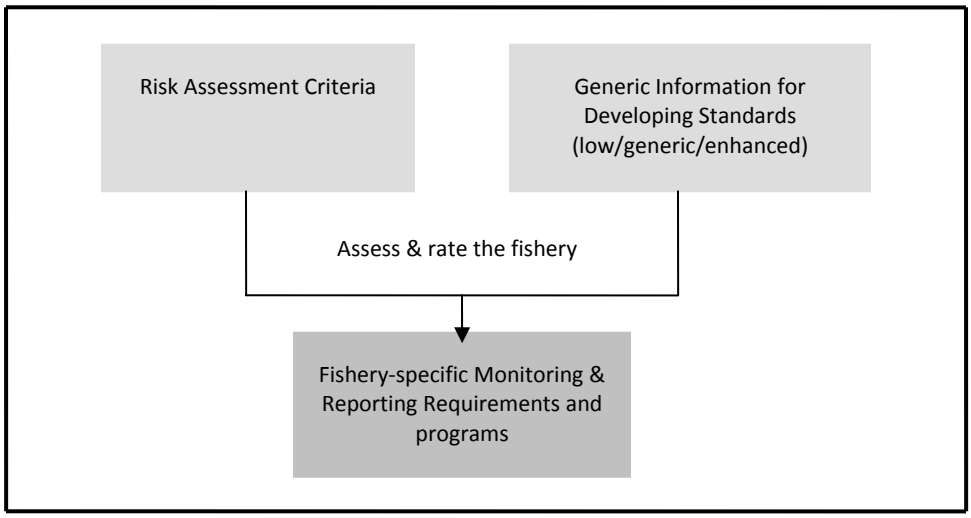

Figure 1. Approach for Monitoring and Reporting Standards

2. Goal and Guiding Principles

DFO has consolidated its efforts on current initiatives and emerging trends to support sustainable fisheries across Canada. This consolidation initiative, Fisheries Renewal, has put in place new

[5] Integrated Salmon Dialogue Forum M&C Panel. The Forum itself was created as a means to bring together various fishing interests to work towards a sustainable salmon fishery.

[6] See DFO (2008), *Interim Fishery Monitoring and Catch Reporting Standards for Commercial Salmon Fisheries* (Draft for Discussion); and Lightly and Masson (2009), *First Nation FSC Catch Monitoring and Reporting: Preliminary Considerations, Standards and Recommendations* (Draft for Discussion). The draft interim commercial salmon fishery standards were developed for discussion purposes and were never applied; instead, some ad hoc improvements were made through commercial demonstration salmon fisheries, as noted above. The FSC fisheries discussion paper will inform upcoming consultations with First Nations.

[7] See further under Sections 3 and 4

policies, tools and mechanisms to support a robust and diverse fisheries sector. Fisheries Renewal is being implemented through policy and process guidance that support DFO's vision of prosperous fisheries based on credible, science-based, and cost-effective fisheries management programs. Improvements in fishery monitoring and catch reporting contribute significantly to Fisheries Renewal objectives.

Long-term sustainability – A comprehensive risk-based monitoring and catch reporting program is essential for evaluating and reporting on a fishery's progress towards long-term sustainability. Broadening the scope of information collected to include discards, bycatch, sensitive habitat and other environmental impacts supports the continued application of an ecosystem-based management approach to fisheries.

Economic prosperity – By providing the data needed to demonstrate fisheries are managed sustainably , comprehensive monitoring and reporting systems can help to maintain or improve access to fishing opportunities and specialty markets and the resulting benefits for harvesters, coastal communities and other stakeholders.

Long-term planning and a stable approach to decision-making – a new management approach based on longer term planning and strategies including use of "evergreen" (multi-year) IFMPs, stable allocations and development of strategic business plans in the fishing industry that includes an enhanced role for harvesters in assuming the responsibilities and costs for fishery monitoring and reporting.

DFO's vision is for a monitoring and catch reporting system across all Pacific fisheries that inspires increased confidence, fosters collaborative management and supports an ecosystem approach.

Goal

To have accurate, timely and accessible fisheries data, such that there is sufficient information and public confidence for all Pacific fisheries to be managed sustainably and to meet other reporting obligations and objectives.

An effective fisheries management regime requires "close collaboration with resource users and stakeholders based on shared stewardship." For that collaboration to happen, Resource Managers, harvesters, First Nations and other stakeholders must all be satisfactorily assured on the amount, depth and quality of fishery monitoring and catch reporting data. The public, in turn, is more likely to have confidence in management decisions and their successful implementation if there is a broad-based understanding and acceptance of the information behind these decisions.

In addition to serving the needs of sustainable management, monitoring programs must be adequate to meet the provisions of domestic and international agreements, First Nations treaties, harvest allocation arrangements, fishery certification requirements and any other reporting obligations.

Principle 1: Conservation and sustainable use

Fishery monitoring and catch reporting must provide the right information to support prosperous, sustainable fisheries that ensure the protection of fish populations, their habitat and the broader ecosystem.

Sustainable fisheries based on the conservation of resources are the ultimate objective of better monitoring and reporting systems. Sustainability means that fish stocks are harvested in a way that

meets today's needs without compromising the ability of future generations to satisfy their own requirements. Pacific fisheries must be able to clearly demonstrate their sustainability, in environmental and socioeconomic terms, if they are to be viable for the long term.

The growing national and international concern around ecosystem impacts of fishing has put a spotlight on the need to demonstrate the long-term sustainability of fisheries. The information necessary to sustain and protect fishery resources and their habitat is the first priority of monitoring and reporting. Monitoring will encompass documentation of all catch including, retained target fish stock(s), releases, and bycatch and discards, as well as information on further components of the ecosystem such as habitat impacts. Key additional information required includes, for example, specifics on species at risk and critical habitat such as estuaries and sponge reefs. Where a fishery has significant ecosystem impacts, these impacts must be adequately assessed and tracked over time. Comprehensive monitoring and reporting information is also key to gathering the data to manage to identified limits and to evaluate the success of a chosen management and/or harvest strategy.

The Policy Framework on Managing Bycatch and Discards, part of DFO's Sustainable Fisheries Framework, describes in detail the need to account for total catch, including bycatch and discards (DFO in prep (b) – also see Appendix 1).

The Uses for Fisheries Information

Fishery monitoring and catch reporting provides information of value to DFO, other government agencies at the local, provincial, federal and international levels, First Nations and stakeholder groups. Monitoring programs serve a variety of purposes.

Resource Managers use data on the quantity, timing and location of catch and bycatch as well as vessel and gear details to make in-season management decisions, e.g., opening and closing fisheries. This information also guides pre-season fisheries planning and post-season evaluations. Scientists need data on fishing mortality and various biological characteristics (e.g., size, age, sex, feeding behaviour) to conduct stock assessments and research. Fishery officers require catch and other data to carry out compliance and enforcement with respect to catch and bycatch limits, gear restrictions, area closures, seasonal restrictions and other regulations and licence conditions.

Government planners and policymakers use fisheries information for socioeconomic analyses (e.g., to assess the employment and income impacts of different harvest regimes) and administration of programs including employment insurance and workers compensation. In addition, data must be provided to meet the specific reporting provisions of domestic and international treaties and agreements, such as the Nisga'a Treaty, regulations by the International Pacific Halibut Commission and UN fisheries agreements.

Principle 2: Consistency and transparency

While monitoring and reporting requirements will vary by fishery, they will apply equally to all harvesters and will be determined based on consistent criteria and in a transparent manner that allows information to be easily accessed and understood by Resource Managers, other data users and the general public.

Different fisheries require different levels of information, in view of their individual characteristics and risks (see Principle 3). However, it is vital that a standardized approach be used when determining the appropriate information level for each fishery. In every case, fishery managers

must clearly explain the requirements for monitoring and catch reporting, and how they were derived, to harvesters, other stakeholders and the public.

A consistent set of criteria will guide the determination of monitoring and reporting requirements for all Pacific fisheries. These criteria will consider the status of retained target and non-target stocks, discards, habitat and ecosystem impacts, allocation arrangements and other factors. For any given fishery, the resulting requirements will apply consistently to all harvesters.

Information management systems must provide timely access to monitoring and catch reporting data to serve fisheries management and other uses. The information should be of defined quality and in a consistent format that enables various kinds of data (e.g., fishing effort and catch, catch from different fisheries in the same area) to be integrated. It will be stored in centralized data systems that balance the need for access by all users with the protection of proprietary information.

Principle 3: Tailored requirements

Information requirements will depend on the nature and scope of the fishery, reflecting the particular risks and management regime; and they may evolve over time.

The level of fishery monitoring and catch reporting has to respond appropriately to the complexity and degree of risk associated with each fishery. Such flexibility is consistent with the precautionary approach, which requires increased risk avoidance—in this case, enhanced information gathering—where there is greater uncertainty or risk of serious or irreversible harm.

Information requirements will vary by fishery with certain key characteristics, risk factors and reporting obligations, including:

- Single stock or single species fishery versus multi-stock or multi-species fishery;
- Abundant, healthy target stock versus stock or species of concern;
- Extent and status of bycatch, discard mortality and other ecosystem impacts;
- Economic and socio-cultural value of the fishery;
- Fishing power and exploitation rate; and
- Open access or competitive fishery versus quotas or defined shares.

If the fishery is more complex, with higher biological, socio-economic and other risks, or there are specific reporting needs to be met, then monitoring and catch reporting will be more intensive. This enhanced requirement will be expressed in terms of information attributes, for example, greater detail in the fishery data collected, a higher frequency of reporting, or more precision and accuracy of estimates derived from the data.

Monitoring and reporting requirements may evolve with changes in the nature and intensity of the fishery as well as in the management approach. For instance, some management measures may allow the information level to be reduced while maintaining an acceptable degree of risk (e.g., by modifying the harvest area or gear after assessments have identified high-risk factors).

Principle 4: Shared accountability and access

Everyone involved in monitoring and reporting—harvesters, DFO and third parties—must be committed to providing timely, accurate fisheries information. Continued access to the resource and its benefits is contingent on all harvesting groups fulfilling their roles in data provision and meeting identified compliance levels.

DFO's responsibilities include ensuring the effective management and control of fisheries, compiling, analyzing and auditing catch estimates and related information, integrating it into established databases, and publicly reporting the data as required.

Harvesters are individually and collectively responsible for complying with management regimes and controls and providing fishery monitoring and catch reporting data. This includes collecting, recording and communicating all catch and fishery monitoring information. DFO will work with harvesters on planning and implementing the specific monitoring and reporting programs for individual fisheries. Increasingly in Pacific fisheries, harvesters have been assuming responsibility for the costs of monitoring and reporting. Over the long term, all harvesting groups in every fishery are expected to bear their share of costs to meet these information requirements.

All participants need to appreciate that their responsibility will be increased where a higher level of information is required to manage ecosystem risks, or to satisfy other management objectives. Harvesters may experience sustained or greater access to fishing and additional resource benefits if the right data are available to properly address these elevated risks and/or other objectives. Conversely, a failure to comply with monitoring and reporting requirements may lead to restrictions on fishery openings and future fishing opportunities.

The effective monitoring and catch reporting of fisheries requires high levels of compliance. Failure to comply with monitoring and reporting requirements and other priority regulations and Conditions of Licences will require Resource Managers to review alternatives to addressing fishery risks such as adjusting the management regime or reducing the scope and nature of harvest opportunities. Collaborative processes will identify required compliance rates for and anticipated responses to, non-compliance. Incentives and disincentives will be highlighted in these discussions.

Principle 5: Cost-effectiveness

Fishery monitoring and catch reporting programs will ensure that the information requirements are achieved as cost-effectively as possible.

Various tools and methods are available for collecting and transmitting data, each with its own costs and benefits. For example, more effective monitoring programs could be designed and shared between fisheries and sectors to achieve efficiencies while still meeting specific requirements. The challenge for Resource Managers and harvesters is to agree on a monitoring program that balances rigor, affordability and practicality of implementation. This is not to say that programs will sacrifice accuracy and thoroughness of information gathering for lower harvester costs. In cases where an enhanced monitoring program is not affordable, a more conservative harvest regime (e.g., by controlling area, time, effort or gear type) may be required to adequately manage the risks.

3. Strategic Approach

The Department will implement this Strategic Framework within ongoing Pacific fisheries operations. The remaining work involves six basic strategies (see Figure 2):

1. Determine fishery-specific monitoring and reporting requirements and level;
2. Collaborate with harvesters to plan and implement monitoring and reporting programs to meet the fisheries' requirements and specify roles and responsibilities;

3. Complete development, implementation and management of the fisheries information management system ("PacFish") and identify ongoing support and maintenance requirements;
4. Collaborate as appropriate to clarify accountabilities, develop funding mechanisms, identify capacity needs and other support;
5. Improve collaboration between Resource Managers, Conservation and Protection (C&P) and harvesters to achieve integrated compliance management.
6. Continually improve monitoring and reporting requirements, best practices and technologies.

Strategy 1: Monitoring and Reporting Requirements

DFO Resource Managers will use consistent criteria to confirm the information level needed for each fishery and work with harvesters to develop tailored requirements for fishery monitoring and catch reporting.

A risk assessment tool has been prepared to determine monitoring and reporting information requirements for Pacific fisheries (Appendix 2). Components of this assessment are distilled from, and build on, the list of questions in the Fishery Checklist Resource Managers use as part of IFMP planning and the Ecological Risk Analysis Framework for Coldwater Corals and Sponge Dominated Communities (DFO in prep (c)). Resource managers will work with harvesters to review the ecological risks and management requirements of each fishery and review current efficiency of monitoring and reporting programs and identify gaps.

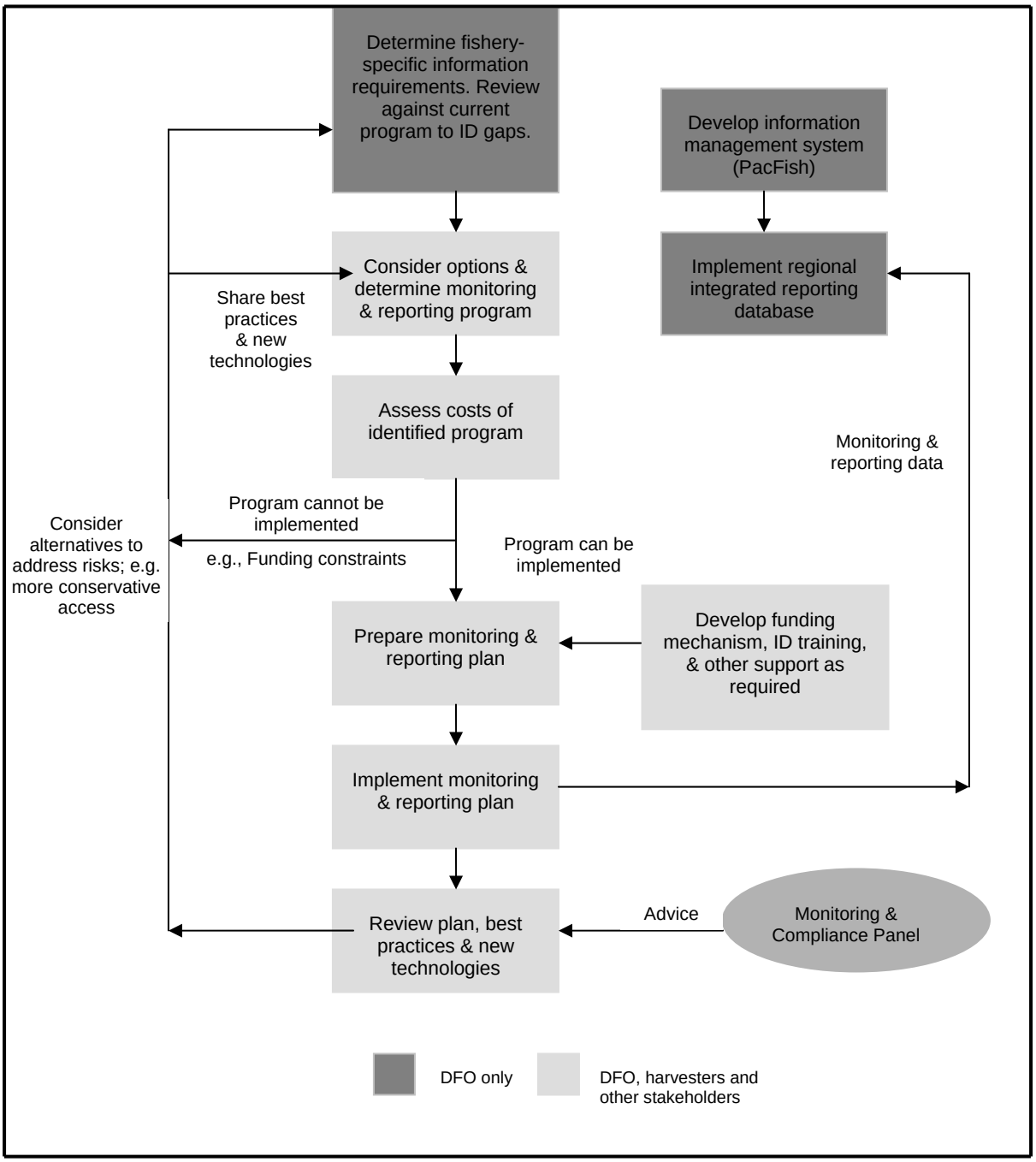

Figure 2. Monitoring and Reporting Process for Pacific Fisheries

In general three levels of monitoring have been established based on criteria that considers key biological and ecosystem impacts and resource management requirements: Low, Generic and Enhanced (Figure 3). Each level outlines requirements for quantitative versus qualitative information on catch, effort and ecosystem impacts, as well as for statistical quality (i.e., precision/accuracy) and independent verification).

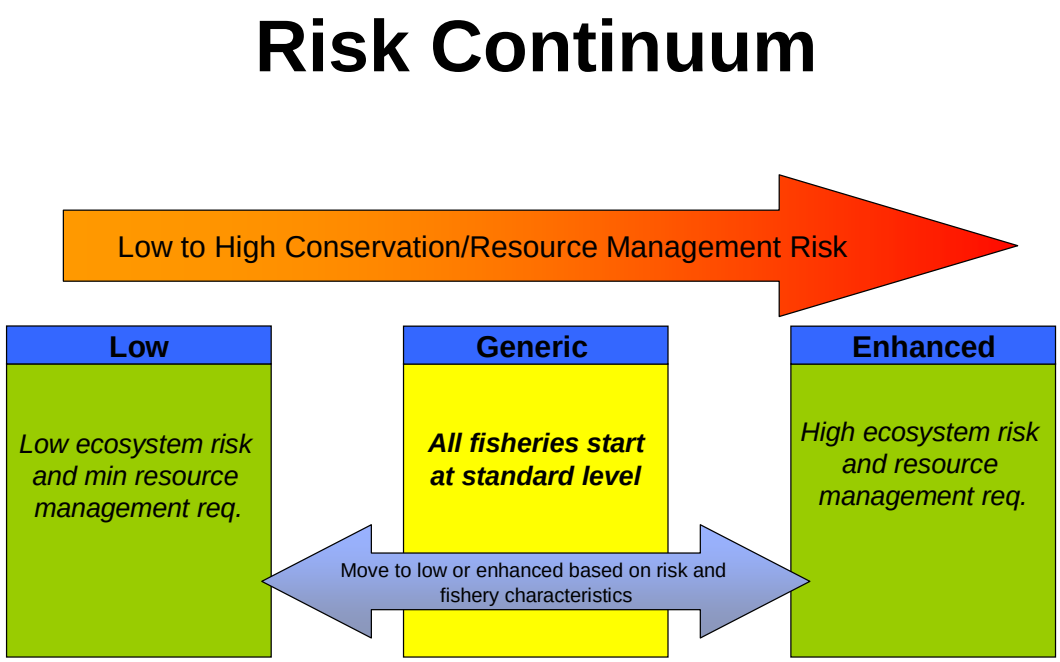

Figure 3. Risk continuum showing three levels of information requirements to address risk

The generic level (the middle level) is the ***starting point*** to assess monitoring required for all Pacific fisheries. Depending on how a fishery is assessed against the criteria, it may then move to either low or enhanced. Over time, changing circumstances will more often raise information requirements to the enhanced level. This approach recognizes that, as long as the criteria is applied consistently, not all fisheries will require the same level of monitoring (i.e., one format does not apply to all fisheries) (see above box for examples).

Once Resource Managers have determined the appropriate monitoring level, they then must develop specific monitoring and reporting requirements for their fishery consistent with the specific levels identified. Table 2 shows the information attributes that can be used to express these fishery-specific requirements.

Table 2: Information Attributes for Monitoring Requirements

Attribute/Description	Sample Components
Content – type of data to be collected	Catch – number and/or weight, retained and discarded , location and time Fishing effort – number of harvesters and/or units of gear, gear type/details, location and length of time fished Biological characteristics – stock, age, sex, length/weight, flesh colour, marks/ tags, etc. Ecosystem impacts – amount of bycatch, retained and discarded , condition of releases, number and nature of other species encounters, extent and nature of habitat and other ecosystem impacts Socioeconomics – e.g., landed price/value, value of fishing experience, interactions with other fisheries and industry (e.g., FSC fishery, aquaculture operations)
Resolution – level of detail	By species/stock, gear type, area/sub-area/specific location, etc.
Statistical Quality – precision and accuracy	Estimates within x% of the true value, x% of the time (e.g., +/-5%, 9 times out of 10) Percentage coverage by independent verification (as a tool for bycatch monitoring)
Timeliness – frequency and response time of monitoring and reporting	Frequency – annually, monthly, daily, every half-day, after every set Response time – e.g., within 24 hours of harvest, post-season by a certain date
Data Format and Delivery	Format – uniform data coding, standardized reporting formats Delivery methods – electronic, mail, telephone/radio, etc. (see Table 3)

Strategy 2: Monitoring and reporting programs

DFO will work with harvesters and others to identify and implement a cost-effective package of monitoring and reporting measures to meet the specified information requirements.

The tools and methods commonly used for fishery monitoring and catch reporting are listed in Table 3. There are two broad categories of activity that can be combined in various ways to provide the necessary level and attributes of monitoring and catch information:

- **Fisher dependent** techniques rely on individual harvesters or groups of harvesters to monitor and report on their own catch. In reality, no one is better positioned to monitor the fishery and associated catches than the participants themselves. Given positive engagement, adequate training and the appropriate reporting technologies, this type of information gathering can be very cost-effective when accurate.

  On the other hand, a fisher dependent approach has limitations. For example, it can be hindered by non-compliance, a lack of key information (e.g., releases, bycatch) and

unreliable data communication. Independent verification can remove or reduce many of these problems.

- **Fisher independent** monitoring and reporting is typically carried out by regulatory authorities (i.e., DFO fishery officers, managers, scientists and other staff) and designated third party observers. This type of approach is preferred where conservation risks are high, catch quotas or defined shares must be confirmed, or there are other circumstances that demand greater objectivity and certainty of information.

  Independent monitoring techniques vary considerably in the kinds of data they can collect. As with any sampling program, they also have their own inherent biases. In general, these tools and methods are often expensive and it can be problematic extrapolating the data to the entire fishery.

Table 3: Monitoring and Reporting Tools and Methods

Data Gathering Tool		Data Delivery Method
Fisher Dependent	**Fisher Independent**	
Commercial sales slips Logbooks (paper/electronic) Fisher hail-ins/hail-outs Harvester/creel surveys Fisher collected biological Samples	Aerial gear counts (over-flights) On-water gear counts (charter patrols) On-board observers Camera systems (video monitoring) Dockside monitoring Post-season buyer/supplier surveys	Mail Internet/intranet/e-mail Telephone/radio In-person interviews Real-time vessel monitoring

For each fishery, Resource Managers and harvesters will come together to decide on the appropriate combination of measures for meeting the information requirements from Strategy 1. They will begin by reviewing the current monitoring and reporting program to determine its adequacy and identify any required improvements. Where changes are necessary, the participants will review the options and develop a mutually agreeable monitoring and reporting program.

The costs of the identified program must then be estimated. If the program is affordable, it can be implemented; if not, the level of information requirements may be relaxed in exchange for a more conservative harvest opportunity or management regime (e.g., a pooled fishery). In this way, the process can be iterative, whereby discussions on monitoring measures and costs lead back to a re-examination of the options to manage fishery risks and standards.

In order to gain efficiencies, the potential for coordinated monitoring and reporting measures across fisheries must be explored. The joint collection of biological data and the use of dockside monitoring programs for multiple fisheries are examples of possible efficiencies. Fisheries should also share information on best management practices and take advantage of cost-effective technological advances as much as possible (see Strategy 6).

Strategy 3: Data management

DFO will complete the development of its major information management framework, PacFish, to facilitate access to Pacific fisheries data for Resource Managers and other users. Ongoing support and maintenance requirements are to be identified and incorporated into operational budgets.

The Pacific Region has a multi-year project under way to develop an information management framework for Pacific fisheries. PacFish aims to provide the human resources, data and technology for enabling the effective management and use of fisheries data. When completed, the project will represent a fundamental change to the management of fisheries information in the Pacific Region and ensure that:

- Users of fisheries information have easy and secure access to timely, complete and consistent data of defined quality;
- The data collected serve both local and broad (integrated) needs;
- Data and technology management has clear accountabilities and is cost-efficient and service-oriented; and
- A comprehensive framework is in place to guide the future evolution of Pacific fisheries data and associated systems.

Under the framework, information from monitoring and reporting programs will be subject to common data standards and formats and will be stored and managed in designated enterprise repositories. Within DFO, a regional data group will be responsible for determining standards, guidelines, accountabilities and processes for data transfer and management. This central unit will coordinate the work of various sub-groups organized by species grouping and/or harvesting sector. Cross-fishery data will be consolidated in a regionally integrated reporting database to facilitate user access. Other fishery or species-specific data will be available to users through a variety of Fishery Data Systems.

Strategy 4: Other program support

The Department will work with harvesters and others to clarify accountabilities, develop funding mechanisms, identify and address capacity needs, and provide further support for monitoring and reporting programs, as required.

Clarification of DFO and harvester responsibilities for various fishery monitoring and catch reporting functions must clearly documented and updated.

Where fisheries do not have self-funding mechanisms in place to recover monitoring and reporting costs, DFO will consult with harvesting groups on options for these mechanisms and a suitable schedule for their implementation.

Effective monitoring and reporting programs require not only sufficient funding but also the appropriate skills for information gathering and management. Individual harvesters may lack the knowledge necessary (e.g., the ability to identify different species) to conduct fishery monitoring and catch reporting on their own or as part of a structure monitoring program. DFO will work with harvesters to clarify monitoring requirements for each fishery and to foster cost-effective local technical capacity. This may include support for training and certification of First Nations and others as technicians and monitors.

Strategy 5: Integrated Compliance Management

Improve collaboration between Resource Managers, C&P and harvesters to achieve integrated compliance management.

The monitoring and catch reporting of fisheries requires effective and well supported high levels of compliance. C&P will strengthen its role in integrated management processes by providing

leadership in collaborative processes with Resource Managers and harvesters to identify compliance targets for priority requirements, regulations and conditions of licences.

In addition, this collaborative approach will attempt to reach agreement on and improve understanding of the anticipated responses to non-compliance.

Regionally, C&P will continue to support the Monitoring and Compliance Panel in an effort to establish effective incentives for fostering harvester support of agreed fishery controls and information requirements. C&P will also reach out to harvesters with information and open dialogue about the fundamental importance of ensuring effective controls in support of desired changes in fisheries management.

Strategy 6: Continual improvement

Regular reviews will be conducted to update standards and monitoring and reporting programs and evaluate progress; as well, best management practices and new technologies will be identified.

Monitoring and reporting plans will be developed through the harvest advisory processes and in collaboration with First Nations. The plans and their requirements, in turn, will be included in IFMPs. Documentation of fishery-specific information requirements and monitoring standards, monitoring program details, and the duties and accountabilities of the various participants will be included.

Monitoring plans and requirements must be revised over time in response to natural shifts in the resource and ecosystems, changes in fishing power, the impact of management measures and other factors. The process of reviewing existing standards against the assessment criteria and developing monitoring and reporting programs and plans will be repeated periodically and revisions will be made, as needed. These regular reviews will also provide a means to communicate new policy priorities and evaluate overall success in improving the information required for sustainable management and other objectives.

To promote cost-effective, state-of-the-art monitoring and reporting, it is important to take advantage of best practices and new and emerging technologies for information gathering and management. A collaborative process such as the M&C Panel can be used to identify these opportunities. Additionally, the M&C Panel can have an ongoing role in looking for ways to coordinate efforts across fisheries and tracking region-wide progress on monitoring and reporting (Figure 2).

4. Summary and Next Steps

To support sustainable fisheries management and other Pacific Region priorities, fishery monitoring and catch reporting must be improved in all harvest sectors across the majority of Pacific fisheries. The Strategic Framework establishes a consistent basis for the development of catch monitoring standards in all fisheries. The second principle requiring consistent application of criteria to determine the level of information requirements and the third principle which recognizes that differences exist between fisheries and must be appropriately considered, are particularly relevant for applying the framework to the development of monitoring standards specific to each type of fishery. The ultimate objective is to build trust in Pacific fisheries and their management by enabling accurate, timely and accessible information in which harvesters, other fishery interests and the public can have confidence.

Implementing the strategic framework will involve a multi-year process with harvesters and other partners, the details of which will be determined through existing advisory processes. Important early steps for proceeding with implementation are:

Local Actions:

- Resource Managers to collaborate with fishery representatives (First Nations, harvest advisory groups, etc.) to determine the fishery specific information requirements. The Strategic Framework risk-assessment criteria are then used to determine the level of monitoring.
- The current monitoring programs can then be reviewed against these requirements to identify gaps and areas for improved monitoring.
- Monitoring program options must be considered and analyzed for operational feasibility and affordability. If harvesters are unable to support the required monitoring program , a discussion about more conservative or limited access (e.g., a change in the management regime) will need to occur.

Regional Actions:

- Changes to monitoring programs within a harvest sector typically require an integrated and coordinated approach to achieve affordability, consistency and effectiveness. Thus the development of a strategy to move forward with changes within harvest sectors and major fisheries is required.
- Regional discussions will assist in developing priorities for improvements and changes (where required) and developing options for phasing in improvements. Opportunities to link mechanisms for cost effective implementation should be considered.

  For example, significant progress has recently been made in the development of a recreational monitoring strategy by a Sport Fish Advisory Board (SFAB)/DFO Catch Monitoring Working Group. This broad strategy, using the Strategic Framework for guidance, links together similar recreational fisheries throughout the region and establishes standards for monitoring programs for recreational fisheries of similar risk. In this way recreational fisheries at each level will be using the same fundamental monitoring tool and/or program mix. Area Resource Managers will continue to work at the local level to review specific fisheries with local SFAB groups following the local actions described above, but would incorporate the regional strategic approach described here. Other key processes in place include the Catch Monitoring Working Groups of the Commercial Salmon Advisory Board and the Sardine Integrated Advisory Board.

  Regional advisory processes (e.g., Groundfish Integrated Advisory Board, Commercial Salmon Advisory Board, Herring Advisory Board and Sardine Integrated Advisory Board) will include strategic discussions on minimum standards and longer term monitoring objectives
- DFO remains committed to consulting with First Nations on the implementation of their FSC fisheries and associated monitoring programs. However, there are many opportunities for improved coordination, consistency and effectiveness by interacting at area aggregates or tribal council / watershed levels. Common FSC implementation

issues and challenges (such as fishery monitoring and catch reporting) can also be effectively considered at the regional First Nation Fisheries Council level.

- Continue to support PacFish development, implementation and the associated ongoing maintenance.
- Two key positions established in Pacific Region, The Regional Monitoring Coordinator and the Regional Fisheries Data Coordinator are central to the implementation and coordination of this framework. The Regional Monitoring Coordinator will support the development of fishery-specific monitoring standards, coordinate implementation of monitoring programs across fisheries and harvest sectors to ensure consistent application of the risk-based criteria and identify emerging information requirements. The Regional Fisheries Data Coordinator will guide the implementation of standards, data management accountabilities, common technologies and the consolidation of data into designated enterprise databases to support the effective management and use of fisheries data. These two positions will work together to ensure that data collected by fishery monitoring programs meets objectives, is of sufficient quality and timeliness and is available to all users.
- C&P will work with Resource Managers and harvesters to develop fishery-specific compliance targets and clearly outline responses to non-compliance.

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Appendix 1

Draft Policy Framework on Managing Bycatch and Discards

Statement Summary (as of June 30, 2011)

Scope and objectives

The scope of this Policy is national, and it applies to all commercial, recreational and Aboriginal fisheries licensed and/or managed by DFO under the *Fisheries Act*. It also applies to fisheries managed by DFO operating outside of Canada's Exclusive Economic Zone.

Reflecting Canada's international commitments and its adoption domestically of an ecosystem approach to management, the objectives of the policy are to:

1. Ensure that Canadian fisheries are managed in a manner that supports the sustainable harvesting of aquatic species and that minimizes the risk of fisheries causing serious or irreversible harm to bycatch and discard species;
2. Account for total catch, including bycatch and discards.

Guiding principles

Overarching principles used to guide the application of the policy were drawn from DFO policies and management frameworks developed in recent years - e.g., economic prosperity[8], transparency and accountability, ecosystem approach to fisheries management[9], integration of Aboriginal traditional knowledge and other local and traditional knowledge and shared stewardship.

Core strategies to achieve the objectives

Develop data collection and monitoring systems that will support timely, accurate, and aggregated reporting on retained and discarded bycatch species.

Evaluate the impact of fishing on bycatch species, whether they are retained for use or discarded.

Minimize the capture of discarded bycatch species and specimens, to the extent practicable.

[8] http://www.dfo-mpo.gc.ca/sds-sdd/2011-2012/index-eng.htm,
[9] http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm

Where discarding of bycatch species and specimens is unavoidable, maximize the potential for live release and post-release survival.

Manage the catch of retained bycatch species and specimens so as not to exceed established harvest levels for the species.

Develop appropriate measures to manage bycatch and regularly evaluate their effectiveness.

Implementation of the policy framework will be phased in over time, according to national and regional priorities and resource availability.

Appendix 2

RISK ASSESSMENT TO DETERMINE THE REQUIRED LEVEL OF FISHERIES MONITORING

1.0 Introduction

The *Strategic Framework for Fisheries Monitoring and Catch Reporting in Pacific Fisheries* outlines an approach to strengthen fishery monitoring and catch reporting in all fisheries. The goal for fisheries monitoring and catch reporting as set out in the Framework document is:

> *To have accurate, timely and accessible fisheries data, such that there is sufficient information and public confidence for all Pacific fisheries to be managed effectively and sustainably and to meet reporting obligations and objectives.*

Monitoring and reporting programs currently vary considerably both within and between harvest sectors and specific fisheries. A key component of the framework includes the development and application of standardized criteria to assess and assign monitoring levels to all Pacific fisheries. The purpose of developing standardized criteria is to establish a common understanding of catch monitoring requirements across all fisheries.

The purpose of this document is to provide a risk assessment method to be used as a decision making tool to determine the required level of monitoring as outlined in the Framework. Fisheries have impacts on marine species, habitats and ecosystems that go beyond impacts on target species. There are many different ways to assess risk. This approach examines the risk the fishery activity presents to an ecosystem component(s) and outlines a process for assessing the ecological effects of fishing (on species - retained, released, species of concern, and communities, habitats) and the requirements of the accompanying management regime.

The assessment applies to all commercial, recreational and Aboriginal fishing activities licenced and/or managed pursuant to the *Fisheries Act, Fishery General Regulations, Pacific Fishery Regulations* and the *Coastal Fisheries Protection Act*, including any such fishing activity licence and/or managed by the Government of Canada outside Canada's Exclusive Economic Zone. It is based on approaches taken in the Ecological Risk Analysis Framework for Coldwater Corals and Sponge Dominated Communities (DFO 2013). It is also based on similar risk analysis frameworks and approaches produced by Hobday *et al.* (2011) and Holt *et al.* (in prep). Changes may be made to the risk assessment when further information and experience indicates that significant improvements to the framework are necessary.

Completion of the risk assessment on a given fishery will be led by DFO Resource Managers, C&P and Science staff. DFO will also collaborate, when possible, with stakeholders while conducting the assessment. Results of a risk assessment and accompanying monitoring strategies will then be incorporated into IFMPs.

2.0 Criteria

The monitoring criteria incorporate an evaluation of the ecological effects of fishing and the requirements of the accompanying management regime. Table 1 describes the types of ecosystem components and management requirements/regimes that need to be considered when assessing the impacts of fishing. At level one, three main ecosystem components are identified: species, community and habitat. If an impact is identified at level one, more focussed criteria can be used to help determine where the effect lies. A hierarchical approach then defines the significance of each ecosystem component (see Table 1). The risk assessment may focus on a a single or it may involve several components and more detailed effects. It is important to note that species and community components can include species, stocks or conservation units (CUs). Table 1 helps identify specific effects a fishery has on the ecosystem. This is then used as the basis for the risk assessment description in Section 4.

Table 1. Examples of risks to ecosystem components and resource management requirements and/or regimes.

	Component	Examples
Ecosystem Risks	Species impacts (species, stocks or CUs) (includes all retained, released/discarded species) -	• Potential for overharvest above identified levels or limits • Stock vulnerability and susceptibility o life history characteristics o degree fishery negatively impacts stock • Risk of injury or death of released/discarded animals • Behaviour changes resulting from disruptions from fishing activities (includes noise) o displacement and/or interruption to breeding, migration etc. • Status o SARA listed species and/or stocks of concerns o Wild Salmon Policy o Precautionary Approach Framework
	Community impacts	• Specific interactions with and impacts on species including alterations to assemblages of species o forage species DFO (2008) o predator/prey species o SARA listed and/or stocks of concern
	Habitat impacts (benthic or pelagic)	• Direct changes to structure, composition or destruction as result of fishing activity o impact on identified sensitive areas o overlap with marine protected areas, national marine conservation areas, marine parks or other protected areas • Indirect changes to habitat feature/function due to indirect impacts of fishing activity o Sedimentation, prey dispersement or removal

Resource Management Requirements/Regimes	• Ensuring sufficient information is available to make critical resource management decisions:	• Quota vs derby management information requirements • Timeliness of catch information - during or post season • International/treaty information requirements • information to manage availability of fish for FSC fisheries
	• Enforcement and compliance targets	• Determination of enforcement priorities between resource management and enforcement • Determination of information to set compliance targets and monitoring strategies

3. Fishery Monitoring and Catch Reporting Levels

In general three levels of monitoring have been established – Low Generic and Enhanced (Figure 1). The Generic level is the ***starting point*** to assess the monitoring level required for all Pacific fisheries. This Generic standard is based on criteria that consider key ecosystem impacts and resource management requirements (Table 1). This approach recognizes that, as long as the criteria are applied consistently, not all fisheries will require the same level of monitoring (i.e., one format does not apply to all fisheries). Therefore, fishery monitoring levels may vary from Generic to a "Low" or "Enhanced" level of monitoring.

Risk Continuum

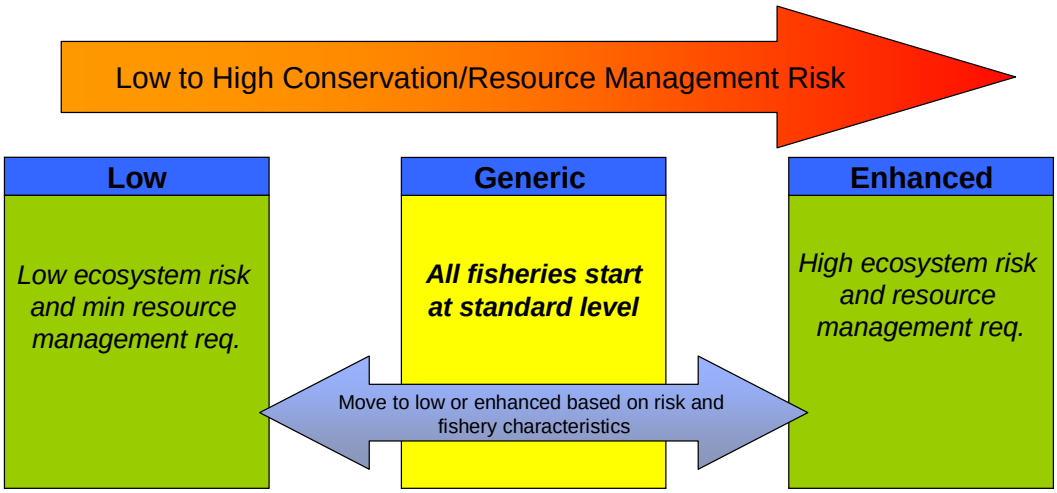

Figure 1. Catch reporting and fishery monitoring levels in Pacific fisheries

4. Risk Assessment

In general, the objectives of this risk assessment are to provide managers with an estimated level of ecosystem risk resulting from fishing activity while at the same time providing direction on the appropriate level of fishery monitoring and catch reporting required based on the risk. Specifically, objectives for the risk assessment are to ensure:

- Consistency
- Defensible outcomes (based on scientific information and/or reputable local information)
- Simple and understandable tool for all users (e.g., Resource Managers, harvesters, other stakeholders)
- Flexibility in application (for all Pacific fisheries)
- Transparency around process and repeatability
- Precautionary approach (when there is uncertainty)

There are many complex risk assessments available that take into consideration several factors (e.g., Hobday *et al* 2011 for e.g.). Given the wide range of people applying and communicating these assessment results, it is important to keep the approach as simple as possible so it can be

applied consistently across the region and understood by the various users. When working through the assessment there may be tradeoffs between the various objectives outlined above, however it should be conducted with all of them in mind.

Identifying an appropriate monitoring level requires an assessment of the risks the fishery presents to the ecosystem as well as determining resource management requirements (Table 1 and Figure 1). Risk analysis can be conducted using various levels of qualitative and quantitative detail. The appropriate level of detail, and effort for any risk assessment will depend on a number of factors. These include the objectives outlined for the analysis, the availability and reliability of data and information, the extent of those data and information, and the available expertise. A number of data sources can be used including existing fishery data such as catch and effort reports, local and traditional knowledge and information from other programs including marine mammal response network, surveys etc.). There is no one formula or weighting approach for assessing the priority of one risk over the other, rather each fishery and its impacts will be assessed on an individual basis.

There will be some cases where using this risk assessment is not required. For example, in determining appropriate monitoring levels, any quota or share-based fishery will automatically require an enhanced level of monitoring given the significant management complexity and information requirements to manage those types of fisheries. Further, fisheries that clearly have high information needs (e.g., scientific research, demonstration, pilot) or ecosystem risks, regardless of management requirements (whether high or low), or a new and emerging fishery (DFO 2001b) will also likely require enhanced monitoring. On the other hand, many other fisheries present varying levels of more moderate types of ecosystem risks and resource management requirements. These fisheries need to be evaluated using this risk assessment on an individual basis to review and prioritize monitoring requirements.

4.1 Assessment Process

The risk assessment process involves five steps:

1) Scoping.

2) Estimation of the ***consequence*** of an overlap between the type of ecosystem risk and the fishing activity.

3) Estimation of the ***likelihood*** of an overlap between the type of ecosystem risk and the fishing activity.

4) Scoring of the risk.

5) Categorization of the risk.

6) Reporting and periodic review of risk assessment

Determining a risk level requires defensible estimates of the consequences and likelihood. To properly formulate the risk scenario it is important to review available data, qualitative information and expert opinion from science, management and stakeholders, if available. To be able to defend consequence and likelihood estimates, clear rationale should be provided on how the scores were chosen, so that the exercise can be traced and verified. Clear rationale also provides a basis from which future assessments can be measured. It is important to note that there may be various sources of uncertainty associated with determining risk. Acknowledging uncertainty does not preclude making determinations and assigning a score in the risk assessment. The uncertainty simply needs to be described. Further, in situations where the information is not available or insufficient (i.e. lack of data and/or information), or is unknown or uncertain (i.e. level of confidence in the data) a precautionary approach should be taken and it should be assumed that the fishing activity poses a high risk. Therefore, a high score would be assigned for consequence and likelihood in order to highlight the need to obtain better information for any future assessments.

Scoping

Before beginning the assessment, managers should outline the specific fishery management objectives, management regime and ecosystem risks (see Table 1) as they relate to their fisheries. Collecting and consolidating the current fishery information is a key step of the risk assessment. Setting specific objectives will help to direct the development of fishery-specific monitoring strategies and inform the decision making process of the changes required.

Consequence

Consequence scores are based on the expected magnitude of impact that may occur as a result of the fishing activity. Table 2 outlines four levels that describe consequence, and their corresponding score.

It is important to consider the reliability of the existing data and information when estimating the consequence of interaction. A lack of confidence in the information and data adds an element of uncertainty to estimated levels but does not preclude conducting the risk assessment. The degree and reasons for any such uncertainty should be recorded in the overall documentation of the risk analysis process, and be taken into consideration when determining next steps and developing monitoring options. For example, if there is a high level of uncertainty then a higher level of monitoring would be required in order to gather more reliable and defendable information.

Table 2: Consequence – Levels and Descriptions

Level	Descriptions
Low (1)	Fishery is known/anticipated to have minimal impact on ecosystem components. Examples include small scale fishing operations with selective gear (e.g., troll gear with no bycatch, single lines/rods), target species is known to be healthy and productive, limited to no releases/discarding of non-target species etc.
Moderate (2)	Fishery is known/anticipated to impact various ecosystem components including combination of or direct impact on habitat and/or species. Examples include moderate fishing operations with limited selectivity (e.g., seine, troll gears), interactions with species or stocks of concern (SARA listed, prey, forage,)
High (3)	Fishery is known/anticipated to impact multiple ecosystem components directly and regularly including single or combination impact on habitat and/or species. Examples include bottom contacting gear types, unselective gear (gillnets) or techniques, interaction with species of concern (prey, forage, SARA listed, and/or stocks of concern.

Likelihood

Likelihood examines the degree of probability that the fishing activity will overlap with ecosystem components. For example, a high score in this section would indicate that the risk of the fishery encountering or overlapping with one or more of the ecosystem components is highly likely. Information on the historical fishing activity may prove useful in determining the potential extent of interaction with the ecosystem. Table 3 outlines three levels that describe the likelihood of interaction with the ecosystem components and the corresponding score.

As with 'consequence', it is important to consider the reliability of the existing data and information when estimating the likelihood of interaction. A lack of confidence in the information and data adds an element of uncertainty to estimated levels but does not preclude conducting the risk assessment. The degree and reasons for any such uncertainty should be recorded in the overall documentation of the risk analysis process, and be taken into consideration when determining next steps and developing monitoring options. For example, if there is a high level of uncertainty then a higher level of monitoring would be required in order to gather more reliable and defendable information.

Table 3: Likelihood - Levels and Descriptions

Level	Descriptions
Rarely (1)	Fishery is known to have minimal interaction/overlap with ecosystem components. Examples include fisheries with minimal releases/discards, target species is healthy and productive, gear does not impact/overlap habitat.
Occasionally (2)	Fishery is known/anticipated to impact various ecosystem components including combination of or direct impact on habitat and/or species. Examples include fisheries with releases/discards and/or limited selectivity (e.g., seine, troll gears), gear has medium overlap with habitat, interactions with species of concern (prey, forage, SARA listed, stocks of concern.
Frequent (3)	Fishery is known to impact on single or multiple ecosystem components. Examples include bottom contacting gear types, unselective gear or techniques, interaction with species of concern (prey, forage, SARA listed, stocks of concern), high overlap with habitat.

Scoring

In order to determine the risk of a specific fishing activity or fishery, the levels for the consequence of interaction (low - 1, moderate - 2, major - 3) are multiplied by the likelihood of overlap between the fishing activity and the ecosystem component (rarely - 1, occasionally - 2, regularly - 3). Table 4 outlines the resulting **Risk Matrix**.

Table 4: Risk Matrix

Consequence	Likelihood		
	1	**2**	**3**
1	1	2	3
2	2	4	6
3	3	6	9

Risk Categorization

Risk values are separated into three **Risk Categories** (Table 5), ranging from low to high risk, along with the corresponding monitoring level resulting from the risk analysis.

Table 5: Risk categories and corresponding monitoring level

Risk Level	Descriptor	Monitoring Level
1, 2	The fishing activity presents a **Low** risk to ecosystem components	**Low**
3, 4	The fishing activity presents a **Moderate** risk to ecosystem components	**Generic**
6, 9	The fishing activity presents a **High** risk to ecosystem components	**Enhanced**

5. Monitoring Levels and Information Requirements

Table 6 outlines the specific information requirements once a monitoring level for a fishery has been determined.

Table 6. Detailed description of information requirements for Low, Generic and Enhanced monitoring levels

Monitoring Level		
Low - *Low risk fishery*	**Generic -** *Moderate risk fishery*	**Enhanced -** *High risk fishery*
• Total catch estimates within approved accuracy/precision levels (retained and discarded) • Fishing effort and capacity information collected as per management requirements • Sufficient information is provided to meet domestic or international agreements, treaties (including FN Treaties) or other reporting obligations such as: ➢ general information to support international commitments and/or obligations ➢ information and data requirements specified in a treaty (e.g., First Nation, Pacific Salmon Treaty, Pacific Halibut Treaty) • Compliance targets (TBD in collaboration with C&P/RM/Harvesters) ***Examples***: • Low ecosystem concerns • Very selective gear used to eliminate risks	• Accurate and precise total catch estimates. Specific levels to be determined based on fishery-specific analysis. • Independent verification of catch required. Specific levels to be determined based on fishery-specific analysis including science and management accuracy and precision requirements. • Catch information location standards developed and outlined in IFMP and licence conditions. • Habitat impacts are monitored ➢ Substrate quality and/or dynamics • Fishing effort and capacity information collected as per management requirements • Information is provided to meet domestic or international agreements, treaties (including FN treaties) or other reporting obligations such as: ➢ general information to support international commitments and/or obligations ➢ information and data requirements specified in a treaty (e.g., First Nation, Pacific Salmon Treaty, Pacific Halibut Treaty) • Compliance targets and corresponding monitoring needs outlined in IFMPs (to be determined in collaboration with C&P/RM/Harvesters)	• Accurate and precise total catch estimates. Specific levels to be determined based on fishery-specific analysis – however should be at a high level. • High level of independent verification of catch. Specific levels to be determined based on fishery-specific analysis– however should be at a higher level than Generic. • Catch information location standards developed and outlined in IFMP and licence conditions. • Habitat impacts are monitored ➢ Substrate quality and/or dynamics • Fishing effort and capacity information collected as per management requirements • Information is provided to meet domestic or international agreements, treaties (including FN treaties) or other reporting obligations such as: ➢ general information to support international commitments and/or obligations ➢ information and data requirements specified in a treaty (e.g., First Nation, Pacific Salmon Treaty, Pacific Halibut Treaty) ➢ Compliance targets and corresponding monitoring needs outlined in IFMPs (to be determined in collaboration with C&P/RM/Harvesters) ***Examples:*** • High risk of bycatch of stocks of concern, SARA listed • Gear used has high habitat impacts/unselective • History of catch over Total Allowable Catch • New fishery or fishery with unknown impacts • Specific information requirements: ➢ Individual Quota/Share-based fisheries ➢ Scientific research fishery ➢ Special management fishery (stock

		assessment, pilot/demonstration)

6. Gap Analysis and Management Strategies

Once risk levels have been identified and categorized, Resource Managers must work with other relevant DFO sectors and harvesters to develop specific monitoring programs to meet the required level. A step in this process is conducting a gap analysis whereby the current monitoring programs in place in the fisheries and the information they are providing will be assessed against the required monitoring level and information. With this assessment, specific gaps and improvements can be highlighted and discussed with harvesters. IFMPs, and their associated development and approval processes, provide an appropriate tool through which development and implementation of additional monitoring programs can be communicated and implemented.

All monitoring strategies implemented should be reviewed carefully to determine both the effectiveness of the programs in place, as well has to gather additional data and information which may be used to improve on techniques and/or technologies.

Implementation of monitoring programs may require a phased-in approach depending on costs and logistics. However a specific goal, steps and timeline to reach the required monitoring level must be specified in the IFMP. Once the monitoring programs are in place the objectives and results must be reviewed at the start of all subsequent planning cycles for the fishery. Changes to the fishery or improved knowledge of the risk may warrant the completion of a revised risk analysis. The results of this planning cycle review (and the results of any revised risk analysis process, where applicable) should be documented and incorporated into IFMPs. In addition, it is recommended that the results of all risk analyses be reviewed collectively on a regular basis, to ensure that the framework is being applied in a consistent manner.