DFO Pacific Salmon Science Workshop 2022: Addressing conservation and management challenges now and into the future

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A DFO Pacific Region workshop focused on Pacific salmon research and conservation was held from November 15 to 17, 2022, in Nanaimo, British Columbia. The theme of the workshop was “To address the challenges associated with salmon conservation and management now and into the future, we need to know more about…”. The workshop format consisted of a mix of plenary talks, interactive discussions, and breakout activities to solicit ideas and priorities from DFO researchers and managers. Emergent themes and recommendations from the workshop include both organizational and research considerations. The priority organizational topics were collaboration and engagement, human resources and administration, and data management and sharing. For each of these themes, a number of challenges were identified along with recommendations to address them. Many of the research priorities identified were broad in scope and fell under the themes of integrated life history monitoring and assessment, climate change, and decision-making and prioritization. In this report, we summarize workshop proceedings, results from activities, and recommendations across the main organizational and research themes. These recommendations and priorities will inform the development of new research and monitoring led by DFO Science over the next few years of the Pacific Salmon Strategy Initiative (PSSI).

RÉSUMÉ

Lagasse, C.R., Czembor, C.A., Huang, A.-M., Dobson, D. 2024. DFO Pacific Salmon Science Workshop 2022: Addressing conservation and management challenges now and into the future. Can. Manuscr. Rep. Fish. Aquat. Sci. 3267: v + 43 p.

Un atelier de Région Pacifique du MPO axé sur la recherche et la conservation du saumon du Pacifique s'est tenu du 15 au 17 novembre 2022 à Nanaimo, en Colombie-Britannique. Le thème de l'atelier était "Pour relever les défis associés à la conservation et à la gestion du saumon aujourd'hui et à l'avenir, nous devons en savoir plus sur...". Le format de l'atelier consistait en un mélange de conférences plénières, de discussions interactives et d'activités mixtes pour solliciter les idées et les priorités de l'expertise présente dans la salle. Les thèmes émergents et les recommandations de l'atelier comprennent des considérations organisationnel et de recherche. Les thèmes organisationnel prioritaires étaient la collaboration et l'engagement, les ressources humaines et l'administration, ainsi que la gestion et le partage des données. Pour chacun de ces thèmes, un certain nombre de défis ont été identifiés, ainsi que des recommandations pour les relever. Un grand nombre des priorités de recherche identifiées sont de portée générale et relèvent des thèmes de la surveillance et de l'évaluation intégrées du cycle biologique, du changement climatique, ainsi que de la prise de décision et de l'établissement de priorités. Dans ce rapport, nous résumons les comptes rendus des ateliers, les résultats des activités et les recommandations sur les principaux thèmes organisationnels et de recherche. Ces recommandations et priorités éclaireront à l'élaboration de nouvelles activités de recherche et de surveillance menées par le secteur des Sciences du MPO au cours des prochaines années dans le cadre de l'initiative de la Stratégie relative au saumon du Pacifique (ISSP).

INTRODUCTION

Context

Over the past 25 years, salmon fisheries have been significantly reduced relative to historic levels, yet many salmon stocks are not rebuilding, and many continue to decline (Walters et al. 2018; Grant et al. 2019). These declines have serious, negative social and ecological implications for the human and non-human biological communities that depend on salmon (Gislason et al. 2017; Oke et al. 2020; Atlas et al. 2021; Earth Economics 2021). The causes of salmon declines are multifaceted, and these factors are increasingly resultant from and exacerbated by the impacts of climate change (Grant et al. 2019).

Our ability to identify and distinguish among the many potential factors driving productivity of salmon stocks and their associated declines requires a collaborative and integrative approach to conducting research (e.g. Bull et al. 2022; Feddern et al. 2023). This means not only focusing on areas of research that warrant further investigation because of their high potential to limit our ability to inform salmon conservation and management, but also identifying challenges to engagement and collaboration among scientists, managers, other DFO staff, partners, and clients (Goring et al. 2014; Beier et al. 2017).

In the context of salmon conservation, ineffective collaboration within and among scientists, managers, stakeholders, and Indigenous groups may result in:

- Insufficient recognition of the fundamental (or multiple) drivers of salmon declines (Ruckelshaus et al. 2002; Bull et al. 2022; Atlas et al. 2023);
- Mismatches between the research priorities of scientists versus practitioners and managers (Buxton et al. 2021);
- An overly narrow group of targeted management responses (e.g., focus on fishery reductions (Walters et al. 2018), hatchery supplementation in lieu of conservation actions that may be more effective (Naish et al. 2007);
- Failure to incorporate current, ongoing, and future climate change impacts (Pepin et al. 2022);
- Inattention to socio-economic structural determinates of salmon outcomes (e.g., institutional factors such as governing process, jurisdictions, economic and social policies) (Atlas et al. 2021; Connors 2023).

In other words, more effective collaboration is one way that salmon science could be more impactful and relevant. Therefore, this workshop was conceived to contribute towards understanding and recognition of engagement and collaboration needs. By design, the workshop included participants from Science and other branches within DFO more focused on management and operations (i.e., Fisheries Management, Salmonid Enhancement Program, and Ecosystem Management). Management staff were included so that priorities and perspectives in a decision-making context could be shared and also to facilitate a better understanding among managers of hypotheses-driven questions that inform the selection of conservation strategies.

One potential barrier to effective engagement across branches includes a lack of effective tools and practices for facilitating engagement. While the pandemic greatly improved our capacity to engage virtually, there was a loss in our ability to build meaningful collaborations and relationships through in-person interactions. Therefore, another goal for the workshop was to give staff a set of tools that could be used to facilitate engagement and collaboration within teams and across the organization. To that end, a facilitator with extensive experience in government engagement was chosen to help plan and lead the workshop.

As well as a general need for more effective engagement and collaboration, this workshop occurred amid a significant investment by the Government of Canada to support rebuilding of Pacific salmon stocks under the Pacific Salmon Strategy Initiative (PSSI). PSSI was designed to bring new capacity and resources for science programs related to salmon recovery. To use these resources effectively, science work plans need to be developed collaboratively with input from scientists and decision-makers. Therefore, by promoting dialogue and engagement to support prioritization and program delivery, the workshop was intended to set the stage for development of a coherent strategy for Pacific Salmon research that would take advantage of the transformative potential of the PSSI.

Workshop Details

The 2022 DFO Salmon Science Workshop was held over two and a half days from November 15 to 17, 2022, at the Vancouver Island Conference Centre in Nanaimo, BC (for full agenda see Appendix A). Workshop facilitation was provided by Bob Chartier (https://bobchartier.ca/). There were 114 participants over the 3 days of the workshop, including 82 participants from Science, 15 from Fisheries Management, 14 from the Pacific Salmon Strategy Initiative and the Salmonid Enhancement Program, and 2 from Ecosystem Management branches (for a full list of participants see Appendix B). The workshop also included different levels of leadership and responsibility from within DFO, including Science division managers, section heads, research scientists, and biologists.

The format consisted of a mix of plenary talks, interactive discussions, and mixed-format activities that included idea solicitation and smaller group discussions, as well as opportunities to pitch ideas to DFO leadership. Most participants attended the workshop in-person, but a virtual option was provided for the plenary talks and most activities. The number of virtual participants varied throughout the workshop with a maximum of 43 on the first day and 34 on days two and three.

WORKSHOP PROCEEDINGS

Introductory Remarks

The workshop began with introductory remarks by Andy Thompson, Regional Director of Science for the Pacific Region. Andy discussed the wide array of research initiatives currently occurring related to Pacific Salmon and the need to bring all of this research together to prioritize direction. He acknowledged that DFO staff have had few opportunities to get together over the past few years as a result of the COVID-19 pandemic, and that this workshop represents an important opportunity for staff to reconnect and share ideas. Ann-Marie Huang provided some additional context on workshop goals; the workshop was not designed to solve all the issues and research challenges associated with Pacific salmon conservation, but instead to set the stage for collaboratively identifying these challenges and begin generating ideas to address them.

Opening Plenary on Engagement

Workshop facilitator Bob Chartier provided a plenary talk on the importance of engagement in science. Drawing on his 40 years as a public servant, Mr. Chartier discussed how typical idea generation tools used by the public service, such as committees, PowerPoint presentations, and workshops, do not effectively engage people, teams, and organizations. As such, the ‘status-quo’ mode of conducting business leads to disengagement and ineffective actions. To overcome this lack of engagement, the workshop agenda included instructions and application of tools to foster effective engagement within teams and

organizations. These tools can be used to collaborate more effectively within DFO, but also when engaging with external organizations and the public (Chartier 2015).

Mr. Chartier suggested that the need for change in our current approach to salmon research, conservation, and management can be examined through three categories: 1) *status quo*: what is currently working well and should not be changed; 2) *innovation*: what needs modification from its current state and can be improved; 3) *shifts*: what needs to be completely rethought and approached differently. Some systems may only need slight changes through innovation, while other ways of working towards salmon conservation may need a complete shift in order to achieve better outcomes.

Mr. Chartier stated that engagement is an important theme for this workshop, yet it is a cultural characteristic that must be fostered through daily interactions. It involves constant relationship building and attention at multiple levels. There are three levels of engagement that were discussed: 1) engaging the system, which is the broadest level involving the entire organization; 2) engaging the team, which involves smaller functional groups within or across organizations; and 3) engaging the individual. This workshop provides tools for engaging across each of these three levels (Table 1).

Recognizing the three levels of engagement, Mr. Chartier introduced a number of engagement tools using the overarching workshop theme of salmon conservation and management. Tools to engage the system are based on principles of systems thinking (Senge and Sterman 1992), and involve building relationships and engaging across an organization to provide integrated services. At the organizational level, broad-scale ideation and prioritization are often challenging because complex systems involve priorities and diverse perspectives that intersect in often unanticipated ways. For large and diverse groups, the Open Space and Bucket List tools (Table 1) were designed to apply systems thinking to solicit ideas and define priorities. Events like this workshop that bring together a large number of staff from across the Department are critical for engaging the system to tackle complex problems. Engaging the team applies to how we work as smaller groups and invest time in team building. Tools for team engagement included the Team Charter, WorkOut, the Stand Up, and the Jam Session (Table 1). Engaging the individual is about personal leadership within a larger organization and getting people excited about their work. Individual tools that were presented include the sea star diagram and the feedback tool.

In the following sections, the process and results for each engagement tool are summarized based upon the discussions that occurred and ideas that were generated during the workshop.

World Café Activity

The first organizational-level activity, called the World Café, was based around group discussions and identifying priority questions across the organization (Table 1). Workshop participants were split into groups of four and engaged in four rounds of discussion of about five minutes each. The prompts for each round were: 1) What are we already doing well? 2) What should we stop? 3) What should we start? and 4) What is the biggest unanswered question right now? A key component of the activity involved cross-pollination of ideas between groups. To facilitate this, each group had a note-taker that moved to a new group at the beginning of each five-minute round. At the start of each new discussion, the newly-moved note-taker would summarize key points from the previous round. For example, the discussion of 'What should we stop'? started out with the note-taker sharing notes on 'what are we doing well' from their previous group. This summary, combined with the discussion the group had already engaged in, meant that each group got a new set of ideas to contrast against their own and bring into their next conversation. These discussions culminated in the 'biggest unanswered questions' which identify focal points for change

within the organization. The questions that were identified in the last round were input into Slido for online voting and prioritization (Appendix C).

Following the breakout groups, everyone reconvened as plenary and the questions that received the most votes were discussed with the facilitator. The questions were 1) How are we going to transcend deep silos and who is responsible for making this happen? 2) How do we reduce the administrative burden on staff? 3) What is going to occur after PSSI? How do we integrate results of short-term funding and turn it into long term results? and 4) Why are we not getting any traction on climate change?

Mr. Chartier responded to the questions by emphasizing the importance of engagement at multiple levels, through systems thinking to personal leadership. According to Mr. Chartier, senior management should not be expected to fix all of the problems and challenges faced by an organization. Individual leadership and action are required to make progress, and every individual must commit to contributing towards their team and the larger system. Complex, large-scale problems such as climate change should be broken into smaller parts and addressed at more manageable levels. Team engagement tools such as WorkOuts (Table 1) can be used to more effectively and quickly address smaller problems compared to committees and other more conventional methods.

Table 1 – Description of engagement tools introduced during the workshop. Adapted from: *Handcrafted Leadership: The Art & Craft of Building Engaged Workplaces & Communities* (Chartier 2015).

Engagement Tool	Type	Description
Open Space	Systems	An agenda-setting, issue identification, and prioritization activity for medium to large groups. It involves eliciting issues from all workshop participants then forming discussion groups to identify solutions to priority topics.
World Café	Systems	A tool for group dialogue where small discussion groups occur over four rounds and participants move among groups between rounds.
Bucket List (affinity diagrams)	Systems	A large group activity to identify priorities using sticky notes from every participant that are put on a wall and grouped into themes. Everyone has the opportunity to vote on themes to identify the most important topics for further discussion.
Matrix Interview	Systems/ Teams	A series of short interviews in breakout groups of four people to identify solutions to a theme or problem, with each group member having the opportunity to share their ideas. Breakout groups are followed with larger group discussions to identify the main ideas and recommendations for each theme.
The WorkOut	Teams	Full-day meetings involving all relevant operational staff to develop solutions to specific problems or needs, followed promptly with a meeting with executives to solicit their feedback.
Jam Session	Teams	A team exercise for developing a proposal or work plan to address a problem or question and then subjecting that plan to rigorous feedback from peers via short presentations followed by critical feedback.
Team Charter	Teams	Living documents that encourage conversations regarding how work is done, rather than specific goals or work plans. They can include a purpose statement, core values, a code of conduct, roles and responsibilities, skill inventories and communication protocols.
Sea Star diagram	Individual	An individual accountability exercise to encourage taking leadership to address an issue following the workshop. Individuals record responses to the prompts of 1) issue, 2) tool, 3) steps, 4) timing, and 5) results, then share with others at the workshop.
Feedback Tool	Individual/ Teams	Prompts for providing feedback between two individuals or small groups: What went well? What was tricky? What could you have done differently?

Open Space Activity

The afternoon activity on day one of the workshop was a systems tool called Open Space that dynamically builds a meeting agenda based on priorities identified by participants. The activity began with a topic prompt and an invitation for anyone to share their idea with the room. Every participant had an opportunity to share their idea, write it on a piece of paper and post it on the wall. By the end of this portion of the activity, all ideas were displayed on the wall and organized into three sections for breakout discussions. During the second part of Open Space, individuals chose which of the issues they wanted to discuss from each section over three rounds of conversation. Conversations were structured around the following prompts: two things we are doing well on the issue, two ideas to move us forward on the issue, and the key message.

The topic for this workshop's Open Space activity was "To address the challenges associated with salmon conservation and management now and into the future, we need to know more about...". Based on this prompt, 64 ideas were provided by workshop participants. Following the Open Space activity, all the ideas were collected on a "Fishsues" (Issues) Wall in the conference room and attendees were given the opportunity to add additional ideas during the next two days of the workshop. Thirteen additional ideas were identified, bringing the total number to 77 at the end of the workshop.

Following the workshop, the 77 ideas identified by workshop participants were sorted into categories to determine the prevalent themes. The categories included scientific or research themes related to salmon conservation and management as well as organizational and cultural themes related to how work occurs (Figure 1). Many of the ideas spanned multiple categories across both research and organizational themes. The full list of 77 ideas and assigned themes are provided in Appendix D.

Figure 1 – Tree map diagram of categories for ideas identified by the Open Space activity. The box area and subtitle numbers correspond to the number of ideas that were assigned to each category. Ideas could be assigned to multiple categories if the subject spanned multiple topics.

Bucket List and Matrix Interview Activities

The second day of the workshop began with the Bucket List (Table 1), a group brainstorming and prioritization activity, followed by a breakout group activity called Matrix Interviews. The focus for these activities was on organizational challenges and how DFO conducts its work rather than knowledge gaps or research priorities.

For the Bucket List activity, every workshop participant was given two sticky notes and instructed to put their two highest priority ideas on the wall in response to the prompt: "To better collaborate on salmon conservation and management now and into the future, we need to address the following logistical and cultural challenges...". Once all the sticky notes were collected on the wall, workshop participants rearranged them into buckets (i.e., groups) based on common themes, placing similar ideas within the same buckets. Next, buckets were named according to the theme represented by the ideas. Finally, once all the buckets were labelled, every participant was given four stickers to place on the buckets and vote for their highest priority theme. The four themes with the highest number of votes became the topic for conversations in the Matrix Interviews that followed. This activity was conducted separately for in-person and virtual workshop participants, with the virtual session utilizing Microsoft Whiteboard instead of physical sticky notes. There was a total of 125 sticky notes that were categorized into 16 buckets for the in-person session. For the virtual session, 50 sticky notes were categorized into 5 buckets. Results for the Bucket List activity are in Appendix E.

Following the Bucket List, Matrix Interviews were conducted by first dividing all participants into groups of four. Each person in the group was assigned a different theme or bucket and instructed to interview others in the group to solicit 2-3 solutions for the priority issue. The top priority themes used for the in-person session were (1) sharing knowledge; (2) silos and collaboration; (3) data; and (4) administrative challenges. For the virtual session, the four highest priority themes were (1) communication; (2) different priorities between executives and operational staff; (3) flexibility, proactiveness and efficacy; and (4) equity, inclusiveness and diversity. Once the interviews were complete, interviewers for each theme came together in a larger group to develop a list of all the recommendations that were discussed. The full list of recommendations from these group discussions are in Appendix F.

Team Charters and Jam Session Activities

Following a morning break, Mr. Chartier introduced the Team Charters and Jam Session activities. As explained by Mr. Chartier, these tools were designed for small to moderate size groups to improve collaboration and solicit feedback. Team Charters are evergreen documents intended to encourage conversations regarding how work is done, rather than specific work plans or goals. By making time for these conversations, the intent is that teams better engage participants and function more effectively. Team Charters can include a purpose statement, code of conduct, roles and responsibilities, skill inventories, and communication protocols (Table 2). To begin the Team Charter activity, participants were split into ten teams of 8 to 10 individuals and given 45 minutes to focus on aspects of the Team Charter that they considered most relevant.

Following Team Charter discussions, the Jam Session activity was initiated by assigning each team a research question selected from fifteen of the ideas generated during the Open Space activity. Teams developed a three-minute elevator pitch to executives on a project to address their research question. After 30 minutes, one representative from each group delivered the pitch to another group and was provided positive and critical feedback on the pitch, which was then used to refine the pitch. This was repeated a few times to get additional feedback on the pitch, with different representatives presenting

the pitch to different groups each time. In the afternoon, one person from each group delivered their pitch to all workshop participants.

Table 2 – Team Charter elements and sub-components that were provided to workshop participants as part of the Jam Session activity.

Team Charter Element	Sub-Components
Purpose Statement	
Core Values (in phrases or sentences)	
Code of Conduct	
Service Standards	
Roles and Responsibilities	
Business Lines	Products Services
Skills Inventory	Professional Skills Amateur Skills
Protocols	Communication Protocols Decision-making Protocols Conflict Resolution Protocols Meeting Design Protocols
Team Improvement Goals	

Dragon's Den Activity

For the final day of the workshop, participants were provided the opportunity to choose their own research topic or idea and form teams to develop three-minute pitches. A representative from each team presented their idea to the workshop plenary and a "Dragon's Den" panel of DFO Science division managers and Pacific Region executives. The panel provided feedback on the delivery and content of the presentation, focusing on what they liked about the presentation, what needs improvement, and what could be done differently.

There were ten teams formed with topics addressing many of the research and organizational themes that were identified earlier in the workshop (Table 3). Input provided by the panel highlighted the importance of many of the projects that were proposed in terms of addressing PSSI priorities and understanding the future of salmon under climate change, but also the challenges in executing these complex projects, and the need to engage within the Department to ensure that science advice or tools that are developed will be useful.

Table 3 – Teams and topics for pitches presented to the Dragon's Den on day 3 of the workshop

Group members	Topic
Catarina Wor, Evan Henderson, Adam Keizer, Jim Irvine, Diana Dobson, Brittany Jenewein, Carrie Holt	Identifying Management Objectives: What do we want? When do we want it and how bad do we want it?
Karia Kaukinen, Tom Therriault, Wilf Luedke, Carrie Holt, Christie Nelson	Assessing and prioritizing threats across life stages
Colin Bailey, Dan Greenberg, Mike Hawkshaw, Cher LaCoste, Doug Braun, Joel Harding, Dave Patterson, Noel Swain, Kendra Robinson, Christina Czembor	Integrated salmon monitoring from mountain top to sea floor using existing resources connecting across governments

Patrick Thompson, Josie Iacarella, Cameron Freshwater, Brendan Connors, Jeffery Lemieux, John Candy, Eddy Kennedy	Developing population models across life cycles that allow for stock prioritization under future climate scenarios
Amber Holdsworth, Charles Hannah, Sue Grant, Laura Bianucci, Jacqueline Belzile, Dale Desrochers, Jackie King, James Mortimer, Josephine Iacarella, Brendan Connors, Dan Selbie, Diana McHugh	Towards a culture of being climate nimble: Climate downscaling models
Erin Rechisky, Scott Decker	Tools for improving climate change communication
Nikki Kroetsch, Erica Blake, Amelia Mahony, Arthur Liao	Accessible and visible science: Facilitating science communication and engagement
Chuck Parken, Nicole Trouton, Lauren Weir, Matt Townsend, Peiter Van Will, Jessica Ottley, Lindsay Begemann, Adam Silverstein	Reconnecting areas with regional science
Cory Lagasse, Yi Xu, Eric Rondeau, Michael Thom, Nick Bolingbroke, Ge Li	Tools for collaboration and information sharing
Tom Bird, Shelee Hamilton, Nick Bolingbroke	Salmon data mobilization

EMERGENT THEMES AND RECOMMENDATIONS

The previous section described the main activities that occurred during the workshop and how information and ideas were elicited from workshop participants. Detailed results from each of these activities are provided in the appendices. In this section, the workshop results are synthesized across all the workshop activities to identify emergent themes and recommendations. Results are broadly divided into organizational themes and research themes. Organizational themes focus on how work is conducted within DFO, such as logistical aspects of implementation, organizational structure, relationships, and communication, while research themes focus on what work is conducted and the priorities for future investigation. The two themes are not mutually exclusive, particularly for topics such as data management and communication.

Organizational Themes

In contrast to a conventional science workshop where the agenda is focused solely on research and scientific lines of inquiry, several of the activities in the salmon science workshop were framed around the organizational, social and logistical challenges that affect DFO and the scientific community's ability to effectively conduct research and inform the management and conservation of Pacific salmon. These organizational challenges were elicited through the idea prompts provided for certain activities as well as the structure of the activities themselves, which allowed for open sharing of ideas and semi-structured discussions of those ideas.

Throughout the workshop, three themes emerged as dominant among organizational priorities, as evidenced by how frequently they were mentioned and vote counts from the Bucket List activity. These themes were 1) Collaboration and Communication, 2) Human Resources and Administration, and 3) Data Management and Sharing. For each theme, key challenges and recommendations to address them are

listed below based on synthesis of group discussions, pre-workshop survey results, and plenary talk insights.

Collaboration and Communication

This topic encompassed a few related concepts including engagement within and outside the organization, work silos, knowledge sharing, relationship building, and diversity. Themes from the Bucket List activity under this topic included Sharing Knowledge, Silos and Collaboration, and Communication, each of which received the highest number of votes from the in-person and virtual workshop sessions. These themes were grouped together under this topic because the challenges and recommendations identified were similar. While it was broadly recognized that collaboration and communication is essential to successful conservation and management, the identified challenges highlighted how organizational structures, incentives, ineffective information sharing, and time limitations can create barriers to effective collaboration.

Challenge: Collaboration is not always rewarded or supported as part of job descriptions and work objectives.

Recommendations:

- Identify time for collaboration and relationship building as part of the job by including it in professional development and performance management agreements (PMAs).
- Add at least one annual project that requires collaboration with other groups to staff work plans.
- Identify shared objectives, work plans, and outcomes for branches or the entire region, with shared accountabilities in achieving them.
- Reduce the time burden associated with meetings, administration and excessive workload (via other recommendations) to free up more time for collaboration.

Challenge: There is often poor information sharing between teams and limited understanding of what other research is underway or roles within the organization.

Recommendations:

- Develop a website or application with information on sections, programs, and science staff, what data they collect and where to find it, and linkages to management processes.
- Create and maintain an inventory of projects and research that are being conducted that is searchable by name, subject, area, and other keywords.
- Host forums, seminar series or symposiums to share information and discuss research occurring within the Department, with particular emphasis on themes that span multiple groups and research areas. The State of the Pacific Ocean (SOPO) conference is an example that was mentioned multiple times.
- Publish a newsletter or other regular form of reporting on activities underway by different Science programs.

Challenge: It can be difficult for new staff to get oriented to the Department.

Recommendations:

- Develop a mentorship program (previous program was dissolved in 2005).
- Create an exchange or job shadowing program, for example, between the Areas and Regional Science.

- Provide resources on division and section activities as part of onboarding, through a detailed organizational chart or other application.

Challenge: The lack of face-to-face meetings and interactions prevents meaningful collaboration.

Recommendations:

- Allocate resources and time to host team building in-person events, such as workshops or retreats, to build trust and relationships within and across teams.
- Plan more social events at office locations or off-site, such as weekly coffee socials or lunches.
- Create and support opportunities for staff to work together in the field across different branches (e.g., Resource Management and Science).

Challenge: Salmon-related research is difficult to coordinate because it is spread across multiple divisions and sections within DFO Science in Pacific Region.

Recommendations:

- Re-organize programs and sections into a 'salmon division' that integrates habitat, population dynamics, stock assessment and other research.
- Develop cross-sectoral working groups with staff of different backgrounds and expertise.
- Create stronger connections between regional and area staff.
- Assign team ambassadors to meet with other team ambassadors to exchange info, ideas and contacts.
- Have staff dedicated to facilitating integration and organizing events.

Human Resources and Administration

This theme centered on the logistical and operational aspects of DFO Science activities within a government bureaucracy. It was generally perceived that current administrative procedures and requirements added significantly to workloads for researchers and had an adverse effect on their ability to effectively deliver science programs and research. On the human resources (HR) side, challenges were focused primarily on hiring and keeping staff within positions to create stability for programs and build relationships.

Challenge: Administrative tasks and HR processes are not well-documented, assistance, training and points of contact are unclear or unavailable.

Recommendations:

- Develop easy-to-follow, accessible, up-to-date, and authoritative instructions for common administrative and HR tasks (e.g., expensing, procurement, hiring). This could include verification that there are up-to-date links for all forms on the intranet and organizing these links by the process for which they are needed.
- Develop orientation materials and better training for staff on common administrative tasks, responsibilities, and contacts, including clear points of contact for HR and administrative processes.
- Create centres of expertise for administrative and HR specializations (e.g., travel requests and expenses, hiring) that are accessible to staff on short notice, or alternatively train and designate some administrative staff as subject matter specialists so that there is a point of contact for different questions.

Challenge: Administrative tasks are time-consuming for scientists and managers, inhibiting their ability to focus on research or collaboration.

Recommendations:

- Review the roles and responsibilities of scientists, managers and administrative staff across processes and reduce the proportion of administrative-related tasks that are being completed by scientists and managers. Examples where administrative staff could provide more support include financial coding in the SAP system, procurement processes, approval of Government Acquisition Card (GAC) transactions, hiring forms, and contracting.
- Conduct process mapping exercises for administrative and HR processes to identify and eliminate inefficiencies, such as multiple approvals for expenses.
- Adopt modern data management tools for administrative data to improve efficiency. For example, instead of using PDF forms that are e-mailed multiple times, instead use online forms that can auto-populate and store information.
- Give administrative staff the authority to change minor errors so there are fewer minor revisions required with paperwork.
- Review and/or establish service standards and timelines for approvals (e.g., approving Blanket Travel Authorities, completing tasks in SAP), ensuring that these are realistic given the needs of field programs and other operations.

Challenge: Administrative efficiency is limited by capacity and frequent staff turnover.

Recommendations:

- Increase the number of administrative staff to ensure they have a manageable workload and enhanced capacity to reduce the administrative burden on scientists.
- Find ways to reward and recognize administrative staff when they are doing their job well to promote staff retention.
- Investigate why there is such rapid turnover in administrative staff and options to improve retention. Ideas provided included allowing full tele-work agreements for high functioning administrative staff and increasing pay.
- Include performance objectives related to helping scientists and managers with administrative tasks on performance management plans for administrative staff.

Challenge: There are inefficiencies in approvals, budget reviews, delegation of authority, and document routing that are time consuming for staff, particularly managers.

Recommendations:

- Review all approval processes (financial, HR, travel, conferences, briefing notes) and delegate approval authority lower where possible in order to free up time for managers to focus on management rather than forwarding recommendations.
- Allow delegation of the approval step for GAC transactions in SAP, so that section 34 managers can review and approve a summary while administrative staff can quality control the detailed entries in SAP. Approving individual GAC transactions was considered time consuming by some managers.
- The new MyGCHR (online HR system) creates redundancy with Phoenix in having to review overtime transactions, when they should be completed through one interaction.

- Develop clearer processes for document approval routing and better training for administrative staff to identify subject matter experts.
- Allow for more flexibility in blanket travel authority requirements so that they can be issued for field staff and co-op students.

Challenge: Procurement of supplies and services for research is time-consuming and difficult.

Recommendations:

- Decentralize or extend the hours of the Procurement Hub for contracting to better match the Pacific region time zone
- Increase the low dollar value (LDV) contract limit from the current limit of $10,000
- Allow for multi-year project funding to eliminate challenges associated with fiscal year end
- Combine the procurement forms into a single form (i.e., use 9200, but remove 1448/49/5081)
- Develop expertise in procurement within the branch administrative staff so that managers and scientists don't need to be the experts.
- Develop and approve budgets earlier in the year to make it easier for staff to plan ahead and provide more certainty on contracts and procurement.

Data Management and Sharing

Data was mentioned frequently throughout the workshop and is foundational to the research that DFO Science produces. However, issues identified from various workshop activities describe how finding and accessing data is a challenge even for those that work within DFO. There has been inconsistency in how data are handled among programs and divisions, and many data sets have not been uploaded to open data platforms. Data inaccessibility may hinder collaboration and the ability to address research questions that span across areas, life stages or habitats. Recommendations from the workshop centered around a need for improved data policies and management practices, as well as increased resources and staffing to support data management.

Challenge: Inconsistent data management standards and processes reduce efficiency and data accessibility.

Recommendations:

- For programs with similar data, create and implement standards for collecting, storing and structuring data, including metadata requirements. For work that focuses on salmon, standards could be created by life history or activity types to ensure its applicability.
- Data should be centralized and accessible across programs with regular updates.
- Require data sharing agreements as part of project funding approvals and reporting. These agreements could include requirements for annual updates and metadata standards. New projects should have mandatory data production and publication as part of the requirements.
- Develop a formal data management plan within DFO Science and ensure that it is implemented.
- Create tracking tools to understand who is using what data and the intended purpose (e.g., the Marine Spatial Ecology GIS Hub).

Challenge: There is often insufficient capacity, expertise and IT support for data management.

Recommendations:

- Hire dedicated staff for quality assurance/quality control and data management (i.e. data stewards).
- Provide improved access to IT services to support data initiatives, such as allowing scientists and Areas to hire computer scientists to build databases.
- Dedicate funds to create and maintain regional databases for common data types across programs using established standards.
- Dedicate funds to clean and digitize archived data.
- Ensure there is storage capacity for long-term storage of data.
- Create an adaptable, centralized data management system with permissions for access, that is searchable by data type, geographic region, dates, keywords, species.

Challenge: There is limited training or documentation available to most staff on data management and data products that exist within DFO.

Recommendations:

- Institute mandatory data skill training for scientists (e.g., covering the FAIR principles for data management).
- Develop documentation and training on how to access existing data repositories.
- Provide orientations on data management practices and resources for new employees.
- Conduct exit interviews for retiring or outgoing staff to retain institutional knowledge.
- Learn and adopt practices from other programs with good data management (e.g., Canadian Hydrographic Services, groundfish database, Marine Spatial Ecology GIS Hub).
- Hold an annual symposium or distribute a report to summarize data produced by DFO programs.

Research Themes

Scientific research on Pacific salmon spans a broad range of ecosystem types, management jurisdictions, spatial scales, and science disciplines, as reflected in the diversity of positions and expertise of DFO workshop participants. The major themes that emerged were correspondingly integrative and broad in scope, applying to all life stages of Pacific salmon and their habitats. These themes were identified by categorizing the issues shared during the Open Space activity (Figure 1) but were also represented by the topics selected by teams for the Dragon's Den activity (Table 3). Collectively, themes represented how we develop and apply scientific knowledge to assess, predict, plan and manage the current and future states of Pacific salmon.

Integrated Life History Monitoring & Assessments

This theme broadly represented the monitoring, assessment and analytical methods used to understand the population dynamics of salmon, and how they are affected by ecosystem changes and anthropogenic stressors. This therefore described many of the activities and research undertaken by DFO Science, including escapement monitoring, juvenile monitoring, quantitative stock assessment, freshwater ecosystem research, and oceanographic monitoring.

Elements of this theme emerged during the Open Space activity under categories of Productivity Drivers & Population Assessments, Ecosystem Monitoring, Population Monitoring, and Non-Fisheries Threats, which collectively accounted for 31 out of the 77 ideas identified. Many of the ideas discussed our need to assess threats and causes of declines, monitor ecosystems and species interactions, integrate our understanding across the salmon life cycle, consider how different spatial scales may affect our inferences,

and link environmental indicators with biological trends. These ideas are linked to concepts of ecosystem-based management, population modelling, and risk assessment and prioritization.

While many research programs and projects have been contributing to monitoring and assessment of stocks, integration of these components to understand drivers of productivity and ecosystem changes is the key gap that emerged during the workshop. Population and ecosystem assessments, and their application in management, have been variable across the Pacific region and there was a strong need identified to improve the way we share data and research methods, conduct standardized monitoring and assessments, and draw inferences across ecosystems and populations.

There were three projects relevant to this theme that were proposed to the Dragon's Den: a framework for assessing and prioritizing threats across life stages, developing population models across life cycles that allow for stock prioritization under future climate scenarios, and integrated salmon monitoring from mountain top to sea floor. This theme was also linked to the organizational themes of data management and collaboration because developing models across the entire salmon life cycle would require leveraging data and expertise from across the Department.

Climate Change and Future Scenarios for Salmon

Climate change has already had widespread effects on salmon and their ecosystems in British Columbia and the Yukon (Grant et al. 2019), and those impacts are expected to intensify over time (Crozier et al. 2021). As such, it is not surprising that climate change was one of the most frequent research themes identified throughout the workshop discussions and activities. During the Open Space activity, there were 16 ideas directly or closely related to climate change that were identified out of all 77 ideas (Appendix D). Climate change was also the subject of one of the priority questions from the World Café activity.

Issues and research gaps highlighted a need to better understand future climate change impacts on salmon populations and their habitats, in combination with other stressors and drivers of productivity. Several identified research priorities described a need to come to a realistic understanding of future scenarios for Pacific salmon in a changing climate. Research priorities to support this that were discussed included downscaled models of climate projections in BC, population models that predict changes in productivity among life stages under different climate scenarios, as well as climate change vulnerability analyses that provide a better understanding of sensitivity and exposure of stocks to future climate changes. A few of the climate change research needs related to themes of decision-making and communication. These included needs such as determining how we set realistic conservation goals for salmon in an era of climate change and shifting baselines, and communicating realistic expectations based on our scientific understanding.

Proposed work to address these gaps was included in three of the ten topics presented to the Dragon's Den. These projects proposed to develop 1) downscaled climate models in marine areas, 2) population lifecycle models for alternative climate scenarios, and 3) communication tools on climate change and salmon (Table 3).

Decision-Making, Prioritization, and the Interface Between Science and Management

Many of the issues and priorities identified during the workshop were not focused on knowledge gaps, but on how priorities are determined and how decisions are made related to salmon conservation and management. These needs were captured under the theme of decision-making and prioritization, which includes the setting of management objectives, prioritizing resources and using those resources efficiently, and the interface between science and management in terms of how science provides advice

to managers, how managers use that advice, and how scientists co-develop their research with managers to address real-world challenges.

This theme emerged throughout almost all workshop activities and discussions. During the Open Space activity, there were 37 ideas raised that related to this theme throughout a diversity of topics such as engaging senior management to influence decision-making, incorporating adaptive management into our systems, defining management objectives for fisheries and conservation, and assessing the adequacy of current escapement goals. This theme also emerged during the Bucket List activity with one of the top voted buckets being priority setting. It was also mentioned during World Café discussions, for example, under the need for long-term planning and focusing on a common goal.

During discussions, the role of science in supporting prioritization and decision making was characterized as increasingly important given the imperiled status of many salmon populations and the expectation for climate change to magnify existing threats and alter habitat suitability. The social and ecological decision landscape for salmon management is becoming increasingly complex, and many workshop participants saw a role for science in helping to navigate that landscape. Some of the ideas and discussions identified the need to adapt our processes to take risks and proactively manage for changing conditions and towards shared goals, as opposed to reactively managing crises and conflicts. Many of the identified priorities described a need to set clear objectives, including stock management and escapement goals, conservation targets, and a long-term vision.

There were two projects proposed to the Dragon's Den closely related to this theme: a framework for the identification of management objectives, and a framework for assessing and prioritizing threats across life stages. Prioritization of conservation actions for key stocks is an objective of the PSSI that relates to work proposed under this theme.

DISCUSSION

Priorities for Improved Understanding of Salmon Ecosystems

The 2022 DFO Pacific Salmon Science workshop was convened with a dynamic agenda that didn't identify specific research areas or discussion topics, but instead elicited priorities and ideas from workshop participants through prompts and activities. Through this process, a number of emergent themes and priorities were identified across research and organizational lenses related to salmon conservation and management. While some of the ideas and discussion topics were specific to research disciplines, threats, or management issues, such as fisheries size limits or environmental contaminants, many others were integrative and broad in scope. Collectively, these ideas seek to better understand the drivers of changes in salmon populations and their habitats, both in the past and looking forward to a future with a changing climate. The workshop also identified that advancing and improving organizational data management, communication, and engagement, both internally and externally, are important supporting principles to enable integrative assessments and planning.

Research related to Pacific salmon is conducted by DFO across a large number of programs and sections, often with a specific focus on a particular life stage, ecosystem, stock group, or management area. These intensive studies are essential to understand the mechanisms and ecosystem interactions that influence population dynamics and survival. However, the workshop also identified a need for frameworks and processes to synthesize the diversity of research currently underway, so that it can better inform and advance decision making and planning. Many of the emergent themes share this common purpose;

integrated life history monitoring and assessments aims to understand the factors driving productivity in the past and present, while climate change modelling and vulnerability analyses aim to understand how productivity and stock status will change in the future (Figure 2). Both themes are important to inform and advance effective decision-making and planning for salmon conservation and rebuilding.

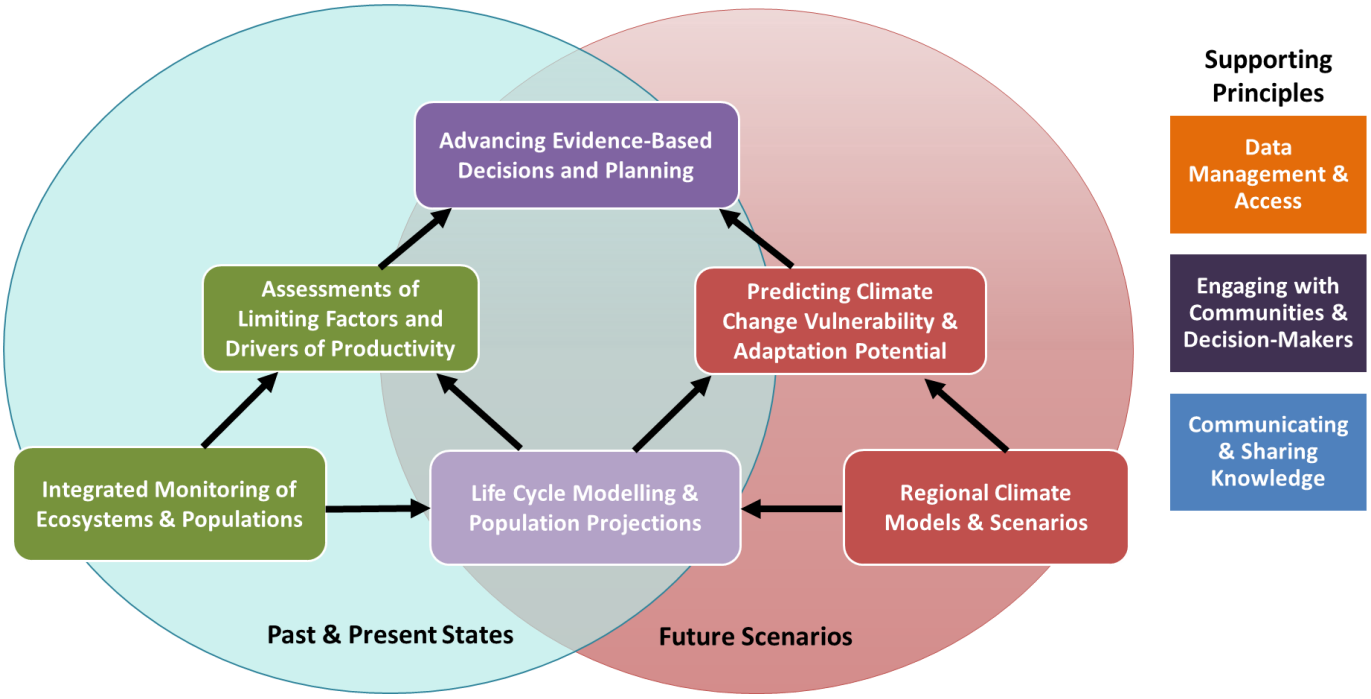

Figure 2 – Schematic of the relationships between emergent workshop themes and broad research areas related to Pacific salmon conservation and management. Elements on the lower tier support more integrative assessments of past and present drivers of productivity and future climate change vulnerability, which ultimately support and advance decision-making and planning. Supporting principles to enable effective research and synthesis are identified on the right.

Next Steps

While hybrid in nature, this workshop represented the first large in-person gathering of DFO Science staff since the COVID pandemic and was designed as the beginning of a longer-term strategic planning process that will unfold over the remaining three years of the PSSI and beyond. Workshop discussions revealed a strong need for opportunities to come together to discuss research priorities and gaps, forge linkages between programs, share information, and build relationships. PSSI implementation over the next few years will include additional meetings and workshops to support these outcomes and further strategic planning.

Over the next three years, PSSI will also provide resources to support new research and monitoring that addresses PSSI objectives as well as needs identified in this workshop. This research will be undertaken by a variety of DFO science programs and coordinated through working groups. Future reports will be prepared to synthesize these results and demonstrate progress on priorities identified in this report.

ACKNOWLEDGEMENTS

This report attempts to accurately represent the ideas, knowledge, and collective insights from 114 DFO staff that contributed their time and expertise towards the workshop. We are very thankful for everyone's participation in the workshop, in both the time they committed and the enthusiasm they brought to discussions and activities. Aside from the authors of this report, several staff also contributed towards the organization and execution of this workshop. In particular, Sue Grant, Julie Marentette and Jason Ladell were instrumental in planning and facilitating the virtual component of the workshop, while Tom Bird contributed significantly to planning the in-person component. We are grateful to Tom and Julie for also reviewing this report. We are especially thankful to Bob Chartier for his leadership in planning and facilitating the workshop and sharing his considerable experience and enthusiasm for bureaucratic reform and engagement.

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APPENDIX A - WORKSHOP AGENDA

Time	Item	Description
	Day 1, 15-Nov-2022	
0900	Introductory remarks	Workshop introduction by Andy Thomson, Regional Director of Science
0920	What are we doing	General Orientation
0930	Engagement strategy • TED talk • World café • The talk show (1h 30min)	TED Talk: The Suzuki Method Plenary exercise: • What are we doing well • Maybe we should stop… • Maybe we should start… • What's your biggest unanswered question right now? The Talk Show: Your Questions, Answered
1100	Break	
1115	Browsing the Toolshed: basic six pack (mini-sized)	Tools for engaging: • Individuals • The team • The system
1200	Lunch	
1300	Open Space Session (2h 40min total)	Finish this sentence: *To address the challenges associated with salmon conservation and management now and into the future, we need to know more about...*
	Break	
	Open Space Session – part 2	Convo pods: Discuss your menu topics Plenary: • Feedback • Leadership toss
1600	Talk Show	End of day reflection
	Day2, 16-Nov-2022	

Time	Item	Description
0900	Bucket List	Finish this sentence: *To better collaborate on salmon conservation and management now and into the future, we need to address the following logistical and cultural challenges...*
0945	Matrix Interview	Discussions of solutions to priority bucket list themes
1100	Break	
1115	Jam team formation	Assigned teams to put engagement tools into practice: • Create a mini-charter
1200	Lunch	
1300	Jam session	Assigned teams: create an elevator pitch on a research topic identified during the Open Space Session
1450	Break	
1510	Sea stars	Individual accountability exercise to action ideas from the workshop
1600	Talk Show	End of day reflection, plenary discussion + priming the pufflings for tomorrow
	Day 3, 17-Nov-2022	
0900	Workout Teams	Participant-led formation of teams to address research topics and cultural challenges • Develop mini charter • Develop mini workplan
1010	Break	
1030	Workout Teams, continued	Teams develop a 3-minute elevator pitch
1115	Dragon's Den	Present elevator pitches and receive feedback from senior management via discussion panel
1230	Talk Show	• Next steps • Workshop wrap-up
1300	END of workshop	

APPENDIX B - WORKSHOP PARTICIPANTS

First Name	Last Name	Branch / Program	Attendance
Paige	Ackerman	SEP	Virtual
Scott	Akenhead	Science	In-person
Dean	Allan	Science	In-person
Colin	Bailey	Science / Ecosystem Science Division	In-person
Leslie	Barton	Science / Strategic Science Initiatives	In-person
Dick	Beamish	Emeritus Scientist	In-person
Lindsay	Begemann	Fish Management	In-person
Jacquie	Belzile	FAM / Fisheries Policy & Planning	Virtual
Laura	Bianucci	Science/Ocean Sciences Division	Virtual
Tomas	Bird	Science/ StAR	In-person
Erica	Blake	SEP	In-person
Nick	Bolingbroke	Science / StAR	In-person
Alston	Bonamis	FFHPP	In-person
Douglas	Braun	Science / Ecosystem Science	In-person
Tanya	Brown	Science	Virtual
Karen	Burnett	Fraser and Interior Area Resource Management	In-person
John	Candy	Science	In-person
Jon	Chamberlain	Science	In-person
Bob	Chartier	External	In-person
Matt	Clarke	Science/Stock Assessment	In-person
Brendan	Connors	Stock Assessment and Research	In-person
Chrissy	Czembor	Science	In-person
Brooke	Davis	Science / Stock Assessment and Research	Virtual
Scott	Decker	Science	In-person
Dale	Desrochers	SEP	Virtual
Kaitlyn	Dionne	Science/Stock Assessment	In-person
Diana	Dobson	Science	In-person
Sebastien	Donnet	Science	Virtual
Sully	Drysdale	FAM	In-person
Rick	Ferguson	Science / STAD	In-person/Virtual
Cameron	Freshwater	Science ESD	In-person
Kyle	Garver	Science/ADGT	In-person
Stephane	Gauthier	Science/OSD	In-person/Virtual
Dylan	Glaser	Science/Stock Assessment	In-person
Sue	Grant	Science	Virtual
Dan	Greenberg	Science/Stock Assessment	In-person
Jeff	Grout	FM	Virtual
Shelee	Hamilton	Science	In-person
Charles	Hannah	Science	In-person
Lucie	Hannah	Science	Virtual
Jennifer	Harding	SEP	Virtual
Joel	Harding	PSSI	In-person/Virtual
Mike	Hawkshaw	Fisheries Management/Salmon Management	In-person
Tim	Healy	Science	In-person
Evan	Henderson	EMB	In-person
Amber	Holdsworth	Science	Virtual
John	Holmes	Science/StAR	In-person
Carrie	Holt	Science	In-person
Trish	House	Fisheries Resource Management	In-person
Kim	Houston	Science - Ocean Sciences Division	In-person
Ann-Marie	Huang	Science	In-person
Karen	Hunter	Science	In-person
Josephine	Iacarella	Science	In-person
Jim	Irvine	Science/SC Area	In-person
Brittany	Jenewein	EFM/Fisheries Management	In-person
Stewart	Johnson	Science	In-person

First Name	Last Name	Branch / Program	Attendance
Simon	Jones	Science	Both
Karia	Kaukinen	Science	In-person
Adam	Keizer	Fisheries Management	In-person
Eddy	Kennedy	Science	In-person
Meagan	Kindree	Fisheries Management/North Coast Area	In-person
Jackie	King	Science	In-person
Jim	Krivanek	EMB/SEP	In-person
Nikki	Kroetsch	Science/Ecosystems and Oceans Science	In-person
Cher	LaCoste	Science	In-person
Jason	Ladell	Science/FPS	Virtual
Cory	Lagasse	Science	In-person
Jeffrey	Lemieux	Science	In-person
Dawn	Lewis	Science	In-person
Ge	Li	FAM	In-person
Arthur	Liao	FAM - Salmon	In-person
Amy	Long	Science	In-person
Geoff	Lowe	Science	In-person
Wilf	Luedke	Science	In-person
Jason	Mahoney	PSSI - SEP	In-person
Amelia	Mahony	Science/STAD	In-person
Julie	Marentette	Science	Virtual
Marla	Maxwell	FAM	In-person
Diana	McHugh	Science/Stock Assessment	Virtual
James	Mortimor	Science	In-person
Sarah	Murdoch	PSSI	In-person
Sean	Naman	Science	Both
Christie	Nelson	FAM	In-person
Chantal	Nessman	PSSI/Salmon Stewardship Directorate	Virtual
Scott	Northrup	SEP	Virtual
Miriam	O	Science/ESD	In-person/Virtual
Jessica	Ottley	Science/Stock Assessment	In-person
Chuck	Parken	Science, FIA Stock Assessment	In-person
David	Patterson	Science / ESD	In-person
Kevin	Pellett	Stock Assessment	In-person
Erin	Rechisky	Science and South Coast	In-person
Karen	Rickards	Ecosystems and Fisheries Management	Virtual
Carrie	Robb	Science/ESD	Virtual
Kendra	Robinson	Science/ESD	In-person
Eric	Rondeau	Science / ADGT	In-person
Akash	Sastri	Science/Ocean Sciences	Virtual
Steve	Schut	Science/StAR	Both
Daniel	Selbie	Science	In-person
Dave	Semeniuk	PSSI	Both
Adam	Silverstein	SEP	In-person
Howard	Stiff	Science / SIRE	Both
Noel	Swain	Science/StAR	In-person
Laura	Tessier	Science/Stock Assessment	Virtual
Tom	Therriault	Science	In-person
Michael	Thom	EMB / SEP	In-person
Patrick	Thompson	Science/Ecosystem Sciences	In-person
Andrew	Thomson	Science	In-person
Matt	Townsend	Science / Stock Assessment	In-person
Nicole	Trouton	Science	In-person
Pieter	Van Will	Science/Stock Assessment	In-person
Lauren	Weir	Stock Assessment	In-person
David	Willis	SEP	In-person/Virtual
Catarina	Wor	Science	In-person
Yi	Xu	Science/Stock Assessment	In-person

APPENDIX C - WORLD CAFÉ RESULTS

Theme: A conversation about the key issues at DFO

Discussion prompts:

1. What are we already doing well?
2. Maybe we should stop…
3. Maybe we should start…
4. The biggest unanswered question right now is…

Figure C.1 Numbers of responses by different categories for examples of "What are we doing well?"

Table C.1 Logistical and organizational issues

Issue	Needs revision ("Maybe we should stop…")	Solutions ("Maybe we should start…")
Ability to change programs and processes	• Requiring national IT approval and support to build products • Requiring official translation on new products • Continuing with infrastructure that doesn't function, e.g. Phoenix • Using the B-base funding model • Maintenance of status quo	
Data management and access	• Holding onto data • Storing data on own computer or networks that are hard to find or have limited internal access	• Make data internally accessible • Better data sharing with the public • Use existing or create new data portals

	• Collecting data without defined need	• Consider what data needs to be invested in • Need data to answer new questions at the appropriate resolution and certainty level
Information overload… but also need better knowledge sharing and communication	• Number of meetings • Number of emails • Number of meetings that could have been emails • Generic and unnecessary communication • Lengthy meetings without focus	• Transparent communication within and between levels, branches, sectors • Create time and space for communicating DFO science to the public • Hire dedicated Information liaisons or science communicators within Science • Public data portal • Communication training
Silos and Internal Collaboration	• Creating the same programs with different names • Staff being territorial about projects, budgets, their data	• Integrated approaches and coordination across programs • Learn about other people's jobs through job shadowing or rotating through other offices • Lunch and Learns – who is doing what, across programs, branches, and ministries • Science Symposium • Training among and within teams • Interact between teams and within teams (connect admin and tech staff so they understand workloads)
Building external relationships	• The extent of virtual collaboration impacts team building, especially with new hires • Focusing conservation on rebuilding and "stopping the decline" • Severely limiting number of DFO participants at relevant conferences due to bureaucracy, when attendance allows for networking. Collaboration, and building faith in government science	• Greater role in public education • Bring scientists to resource management consultations • Encourage and incorporate bottom-up movement of ideas on how programs should be run • Inclusive problem solving • Social science data collection • Hire specialists who can facilitate meetings • Bring First Nation and stakeholders into conversations sooner • Look to NOAA for innovation on drivers of salmon collapse, especially under climate change • Engage with other governments

Science Management Interface	• Lack of holistic view on salmon management • Lack of expert teams guiding decision-making	• Integrated ecosystem management that incorporates invasive species, all habitats, and all life stages • Be more transparent about initiatives and how they add to the current work of DFO • Define decision-making processes • Documenting issues and working together to make decisions • Rapid science advice, e.g. memos • Need to be able to prioritize mandates to conserve stocks over promoting fisheries and economic development • Build interdisciplinary teams to solve vexing problems and guide decisions
Workload	• Taking on too much at once • Learning Plans • Being constrained by historic work plan objectives • Redundancies in programs (RPAs, SARA, planning processes) • Committees • Being reactionary	• Be supported by management to say no • Set realistic expectations for objectives • Aim to be proactive • Succession planning • Consistent onboarding
Administrative Challenges	• Downloading administrative tasks on operational staff • Procurement • Contracting • Administrative staff without the capacity or experience to support staff with administrative barriers • Amount of paperwork • Operational staff with no administrative support • Travel approvals • PeopleSoft / MyGCHR • Contract / GAC processing	• Make paperwork and processes universal • Improve administrative support – training, reduce complexity of administrative tasks, communicate roles and responsibilities • Hire sufficient administrative staff to support operational teams • Create administrative staff with specialties (e.g. HR, travel, GAC) • Include administrative staff in research and field activities to provide ownership • Streamline processes
Human Resources	• Hiring biologists to do administrative tasks • Persistent acting positions and position movement – it causes instability • Hiring retired staff on contracts instead of hiring new, young staff	• Facilitate overlap between retiring / leaving staff – imaginative contracts, rather than being constrained by an available HR box • Create transition plans for retiring staff

	• Training staff in term positions and not retaining the expertise (maybe just stop term positions that require specialized skills or training)	
Long-term vision	• Expecting PSSI to achieve all their goals in only 5 years • Giving away so much G&C money • Being reactive to crises	• Long-term proactive work plan • Define, communicate, and focus on a common goal

Table C.2. Technical and scientific issues

Issue	Needs revision ("Maybe we should stop…")	Solutions (Maybe we should start…")
Hatcheries	• Enhancement that does not meet objectives (e.g. for rebuilding)	
Fisheries	• Mixed stock fisheries • Misaligning information release / IFMP with fishing season • Telling the public we can fix everything	• Need escapement goals – how many fish should get to their spawning grounds • Understanding impacts or unregulated fishing • Reduce barriers to innovation, i.e. gear switching
Climate change	• Telling the public we can fix everything • Avoiding all risk	• Planning for current and future climate change • Identify salmon priorities related to climate change: conservation or hatcheries • Assess cumulative effects
Monitoring	• Isolating work on different life stages	• Consistent data collection and analyses

APPENDIX D – OPEN SPACE RESULTS

Prompt: To address the challenges associated with salmon conservation and management now and into the future, we need to know more about...

Table D.1 – Themes used to categorize ideas generated during the Open Space session. Themes were identified after the workshop based on commonalities in the ideas.

Open Space Theme	Number of ideas assigned to theme
Climate Change	16
Productivity Drivers/ Population Assessments	13
Non-Fisheries Threats	4
Ecosystem Monitoring	9
Population Monitoring	5
Fisheries Management	3
Management Objectives	7
Science-Management Interface	19
Prioritization & Efficiency	8
Data	6
Communication	5
Collaboration & Engagement	13

Table D.2 – List of 77 ideas generated during the Open Space session using the prompt. Ideas could be assigned across multiple themes if relevant.

Themes	Idea
Climate Change; Productivity Drivers/ Population Assessments; Science-Management Interface; Ecosystem Monitoring; Population Monitoring	How to integrate our understanding of climate change plus other impacts to salmon across the full life cycle for freshwater and marine. How do we manage resources across freshwater and marine life cycles?
Climate Change; Productivity Drivers/ Population Assessments; Ecosystem Monitoring	How climate change affects the salmon ecosystem and the mechanisms affecting salmon production
Climate Change; Productivity Drivers/ Population Assessments	Know more about scenario planning (climate change)
Climate Change; Productivity Drivers/ Population Assessments	The state of the salmon and how we expect them to respond (today, tomorrow, down the road) to a changing environment
Climate Change; Science-Management Interface	How will DFO deal with apocalyptic predictions for salmon due to climate change
Climate Change; Science-Management Interface	A better understanding of hydrological regimes under a changing climate. How are we balancing trade-offs with water scarcity (fish vs agriculture vs forestry)?
Climate Change; Science-Management Interface	How does or how can social science capacity support our response to climate change?

Climate Change; Prioritization & Efficiency; Ecosystem Monitoring	How does climate change affect salmon ecosystem and how does understanding that help us make better habitat prioritization decisions?
Climate Change; Management Objectives; Collaboration & Engagement	How do we get a shared understanding of a realistic future for people and salmon in light of climate change?
Climate Change; Management Objectives	How to develop realistic and achievable goals for salmon conservation in a period of climate change
Climate Change; Communication	Realistic expectations and communication especially under climate change. i.e. we will not restore
Climate Change; Communication	Define Climate Change Adaptation
Climate Change; Ecosystem Monitoring	Major effects on estuarine systems from extreme weather events
Climate Change	How we will reinvent the wheel to deal with climate change
Climate Change	Are there any possible positive effects of climate change on salmon populations?
Climate Change	How to measure resilience/vulnerability
Productivity Drivers/ Population Assessments; Science-Management Interface	We need to know about trade-offs associated with land-use planning and water management decisions
Productivity Drivers/ Population Assessments; Prioritization & Efficiency	Prioritization of current and future threats in both marine and freshwater across all life stages and how to effectively manage them
Productivity Drivers/ Population Assessments; Ecosystem Monitoring	How do we better integrate population and habitat assessment science?
Productivity Drivers/ Population Assessments	What did humans do to cause a dramatic, worldwide collapse of salmon marine survival?
Productivity Drivers/ Population Assessments	Impacts of changes in body size on productivity
Productivity Drivers/ Population Assessments	What spatial and temporal scales should we be linking environmental and biological data to understand salmon dynamics?
Productivity Drivers/ Population Assessments	How do we (and is it possible to) understand cumulative effects on salmon?
Productivity Drivers/ Population Assessments	What are the causes of salmon declines? Can we quantify relative impacts?
Productivity Drivers/ Population Assessments	How do we measure the value of incremental progress in a way that considers ecological effects at different scales?
Science-Management Interface; Collaboration & Engagement	How does DFO create change in areas not under DFOs jurisdiction (e.g. provincial, municipal)?
Science-Management Interface; Collaboration & Engagement	Science directive shift from top-down to bottom-up and how to initiate this change
Science-Management Interface; Communication	Define: conservation, management and futures

Science-Management Interface; Fisheries Management	How can we build better forecasts that include environmental variables? Do we need to change the way we think about/use forecasts?
Science-Management Interface	What is the process map for our current management approach?
Science-Management Interface	How will we adapt our decision processes to account for declining salmon status?
Science-Management Interface	How do we effectively engage senior managers to affect change?
Science-Management Interface	What are we accountable for and how do we apply that concept?
Science-Management Interface	What is the relationship between science and decision making?
Science-Management Interface	How do we better understand Ottawa's thinking and priorities?
Science-Management Interface	How do we adopt adaptive management as a practice?
Science-Management Interface	How do we give managers what they need, as opposed to what they ask for?
Science-Management Interface	How to go from risk to risk assessment to risk management
Science-Management Interface	How can spatio-temporal distribution data improve management decisions?
Prioritization & Efficiency; Population Monitoring	How do we build capacity to fill gaps in monitoring? (creel surveys, etc.)
Prioritization & Efficiency	How are we going to deliver on everything when the number of experts are fewer than the number of commitments, projects, etc.?
Prioritization & Efficiency	How to use complex systems thinking/optimization
Prioritization & Efficiency	How do we prioritize while we are trying to figure out to prioritize?
Prioritization & Efficiency	How do we apply existing risk assessment tools broader and more quickly?
Prioritization & Efficiency	The top 5 things to do differently to get better outcomes for salmon
Management Objectives	What is our long term strategic vision?
Management Objectives	What are the top 5 management objectives?
Management Objectives	Definition of management objectives for conservation and fishery management. What we want, when we want it and how badly we want it
Management Objectives	Are current escapement goals adequate (and if not, available?)?

Management Objectives	Clear stock management goals! Are we shooting for wild status for all or will some be "acceptable" as hatchery influenced to balance socio-economic values
Collaboration & Engagement; Data	How can Regional Science better support Areas with data management?
Collaboration & Engagement; Data	Skills inventory to meet program need, including external to DFO resources, collaborations and programs
Collaboration & Engagement	How to harness science to support citizen science
Collaboration & Engagement	What happens to the information "gathered" at DFO public/stakeholder/rightsholder engagement and can we do things differently? Can we use it more frequently?
Collaboration & Engagement	How we can more effectively collaborate with other levels of government that have jurisdiction over things that affect salmon / salmon habitat (e.g. land use)?
Collaboration & Engagement	How do we informally leverage all of the knowledge in this room?
Collaboration & Engagement	What are other areas, branches, staff doing and how does it relate to me?
Collaboration & Engagement	Reestablish relationships between regional and area science?
Collaboration & Engagement	How to deal with diversity
Collaboration & Engagement	Indigenous knowledge and how we can coproduce knowledge
Communication; Data	Data driven --> Data informed to engage, tell story
Communication	Communicate and identify uncertainties and plausible ranges effectively (e.g. in trade-off analysis)
Data	How do we store data to make them more accessible?
Data	How do we progress with data management while we transition to the cloud?
Data	Develop a structure to process map everything
Ecosystem Monitoring; Population Monitoring	Food web interactions. Diet!
Ecosystem Monitoring	Know more about the past (of watersheds, areas of management) to better inform our thinking and decision and priorities
Ecosystem Monitoring	Current assessment of mid-upper Fraser Chinook juvenile rearing habitat - is this a bottleneck?
Ecosystem Monitoring	What does PSSI and salmon research need from oceanographers?
Population Monitoring	Are we collecting enough and/or the right information from salmon on the spawning grounds where we have a unique opportunity to access them?

Population Monitoring	Increased resolution of escapement data (boots on the ground vs just a few overflights) - allow for the collection of bio-data
Non-Fisheries Threats	What and how do new/emerging diseases impact salmon?
Non-Fisheries Threats	Pinniped predation on salmon
Non-Fisheries Threats	Impacts of contaminants on salmon and their food sources (e.g. invertebrates)
Non-Fisheries Threats	What are we able to do about non-fishing threats?
Fisheries Management	Why are there minimum size limits for salmon?
Fisheries Management	Can someone please quantify Fisheries Related Incidental Mortality (FRIM) for different gears, species, and areas?

APPENDIX E – BUCKET LIST RESULTS

Prompt: To better collaborate on salmon conservation and management now and into the future, we need to address the following logistical and cultural challenges...

Table E.1 – Logistical and cultural themes (also called buckets) that were identified via aggregation of ideas during the bucket list exercises for the in-person and virtual workshop sessions. Three themes were identified following the workshop (communication, funding cycles, and hierarchy) to more accurately classify the ideas represented.

THEME	VOTES	FORMAT
Sharing Knowledge	47	in-person
Silos and Collaboration	46	in-person
Data	36	in-person
Admin Challenges	35	in-person
Priority Setting	28	in-person
Staffing	21	in-person
Us vs Them attitudes	19	in-person
Communication	19	virtual
Different priorities b/w Exec & Ops staff	19	virtual
Flexibility, Proactiveness, and Efficacy	18	virtual
Relationships	17	in-person
Resistance to change	16	in-person
workload	16	in-person
Human and other resources	15	virtual
Equity, inclusiveness, diversity	9	virtual
New Tech Tools & Programs	6	in-person
Celebrating success	5	in-person
Orientation / Professional Development	3	in-person
Sharing Resources	3	in-person
Meetings	2	in-person
Red Tape	1	in-person
Communication	N/A	Post-workshop in-person
Funding Cycles	N/A	Post-workshop in-person
Hierarchy	N/A	Post-workshop in-person

Table E.2 – Themes and the associated sticky notes of ideas (represented by each bullet point) that were identified during the virtual and in-person bucket list exercise. Each workshop participant provided two sticky notes on their highest priority logistical and cultural challenges.

Theme: Sharing Knowledge		
Format: in-person		#Votes: 47
• Knowledge transfer across areas to share approaches and tools • better understanding of the work other groups do • knowing what others have for collaboration • we need to listen to our people (e.g. the PSSI	• more formal methods of engaging with other groups, match up similar processes across groups • communication between teams • increasing communication between branches	• clear understanding of state of knowledge • communicate what we are working on to a broader audience (ie science FAM SEP) • provide more opportunities for work exchange

townhalls are not effective engagement) • lack of information sharing • informal science advice processes	• documenting and sharing institutional knowledge • little inter-program contact or information exchange	• encourage communication across programs through internal conferences of seminar series • knowledge of who to collaborate with
Theme: Silos and Collaboration Format: in-person		#Votes: 46
• Silos (x3) • expertise is spread across sections & divisions • salmon science people now spread across multiple divisions • reducing stove piping to improve multi-disciplinary work • geographic separation of team members • geography (BC is big)	• distance between labs • communicate outside of salmon silos • collaboration across different jurisdictions • we need to require staff from different teams to work together in the field • how to disperse large amounts of money to support multi-faceted salmon programs	• understanding our structure, who does what? • knowing what everyone does. The organization is very large • large size of organization • organizational structure • make collaborations a goal on individual workplans which we are accountable to
Theme: Data Format: in-person		#Votes: 36
• data is collected to be shared • increase data transparency • finding historical data • data is not always available easily	• data accessibility • gatekeeping/ data information • central data repository • sharing data	• data ownership - sharing data and conclusions by default • improve transparency in datsets across areas and programs. Master database?
Theme: Admin Challenges Format: in-person		#Votes: 35
• bureaucracy/paperwork/ processing delays • clunky administration • distracted by admin work • admin burden (x2)	• administrative downloading to science staff • streamline bureaucracy • roadblocks and lengthy processes •	• reduce procurement timelines & complexity • too much time on administration, not enough for creative thinking • better admin support
Theme: Priority Setting Format: in-person		#Votes: 28
• poor communication of mandate objectives • agree on endpoints • lack of understanding about competing objectives • defining clear objectives • unclear mandate/vision	• conflicting mandates/priorities • making sure the team has a common vision • having enough time to meet client needs and also explore new collaborative projects that may not directly meet program priorities	• setting priorities difficult with so many populations and geographic areas • more holistic management, less ad hoc (i.e. SEP production) • agreeing on priorities • lack of shared objectives across programs

Theme: Staffing		
Format: in-person		#Votes: 21
• continuity of staff in positions • HR timelines to hire new staff	• rapid staff turnover	• staffing constraints (x2)
Theme: Us vs Them Attitudes		
Format: in-person		#Votes: 19
• us vs them mentality • integrate leadership in FM, STAD, SEP, etc • be mindful of contagious cynicism • applied science vs basic science	• the false notion that science is separate from management • "some people are more important than others"	• consider that there are groups outside of the DFO salmon culture that can contribute to salmon objectives • picking favourites
Theme: Communication		
Format: virtual		#Votes: 19
• better two way communication (ie we get direction from the supervisors and send feedback back up the chain • increase transparency between groups • coordination among work that has been typically split between marine and freshwater • knowing who is working on what task and in which group so we know who we can reach out to	• sector silos • better data sharing • need to address the siloed working habits • need to understand not only who is doing what but also who knows what from past experience because people move around • break down information silos	• lack of shared work planning • use existing or new digital tools more effectively to communicate what different groups are doing and when and where • need for better connections across branches/silos on intiatives that impact salmon mgmt but are not specifically targeted at salmon (e.g. NSB MPAN - biodiversity & ecosystem objectives)
Theme: Different priorities between Exec and Ops Staff		
Format: virtual		#Votes: 19
• Different priorities between executive and operational staff: short-term political fires versus long-term strategic priorities • staff empowerment to work on innovative approaches wherever they are (core values updates - e.g. innovation, resilience, etc) • lack of engagement of SMEs to drive strategic direction • willingness to stick our necks out to try new things without fear of retribution for failure	• willingness to acknowledge our mistakes and learn from them. The story is not always rosy, and we need to be honest about that with the public • lack of a shared understanding on realistic expectations for salmon under Climate Change • define what conservation means for DFO (is this different than current exploitation focus?). Develop a conservation culture	• drop the business model approach (clients, deliverables) in a science organization to allow free flow of ideas • understand that climate change is changing our work in a miassive way • too much emphasis on consensus silences different views and novel ideas • access to scientific conferences - management should be more accommodating
Theme: Flexibility, Proactiveness, and Efficacy		
Format: virtual		#Votes: 18

• too much talk not enough action • time advances along - we are slow to action • too much time talking about doing and not actually doing • new ideas get a lot of criticism, but not much is constructive or offers improvements	• there's room for innovation and finding efficiences but that take times which is hard to find • filling knowledge gaps and actually funding those efforts rather than ribbon-cutting projects • streamlining processes	• improve our adaptive management cycle • flexibility on select who to collaborate with not only based on project/expertise but also based on relationship/connection there is resistance to change, which is natural and based on experience
Theme: Human and Other Resources Format: in-person		#Votes: 15
• retention of highly qualified personnel (term positions don't cut it) • recruiting new talent (rather than poaching from other groups) • hard to keep track of who is doing what with so much job shuffling • ensuring we stay engaged and continue to help guide work even with money going externally	• better external recruitment to expand networking opportunities rather than fortify existing ones • challenges between Science and IT/admin/HR • very short term funding cycles, with significant variation in availability of funding over years, impacting the ability of staff to prioritize and undertake long term and meaningful work	• too few experts and too many initiatives requiring expertise • flexibility to allow experts to grow within their position (or positions to adapt) vs. experts having to move programs to advance or become indeterminate
Theme: Equity, Inclusiveness, Diversity Format: in-person		#Votes: 9
• recognize different communication styles (introverted vs extroverted) and be more inclusive of different styles • respecting diversity of objective • better recognition of gender bias and challenges that are faced by those on receiving end of soft and benevolent biases	• provide opportunities for quiet types; silence should not equal agreement. Provide space for deep/slow thinkers and don't prioritize the louder voices in a room. Brainstorming sessions often lose the quiet thinkers who may have amazing ideas that are bulldozed over	• get managers out in the field more often so they are aware of the challenges faced by staff
Theme: Orientation / Professional Development Format: in-person		#Votes: 3
• new people who don't know anyone or who has what information	• comprehensive training for new staff	• supporting professional growth through knowledge transfer and training • mentoring
Theme: Sharing Resources Format: in-person		#Votes: 3
• pooling resources to achieve a shared objective		•
Theme: Meetings Format: in-person		#Votes: 2

• Too many meetings for sake of meeting • Unproductive meetings	• Culture of a business	• Too many unproductive meetings
Theme: Communication Format: post-workshop in-person		#Votes: N/A
• maintaining communication between groups without adding time burden of more meetings • translating the science into understandable messages for internal and external parties	• communicate in lay terms so we can understand each other • lack of communication between Federal and Provincial governments	• communication between research groups in science • poor communicatiom • communication and coordination across teams and divisions • science communication: context, uncertainty that accompany the data we produce
Theme: Funding Cycles Format: post-workshop in-person		#Votes: N/A
• Allow 5 yr programs to actually work towards decadal problems	• government funding cycles don't align with academics and other partners	• year-end constraints - how to do large scale, meaningful work across arbitrary fiscal year boundaries
Theme: Hierarchy Format: post-workshop in-person		#Votes: N/A
• content knowledge within management • hierarchy vs expertise in decision making	• many levels of overview in approval, which slows down decision-making • hierarchy	• reduce the hierarchy • knowledge holders vs experts (part of hierarchy)

APPENDIX F – MATRIX INTERVIEW RESULTS

Table F.1 – Priority themes and prompts used for the matrix interview sessions for in-person and virtual sessions. The priority themes were selected from the bucket list themes that received the highest numbers of votes from workshop participants.

THEME	PROMPT
In-person meeting	
Sharing Knowledge	What are 2-3 ways we can improve sharing?
Silos and Collaboration	What are 2-3 best practices that encourage more collaboration and silo awareness?
Data	What are 2-3 suggestions to help us better manage and share data?
Administrative Challenges	What are 2-3 best practices that reduce admin burden on everyone?
Virtual meeting	
Different priorities between Exec and Ops staff	What are 2-3 ways to address different priorities between executives and operational staff?
Communication	What are 2-3 ways to improve communication?
Flexibility, Proactiveness, and Efficacy	What are 2-3 ways to improve flexibility, proactiveness and efficacy?
Human and other resources	What are 2-3 ways to improve human and other resource availability and use?

Matrix interview results are organized into three major themes (Collaboration and Communication, Human Resources and Administration, and Data Management and Sharing) that synthesize the recommendations from the matrix interviews across both the virtual and in-person sessions. Recommendations that were most realistic and actionable, as well as most frequently suggested, were included from among the matrix interview results.

Collaboration and Communication

- Collaboration is not always rewarded or supported as part of job descriptions and work objectives. Potential ideas to address this include:
    - Include collaboration objectives as part of professional development and performance management
    - Add at least one annual project that requires collaboration with other groups to staff work plans
    - Identify shared objectives and outcomes for the entire department or branches and ensure there are shared accountabilities in achieving them
    - Identifying time for collaboration and relationship building as being a part of the job

- There is often poor information sharing between teams and limited understanding of what other research is underway within Science. Tools to address this could include:
    - A wiki/website of what sections and programs do, what data they collect (and where to find it) and how they contribute to management processes
    - Along similar lines, there were recommendations for a science staff directory of who's who at DFO, including what they work on and areas of expertise. Dedicated effort to keep this current would need to be identified.
    - An inventory of projects and research that are being conducted that is searchable by name, subject, area, and other keywords
    - Forums, seminar series or mini-symposiums to share information and discuss research that is occurring. Themes can be focused on issues that span multiple groups and research areas. The State of the Pacific Ocean (SOPO) is an example that was mentioned multiple times.
    - A newsletter or other regular form of communication on activities underway by different Science programs. Support would likely be needed to produce this.
    - Adoption of a single system for document searching among all DFO publications and reports.
- It can be difficult for new staff to get oriented to the Department. Onboarding and orientation could be improved by:
    - Developing a mentorship program (previous program was dissolved in 2005)
    - Create an exchange or job shadowing program, for example, between the Areas and Regional Science
    - Include information on what sections/divisions do as part of onboarding. If there was a project inventory or directory of programs then reviewing these resources could become a part of the onboarding process.
- The lack of face-to-face meetings and interactions was identified by several participants as a barrier to collaboration. Ideas to address this included:
    - Regular (annual or more frequent) large workshops or retreats between teams to build trust and relationships, not focused exclusively on work and program objectives.
    - More social events at office locations or off-site, including coffee breaks or lunches.
    - Create opportunities for staff to work together in the field across different branches (e.g. Resource Management and Science).
    - Dedicated funding to enable team-building and in-person gatherings.
- Organizational structure was considered a barrier to collaboration. A wide range of ideas were proposed to mitigate this, including:
    - Create a 'salmon division' that integrates habitat, population dynamics, etc.
    - Encouraging cross-sectoral working groups with staff of different backgrounds and expertise.
    - Create stronger connections between regional and area staff.
    - Creating team ambassadors that meet with other team ambassadors to exchange info, ideas and contacts.
    - Having staff (not researchers) dedicated to facilitating integration, for example by organizing events.

    - Reducing the burden associated with meetings, administration and excessive workload to free up more time for collaboration.
- Other ideas to promote collaboration included:
    - Regular "speed dating" or other networking events
    - Better sharing of methods and protocols, not just field/lab methods
    - Manageable group sizes exchanging best practices on specific science tools
    - Dedicated resources to actively engage with other agencies, academics, First Nations, and NGOs, and better communicate what we are doing with them.
    - Conducting field surveys across species and projects, taking advantage of staff and capacity that already exist in a location.
    - Observer opportunities to attend meetings across branches (e.g. fisheries management attending science meetings and vice-versa).
    - Structuring meetings to be more inclusive of participants (for example, using engagement tools from this workshop).
    - Declare a Silo Awareness Week and appoint a regional workplace champion (this one was probably a joke).

Human Resources and Administration

- Many recommendations described how administrative tasks and HR processes are not always well-documented, assistance and points of contact are unclear or unavailable, and training is inadequate. Suggestions to address this include:
    - Develop easy-to-follow, up-to-date guides and instructions for common administrative and HR tasks (e.g. HRG expensing, procurement, hiring). These should be readily available across the Department, updated whenever processes change, and clearly identifiable as the authoritative source for this information.
    - Ensure there is clear guidance to all staff on where to search for information or who to contact regarding HR and admin processes.
    - Develop orientation materials and better training for staff on common administrative tasks, responsibilities, and contacts that is provided to all staff as part of onboarding.
    - Ensure there are up-to-date links for all forms on the intranet and organize them by the process for which they are needed.
    - Create centres of expertise for admin and HR specializations (e.g. travel requests and expenses, hiring) that are accessible to all on short notice, or alternatively train and designate some admin staff as subject matter specialists so that there is a point of contact for different questions.

- The time burden of administrative tasks for scientists and managers was a common issue identified during the bucket list. There were a number of suggestions to improve efficiency and reduce admin burden on non-administrative staff:
    - Review the roles and responsibilities of scientists, managers and admin staff for admin tasks and reduce the amount of admin related tasks that are being completed by scientists and managers. Examples where admin staff could provide more support include coding in SAP, procurement, approval of GAC transactions, hiring forms, and contracting.
    - Conduct flow charting exercises for admin and HR processes to identify and eliminate inefficiencies, such as multiple approvals for expenses.

- Use modern data management tools for admin data to improve efficiency (e.g. eliminate multiple e-mailing of PDF forms and instead use online forms that can auto-populate and store information).
- Review and/or establish service standards and timelines for approvals (e.g. approving BTAs, completing tasks in SAP), ensuring that these are realistic given the needs of field programs and other operations.
- Give admin staff the authority to change minor errors so there is less back and forth with paperwork.
- Aim for more rigorous testing and training of new software before it is deployed, including better engagement with staff as part of development.

- Administrative capacity and frequent staff turnover were commonly listed as issues. Suggestions to address this included:
  - Hire more admin staff to ensure they have a manageable workload and increase their capacity for taking admin work away from scientists.
  - Find ways to reward and recognize admin staff when they are doing their job well.
  - Investigate why there is such rapid turnover in admin staff and find options to improve retention. Ideas provided included allowing 100% tele-work agreements for high functioning admin staff, and increasing pay.
  - Include helping scientists and managers with administrative tasks (i.e. reducing admin burden) on performance reviews for admin staff.

- There were a few recommendations related to approvals, delegation of authority, and document routing:
  - Review all approval processes (financial, HR, travel, conferences, briefing notes) and delegate approval authority lower where possible in order to free up time for managers to focus on management rather than forwarding recommendations.
  - Allow delegation of the approval step for GAC transactions in SAP, so that s.34 managers can review and approve a summary while admin staff can QA/QC the detailed entries in SAP. Some staff considered it onerous for managers to approve individual GAC transactions.
  - The new MyGCHR creates redundancy with Phoenix in having to review cash plus overtime (EDP) twice, which is an inefficient use of manager time. These reviews should be completed through one interaction. It was also recommended that efficiency of entering and reviewing this information could be improved by entering information by week/month and not by day.
  - Develop clearer processes for document approval routing and better training for admin staff to identify subject matter experts.
  - Allow for more flexibility in BTA requirements so that they can be issued for field staff and co-op students.

- Procurement and purchasing were the focus of several suggestions:
  - Decentralize or extend the hours of the Procurement Hub for contracting to better match the Pacific region time zone
  - Increase the low dollar value (LDV) contract limit to $20K
  - Allow for multi-year project funding to eliminate challenges associated with fiscal year end
  - Combine the procurement forms into a single form (i.e. use 9200, but remove 1448/49/5081)

- Develop expertise in procurement within the branch administrative staff so that managers and scientists don't need to be the experts

- There were some suggestions related to financial management and budgeting:
  - The frequency of financial/budget reviews should be examined and reviews that are not necessary or useful should be eliminated (the P8 was one example that was provided).
  - Budgets should be known and approved earlier in the year to make it easier for staff to plan ahead and provide more certainty on contracts and procurement.

Data Management and Sharing

- A common theme of the recommendations were for new or improved data policies and processes. These included:
  - For programs with similar data, create and implement standards for collecting, storing and structuring data, including metadata requirements. Standards could also be created by life history or activity types for work that focuses on salmon.
  - Data should be centralized plus accessible across programs with regular updates
  - Require data sharing agreements as part of project funding approvals and reporting. These could include requirements for annual updates and metadata standards. New projects should have mandatory data production and publication as part of the requirements.
  - Developing a formal data management plan within the program and ensuring that it is implemented.
  - Tracking tools to understand who is using what data and the intended purpose (e.g. MSEA GIS Hub)

- Many of the recommendations centered around increased resources, staff, and IT support for data management initiatives. Specific recommendations included:
  - Hire dedicated staff for quality assurance/quality control and data management (i.e. data stewards)
  - Provide improved access to IT services to support data initiatives, such as allowing scientists and Areas to hire computer scientists to build databases
  - Dedicate funds to create and maintain regional databases for common data types across programs using established standards
  - Dedicate funds to clean and digitize archived data
  - Ensure there is storage capacity for long-term storage of data
  - Create an adaptable, centralized database management system with permissions for access, that is searchable by data type, geographic region, dates, keywords, species.

- The need for better data management practices, training and awareness were identified in some interviews. Recommendations related to this theme included:
  - Mandatory data skill training (e.g. covering the FAIR principles for data management)
  - Training on how to access existing data repositories
  - Data orientations for new employees
  - Retirement exit interviews to capture institutional knowledge
  - Moving away from using spreadsheets and using databases as a storage solution

- Learning from other programs or organizations with good data collection and storage practices (e.g. CHS, groundfish database, MSEA GIS Hub)
- Hold an annual symposium or distribute a report to showcase data produced by programs