FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

March 30, 2012

IR Number: 72

Subject: Cumulative effects assessment – induced effects and increased access

Request

1. Please provide and explain the anticipated "management restrictions" that may need to be developed for the Highway.
2. Please indicate when "management restrictions" will be developed, whether they will be in place prior to Highway completion and who will be responsible for implementation and enforcement.
3. Please explain and justify how "management restrictions" will be evaluated in terms of their relative success at minimizing or elimination environmental impacts.

FJMC Response

1. When considering management restrictions for fishery resources along the proposed highway corridor it should be made clear that there are two separate fisheries that require attention. 1) The subsistence fishery of the Inuvialuit at and around Husky Lakes and 2) the recreational sport fishery by non-beneficiaries that is expected to intensify as a result of the increased access provided by the highway. Management restrictions may need to be applied differently to recreational sport fishers and to subsistence fishers. The possible impacts to fishery resources and traditional fishing practices of the Inuvialuit from the Inuvik to Tuktoyaktuk Highway construction are currently being considered and discussed by the Tuktoyaktuk – Inuvik Working Group (TIWG). Any required management restrictions with respect to the Inuvialuit subsistence fishery at in and around Husky lakes and the highway corridor will be developed by the Tuktoyaktuk – Inuvik Working Group, established by the FJMC to "ensure the fishery resources of Husky Lakes and area are sustainably managed" in cooperation with the Department of Fisheries and Oceans (DFO), the Fisheries Joint Management Committee (FJMC) and the local Hunters and Trappers Committees (HTC) of Inuvik and Tuktoyaktuk. Examples of management restrictions implemented in other situations include:
    - Closing some streams or lakes to any fishing
    - Seasonal closures during spawning or migration periods
    - Limits on the numbers of fish that can be harvested
    - Limits on the size of fish that can be harvested
    - Gear Restrictions (i.e. nets vs. hooks)
    - Total Allowable Harvest Levels, etc.

    Management restrictions need to be based on the status of the resource as well as the actions of the harvesters. There is currently limited information on the status of the resources in the areas that will be affected and therefore there is little baseline on which

to make management decisions. Further, the FJMC and DFO do not have the necessary funds to determine the entire baseline. The FJMC recognises that the developer has contributed to the improved understanding of the baseline by conducting Fish Habitat Assessment studies at proposed water crossing sites but it is also felt that the developer should, in addition, contribute to the necessary community consultations and the development of the fisheries management plan.

2. Through participation at the Tuktoyaktuk – Inuvik Working Group the FJMC and the Inuvik and Tuktoyaktuk HTC's are collaboratively working with DFO on the development of a fisheries management plan, these agencies will also be responsible for the implementation of the plan once completed. The document will outline the overall plan for the potential fisheries along the road. Specific enforcement initiatives would be the responsibility of DFO but may also be the subject of HTC by-laws. As part of the fisheries management plan, guidelines for responsible behaviour would be developed as the first step in ensuring protection of the resource. Preliminary guidelines should be in place prior to the highway opening and they could lead to voluntary action on the part of fishers. Formal actions such as seasonal or area closures could require changes in the federal fisheries regulations and would not be in place initially. Further putting such restrictions in place would involve considerable time and community consultation. The full suite of management restrictions can not be developed before the completion of the road for two reasons; 1) Restrictions will depend on knowledge of the baseline (e.g. if there are no fish in some lakes they don't need to be closed) and 2) Restrictions will depend on the response of fishers (e.g. if few fishers go out it is unnecessary to impose restrictions). It should be noted that the FJMC and HTC's are developing the IFMP with funds redirected to this priority but funding for the implementation of the IFMP has not yet been secured.
3. There are established protocols for evaluating enforcement actions (i.e. number of patrols, number of violations, etc.) these are the responsibility of DFO. Ultimate evaluating of the impacts will depend on biological stock assessments of the impacted fish stocks (harvest levels, population estimates, creel census, etc.). Processes for evaluating the success of any fisheries management restrictions developed under the plan would be outlined in an implementation plan. Successful implementation of the plan will depend on further development of the baseline and monitoring and enforcement as will be presented in the Plan.

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

IR Number: 80

Subject: Environmental Management Plans and Effects Monitoring

Request

For each resource and regulatory agency, please clarify your agency's role in developing an effects monitoring and an adaptive management program. Please identify:

1. Which programs you anticipate to review and approve as part of your agency's mandate.
2. What regulatory tools are available to your agency, to ensure that both compliance and effects monitoring would be in place to ensure that the effects on any given valued component will be at or below the effects predicted in the EIS.
3. How your agency would ensure that the above programs would be designed and implemented prior to construction.

FJMC Response

1. There are two types of programs that need to be considered here: 1) programs related to the planning and construction of the highway and the direct and long term effects on fish habitat of that construction and the operations associated with the construction and 2) programs related to the management of the resource in the areas that the proposed highway would make available to fishers. The FJMC would review and approve or provide recommendations on programs related to 1) the highway construction and operations through the Environmental Impact Screening Committee (EISC) process. The FJMC, DFO and HTC's will develop and implement programs related to the management of the resource subsequent to highway construction.
2. With respect to 1) programs related to the planning and construction of the highway, under the IFA section 14. (64) The FJMC has the responsibility for advising the Minister of Fisheries and Oceans on issues related to fish and fish habitat (water quality, water quantity) in the Inuvialuit Settlement Region (ISR) but does not have direct enforcement responsibilities for fish habitat. In relation to 2) programs related to the management of the resource in the areas that the proposed highway would make available to fishers, under the IFA section 14. (64) The FJMC has a responsibility to maintain a public registry on fishing on Inuvialuit 7.1(a) and (b) private lands within the ISR and restricting the public right to enter 7.1(b) lands for the purpose of fishing. The FJMC has further responsibilities for recommending to and advising the Minister of Fisheries and Oceans of fishing and on regulations and research as it relates to the ISR.
3. The FJMC will, with DFO and the HTC's, lead the development of a fisheries management plan for the Husky Lakes and including the proposed highway corridor but the FJMC does not have the resources to implement a significant new program in the ISR.

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

IR Number: 87

Subject: Harvesting

Request

1. Please describe the role of your organization in monitoring and mitigating project-related effects on harvesting.
2. Please describe any measures that could be taken by your organization to encourage voluntary compliance from the users of the proposed highway.

FJMC Response

1. Under the IFA section 14. (64) The FJMC (with DFO and the HTC's) has responsibility for monitoring and mitigating project-related effects on harvesting. DFO would have primary compliance/enforcement responsibilities.
2. Measure would be developed in cooperation with DFO and the HTC's through the fisheries management plan process. Voluntary compliance methods can be very diverse. In the past, HTC's in the ISR have implements mechanisms such as:
    - Voluntary Total Allowable Harvests
    - Dedicated allocations to Elders
    - Seasonal restrictions
    - Area restrictions, and
    - Self-monitoring

    These actions have been supported by community meetings and discussions, mail outs, local radio and posting of notices amongst others. The major difference with the Inuvik to Tuktoyaktuk Highway project is that the area will be easily accessible to non-beneficiaries and public from outside the area and Territory. Many of the local voluntary measures will not address those constituencies.

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

IR Number: 88

Subject: IFA and Community Conservation Plans (CCP) Goals – Land Use

Request

1. Please describe the position of your organization with respect to the proposed highway and its use of Management Category E.
2. Please describe what efforts must be taken by the Developer to reconcile the Project's proposed use of Management Category E.

FJMC Response

1. The FJMC, as identified under section 14. (61) of the IFA, was established to assist Canada and the Inuvialuit in administering the rights and obligations relating to fisheries under the agreement. One of which includes the overarching principal of c) to protect and preserve the Arctic wildlife, environment and biological productivity. It should also be noted that both the Inuvik and Tuktoyaktuk CCP's outline community concerns that the proposed Inuvik to Tuktoyaktuk all weather road may threaten fish habitat. That being said, the only Category E lands related to fisheries are the Husky Lakes. The FJMC position with respect to the projects use of Category E lands is that development activities should not impact the Husky Lakes watershed or fishery resources.
2. At minimum the Inuvik to Tuktoyaktuk Highway project should adhere to the 1km setback from Husky Lakes. With appropriate fish habitat management this should eliminate any immediate effects of project construction. However, it will not eliminate increased harvesting on the Husky Lakes so there will be a long-term impact. It is the position of the FJMC that those impacts can be mitigated with the implementation of a reasonable fisheries management plan and consideration of boat launching and docking when planning and constructing stream crossings (so not to promote boat launching), as noted above there are not adequate resources for such implementation.

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

IR Number: 124

Subject: Adequacy of Commitments

Request

1. Please review the relevant general and specific mitigation measures provided by the Developer in IR Response 55.1 Table F and identify and confirm the adequacy of the wording of the mitigation measures or provide editorial suggestions to improve the wording to ensure the commitments are specific, measurable, attainable, relevant and track able.
2. Please identify and provide wording for additional mitigation measures required to ensure the avoidance or minimization of Project impacts.

FJMC Response

Note: The following comments relate only to the inadequacy of certain commitments. If commitments are acceptable no comment is provided

1.

- Pg 135 (Table F) SOCIO-ECONOMIC – Commitment to install signage: This is only one component of the necessary response to the additional harvesting that the highway will afford. This would be a very minor component of the additional costs created by the need to develop and implement a fisheries management plan. The Developer does not address the need to develop baseline information, or to monitor new harvest activities or to bring about management changes in response to new harvesting activities.
- Pg 140 (Table F) FISH & FISH HABITAT – Commitment to develop a fish and fish habitat protection plan with DFO: This plan should be developed cooperatively with DFO, FJMC and the Tuktoyaktuk – Inuvik Working Group that will be responsible for developing the fisheries management plan and not just with DFO.

2.

- Pg 140 (Table F) FISH & FISH HABITAT – Commitment to develop a fish and fish habitat protection plan with DFO: This plan should also include the development of baseline information on fish and fish habitat along the Inuvik to Tuktoyaktuk Highway and including the larger corridor of lakes and stream systems that would be accessible from the highway to fishers. The baseline would provide the necessary information for future monitoring and management of the increased harvest activities that the highway would create/allow. The Developer should be responsible for funding these baseline studies.

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT XoE oTo
Tel: 867.777.2828 Fax: 867.777.2610

IR Number: 126

Subject: Increased Access to Fisheries Resources during Project Operations

Request

1. Please confirm the roles and responsibilities of the Fisheries Joint Management Committee in fisheries management in the LSA and RSA.
2. Please describe the processes use by the Fisheries Joint Management Committee to establish limits and restrictions on sport, subsistence and commercial fishing activities.
3. Please describe the status of any relevant fisheries management plans and studies underway and file copies of study results or management plans.
4. Please clarify and explain how the Developers commitment to develop an "action plan" fits within the existing planning and regulatory processes to manage fish harvest by subsistence, sport or commercial harvesters as a mitigation to minimize residual impacts to fish. In particular, describe the expected role of the Fisheries Joint Management Committee in "coordinating interactions between government agencies and Inuvialuit communities" regarding this action plan.

FJMC Response

1. The Fisheries Joint Management Committee (FJMC) was established under the IFA s. 14. (61):
   1) "To assist Canada and the Inuvialuit in administering the rights and obligations related to fisheries" under the IFA,
   2) "To assist the Minister of Fisheries and Oceans of Canada in carrying out his responsibilities for the management of fisheries" and,
   3) "To advise him on matters relating to Inuvialuit and Inuvialuit Settlement Region fisheries."

   The IFA indicates in s. 14 (64) that the FJMC shall, among its other activities:
   a) Review information on the state of fishing in waters on 7(1)(a) and 7(1)(b) lands and Crown lands in any areas where the Inuvialuit have an interest and fishery related activities on 7(1)(a) and 7(1)(b) lands;
   b) Identify areas of waters on 7(1)(a) and 7(1)(b) lands where fishing has taken place and predict where fishing may in the future take place;
   c) Determine current harvest levels;
   d) Develop, maintain and control a public registration system for fishing in waters on 7(1)(a) and 7(1)(b) lands and for entry on 7(1)(b) lands for the purpose of fishing;
   e) Restrict and regulate the public right to enter on 7(1)(b) lands for the purpose of fishing where such restriction and regulation is required for the conservation of a stock, to prevent serious conflict with Inuvialuit

activities, to prevent interference with other Inuvialuit use of the land to which they have title or to prevent unreasonable interference with Inuvialuit use and enjoyment of the land;

f) Deny entry to persons who abuse the right;
g) Allocate subsistence quotas among communities;
h) Determine the reporting requirements and review the role of Hunters and Trappers Committees (HTC) in regulating the subsistence harvest and collection of harvest statistics;
i) Make recommendations to the Minister of Fisheries and Oceans on Inuvialuit commercial fishing, allocation of the preferential fishing licences to be granted under subsections (29) to (32), regulations regarding sport and commercial fishing in waters on 7(1)(a) and 7(1)(b) lands and the identification of waters where such fishing may be prohibited; and
j) Advise the Minister of Fisheries and Oceans on regulations, research policies and administration of fisheries generally affecting the Inuvialuit Settlement Region, and on any new international agreements being developed that might apply to Inuvialuit fisheries.

These sections of the IFA give the FJMC the power to directly control fisheries on Inuvialuit lands (e.g. 64(e) "restrict and regulate the public right to enter on 7(1)(b) lands"). They also give the FJMC responsibility to recommend and advise the Minister of Fisheries and Oceans with respect to a range of activities some of which are waters on 7(1)(a) and 7(1)(b) lands (e.g. "regulations concerning sport and commercial fishing" in 64(i) above or more broadly throughout the ISR "the identification of waters where such fishing may be prohibited" also in 64(i) above. The power to make recommendations is especially significant and s. 14(65) to (72) describes how this responsibility is operationalized and how the Minister must respond.

2. The process that the FJMC uses is in a state of development. It is an adaptive co-management process that has been described in broad terms in *Adaptive fisheries co-management in the Western Canadian Arctic* (Ayles *et al.* 2007) and in *Adaptive co-management: Collaboration, learning, and multi-level governance.* (Armitage *et al.* N 125-150. Vancouver: *UBC Press).* (Can be located in Joint Secretariat Library # 1556-3) It involves the establishment of a Working Group (WG) of FJMC, HTC, DFO and other membership as deemed necessary. The general terms of reference for a Working Group are presented in FJMC Operating Procedure 14 (Submitted as a separate file). The WG is charged with a particular task (i.e. developing a fisheries management plan for fish from a particular area or river) and given guidelines and resources. The completed task is reviewed, modified and accepted (or not) by the responsible agencies (primarily the FJMC, DFO, IGC and HTCs) and implemented. The implementation is monitored for the period of the plan (3-5 years normally) and the plan is adjusted based on knowledge gained during the monitoring of the implementation.
3. The FJMC has established a Working Group of members from the FJMC and the Inuvik and Tuktoyaktuk HTC's to assist in the assessment of the Inuvik to Tuktoyaktuk Highway project. The focus of the WG discussions is currently on

FISHERIES JOINT
MANAGEMENT COMMITTEE
Box 2120, Inuvik, NT X0E 0T0
Tel: 867.777.2828 Fax: 867.777.2610

the assessment of the project but as identified in the Terms of Reference the WG has expanded discussions to encompass the development of a fisheries management plan for the streams and lakes in the corridor and areas accessible from the corridor. The Terms of Reference for the WG are submitted as a separate file. The TIWG has also supported a number of fisheries related projects along the highway corridor in 2010/11field season including a Summer Profundal Index Netting (SPIN) study to assess the Lake Trout population of a lake along the highway corridor identified as a priority by the WG. The study report and data are attached. The WG has also requested another study in 2012 field season which will test a model developed to forecast whether any given lake supports a fishery, this information would greatly aid the WG in efficiently identifying lakes along the corridor that support a fishery and that may require management restrictions. This project is pending for summer 2012. The FJMC also supported a DFO lead Husky Lakes Ecological Assessment project (2001 – 2004). The final project report was provided to FJMC in January 2012 and outlined a suite of recommended monitoring parameters for the Husky Lakes fishery. A written copy of the report given to FJMC in January is attached as a separate document.

4. It is not clear to the FJMC what is meant by the Developer's commitment to develop an action plan to minimize the indirect residual effects on fish habitat. The develop does not have the authority to develop a plan for fisheries management independent of the DFO, the FJMC and the HTC's who will have to implement any of the necessary actions. The Developer does recognise this but has not taken part in any suck planning. It is the position of the FHMC that the Developer has the responsibility to participate in and fund some of the necessary actions to minimize the indirect residual effects on fish and fish habitat, particularly the establishment of baseline information. The FJMC is open to discussions with the Developer on how it might participate in the planning process (or a modified process) that is currently underway under the IFA and the Fisheries Act. The only actions that the FJMC has noted in the Developer's response are commitments to responsibilities for implementation of any Action Plan should go well beyond the provision of signage.

FISHERIES JOINT MANAGEMENT COMMITTEE OPERATING PROCEDURES

Title Creation, Operation and funding of FJMC Working Groups **Ref. No.** OP-14

Background

The Fisheries Joint Management Committee during the course of managing its responsibilities within the Inuvialuit Settlement Region may encounter fish, fish habitat, marine mammal, or other related fisheries or oceans matters that require greater involvement and investment of community members to determine potential resolutions or outcomes. To address these issues the Committee may undertake a motion during a business meeting to create a Working Group comprised of representatives from community and other concerned agencies to undertake discussion of specific issues and to provide recommendations to the FJMC on said issues. One of the FJMC RP's will be appointed to each Working Group that is created to act a Secretariat to the Working Group and as the file manager for the Committee. One or more Committee members may be appointed by decision of the Committee to each Working Group and may also act as the FJMC File Manager for the Committee. Individual or multiple communities from within the ISR or from adjacent land claim organizations or communities may be represented on working groups of the FJMC. The FJMC will be responsible for deciding the membership of Working Groups, the number of representatives from each community, the chair of each Working Group as needed, and provide for the remuneration of participants if required.

	Event And Date	**Action And Individual Responsible**
3.	Working Group is identified by FJMC and budget assigned • At Regular business meeting	• FJMC undertakes a motion to create a Working Group, identifies member and RP representation, designates Chair if needed and sets number of community representatives to comprise Working Group • FJMC will identify an annual budget, funding source, and budget allocation. RP to track budget and provide reports as required to FJMC.. • Chair, members, and RP's
4.	Working Group Composition	• The FJMC member appointment or the designated RP will consult with the community(s) HTC involved and determine representatives. For meeting efficiency working groups should not exceed 6 community representatives with a minimum of two representatives from each community involved (maximum of four). This number may be increased to 7 should a community chair be selected for the Working Group. • FJMC member designate, FJMC RP
5.	Working Group Chair Selection	• FJMC Member designate to the Working Group shall act as Chair unless decided by the

		Working Group to recommend a Community Chair to the FJMC (FJMC will approve by Committee decision). • FJMC Member, FJMC, RP.
6.	Remuneration of Community members of Working Groups and community Chair of Working Groups	• Community Representatives will be provided a fixed remuneration of $200.00 per meeting of the Working Group. Maximum of 3 members per community unless approved by the FJMC. • Community Representatives will be provided per diems and travel expenses as guided by the regular travel directive for FJMC Inuvialuit members. RP designate will action travel and honoraria payments for community members. • Community Chairs of Working Groups upon appointment of the FJMC will be eligible for remuneration at the Inuvialuit FJMC member rate of $250.00 per day. The Chair will be allowed ½ day for agenda preparation before meetings, and ½ day following meetings for completion of WG responsibilities. Work in excess of these hours will be compensated on an hourly rate of $20.00 per hour upon receipt of a written record of work elements and time expended.(RP to provide form). • Expenses for Community Chairs shall be the same as for Community Representatives. • The FJMC RP will instruct WG Chairs and members on remuneration and submit claims as required for payment. • FJMC RP.
7.	Remuneration other WG members	• Unless otherwise approved by the FJMC other agency participants to Working Groups will be responsible for their costs and participation in entirely. If approved it shall be similar to the rates for Inuvialuit Community representatives.
8.	Working Group minutes and recommendations and dissolution. • As necessary.	• The FJMC RP will be responsible for recording WG proceedings and assisting with WG action items as required. The FJMC member and the RP will be responsible for briefing of the FJMC at regular meetings on the actions and recommendations of the Working Group to the FJMC or other agencies. • FJMC will provide updates on WG to the IGC and to the communities during regular community tours. • Upon completion of assigned duties the FJMC

		will formally dissolve the WG by motion at a regular business meeting
9.		

Tuktoyaktuk-Inuvik Working Group (TIWG)
Terms of Reference
(Draft February, 2, 2010)

[Draft terms of reference for consideration by the Tuktoyaktuk Hunters and Trappers Committee, the Inuvik Hunters and Trappers Committee, the Fisheries Joint Management Committee and the Department of Fisheries and Oceans Canada.
Approval of these Terms of Reference (with modifications if appropriate) are sought as follows:]

Inuvik HTC -	*Apr 8, 2010. At the next regular meeting of the HTC.*
Tuktoyaktuk HTC -	*Apr 8, 2010. At the next regular meeting of the HTC.*
FJMC -	*Apr 8, 2010. At the April meeting of the FJMC.*
DFO -	*Apr 8, 2010.*

1. Purpose:

1. Ensure the concerns and comments, with respect to the construction of the Inuvik to Tuktoyaktuk highway, of the Inuvialuit in affected communities are incorporated and considered throughout the Environmental Impact Review Boards (EIRB) Public Review of the Project by active participation in the review process.
2. Ensure the fisheries resources of Husky Lakes and water bodies along the proposed Tuktoyaktuk – Inuvik highway corridor, including Noel and Parsons Lakes, are sustainably managed.

2. Reports to:

- Tuktoyaktuk Hunters and Trappers Committee (HTC).
- Inuvik Hunters and Trappers Committee (HTC).
- Chair of the Fisheries Joint Management Committee (FJMC).
- District Manager of the Western Arctic Area –Department of Fisheries and Oceans (DFO).

3. Members:

- Tuktoyaktuk HTC representatives: 3 Members
- Inuvik HTC representatives: 3 Members
- One Inuvialuit FJMC Member
- One DFO representative - Observer
- One FJMC Staff Member to act as secretary to the Working Group.
- In absence of FJMC members at TIWG meetings, the FJMC Resource Person will act as the FJMC observer.
- Others: Representatives of other agencies, ILA, WMAC, EC, AANDC etc., will be invited to participate or contribute as appropriate.

4. Chair:

The Tuktoyaktuk-Inuvik Working Group will practice a permanent Co-Chair approach, having one Tuktoyaktuk HTC representative and one Inuvik HTC representative named as the Co-Chairs.

5. Communications:

- The members of the TIWG are responsible for reporting on progress to their respective agencies.
- The TIWG will develop a communication plan to ensure that the members of the Tuktoyaktuk and Inuvik HTC's and the communities of Tuktoyaktuk and Inuvik understand and support the planning process.

6. Meetings and Timetable:

- There will be approximately 2-3 meetings per year (1 day each with an associated public evening meeting to update the HTC's and community members). Additional meeting may be held throughout the year as needed.
- Meetings will be held at the call of the Chair(s) in consultation with the TIWG members. Meetings will alternate between the communities of Tuktoyaktuk and Inuvik.
- Quorum shall consist of 2 Tuktoyaktuk HTC members, 2 Inuvik HTC members and the Chair.
- If the Terms of Reference are approved by all members of the TIWG. The first meeting of the TIWG is proposed for the week of May, 2010 with a tentative second meeting in September, 2010 (tasks for this first meeting will be the identification of background material and the development of a work plan for the TIWG).

7. Guidelines For The TIWG To Ensure The Sustainable Management Of The Fisheries Resources Of The Husky Lakes.

7.1. Biological Scope:

- The plan(s) will include fish of high importance such as Lake Trout in the area and their habitats. With the possibility of later including other important fish species.

7.2. Geographic Scope:

- The plan(s) will include all important lakes, such as Noel Lake, Jimmy Lakes, Husky Lakes and Big Lake. And possibly extend to other lakes, rivers and streams along the corridor of the proposed Tuktoyaktuk-Inuvik Highway Project.

Tuktoyaktuk – Inuvik Highway Project: Summary of the Fish Assessment of Lake 111

Background

There is a potential for a highway between Tuktoyaktuk and Inuvik. Along this potential highway, there are many waterbodies. In order to protect these waterbodies the Tuktoyaktuk – Inuvik Working Group (TIWG) was created. The TIWG, comprise of the Inuvik Hunters and Trappers Committee (member), the Tuktoyaktuk Hunters and Trappers Committee (member) and the Fisheries Joint Management Council (secretariat) and it has the mandate to do a fish management plan along this highway.

In order to do a fish management plan, the TIWG need to determine what kind of species can be found in the waterbodies that will be close to the potential highway and to see if there are recreational or subsistence species of fish. The lake chosen for a community fish assessment this year is Lake 111 (figure 1). One of the reasons the TIWG chose this lake is because they cannot find any traditional knowledge (TK) on it and they are assuming that Lake Trout (*Salvelinus namaycush*) are living in it.

Finalized November 3, 2011

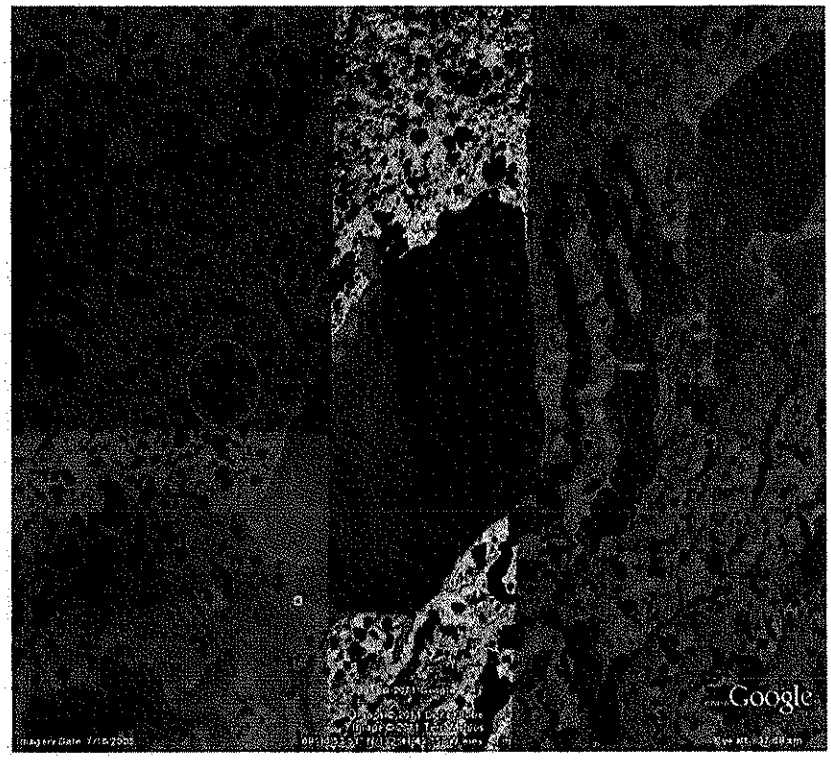


Figure 1: Lake 111 (69°10'55.20" North; 132:57'39.92")

Methodology/Results

Lake 111 was sampled on July 26-27, 2011 using minnow trap, one panel of small meshes (1.25", 0.75", 1.5", 0.5", 1.0") summer profundal index netting nets (SPIN nets) and one panel of big meshes (3.0", 4.5", 2.0", 3.5", 1.5", 5.0", 2.5", 4.0") SPIN nets. The net were set via a zodiac boat. Due to complication with the motor and the low depth of the lake, only a portion of the lake was sampled.

None of the fish capture was kept. Out of 46 fish captured, 28 percent (13 fish) died in the nets. During the assessment a total of 38 broad whitefish (*Coregonus nasus*), one artic cisco (*Coregonus autumnailis*), one grayling (*Thymallus thymallus*), four northern pikes (*Esox Lucius*) and one nine sticklebacks (*Pungitius pungitius*) where captured. No Lake Trout was captured.

The average length and weight of the broad whitefish was 32.7 cm and 0.55 Kg. The average length and weight of the northern pike was 30.5 cm and 0.43 Kg. The arctic cisco was 24.0 cm and 0.3 Kg, the grayling was 35.2 cm and 0.6 Kg and the nine sticklebacks was 5.0 cm and 0.025 Kg.

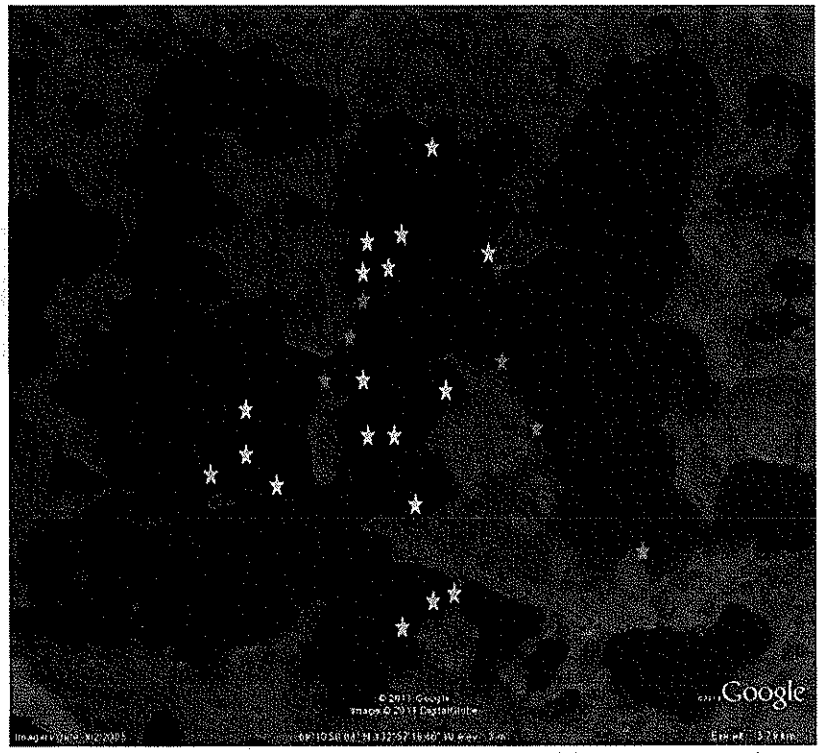


Figure 2: Sample sites. Yellow represent the big SPIN nets, blue represent the small SPIN nets and red represent the minnow trap.

Sample Number	Net Number	Date Caught	Type of Fish	Fork Length (cm)	Round Weight (kg)	Release or Kept
1	B1	26-Jul-11	White Fish	33.8	0.7	R
2	B1	26-Jul-11	White Fish	34.5	0.7	R
3	B1	26-Jul-11	Pike (No measurement/was thrown away)			R
4	B1	26-Jul-11	White Fish	33.3	0.5	R
5	B2	26-Jul-11	White Fish	38.3	0.9	K
6	B2	26-Jul-11	White Fish	35.1	0.6	R
7	B2	26-Jul-11	Cisco	24	0.3	R
8	S4	26-Jul-11	Pike	41.5	0.6	R
9	B3	26-Jul-11	White Fish	35.2	0.6	K
10	B3	26-Jul-11	White Fish	36	0.7	K
11	B3	26-Jul-11	White Fish	35	0.4	K
12	B4	26-Jul-11	White Fish	23.2	0.1	R
13	B5	27-Jul-11	White Fish	35	0.6	R
14	B5	27-Jul-11	White Fish (No measurement/jump of boat)			R
15	B5	27-Jul-11	White Fish	35.2	0.6	R
16	B5	27-Jul-11	White Fish	35.2	0.6	R
17	B5	27-Jul-11	White Fish	35.5	0.65	K
18	B5	27-Jul-11	White Fish	23	0.15	R
19	B5	27-Jul-11	White Fish	23.5	0.2	R
20	B5	27-Jul-11	White Fish	34.1	0.55	R
21	B6	27-Jul-11	White Fish	35.4	0.6	R
22	B6	27-Jul-11	White Fish	35.2	0.65	R
23	B6	27-Jul-11	White Fish	22.5	0.2	K
24	B6	27-Jul-11	White Fish	34	0.55	R
25	B6	27-Jul-11	White Fish	35.2	0.55	K
26	B6	27-Jul-11	White Fish	36.4	0.65	R
27	S5	27-Jul-11	Pike	7.5	0.025	R
28	S5	27-Jul-11	White Fish	34.8	0.55	K
29	S5	27-Jul-11	White Fish	35	0.6	K
30	S6	27-Jul-11	White Fish	23	0.5	K
31	S6	27-Jul-11	Nine Stickleback	5	0.025	R
32	S6	27-Jul-11	White Fish	25	0.2	K
33	B7	27-Jul-11	White Fish	36	0.7	K
34	B7	27-Jul-11	White Fish	37.2	0.8	K
35	B8	27-Jul-11	White Fish	36.3	0.9	R
36	B8	27-Jul-11	White Fish	35.4	0.5	R
37	S7	27-Jul-11	White Fish	37.1	0.7	R
38	S7	27-Jul-11	Pike	42.5	0.65	R
39	S7	27-Jul-11	White Fish	35.5	0.6	R
40	B9	27-Jul-11	White Fish	34.2	0.6	R
41	B9	27-Jul-11	White Fish	35	0.8	R
42	B9	27-Jul-11	Grayling	35.2	0.6	R
43	B10	27-Jul-11	White Fish	32.3	0.5	R
44	B10	27-Jul-11	White Fish	24.8	0.2	R
45	B10	27-Jul-11	White Fish	25	0.3	R

White Fish: 38
Cisco: 1
Grayling: 1
Pike: 4
Nine Stickle Back: 1

Ecological Assessment of Husky Lakes – Schedule & Products at Dec 2011

1. Field, lab work, progress reports – annually 2000-2005
2. Harwood, L. A. and Sparling, P. Lake trout distribution and salinity: an assessment of the relative abundance and distribution of lake trout throughout Husky Lakes, 2001-2004. *In*: Mills, K. H., M. Dyck, and L. A. Harwood. 2008. Proceedings of the Second North American Lake Trout Symposium 2005, Yellowknife, Northwest Territories. Can. Tech. Report Fish. Aquatic Sci. 2778. 247 p.

3. Chris Perin report – 2007 – *Fish species distribution and associated water chemistry attributes in the Husky Lake and Sitidgi Lake system, NT*

4. Marie-Julie Roux, Lois Harwood, Xinhua Zhu, Paul Sparling and Ross Tallman (2011). Fish Assemblage Structure and species diversity with relationships to environmental variables in an arctic estuary: the Husky Lakes ecosystem, Canada. The Fisheries Society of the British Isles 2011 Annual International Conference (FSBI 2011) - Fish Diversity and Conservation: Current State of Knowledge. Bournemouth, U.K. July 2011.

5. Summary report – Dec 2011 (attached)
6. Draft Tech Report – Feb 2012 (Roux et al.)
7. Working Group Meeting – presentation & recommendations – March 2012 (Harwood)

8. Primary publication – fall 2012 (Roux et al.)

Highlights – *Physical ecosystem structure*

- From Thumb Island, the Husky Lakes extend approximately 130 km inland and cover an area of 1933 km^2 (Figure 1).

- The Husky Lakes shoreline is extensive (total perimeter > 2000 km).

- Drainage area for Husky Lakes only (not including Kugaluk Channel) is 9 543 km^2 (see Figure 2 for catchment boundary).

- **The Husky Lakes have a complex bathymetry. Mean depth was 13 m throughout the estuary but varied greatly among basins, from 6 m in B3 and B4 to 23 m in B1. Maximum depth was 98 m in B1 and B2 and exceeded 70 m in all basins but B4 and IF (max depth ≤ 40 m) (Figure 3).**

- Kugaluk Channel had a mean depth of 6 m and maximum depth of 24 m.

- Sitidgi Lake covers an area of 291 km^2 and is characterized by a small perimeter to area ratio (0.38).

- **Sitidgi Lake is relatively shallow with mean and maximum depths of 7 m and 37 m, respectively. Deeper areas (> 20 m) are mainly located in the eastern arm of the lake (Figure 4).**

Highlights – *Water composition and properties (Husky Lakes)*

- Vertical gradients in water composition (i.e. changes in concentrations with increasing depth) were generally small. Horizontal (spatial) gradients were more important.

- **The Husky Lakes estuary is highly oligotrophic with total phosphorous concentrations in surface water ranging from 0.01 mg L^{-1} (in B2, B4 and IF) to 0.07 mg L^{-1} (in B5).**

- Surface water temperature in Kugaluk Channel ranged 8-16°C with a mean of 13°C.

- **Vertical temperature and salinity profiles underlined the prevalence of mixing conditions throughout the estuary (Figure 7).**

- **Intense mixing (as indicated by relatively constant temperature and salinity measurements with increasing depth) was observed in IF and OF and to a lesser extent in KG and at station 13 in B5 (Figure 7).**

- Temperature stratification of the water column was observed in most basins with the occurrence of a mixed layer in B1 and B2 and at station 11 in B4. Mixed layer thickness ranged 3-7 m depending on station (Figure 7 (A,B and D)).

- Salinity stratification of the water column was only visible at one site (station 6 in B2 (Figure 7 (B)).

- A cooler (0-1°C) bottom layer was observed in OF, B5 (station 13), B2 (stations 3, 5-6) and B1.

- A lower salinity layer near the bottom was observed in OF (station 18), B5 (station 13), B4 (stations 9-10), B2 (station 6) and B1 (Figure 7).

Highlights – Fish abundance and catch composition.

- A total of 564 test nets were set in Husky Lakes, 21 nets were set in Kugaluk Channel and 55 nets were set in Sitidgi Lake during the study period.

- **Fish abundance as CPUE (Catch Per Unit Effort – number of fish caught per 100 m^2 experimental net per hour) was highest in Kugaluk Channel with an average of 62 fish per net hour compared to 7 fish per net hour in all of Husky Lakes and 2 fish per net hour in Sitidgi Lake.**

importance were Arctic Cisco (14% of $CPUE_T$) and Pacific Herring (13% of $CPUE_T$).

- **In Sitidgi Lake, the catch was dominated by Lake Whitefish and Lake Trout with average CPUEs of 0.78 Lake Whitefish and 0.65 Lake Trout per net hour explaining 38% and 31% of $CPUE_T$, respectively. Second in importance was Northern Pike which accounted for 16% of $CPUE_T$ in the lake.**

Highlights – Lake Trout abundance and spatial distribution*

- Lake Trout was caught in Sitidgi Lake and in B1, B2, B3 and IF in Husky Lakes (Figure 8).

- Lake Trout abundance was relatively low in individual test nets with a maximum of 4 Lake Trout per net hour recorded in Husky Lakes.

- **Average Lake Trout abundance was lower in the inner fingers (IF) area of Husky Lakes (0.17 Trout per net hour) relative to Sitdgi Lake (0.65 Trout per net hour) and B2 (0.59 Trout per net hour) (Figure 9).**

- **Spatial distribution and relative abundance information indicated that Lake Trout mainly occurred at salinities ranging from 0-5 ppt (in Sitidgi Lake, B1 and B2) but remained present (though in lower abundance) at intermediate salinity levels (7-13 ppt) in IF.**

- **The results suggest that any activity affecting freshwater budget in inland most basins of Husky Lakes (namely B1 and B2) will have consequences for Lake Trout distribution and abundance in the system.**

**The spatial distribution and relative abundance of individual fish species caught in Husky Lakes and Sitidgi Lake was similarly evaluated and discussed in the full report.*

Highlights – Spring Fishery for Lake Trout

- A total of 921 Lake Trout harvested in the spring subsistence fishery were sampled for biological characteristics during the five-year monitoring programme.

- Sampled Lake Trout were harvested in Sitidgi Lake (SL) and in B1, B2, B3 and IF in Husky Lakes. Monitoring efforts targeted harvests from B2 and B3 in all years. B1 was monitored in 2001-2004 and SL was monitored in 2001 and 2004 only.

- **Harvested Lake Trout on average measured 664 mm fork length, weighted 3.7 kg and were 21 years of age.**

- Minimum and maximum size at harvest was 223-1016 mm (fork length) and 0.2-11.5 kg, respectively.

- Larger and heavier Lake Trout were harvested from B3 relative to those harvested in B2 and/or B1 depending on year.

- Minimum age at capture was 8. Maximum age at capture was 55.

- Modal age was variable and a broad range of age classes (spanning 29 to 46 years) characterized annual harvest samples (Figure 11).

- **The occurrence of older Lake Trout in the subsistence harvest was important. Lake Trout ≥ 30 years of age accounted for 5 to 15% of the catch on an annual basis and represented 10% of the entire harvest over the study period (Figure 11).**

- Examination of stomach contents indicated that the diet of Lake Trout from Husky Lakes during spring and summer is dominated by Pacific Herring.

- **Mercury (Hg) levels determined for 10 Lake Trout specimens harvested in the spring fishery averaged 0.18 ppm (range of 0.11-0.22 ppm), which is below the Canadian guideline limit for safe fish consumption (0.5 ppm).**

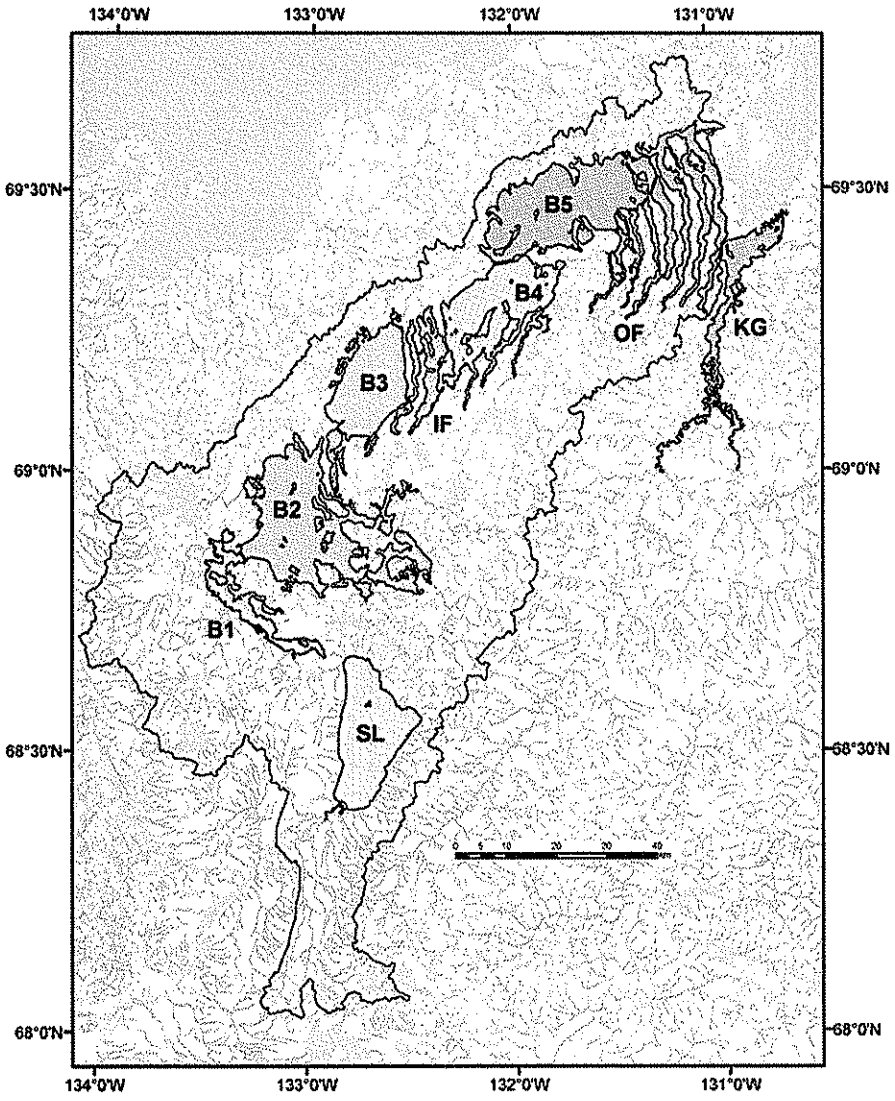


Figure 2. Basins subdivisions for Husky Lakes (B1-B5, Inner Fingers (IF), Outer Fingers (OF) and Kugaluk Channel (KG) in Liverpool Bay). SL = Sitidgi Lake. The contour line indicates catchment area boundary for Husky Lakes (not including KG).

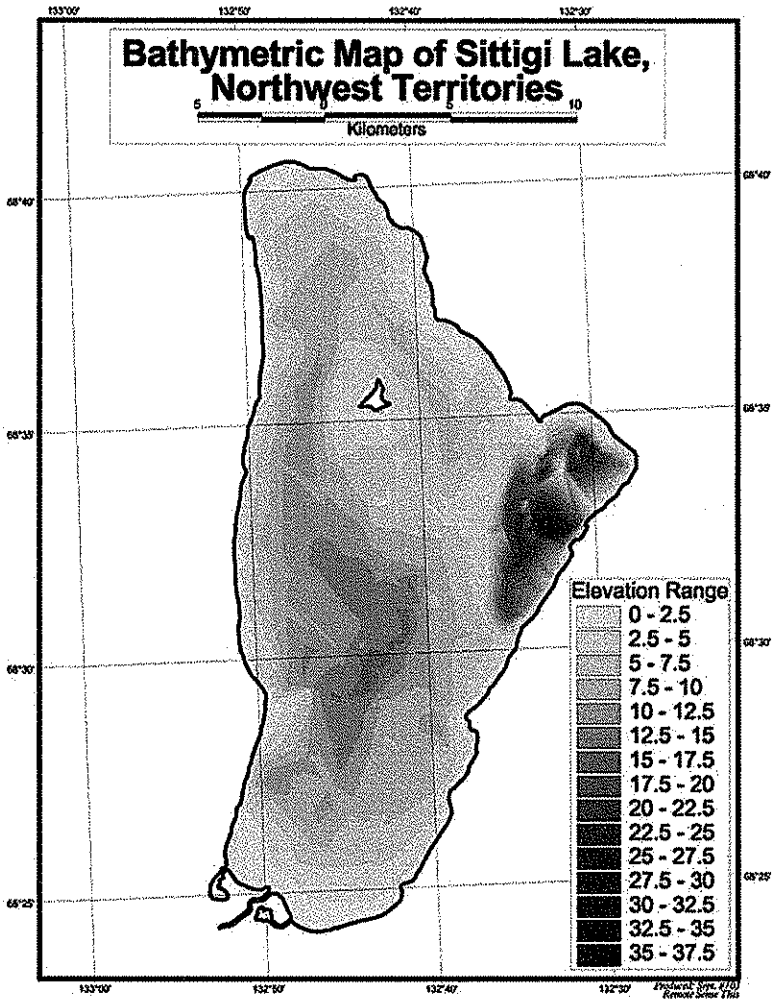


Figure 4. Bathymetric map of Sitidgi Lake.

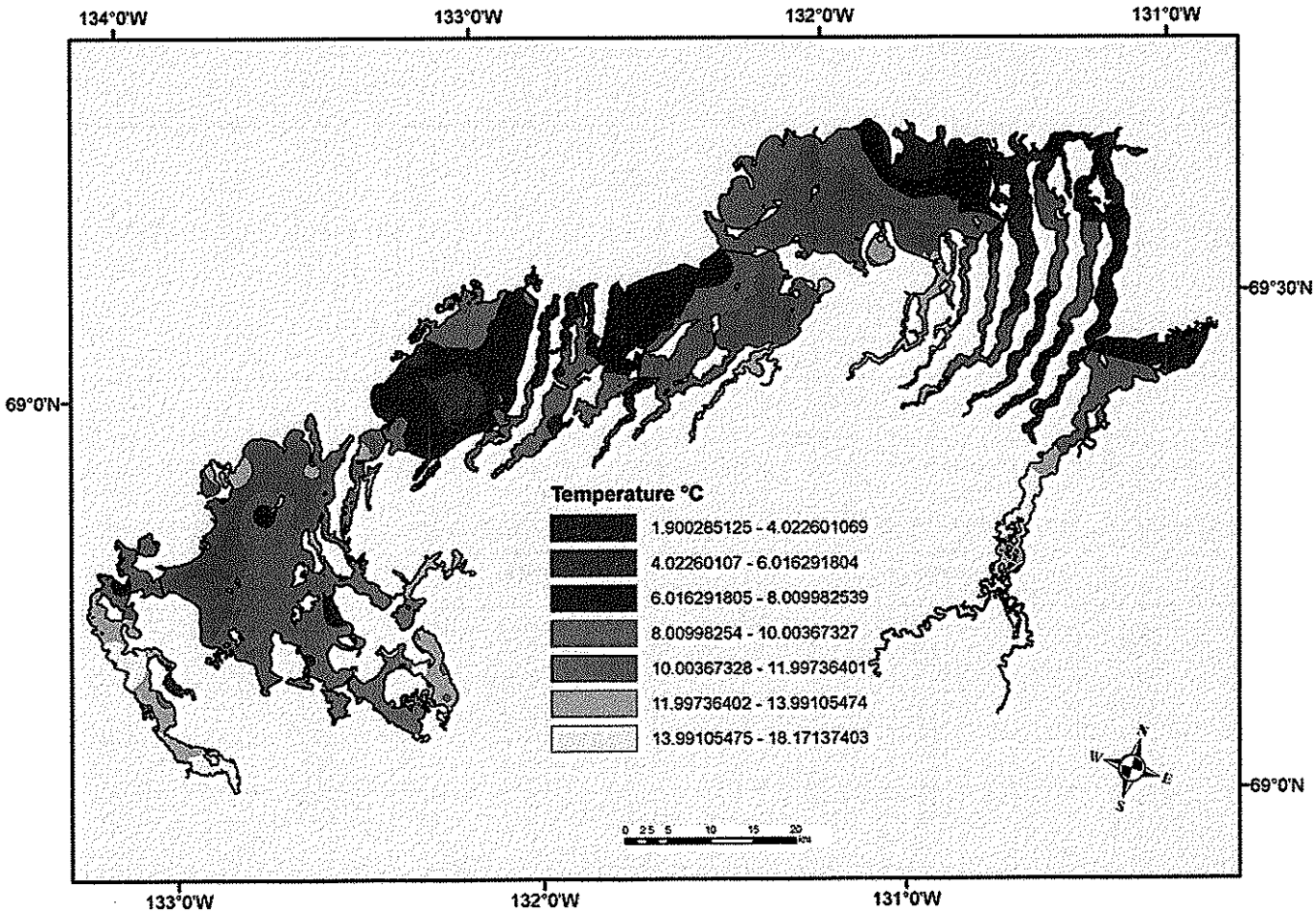
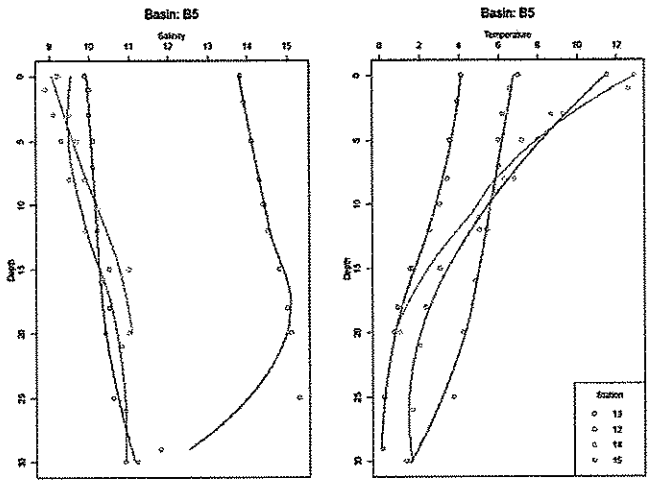
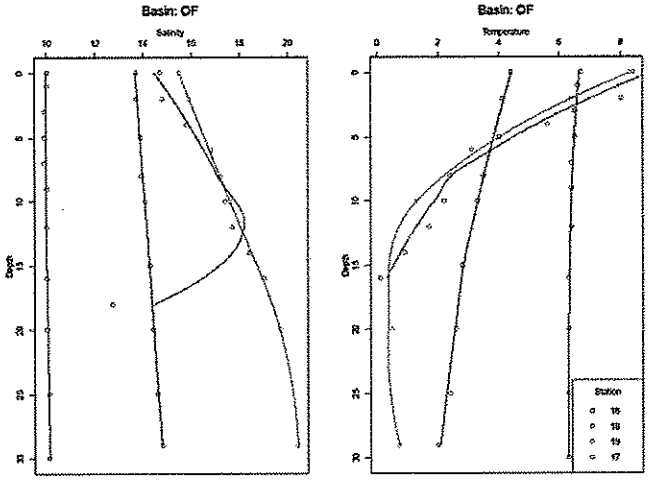


Figure 6. Interpolated surface water temperature in Husky Lakes and Kugaluk Channel during the open water season. Interpolation was conducted based on 196 *in-situ* measurements effectuated throughout the system in late July-early August of each year.

E.



F.



G.

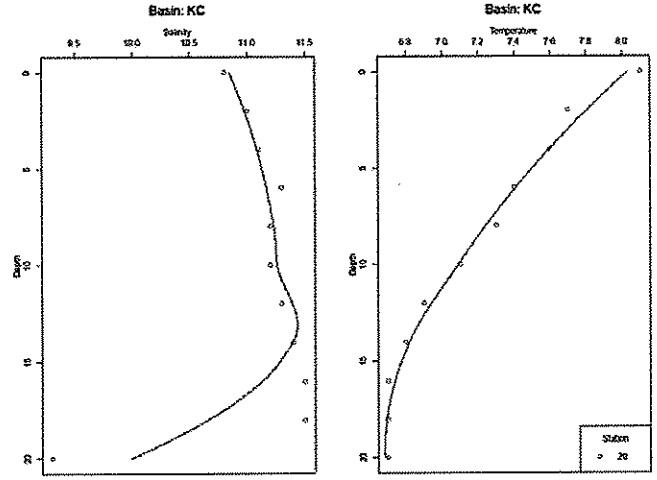


Figure7 (continued).

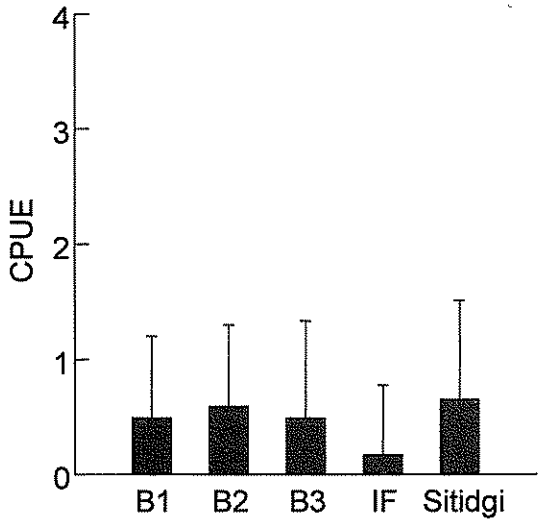


Figure 9. Average Lake Trout abundance as CPUE (no. of Trout per 100 m^2 net per hour) (mean ± 1 SD) by location.

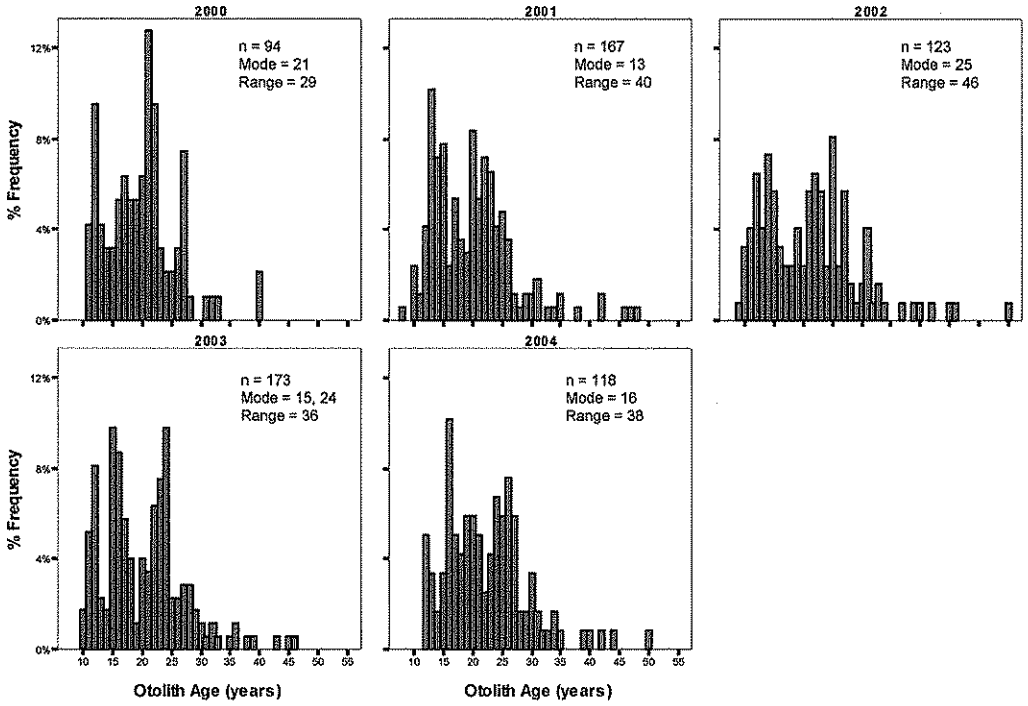


Figure 11. Annual age frequency distributions for Lake Trout harvested in the spring subsistence fishery in Husky Lakes and Sitidgi Lake, 2000-2004.

Olsson, P., C. Folke, and F. Berkes. 2004. Adaptive co-management for building resilience in social-ecological systems. *Environmental Management* 34 (1): 75-90.
Ostrom, E. 2005. *Understanding institutional diversity.* Princeton, NJ: Princeton University Press.
Ostrom, E., T. Dietz, N. Dolsak, P.C. Stern, S. Stonich, and E.U. Weber, eds. 2002. *The drama of the commons.* Washington, DC: National Academy Press.
Pinkerton, E., ed. 1989. *Co-operative management of local fisheries: New directions for improved management and community development.* Vancouver: UBC Press.
Pomeroy, R.S. 1998. A process for community-based co-management. *AFSSRN News.* ICLARM Contribution no. 1448.
Pomeroy, R.S., and T. Goetze. 2003. *Belize case study: Marine protected areas co-managed by Friends of Nature.* Caribbean Coastal Co-management Guidelines Project. Barbados: Caribbean Conservation Association.
Pomeroy, R.S., B.M. Katon, and I. Harkes. 2001. Conditions affecting the success of fisheries co-management: Lessons from Asia. *Marine Policy* 25: 197-208.
Pomeroy, R., P. McConney, and R. Mahon. 2003. *Comparative analysis of coastal resource co-management in the Caribbean.* Caribbean Coastal Co-management Guidelines Project. Barbados: Caribbean Conservation Association.
Pomeroy, R., P. McConney, and R. Mahon. 2004. Comparative analysis of coastal resource co-management in the Caribbean. *Ocean and Coastal Management* 47: 429-47.
Smith, A.H., and F. Berkes. 1991. Solutions to the "tragedy of the commons": Sea urchin management in St. Lucia, West Indies. *Environmental Conservation* 18: 131-36.
Wilson, J. 2002. Scientific uncertainty, complex systems and the design of common-pool institutions. In *The drama of the commons,* ed. E. Ostrom, T. Dietz, N. Dolsak, P.C. Stern, S. Stonich, and E.U. Weber, 327-60. Washington, DC: National Academy Press.

7

Adaptive Fisheries Co-Management in the Western Canadian Arctic

Burton G. Ayles, Robert Bell, and Andrea Hoyt

For a thousand years, the Inuvialuit and their ancestors' people have occupied the lands in the western part of the Canadian Arctic bordering the Beaufort Sea (McGhee 1976; Taylor 1976; Alunik et al. 2003). Although significant economic, social, and political change has occurred in the last fifty years, and the majority of Inuvialuit are now part of the wage economy, hunting and fishing, particularly subsistence fishing, remain critical to the livelihoods of the Inuvialuit (Ayles and Snow 2002; Day 2002; Usher 2002; Alunik et al. 2003).

In 1984, the Inuvialuit and the government of Canada signed the first comprehensive land claim settlement for a region wholly within Arctic Canada, the Inuvialuit Final Agreement (IFA) (Canada 2005; McCann 2005). Established by the IFA, the Inuvialuit Settlement Region (ISR) has an area of approximately 1.09 million square kilometres of land, water, and ice (Bailey et al. 1995). (See Ayles and Snow [2002] for a description of the communities and streams discussed in this chapter.) The IFA also established a co-management system for all matters relating to the management of living resources and their habitats in the ISR (Bailey et al. 1995). Berkes and colleagues (2005) discuss various aspects of the evolution of renewable resource co-management in the ISR and elsewhere in the Canadian Arctic. Kristofferson and Berkes (2005) make the argument that adaptive co-management has been a step in the evolution of resource management of Arctic char in the Cambridge Bay area of Nunavut. The concept of adaptive management, as developed by Holling (1978) and Walters (1986), emphasizes the notion of treating resource management actions as experiments from which managers could learn. Adaptive co-management, as defined in Chapter 1, combines the learning dimension of adaptive management with the sharing of rights and responsibilities of co-management.

This chapter examines how co-management of fisheries, within the context of a comprehensive Arctic land settlement agreement, has led to adaptive management practices and how adaptive management feeds back to

strengthen the co-management process. The co-management context is described, as are adaptive management practices and their results. Three case studies of adaptive fisheries co-management initiatives are discussed. The initiatives vary in terms of complexity of the fisheries, relationships between agencies, and level of success or failure. Themes addressed in this chapter include: partnerships and power sharing; institutional designs for adaptive co-management; and conditions of adaptive co-management success and failure. Recommendations are made for the management of Western Arctic fisheries, and lessons learned for fisheries co-management in other parts of the world are presented.

Fisheries Co-Management in the Western Arctic

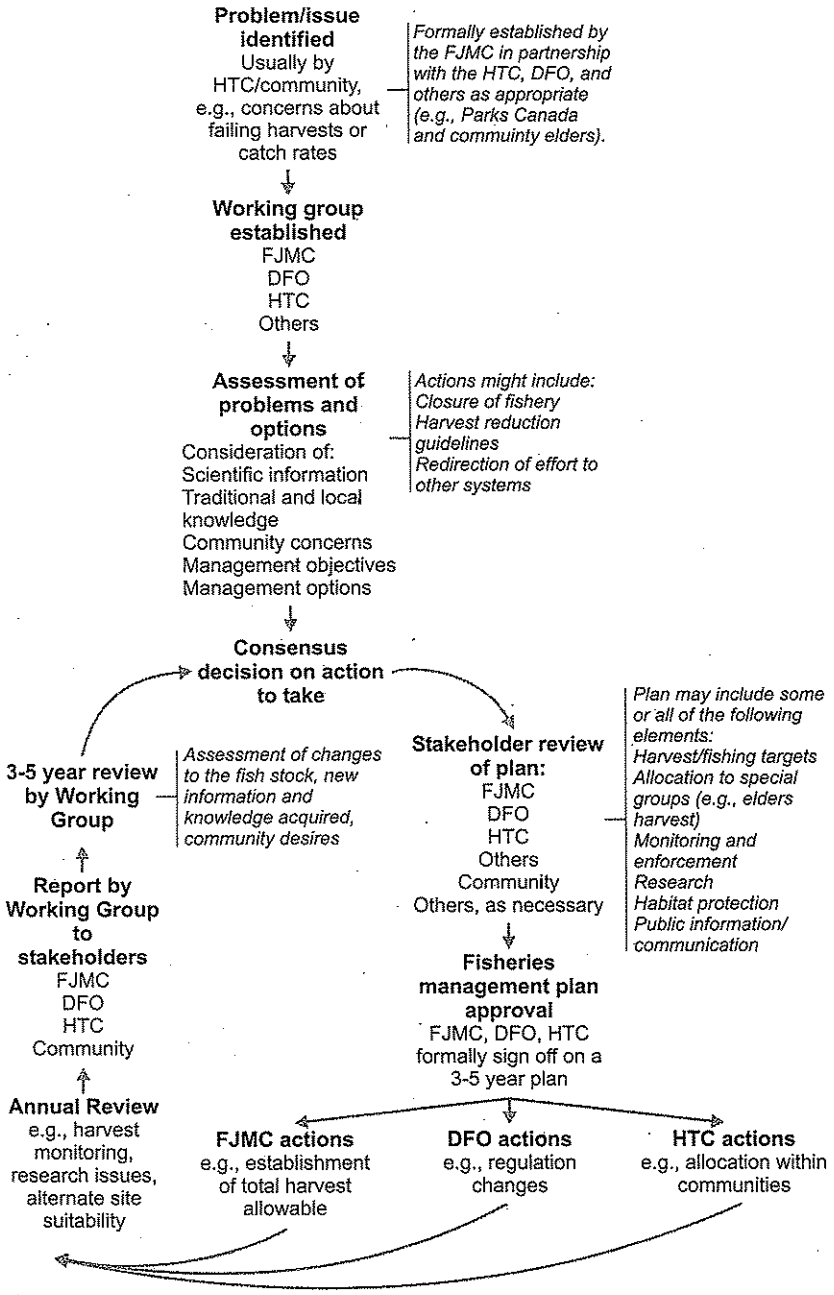
In the Western Arctic, co-management refers to the legislatively based sharing of management responsibilities between beneficiaries and the responsible government agency (Bailey et al. 1995; FJMC 2005). The Fisheries Joint Management Committee (FJMC) is the co-management board with responsibilities for fish and marine mammals in the ISR. Specific responsibilities of the FJMC are defined in the IFA, the Fisheries Act, and the Oceans Act. Some decisions are assigned to a single agency; for example, the FJMC is responsible for allocating subsistence quotas among communities, while local Hunters and Trappers Committees (HTCs)[1] are responsible for the suballocation of community shares and other quotas among individuals. Other decisions are shared; for example, the FJMC advises the Minister of Fisheries and Oceans on regulations and research, and funds research by the Department of Fisheries and Oceans (DFO), universities, and the communities.

The FJMC is a mature organization that has operated for over twenty years and has fully institutionalized procedures (FJMC 2005; Iwasaki-Goodman 2005). While post-IFA agreements are structured differently and have transferred some additional responsibilities to the co-management bodies (Ayles and Snow 2002), fisheries co-management in the ISR essentially meets Pinkerton's (2003) key aspects of "complete co-management."[2]

In the years since it was established, the FJMC, in cooperation with the DFO and the HTCs, has moved towards the development of integrated fisheries management plans for individual fish stocks or stock complexes as the process for establishing conservation, socio-economic, and ecosystem objectives; strategies to support those management objectives; and plans to implement those strategies. The evolving process (Figure 7.1) follows a general DFO model[3] and remains flexible enough to reflect the specifics of the resource and the needs of the communities. The development of each fisheries management plan is an ongoing, cyclical process driven by a multi-agency working group. The group is responsible for assessing the problem, considering a range of management alternatives, monitoring the implementation of the consensus decisions, reviewing the results, and modifying the

Figure 7.1

A generalized cycle of adaptive fisheries co-management in the Inuvialuit Settlement Region



actions at the end of the planning cycle. The HTCs, the DFO, and the FJMC are responsible for the final decisions and implementation.

The development of the process has been driven by several institutional factors (see Chapter 4), primarily the goals of the IFA, the terms of reference for the FJMC, the terms of reference for the HTCs, and DFO policies related to integrated fisheries management planning. Table 7.1 summarizes these key institutional factors in relation to Walters' three cyclical phases (1986) in the adaptive management process (identifying a range of management alternatives, developing key management indicators, and designing and implementing an effective monitoring system) and Hilborn's three essential steps (1992) in institutional learning from trial and error (documenting decisions, evaluating results, and responding to evaluation).

The institutional factors identified in Table 7.1 are further developed through the FJMC's strategic plan (FJMC 2002). The vision of the FJMC is that fish and marine mammal resources will be managed and conserved for the wise use and benefit of present and future generations through the use of sound scientific and traditional knowledge, effective co-management, and support of Inuvialuit culture, beliefs, and practices with respect to fish and marine mammals. Fundamental principles particularly related to adaptive co-management are the following:

- Incorporate the "precautionary principle" in the FJMC's approach to the management of the renewable freshwater and marine resources of the ISR.
- Support the spirit and principles of co-management in the FJMC's approach to the management of the fish and marine mammals of the ISR.

Besides the institutional factors summarized above, the FJMC has established practices that, while not specifically directed towards adaptive management, have fostered cross-scale interactions and social learning within the HTCs, the FJMC, and the DFO. These practices include:

- frequent FJMC meetings (at least five annually) and teleconferences to discuss fisheries issues in the ISR
- meetings with the Minister of Fisheries and Oceans to discuss critical issues and provide advice and recommendations
- facilitation of numerous resource management workshops that involve both scientific and community members
- meetings in each community every eighteen months to discuss community issues
- active participation (non-voting) of the regional DFO representative in virtually all meetings

Table 7.1

Relationship between some of the key institutional factors in the development of the fisheries management planning process in the Inuvialuit Settlement Region (ISR) and their significance for adaptive fisheries management*

Key institutional factors	Significance for an adaptive management process
The goals of the Inuvialuit Final Agreement are (Section 1.[1]): (a) to preserve Inuvialuit cultural identity and values within a changing northern society; (b) to enable Inuvialuit to be equal and meaningful participants in the northern and national economy and society; and (c) to protect and preserve the Arctic wildlife, environment and biological productivity.	Inuvialuit need to be involved in management decision making, thereby ensuring input of local and traditional ecological knowledge, and the aspirations and needs of local people, as well as considering a range of alternatives for managing the fisheries resource(s).
The terms of reference for the Fisheries Joint Management Committee (FJMC) gave the Inuvialuit certain rights and priorities for fish harvests (Sections 14.[24]-[35]) and require the FJMC (Section 14.[61]-[72]) to review fisheries information, determine harvest levels, restrict and regulate aspects of fishing, allocate quotas among communities, recommend to the Minister of Fisheries and Oceans on a range of topics, and advise the minister on any issues related to fisheries in the ISR (14.[61]-[72]).	The FJMC as well as the Department of Fisheries and Oceans (DFO) has to be involved in the management of the fisheries of the ISR. The involvement of the different agencies ensures consideration of a range of alternatives for managing the stock(s). The requirement to review information and determine harvest levels necessitates the establishment of monitoring programs in order to provide the necessary information and make decisions. Because they involve different agencies, these requirements necessitate a formal decision-making process and documentation and evaluation of results on a regular (cyclical) basis. This also means that the FJMC should have funding to address the necessary tasks.

▶

have been recognized sooner. Although the recognition of traditional knowledge was required under the IFA, imbalances with scientific knowledge remain (see Ellis 2005 for a general discussion for the Northwest Territories), and it was not until the stock status review in 2002 (DFO 2002) that this local knowledge was explicitly recognized. It is perhaps a mark of the overall strength of the co-management process that the community members remain willing to be engaged with programs on the Big Fish River, even though the probability of the stock recovering in the near term is minimal.

Recent syntheses have identified numerous conditions that facilitate the successful implementation of co-management (e.g., McConney et al. 2003; Pinkerton 2003; Berkes et al. 2005; Chapter 9). Our three case studies demonstrate that when the adaptive management techniques of acknowledging uncertainty, learning from experience, feedback, and new actions taken have been applied to the fisheries of the ISR, the outcome is an enhanced co-management system. Acknowledging scientific uncertainty of Arctic ecosystems and incorporating traditional and local knowledge improved decision making and increased the sense of empowerment and satisfaction of fishers in all three communities. Community involvement in monitoring and research on problems identified in common has helped to build links between fishers and scientists and to enhance the acquisition of knowledge and understanding. Local fishers are more trusting and supportive of scientific interpretations of data, and scientists have more respect for the local knowledge and experience of fishers. Management actions in Paulatuk and Holman, which led to expected changes/improvements in the resource, helped to build the confidence of fishers, scientists, and managers in the co-management process. Even actions that led to failure or that did not improve circumstances, such as on the Big Fish River, can be viewed positively because they were based on a consensus decision with unknown, but real, risks of failure rather than on decisions based on government fiat. The process has helped to build trust and willingness to take chances, and has built confidence among regulators and users that decisions have the support of all involved. A particular example of this trust was the willingness of the DFO to accept the proposed management objectives for fisheries west of the Mackenzie River, even though the working group could not explain what traditional Inuvialuit cultural practices might mean for fisheries management.

Our review of these three systems has also helped us identify some shortfalls in this developing adaptive management process as viewed from the perspective of Walters (1986) and Hilborn (1992). We need to document actions and rationale more carefully. Our assessment has relied heavily on the memory of specific individuals within the DFO and the FJMC, and this corporate memory needs to be supplanted with proper documentation. As well, if we are going to make full use of the techniques of "adaptive management," we need to make explicit hypotheses and develop management

actions to test those hypotheses. Further, we may need to consider how to use different systems as "experiments" to be able to probe some of the many unknowns related to managing char in the Arctic. The necessary actions are all well within the mandates and capabilities of the FJMC, the DFO, and the HTCs.

Our review has also helped us identify some specific factors that we believe would help promote adaptive co-management of small artisanal fisheries in general:

- a strong co-management process (legislation, money, and a mandate accepted by communities as well as government)
- joint planning for research to develop innovative questions and proposed programs
- a willingness to accept the ideas, beliefs, and practices of others to reach a consensus for change
- plans with renewal times built in to allow feedback, learning, and modification
- regular biological monitoring and communication of results among all parties
- both new scientific and new community knowledge accepted as valid
- a willingness by all parties to trust and to share authority.

The DFO has never had the resources necessary for adequate research, management, or enforcement in the Arctic, and regional and area managers have long tried to work with the communities and fishers on a consensus basis (Kristofferson and Berkes 2005). Nevertheless, prior to 1984 and the signing of the IFA, fisheries management was formally the responsibility of the DFO. Now, clearly, power has been shifted to the FJMC and the Inuvialuit. They have been prepared to accept their responsibilities for these fisheries and to work cooperatively with the DFO, and, arguably, the resource and the fishers have benefited under the new management. The adaptive co-management model described here will not necessarily work under all circumstances (Nadasdy 2003; Chapter 11), but it is working for fisheries in the western Canadian Arctic.

Acknowledgments

We would like to acknowledge the members of the Paulatuk Char Working Group, the Holman Charr Working Group, and the West Side Working Group for their contributions. Their belief in the importance of the resource and in the importance of working together for the resource and for the people of the area are the foundations upon which co-management of char has been built in the Western Arctic. In particular, we would like to recognize the members of the HTCs who chaired and led the various groups, and the late Don Dowler of the FJMC and Lois Harwood of the DFO, who played critical roles in the Holman and Paulatuk groups during their early stages. Special thanks to Erin Hiebert for her contribution to the description of the Paulatuk char fisheries.

Notes

1 The IFA established local Hunters and Trappers Committees in each community in the ISR. HTCs are co-management partners – with the DFO and the FJMC – responsible for fish and marine mammals in their local areas.

2 Pinkerton (2003) has proposed that comparisons between co-management situations be made by distinguishing core aspects of co-management arrangements through a framework that considers the specific rights and powers of fishing communities.

3 Beginning in the 1990s, the DFO developed an "Integrated Fisheries Management Plan" process in order to standardize the fisheries management plan process, identify performance outputs, ensure greater integration within the DFO, and improve program delivery. In the early 2000s, the DFO introduced an objectives-based management approach to help with the application of a more precautionary approach and the use of ecosystem and fishery performance measures. (Many specific plans are available on the departmental website, http://www.dfo-mpo.gc.ca/communic/fsh_man/ifmp/index_e.htm.) A specific initiative emphasized that stakeholders should have a more direct role in developing the plan rather than commenting on a DFO proposal. The following steps are based on current and evolving practices within the Central and Arctic Region of the DFO: (1) Establish working group; (2) assemble background information on the stock(s); (3) set conservation limits for the stock; (4) set fisheries management objectives and fisheries management strategies for the stock; (5) develop the fisheries management operational plan; (6) plan implementation; and (7) review.

4 Exploratory fishing licences may be issued under Section 52 of the federal Fishery (General) Regulations when there is insufficient information to issue a formal commercial fishing licence and more scientific information is required.

References

Alunik, I., E.D. Kolausok, and D. Morrison. 2003. *Across time and tundra: The Inuvialuit of the Western Arctic.* Vancouver: Raincoast Books.

Anonymous. 2003. *Inuvialuit harvest study: Data and methods report 1988-1997.* Available from the Joint Secretariat, Inuvik, NT.

Ayles, G.B. 1998. The FJMC/DFO/Holman HTC Kuujjua River Charr Workshop. Unpublished report. Available from the Fisheries Joint Management Committee, Inuvik, NT.

Ayles, G.B., and N.B. Snow. 2002. Canadian Beaufort Sea 2000: The environmental and social setting. *Arctic* 55 (Supp.): 4-17.

Bailey, J.L, N.B. Snow, A. Carpenter, and L. Carpenter. 1995. Cooperative wildlife management under the Western Arctic Inuvialuit land claim. In *Integrating people and wildlife for a sustainable future. Proceedings of the First International Wildlife Management Congress* (19-25 September, San Jose, Costa Rica), ed. J.A. Bissonette and P.R. Krausman, 11-15. Bethesda, MD: Wildlife Society.

Baker, R.F. 1986. *Report on the test fishery of the Kuuk River, Prince Albert Sound, Northwest Territories, 1986.* Fisheries Joint Management Committee report no. 86-004.28p. Inuvik, NT: Fisheries Joint Management Committee.

Berkes, F., R. Huebert, H. Fast, M. Manseau, and A. Diduck, eds. 2005. *Breaking ice: Renewable resource and ocean management in the Canadian North.* Calgary: University of Calgary Press.

Canada. 2005. *The Western Arctic claim: The Inuvialuit Final Agreement as amended.* Ottawa: Department of Indian Affairs and Northern Development.

Clark, I.D., B. Lauriol, L. Harwood, and M. Marschner. 2001. Groundwater contributions to discharge in a permafrost setting, Big Fish River, NWT, Canada. *Arctic, Antarctic and Alpine Research* 33 (1): 62-69.

Corkum, L.D., and P.J. McCart. 1981. *A review of the fisheries of the Mackenzie Delta and nearshore Beaufort Sea.* Canadian Manuscript Report of Fisheries and Aquatic Sciences, No. 1613, November.

Day, B. 2002. Renewable Resources of the Beaufort Sea for our children: Perspectives from an Inuvialuit elder. *Arctic* 55 (Supp): 1-3.

DFO (Department of Fisheries and Oceans). 1999. *Hornaday River Arctic charr.* DFO Science Stock Status report D5-68. http://www.dfo-mpo.gc.ca/csas.

–. 2002. *Big Fish River Dolly Varden.* DFO Science Stock Status report D5-60. http://www.dfo-mpo.gc.ca/csas.

Ellis, S.C. 2005. Meaningful consideration? A review of traditional knowledge in environmental decision making. *Arctic* 58: 66-77.

FJMC. 2002. Fisheries Joint Management Committee vision: 2000-2010. http://www.fjmc.ca/about_fjmc/FJMC_docs.htm.

–. 2005. Fisheries Joint Management Committee info. http://www.fjmc.ca/about_fjmc/about_the_fjmc.htm.

Harwood, L.A. 1999. *Status of anadromous Arctic charr* (Salvelinus alpinus) *of the Hornaday River, Northwest Territories, as assessed through community-based sampling of the subsistence fishery, August-September 1990-1998.* Canadian Stock Assessment Secretariat research document 99/182. Ottawa: Department of Fisheries and Oceans.

Hilborn, R. 1992. Can fisheries agencies learn from experience? *Fisheries* 17 (4): 6-14.

Holling, C.S., ed. 1978. *Adaptive environmental assessment and management.* New York: John Wiley and Sons.

Holman Charr Working Group. 1996. *Holman Charr Newsletter,* vol. 1. http://www.fjmc.ca/publications/.htm.

–. 1998. *Holman Charr Newsletter,* vol. 3. http://www.fjmc.ca/publications/.htm.

–. 1999. *Holman Charr Newsletter,* vol. 4. http://www.fjmc.ca/publications/.htm.

–. 2004. Holman Charr fishing plan 2004-2006. http://www.fjmc.ca/publications/.htm.

Holman HTC (Hunters and Trappers Committee), FJMC (Fisheries Joint Management Committee), and DFO (Department of Fisheries and Oceans). 1993. Holman area charr fishing plan (draft). Unpublished report. http://www.fjmc.ca/publications/.htm.

Iwasaki-Goodman, M. 2005. Resource management for the next generation: Co-management of fishery resources in the western Canadian Arctic region. In *Indigenous use and management of marine resources,* ed. N. Kishigami and J.M. Savelle. National Museum of Ethnology, Osaka, Japan; and *Senri Ethnological Studies* 67: 101-20.

Kristofferson, A.H., and F. Berkes. 2005. Adaptive co-management of Arctic char in Nunavut territory. In *Breaking ice: Renewable resource and ocean management in the Canadian North,* ed. F. Berkes, R. Huebert, H. Fast, M. Manseau, and A. Diduck, 249-68. Calgary: Arctic Institute of North America and University of Calgary Press.

Kristofferson, A.H., G. Low, and D.K. McGowan. 1984. Test fishery for Arctic charr, Prince Albert Sound (Safety Channel), August-September 1983. Unpublished manuscript, Department of Fisheries and Oceans, Winnipeg.

Lemieux, P.J. 1990. A biological assessment of Arctic char in the Kagloryuak River, Victoria Island, NWT, 1990. Unpublished report. Available from the Fisheries Joint Management Committee, Inuvik, NT.

Lemieux, P.J., and P.D. Sparling. 1989. *A biological assessment of Arctic char in the Naloagyok River, Victoria Island, NWT, 1989.* Fisheries Joint Management Committee report no. 89-006. Inuvik, NT: Fisheries Joint Management Committee.

McCann, D. 2005. Inuvialuit Final Agreement. In *Encyclopedia of the Arctic,* ed. M. Nuttall, 1012-13. New York: Routledge.

McConney, P., R. Pomeroy, and R. Mahon. 2003. *Guidelines for coastal resource co-management in the Caribbean: Communicating the concepts and conditions that favour success.* Caribbean Coastal Co-Management Guidelines Project. Barbados: Caribbean Conservation Association.

McGhee, R. 1976. Mackenzie Eskimos in the 19th century. In *Inuit land use and occupancy project,* ed. M.M.R. Freeman, 141-51. Ottawa: Department of Indian and Northern Affairs.

Nadasdy, P. 2003. Reevaluating the co-management success story. *Arctic* 56: 367-80.

NWT (Northwest Territories). 2005. Northwest Territories Bureau of Statistics. http://www.stats.gov.nt.ca/profile/profile.html.

Papik R., M. Marschke, and G.B. Ayles. 2003. *Inuvialuit traditional ecological knowledge of fisheries in rivers west of the Mackenzie River in the Canadian Arctic.* Canada/Inuvialuit Fisheries Joint Management Committee technical report 2003-4. Inuvik, NT: Fisheries Joint Management Committee.

PHTC (Paulatuk Hunters and Trappers Committee). 1999. *Paulatuk charr management plan 1998-2002.* Paulatuk Charr Working Group. http://www.fjmc.ca/publications.htm.

–. 2003. *Paulatuk char management plan 2003-2005*. Paulatuk Char Working Group. http://www.fjmc.ca/publications.htm.
Pinkerton, E. 2003. Toward specificity in complexity: Understanding co-management from a social science perspective. In *The fisheries co-management experience: Accomplishments, challenges, and prospects*, ed. D.C. Wilson, J.R. Nielson, and P. Degnbol, 61-77. Dordrecht, Netherlands: Kluwer Academic Publishers.
Sandstrom, S.J., and L.A. Harwood. 2002. *Studies of anadromous Dolly Varden (*Salvelinus malma*) of the Big Fish River, NT, Canada 1972-1994*. Canadian Manuscript Report of Fisheries and Aquatic Sciences, No. 2603.
Sparling, P.D., and D.B. Stewart. 1988. A biological assessment of Arctic char in the Kagluk River, Victoria Island, NWT, 1988. Unpublished report prepared for the Holman Hunters and Trappers Association. Available from the Fisheries Joint Management Committee, Inuvik, NT.
Stabler, J.M. 1998. Big Fish River habitat inventory project. Unpublished report. Available from the Fisheries Joint Management Committee, Inuvik, NT.
Stewart, D.B., and P.D. Sparling. 1987. *A biological assessment of Arctic charr stocks in the Kuuk and Kagluk Rivers, Victoria Island, NWT*. A report prepared by Arctic Biological Consultants, Pinawa, MB. Available from the Department of Fisheries and Oceans, Central and Arctic Region, Winnipeg, MB.
Taylor, W.E. 1976. The fragments of Eskimo prehistory. In *Inuit land use and occupancy project*, ed. M.M.R. Freeman, 105-8. Ottawa: Department of Indian and Northern Affairs.
Usher, P. 2002. Inuvialuit use of the Beaufort Sea and its resources, 1960-2000. *Arctic* 55 (Supp): 18-28.
Walters, C.J. 1986. *Adaptive management of renewable resources*. New York: McGraw-Hill.

8

Integrating Holism and Segmentalism: Overcoming Barriers to Adaptive Co-Management between Management Agencies and Multi-Sector Bodies

Evelyn Pinkerton

In January 2005, I and another evaluation team member,[1] Anita Bedo, delivered an evaluation of a three-year pilot initiative in adaptive co-management to the co-managing body, the West Coast Vancouver Island Aquatic Management Board (AMB).[2] This body is attempting to move towards integrated ecosystem-based management of a coastal area covering some two-thirds of the west coast of Vancouver Island in British Columbia. The evaluation was intended to inform not only the co-management board itself but also the four levels of government that fund and sponsor it, as the pilot project was to end in March 2005 (and to be up for renewal). The sponsoring governments are the federal Department of Fisheries and Oceans (DFO), the Province of British Columbia, the Regional Districts of Alberni-Clayoquot and Comox-Strathcona, and the Nuu-chah-nulth Tribal Council. By far the most important funder (50 percent) and sponsor (because they have the legal mandate to manage most aquatic resources) was the DFO.[3]

The DFO eventually opted to continue supporting the AMB, at least for another two years beyond the three-year pilot, but their continued support and vision for the future of the AMB is uncertain. The nature of these differences exemplifies the difficulties in coordinating the perspectives of government bureaucracies and community-based (or regionally based) co-managers. This discussion explores key dimensions of these difficulties and options for overcoming them. After briefly noting how these difficulties surfaced in our evaluation and the discussion surrounding it, I review some aspects of what the literature on organizational behaviour contributes to the discussion. This review is not comprehensive but is meant to highlight key aspects relevant to adaptive co-management.

Local and Non-Local Differences in Perspective on Appropriate Scope and Scale of AMB Issues

Among the challenges facing the Aquatic Management Board that the evaluation team identified was the frequent insistence by DFO board members