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Restoring the Past to Salvage the Future: Report on a Community Participation Workshop in Prince Rupert, BC

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RESTORING THE PAST TO SALVAGE THE FUTURE: REPORT ON A COMMUNITY PARTICIPATION WORKSHOP IN PRINCE RUPERT, BC

Edited by

Tony J. Pitcher, Melanie Power and Louisa Wood

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A Research Report from
'Back to the Future: the Restoration of Past Ecosystems as Policy Goals for Fisheries'
Supported by the Coasts Under Stress 'Arm 2' Project
A Major Collaborative Research Initiative of the Canadian Government

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Director's Foreword

RESTORING THE PAST TO SALVAGE THE FUTURE: SAVING A SHIP OF FOOLS

Although northern British Columbia has seen no overt fishery collapses such as have occurred in eastern Canada and elsewhere in the world (most recently affecting cod in the North Sea), almost everyone is unhappy with the current state of the fisheries. Fishing is heavily restricted because of justifiable fears that, if unregulated, modern fishing gear could quickly wipe out depleted stocks of salmon, herring, halibut, groundfish and shellfish. Meanwhile, the current status of marine mammals, seabirds, sharks and some rockfish are of concern to conservationists. And we hear a continual dissonance from vituperative disputes among the several commercial gear types, recreational and Aboriginal fishers, each sector claiming the sole right to wisdom while absolving themselves of blame for causing the present state of affairs (Walters 1995).

Like the *Ship of Fools* parodied by Heironymous Bosch, we carry on regardless with our unseeing folly, maybe pretending that a few minor adjustments to our course will rectify things. Bosch's ship is filled with people from all parts of the community celebrating their present way of doing things. In fact, we know that Bosch's carousing seafarers are oblivious to the awful fate waiting for them: they are most unwise to carry on as they are doing. Until recently, the fisheries world of scientists, managers, fishers and stakeholders seemed equally oblivious of the dangers just around the corner. It is obvious that those of us concerned with marine ecosystems and their embedded fisheries wish to avoid the *Ship of Fools*' fate. Hence we need fresh policy ideas and initiatives that can foster support from disaffected fishing communities as well as fishery managers from the government agency. Ambitiously, the *Back to the Future* (BTF) work pursued by the UBC Fisheries Centre attempts to meet that need.

If through some miracle, stocks were not already depleted – how would we fish? The chances are that most people would be a lot happier with regulations aimed at sustaining fisheries in a world of abundance, than in a depleted ecosystem epitomized by shared misery. But how can we navigate to such a world? One step on the way is to make sure that we use ecosystem-based analysis which lends itself to participation and inclusiveness (Pitcher 2000). Another step is to focus on rebuilding and restoration goals that all can agree upon before allowing allocation disputes to throw our compass off course.

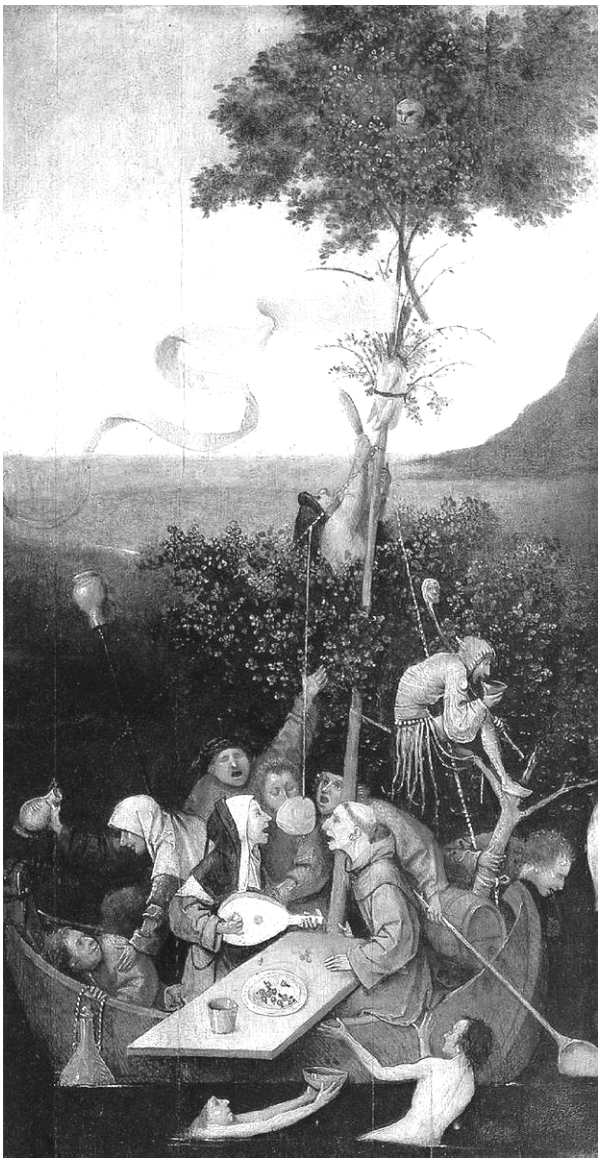

Figure 1. *Ship of Fools* by Heironymous Bosch (a.k.a. Jerome van Aken) c 1450-1516. Painted sometime in the late 1400s and probably originally part of tryptych showing the deadly sins. The oil painting of the rudderless ship rowed by a fool's spoon with a maypole as a mast is an allegory of folly. We eat, drink, flirt, cheat, and play silly games while the clergy abandon their vocation as the leaders of (15th Century) society. As a consequence, our ship drifts aimlessly and never reaches the harbour. Some of the symbolism remains obscure (is that a roast chicken, goose, swan or ham on the mast?), but the cherries, music, booze and its effects are obvious enough. *Musee du Louvre, Paris, 58cm by 35cm.*

This report contains the output from a workshop held in Prince Rupert in late 2001 that attempted to focus attention on what might be achieved through a rational restoration policy for fisheries and marine ecosystems. The workshop aimed to facilitate discussions and community partic--

ipation centered around policy explorations for rebuilding fisheries, part of the *Back to the Future* process. This represents the first BTF workshop in which a local community has participated in the choice of quantitatively defined restoration goals, and in evaluating their benefits. For the BTF team at the Fisheries Centre this was an exciting and demanding step – we all learned a lot from what went well and what did not during the workshop. When and if funds allow, the team would very much like to return to Prince Rupert to allow further interactions around the BTF issue.

The workshop was sponsored by Coasts Under Stress, the Fisheries Centre and by World Wildlife Fund Canada, Pacific Region, and supported by the City of Prince Rupert and the Tsimshiam Tribal Council.

Previous reports in this project (see Annex 5) have published the information upon which ecosystem models have been built, while future reports are expected to present full details of the BTF methodology that has been developed, describe all aspects of the results of the work in British Columbia, Newfoundland and Hong Kong, and suggest ways forward for further BTF research.

The Fisheries Centre Research Reports series publishes results of research work carried out, or workshops held, at the UBC Fisheries Centre. The series focusses on multidisciplinary problems in fisheries management, and aims to provide a synoptic overview of the foundations, themes and prospects of current research. Fisheries Centre Research Reports are distributed to appropriate workshop participants or project partners, and are recorded in the Aquatic Sciences and Fisheries Abstracts. A full list appears on the Fisheries Centre's Web site, www.fisheries.ubc.ca. Copies may be downloaded free from this web site, and paper copies are available on request for a modest cost-recovery charge.

Tony J. Pitcher

Professor of Fisheries
Director, UBC Fisheries Centre

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EXECUTIVE SUMMARY

This report is the proceedings of a workshop on *Back to the Future* (BTF) held in Prince Rupert, a coastal town in northern British Columbia in December 2001. The objective of the workshop was to provide an opportunity for the Prince Rupert community to participate in delineating and evaluating policy options for restoration of past ecosystems. New sustainable fisheries opened in these restored ecosystems aim to restore the wealth of Prince Rupert's fisheries while conserving the health of the marine ecosystem in northern British Columbia. The workshop was follow-up to a preliminary BTF workshop held in 1998, and was attended by 35 people from the local community and by nine members of the UBC BTF team. It was sponsored by Coasts Under Stress, the Fisheries Centre and by World Wildlife Fund Canada, Pacific Region and supported by the City of Prince Rupert.

The workshop opened with presentations and discussion on the aims of the BTF process, including its basis of whole-ecosystem modelling, the incorporation of traditional and local ecological knowledge (interviews had been carried out in Prince Rupert earlier in the same year) and the need for community participation. Models of 3 past states of the northern BC ecosystem (in 1750, 1900 and 1950) constructed by the UBC team over the past year, were presented together with a model of the present day. Four working groups from the local community each chose a past system to restore and discussed what fisheries should be included. Community views often differed from those of the UBC team. Ecosim simulations were used to explore the optimal fishing rates for each of the chosen gear types and the results were presented to the workshop. The report includes summaries of the discussions and participation by the community, and discusses the modelling and consultation issues encountered.

INTRODUCTION TO THE PRINCE RUPERT COMMUNITY PARTICIPATION WORKSHOP FOR 'BACK TO THE FUTURE' IN NORTHERN BRITISH COLUMBIA

Nigel Haggan and Tony Pitcher
UBC Fisheries Centre

The BACK TO THE FUTURE (BTF) project in Northern British Columbia is a component of the Coasts Under Stress (CUS) interdisciplinary Major Collaborative Research Initiative project funded by both SHRCC and NSERC[1]. This is a large project designed to assess the impact of changes in society and resource harvest patterns on individual, community and environmental health.

The major objective of community participation workshops like this one is to work with First Nations, government, community and industry partners to explore local, regional and national policies and options to ensure the long-term survival of vibrant and healthy coastal communities. The reconstruction of healthy ecosystems is an integral part of the process.

BACK TO THE FUTURE is a new philosophy of resource management developed at UBC Fisheries Centre (Pitcher *et al.* 1999) in collaboration with First Nations and other partners (Haggan *et al.* 1998) The central idea is that fisheries agencies are at best 'managing the rate of decline'. If we do nothing, resources will continue to dwindle until there is nothing left. We argue that 'sustainability' is the wrong goal, when things are already depleted (Pitcher and Pauly 1998). That leaves restoration as the only option.

BUT, what is our restoration goal? BACK TO THE FUTURE says that we have to learn what the waters produced in the past, so that we can set restoration goals for the future. The first task is to make the best possible computer models of marine ecosystems and their fisheries at different times in the past. To do this, we need to combine knowledge from First Nations, history, archaeology, science, commercial fishers, processors and others.

The periods of interest for northern BC are:

- the 1750s, prior to first contact and before modern industrial fishing;
- the 1900s with the expansion of commercial salmon fishing but before steam trawlers in Hecate Strait;
- the 1950s; and
- the present day, or what we have left.

The models present an 'audit' of past abundance and diversity compared with today. This can be used to set future policy for restoration and to provide a consensual, community-based exploration of the costs and benefits of specific restoration policies. Here we employ a new form of economic analysis that includes ecological and social values. We also make the case for significantly lower discount rates for natural resources in the interest of inter-generational equity (Sumaila *et al.* 2001; Sumaila 2001). The long-term goal is to restore marine ecosystems to much higher levels of productivity. We assert that this will contribute to the well-being of coastal communities (Haggan 2000).

This project in northern British Columbia is based on earlier pilot work on BTF in the area (Haggan and Beattie 1999). Previous reports in the CUS project have covered the construction of the ecosystem models for each time period and the input of two 'science workshops', one on each coast of Canada, that facilitated input from experts in each taxonomic group. (Pitcher *et al.* 2002a, b: Ainsworth *et al.* 2002).

Table 1. Fisheries Centre members of the Back to the Future team for Northern British Columbia.

Name	Title	Role
Tony Pitcher	Principal Investigator	Project design/modelling
Nigel Haggan	Project Manager	Ethics of collaboration, coordination, funding.
Rashid Sumaila	Resource Economist	Ecological, economic and social valuation of ecosystem states. Intergenerational equity
Sheila Heymans	Post-doctoral fellow	Hecate Strait models
Eny Buchary	Doctoral Student	Modelling expertise
Cameron Ainsworth	Doctoral Student	Hecate Strait models
Robyn Forrest	Research Assistant	Modelling data, sport fishery, climate modelling
Richard Stanford	Masters' Student	Modelling expertise
Pablo Trujillo	Masters' Student	Aquaculture and modelling
Melanie Power	Doctoral Student	Evaluation of community preferences, environmental ethics
Aftab Erfan	Summer NSERC Student 2001 and 02	Interviews and historical database
Erin Foulkes	Undergraduate Student	Rockfish fishery

[1] http://www.coastsunderstress.ca

Table 2. Prince Rupert Workshop Participants

Group 1	*Fisheries Centre members –*
	Melanie Power, Robyn Forrest
	Ray Gardiner
	Alf Ritchie
	Art Stace-Smith
	Paul Paulson
	Robert Lorne Warren
	Robert L. Johnson
	Cyril Stephens
Group 2	*Fisheries Centre members*
	Richard Stanford, Nigel Haggan
	Debbie Jeffrey
	Justin Dickens
	James Bryant
	Laurie Ryan
	Stan Dennis
	Group 3:
Group 3	*Fisheries Centre members*
	Rashid Sumaila
	Charlie Parkin
	Wally Thompson
	Heber Clifton
	Don Roberts Jr
	George Hayes
Group 4	*Fisheries Centre members*
	Tony Pitcher, Pablo Trujillo
	Caroline Butler
	Esther Sample
	Doug Mavin
	Carl Stace-Smith
	Jim Christison
	Quinton Sample
	Robert H. Hill
Group 5	'Modelling Group'
	Fisheries Centre members
	Eny Buchary, Cameron Ainsworth
	Sheila Heymans
	Erika Boulter
	Bart Proctor
	Foster Husoy
	Russ Jones
	Dave Rolston

Maritime community input: Prince Rupert Workshop

Preliminary, or 'strawman', models developed by the FC team in collaboration with DFO and other sources need to be 'groundtruthed' and improved with substantial input from the maritime community. In an ideal world, this would be done through a combination of fieldwork and community research assistants.

Available resources limited us to a July field trip to Prince Rupert to interview First Nations members, fishers and others who spend much of their lives on or beside the water. Additional interviews have since been conducted by the Haida Fisheries Program. Interview details are reported elsewhere (Ainsworth in prep.).

'2nd generation' models incorporating input from the July interviews were presented to a cross section of the maritime community at a December 4-6 workshop in Prince Rupert. Day 1 got off to a slow start courtesy of a snowstorm that grounded half of the team in Vancouver the night before (the senior members who, of all people, should know better). Participants showed a great deal of patience and traded information with the team in informal discussions. The workshop opened with a formal welcome by Tsimshian Tribal Council President Deborah Jeffrey and Deputy Mayor Cyril Stephens for the City of Prince Rupert. The delay made for a fairly compact schedule for the late morning and afternoon. Tony Pitcher and Nigel Haggan presented the scientific and participatory aspects of Back to the Future. Sheila Heymans and Rashid Sumaila then introduced the present-day, 1950s, 1900s and 1750s models and the methodology used to compare the ecological, economic and social value of the 4 systems. This led into a discussion of the problems that might arise if a 'past' or restored system were to be opened with today's fishing fleet. Lastly, Melanie Power introduced a survey designed to identify participants' preferred ecosystem state.

Day 2 got off with a heated debate fuelled by a bad choice of 'what if' fishing scenario that excluded gill-netters and trawl fisheries. This was the more unfortunate as it was perceived as a recommendation rather than an example. Participants, mainly from the gillnet and trawl sectors, said they had borne the brunt of conservation measures to fish selectively and responsibly and made their feelings known in no uncertain terms. On the credit side, the materials passed out on Day 1 and phone calls from participants meant that attendance was substantially higher than would otherwise have been the case. Formal sessions resumed with a presentation by Cameron Ainsworth on how we had used interview information in the models. The meeting then divided into 5 workgroups, one to discuss the models and assumptions, the other 4 to select a preferred system and recommend on the gear types that would be allowed to fish. Interestingly, each group chose a different system. The meeting then adjourned while the modelling team of Tony Pitcher, Sheila Heymans, Cameron Ainsworth, Eny Buchary and Rashid Sumaila ran the scenarios put forward by the groups. The modellers worked until 1.00AM on this.

Day 3 consisted of a report to the groups on the results of their ecosystem and fleet choices. We note here that not all criteria could be

incorporated – for example, the model is not strong on migrating fish such as salmon or the effects of different escapements and factors such as habitat loss. There is a version that can handle this, but the project would need extra resources to include it. But enough excuses, value comparisons presented by Rashid Sumaila showed that all past systems were substantially more valuable than the present-day system.

The workshop concluded with an invitation to all participants to attend the February 20-22 Back to the Future Symposium at UBC.

The Report is organised as follows:

- Summary of project and setup presentations
- Reports from the working group ecosystem preferences and recommended fisheries
- Results of the simulations
- Evaluation of Participants' ecosystem preference survey by MP
- General discussion
- Further model development/assessment of feasibility of participants' requests
- Community perspectives
- What the UBC team learned from the workshop

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OPENING SUSTAINABLE FISHERIES IN NORTHERN BRITISH COLUMBIA

Tony J. Pitcher
UBC Fisheries Centre

Back to the Future (BTF) aims to use past ecosystem states as policy goals for the restoration of ecosystems and their fisheries. The stages of the BTF process are listed in Table 1. We have had to devise a great deal of methodology for BTF, and this will be reported in series of papers in a later report. Community input in the form of local knowledge, advice, consultation and participation is integral to the BTF process, and hence this paper introduces the material presented and discussed at the Prince Rupert community workshop in December 2001.

At present in Northern BC we have reached BTF stages 1, 2 and begun stage 3; i.e. we have constructed improved ecosystem models of the past and present, have consulted with a local fishing community about what kind of sustainable fishery they would like to see, and have made preliminary estimates of which past ecosystem might be the most beneficial to restore. The first of these estimations was made at the Prince Rupert community workshop which is the focus of this report.

Ecosystem Models of Past and Present In Northern British Columbia

A present-day ecosystem model was devised by Beattie *et al.* (1999), and later extended by Ainsworth *et al.* (2002). A historical review of main changes in the Hecate Strait, also by Beattie (2001), was enhanced by input from experts on the various taxonomic groups (Pitcher *et al.* 2002a). An historical database was drawn up by Erfan (2002), and interviews for TEK and LEK carried out in Prince Rupert (Ainsworth 2002) were used as the basis for three models of the past, centered on 1750, 1900 and 1950. In Figure 1, the three past and the present ecosystem models are represented as triangles, while the same triangles represent possible restoration goals in the future, along with depleted ecosystems that will likely result from failures to change current management policies.

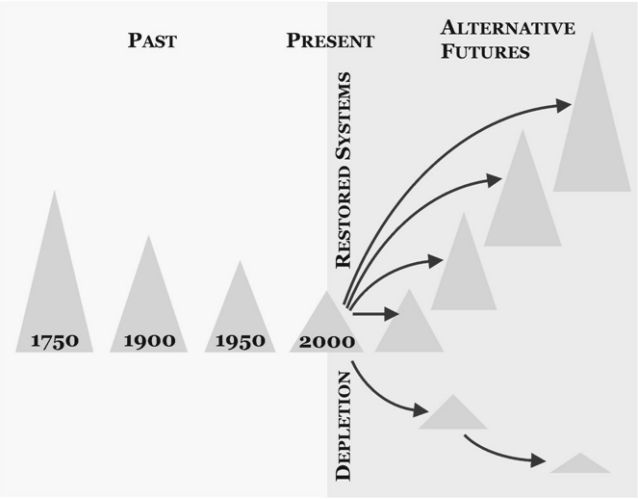

Figure 1. Diagram illustrating the *Back to the Future* concept. Triangles represent ecosystem models (a sharper apex signals higher biodiversity). Models of the past to the left are used as restoration goals among the alternative futures to the right.

Table 1. Stages in the 'Back to the Future' process for the restoration of fisheries and ecosystems. Modified from Pitcher *et al.* (2002).

Stage	Goals	Steps
1	Model construction of present and past aquatic ecosystems	Assemble present-day mass-balance model Assemble preliminary past models using compatible structure and parameters Search data archives Search historical documents Search archeological information Interviews for traditional environmental knowledge Interviews for fisher's behaviour Assemble and standardize historical and interview database Standardize methodology for using material Assemble and test suite of ecosystem models
2	Evaluation of economic and social benefits that could be gained from each system	Determine fisheries with which to exploit reconstructed ecosystems. (*Opening the Lost Valley*) Ecosystem simulation scenarios
3	Choice of system that maximises benefits to society	Identify trade-offs among economic, ecological and social criteria. Searches for optimal mix of fishing gears. Ecological economics evaluations. Participatory policy choice.
4	Design of instruments to achieve this policy goal	Model exploration of MPAs, effort controls, acceptable quotas, times and places for fishing.
5	Participatory choice of instruments	Evaluation of costs of these management measures. Participatory instruments choice.
6	Adaptive implementation and monitoring of management measures	On-going monitoring, validation and improvement of model forecasts using adaptive management procedures. On-going participatory guidance on instruments and policy goals.

It is important to realise that these ecosystem models are subject to continuous improvements, as new data from archaeology, TEK and historical archives become available for past models, and for recent models, as they are tuned to time series of biomass and other estimates from surveys and stock assessment. Updates to the models will be available on the BTF web site. Further discussion of model parameter values and where they maybe improved will be found in Ainsworth *et al.* (2002).

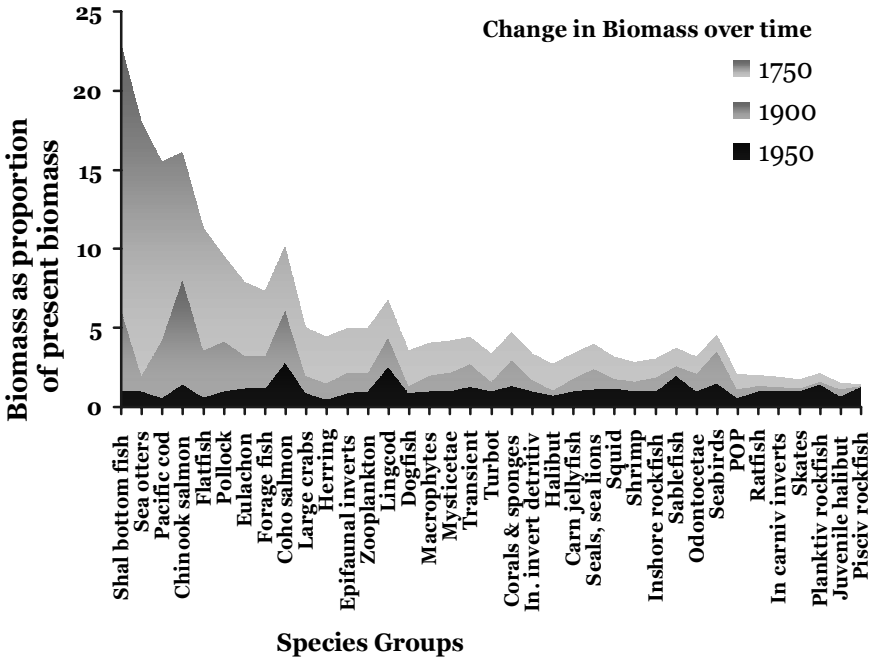

Figure 2. Biomass changes of 37 groups modelled with Ecopath in the Northern British Columbia marine ecosystem over three past time periods, compared to similar data from a model of the present day.

Biomass changes

Figure 2 illustrates relative biomass changes that have occurred since 1750, according to our ecosystem models. Almost a quarter of the groups appear to have declined ten-fold since before contact of Aboriginal peoples with Europeans, and a further quarter have suffered five-fold declines. The absolute magnitude of these changes is uncertain, but our series of models likely reflects the trends. Two factors determine the size of the sustainable fishery that target organisms in our ecosystem can withstand: the biomass of the group itself and the impact on predators and prey species linked through the food web. Hence fisheries opened in restored past ecosystems will differ from today's fleet.

Opening Sustainable Fisheries in a Restored Ecosystem

In order to objectively evaluate the benefits of restoring a past ecosystem (or continuing with today's ecosystem), we have to decide how that system should be fished. We take as given that such new fisheries should be fully sustainable and that they should seek some kind of optimal balance between maximising economic, social and cultural benefits while minimising ecosystem impacts. Important choices have to be made to try to simulate the opening of such fisheries.

The actual route and means of achieving ecosystem restoration is problematic because it is riddled with the shadows of present-day allocation disputes. Hence in BTF we try to deflect attention from the actual restoration process by first setting an agreed restoration policy goal. Then the means and speed with which this goal is reached can be subject to the inevitable disputes. Without setting clear goals first, progress in the actual restoration will likely become entrenched in conflict and thus protracted.

If any of the past ecosystems were to be restored to the state described by our models, we have to describe quantitatively how they would be fished sustainably. The choice of fisheries with which to open a restored ecosystem is termed *Opening the Lost Valley* (Pitcher *et al.* 2002b). Objective criteria for opening these fisheries are listed in Table 2. Each *Lost Valley* (LV) fishery has determined target species, and a minimal level of by-catch and discards, assuming that the successful application of technology improvements to this end can be realistically foreseen. Ecopath with Ecosim models are then constructed with these fisheries.

The next step is to determine the level of effort each LV fishery is allowed to impose whilst remaining sustainable and meeting the goals described above. To do this we use the 'policy search' interface in Ecosim (Cochrane 2002; Walters *et al.* 2002), set to find optima for economic, jobs and ecosystem conservation goals. The results of this process, as implemented at the Prince Rupert workshop, are described in detail in this report. Further details will be reported in a future publication.

Table 2. List of objective criteria for fisheries to be opened in a restored "Lost Valley" (LV) ecosystem. From Pitcher et al. 2002b).

	CRITERIA FOR LV FISHERIES	NOTES
1	Minimal by-catch discards	Technological modifications to gear
2	No damage to habitat by gear	Technological modifications to gear
3	Include Aboriginal fisheries	Customary rights recognized
4	Include traditional target species	Except where #1 and #2 would bar
5	No charismatic species	Except as under #3 and #7
6	Exclude fisheries on juveniles	Except where minimal impact is proven
7	Participatory vetting of fisheries	By management agency and by local community
8	Simulations show fishery sustainable	100-year simulations are satisfactory
9	Biomass monitoring plan in place	Adaptive changes to the unexpected (e.g. climate change)

The result of this analysis provides economic social and ecosystem values for each of the past (and the present day) ecosystem models. The final step is to compare the costs of benefits of each of these goals (see Buchary and Sumaila, this volume) so that the optimally fished ecosystem may be chosen.

Why Community Consent is Required

In order to foster compliance and the success of the BTF policy, it is clear that restoration goals should be set with full consent of the community and the fishery managers (see Haggan and Pitcher, this volume). This workshop represents a first attempt to present the advantages of the BTF process to a local fishing community. Such interactions and the ensuing feedback will enable both the further development of BTF methods and the improvement of ways to present this material to local communities.

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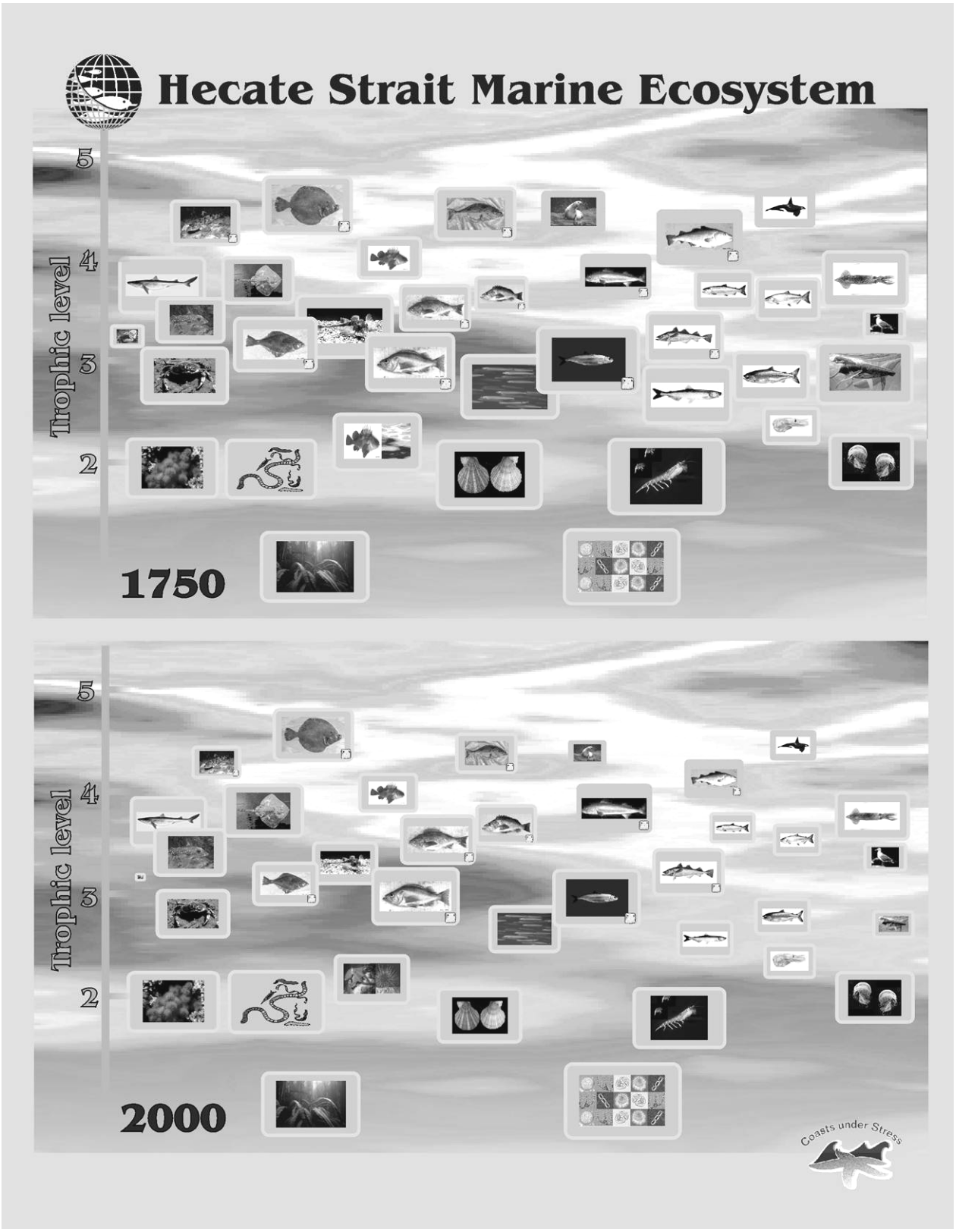
Over page Diagram of the precontact (1750) and present day (2000) northern BC ecosystem models from Ainsworth *et al.* (2002). Modeled groups of species (boxes) are located vertically at their trophic level. Horizontal position groups similar organisms. Size of the boxes is roughly proportional to (log) biomass.


Hecate Strait Marine Ecosystem
Trophic level
5
4
3
2
1750
Trophic level
5
4
3
2
2000
Coasts under Stress

INTRODUCTION TO REPORTS FROM THE WORKING GROUPS ON DESIRED ECOSYSTEMS AND FISHERIES:

Melanie D. Power
UBC Fisheries Centre

During the afternoon of Day Two of the community workshop, participants were divided into five working groups (see page 7 for group composition). One group looked specifically at the construction of the Ecopath with Ecosim (EwE) models, while participants in the other four working groups were asked to consider which of the four modeled ecosystems they preferred and what fleet structure they might wish to see in the preferred ecosystem. The groups were invited to choose one ecosystem and one fleet structure, with the understanding that the Fisheries Centre's modellers would work to simulate those preferences using Ecopath models and present the results during the final day (3) of the workshop.

Workshop participants were not assigned to a particular working group, but rather were encouraged to choose their own group. As such, the groups tended to be fairly homogenous, with the exception of the working group examining the models. In effect, the four groups that discussed ecosystem and fleet preferences were comprised of those who were already sitting together at the round tables used during the workshop. Perhaps as a result of this relative homogeneity, there was general consensus within each working group. Furthermore, as will be seen below, each of the four groups chose different ecosystem and fleet preferences to be modeled, with no ecosystem preferred more than once.

Each of the five groups included at least one person from the Fisheries Centre's team, to answer questions and record the discussion. The discussion is reported below.

REPORT ON DISCUSSIONS: WORKING GROUP 1

Robyn Forrest and Melanie D. Power
UBC Fisheries Centre

Members of group 1 included six commercial fishermen and the Deputy Mayor of Prince Rupert, Mr Cyril Stephens. Some members of the group are retired and all have had many years first-hand fishing experience.

A range of concerns arose from the discussion, the strongest of which was about current management practices in the area, particularly relating to salmon. The group strongly conveyed the feeling that the relationship between fishers and the Department of Fisheries and Oceans (DFO) has worsened over the past decade and expressed concern that their opinions and advice are often ignored.

Opening remarks were about the present state of the fishing industry. The consensus was that fishing in Hecate Strait has been greatly reduced, with trawling (dragging) reduced to less than 20% of its former capacity. Older group-members remembered many more draggers during the Second World War (although ships were smaller then). There were also comments that fishing seasons have been significantly shortened.

Another concern was that the growing number of large commercial companies entering the fishery is replacing family-owned fisheries. This scenario was perceived as being more desirable to government, as few large companies are easier to manage than individual operators. In general, the view of the state of the fishery was somewhat pessimistic, a view encapsulated in the words of one member, who stated "We are not a fishery any more".

There were also remarks about under-representation of First Nations groups at the workshop. While there were several representatives of the Tsimshian nation, one Haida and one Nisga'a, people from many other nations and areas that fish in the waters of northern British Columbia were not present. Mr Stephens suggested that representative people from these areas should be included in future workshops. Areas and nations mentioned included the following:

- Hazelton Area
- Kitwancool
- Greenville (Nass River)
- Canyon City (Nass River)
- Kincolith
- New Aiyarish
- Skidegate / Masset
- Bella (Coola)
- Kitkatla
- Hartley Bay

Other issues discussed are grouped under the following headings: 1) sports and recreational fishing; 2) over-escapement of salmon; 3) aquaculture; and 4) management practices of DFO.

Sports / Recreational fishing

The group felt that there was inequity between the commercial salmon fishing sector and the salmon sport fishing sector (*i.e.*, organised fishing charters operating from lodges). (The editors note that there were no sport fishery representatives at the workshop). The main concern was that, while catches from sports charters are significant, they are largely unquantified in terms of catch, bycatch and discards. According to one member of the group, some sports fishers have been observed taking home more fish "than a family could eat in a year" and it was suggested that there is a black market for the sports catch. The group described wasteful practices on charter boats, such as undressed fish being left on deck and improper handling of the fish, resulting in inedible fish and discarding. Live fish are also often thrown back because they are not large enough to be considered a "trophy". Many of these fish may have a low survival rate due to hook injuries and stress, although his type of fishing mortality is also unquantified. In the group's opinion, sport fisheries should be subject to a similar observer program to that of the commercial sector. Rushbrook Pier was suggested as a place to count catches as they come in. There was resentment that the length of the commercial season has been substantially shortened compared to the recreational season and that commercial fishers are prevented from fishing too close to charter operations in certain areas because "seeing commercial boats spoils the wilderness experience of sport-fishers".

The issues raised here have arisen from the perception that, whilst commercial fishers have been subject to many restrictions in recent years, the same regulations do not seem to apply to recreational charters. Greater control of the amount of fish killed by sports fishers, better regulations for handling fish on charter boats and an observer program were seen as necessary actions. As a consequence of this discussion, the BTF team undertook to provide an analysis of the true amount and nature of sport fishery catches in BC in order to include the best figures available in the modelling and simulations. Subsequent to the workshop, this work was done and the results will be published in a forthcoming Fisheries Centre Research Report (see Forrest, this volume).

Over-escapement of salmon

As most members of the group were salmon gillnetters, another major concern was over-escapement of salmon, particularly at the counting gate in Babine Lake. The group was angry that thousands of fish, that could have been harvested, arrive at the closed counting gate and die without spawning. Group-members wanted to see flexible quotas that allow "fishing to abundance" and the legal harvest of surplus fish before they swim upstream. A comment was made that the BC government seems to want the stocks in the Fraser and Skeena rivers to die out so that the rivers can be used for hydro-electricity or aquaculture.

Aquaculture

In the group's opinion, there is too much government spending on aquaculture compared with resources allocated to wild fish stocks. Whilst not strictly opposed to aquaculture, the group was strongly opposed to net pens in the sea, especially for Atlantic salmon. There are now, apparently, three generations of introduced Atlantic salmon living around Vancouver Island, which are the offspring of continual escapes from the salmon farms (possibly caused by seals breaking into the pens and by storm damage). Another fear regarding sea-pens is that wild juveniles (herring, pink salmon and halibut) will be attracted to lights around the pens and be eaten by farmed fish in the pens. Land-based aquaculture was suggested as a better alternative to ocean-based fish farms.

Management practices of DFO

The group expressed a strong feeling of disenfranchisement from the federal government's system of managing fisheries, and this feeling underlay all the other issues discussed. Specific points are briefly listed.

Sampling: Sampling by DFO survey boats is, in the group's opinion, unrepresentative, due to use of outdated gear and nets and the limited fishing experience of DFO staff. Some time ago, a joint initiative was proposed between DFO's Pacific Biological Station (PBS), UBC and a group of local draggers, in which draggers would conduct surveys in the manner in which draggers actually fish. This would have been, in the group's opinion, a positive step to bring fishers and DFO together but the proposal, unfortunately, was not approved in Ottawa. Another concern was with the sampling of juveniles by the DFO research vessel, *The Ricker*, where fine-meshed nets are used to catch large numbers of juvenile fish. [In fact a joint project that addresses these issues is currently operating though the industry's Groundfish Conservation Society and DFO, but it not clear if there is any Prince Rupert

involvement – Eds].

Licensing: Restricting gillnet fishing to daylight hours has made fishing on the tides difficult. Reduction of the length of the gillnetting season has meant that many fishers have been unable to meet their financial obligations. This has led to banks confiscating their fishing licenses and selling them to others – often to non-local operators, resulting in profits leaving the community.

Communication: There was anger over a DFO report entitled *Vision 2000*, which was apparently produced without the consultation of fishers. There is suspicion of political favouritism, particularly towards corporate and sports fisheries, and a feeling that decisions are made behind closed doors in Ottawa without proper consultation of stakeholders.

It was clear that the group's biggest and most underlying problem with DFO is that it is not always transparent to fishers and is not perceived to listen to the voices of the fishing communities whose lives are impacted by their decisions.

Group's requests for modelling

Many of the items discussed were about problems with management that are not easily incorporated into ecosystem models. Given this group's dissatisfaction with the practices of the present sports fishery, the model requested was today's ecosystem, with recreational fishing reduced by fifty percent.

References

Forrest, R.E. (in press) Northern British Columbia: adding recreational catches to the ecosystem simulation model. *Fisheries Centre Research Reports*.

REPORT ON DISCUSSIONS: WORKING GROUP 2

Richard Stanford
UBC Fisheries Centre

Discussion in the group focused largely around the rights of First Nations (FN). It was difficult to get the group to talk about what they wanted in the model because they just wanted to ensure that the model affirmed their fishing rights. Because the group felt that the white settlers had taken the techniques of First Nations and had overexploited the sea, 1750 was considered the ideal model. Nigel Haggan pointed out that the best we can do is to work on restoration, to increase abundance.

The group said that the stocks of most fish were much smaller than they used to be. Specifically, salmon required enhancement programs and these should be incorporated into the model.

The herring fisheries should be managed on a stock by stock basis, there should be no commercial fishery on eulachon and there should be areas set aside exclusively for FN fishing.

There was substantial discussion on area licensing, with a consensus that there should be exclusive north coast area licenses for north coast residents, i.e. no 'stacking'[2].

Seiners – a lot of salmon and herring are taken by the seine nets. There were two concerns with this:

- that stocks had been too heavily depleted
- that inshore seiners had crushed benthic invertebrates such as crab – this was said to have been a particularly bad problem near the Skeena.

Sports fishery – the group thought this was generally considered a detrimental activity that should be banned in spawning areas and reduced in other areas. Tightening of regulations was recommended.

Trawl fisheries – these were said to be damaging to the environment. Shrimp trawling was thought to be particularly bad, with a ban recommended, while other trawling activities should be reduced. In the absence of a precise estimate of the amount of reduction, 20% was used in the model.

Longline fishery – It probably cannot be built into the model very easily. However a big problem with the longline fishery highlighted by the group was that if you exceed your quota for one species you cannot swap your excess fish with other fishers for different species. Instead they have to be discarded, which was considered highly wasteful.

A question was posed as to whether it would be possible to run the model to calculate the type of

[2] 'stacking' is where several licences for area, gear or species are held by the same fishing vessel and owner. Here, the complaint concerns the ability of licenses for fishing in both northern and southern BC to be held on one vessel.

ecosystem that would meet *all* of the current needs rather than shifting the needs/gears to meet the system.

The general conclusion was that a balanced goal of restoration and economic success was desirable.

In addition to considering model requirements, the group stated that it was imperative to include local management and fish processing in the ecosystem of the future. It was also suggested that the costs needed to return the ecosystem to 1750 may not outweigh the benefits. The group was a little frustrated that we were looking at the question of what to do with the future rather than the more important immediate question of how we get there. Furthermore, they felt that although the ecosystem model was better than single species assessments, it needed to incorporate more parameters, such as aspects of pollution in specific estuaries.

REPORT ON DISCUSSIONS: WORKING GROUP 3

Rashid Sumaila
UBC Fisheries Centre

Throughout the discussion, the group emphasised the need for the use of an ecosystem approach to manage their fisheries. The group thought this was the best way to incorporate all the various concerns of management and stakeholders into a decision-making framework for sustainable and responsible management of the fisheries in the Hecate Strait. The group also wanted a more regional level of modelling effort that includes adjoining fisheries such as those in Alaska. This is because many management issues involving the fisheries in Hecate Strait are essentially trans-boundary in nature.

A principal goal of this group was that no fishing group or sector currently participating in the fishery should be stopped from fishing. Having said that, the group thought it is necessary to restrict the activities of the seine fleet because some of them target juveniles. [No seiners were present at the workshop. Eds]. A similar concern was expressed regarding the activities of sports fishers, and draggers because of their respective impacts on spawning fish populations and the bottom habitat. In particular, the group argued that there is a need for spatial management of the activities of sports fishers to help protect large mature fish. The group also wanted bycatch restrictions to be imposed on gill netters.

The group decided that reconstructed of the Hecate Strait as it was in 1900 would be the 'past' model they would like to use for their policy explorations. The reason for this choice was that commercial fishing in the Hecate Strait started around 1880. Hence, a 1900 model would capture a 'near-pristine' ecosystem.

Finally, the group made the following useful suggestions for improving our work: (i) the linkages in our models between eulachon, krill and salmon need to be developed with care because of their importance in the ecosystem; (ii) we should contact Ken Kristmanson for data on krill; (iii) a report on the biology of fish in the Hecate strait that could be useful to our work was recommended by the group. The book was written by a McGill University Professor, whose name they could not remember; (iv) the group recommended that our research team should try to visit Prince Rupert at strategic times in the year, e.g., during spawning periods for the major species. Such trips, they argued, would help us collect valuable information for our work. Finally, the group mentioned Charles Thompson, whom they say has two datasets for the fish in the Hecate Strait that may be useful to our work.

REPORT ON DISCUSSIONS: WORKING GROUP 4

Tony Pitcher
UBC Fisheries Centre

Gear types represented in Group 4 were troll and gill net for salmon, dragger for groundfish, hook and line for rockfish and halibut, prawn traps. Aboriginal fisheries, including those for food and ceremonial purposes were also represented. All members of the group were aware of Aboriginal fisheries issues and desired them to be dealt with in a spirit of respect and fairness.

Problems discussed were: Alaskan fishers intercepting Canadian salmon, lack of feed for salmon migrating inshore, the undetermined but possibly large impact of the sport fishery. Although the group thought that nearly all fish were now less abundant than in the past, rockfish, especially silvereye, yelloweye and Pacific Ocean perch were likely rebuilding slowly. Halibut ITQs had improved life for those with a licence, but have had all sorts of unexpected consequences for

the rest of the community who now have effectively no access to the resource and have to interact with halibut licence holders in the community in new ways. Turbot discards had been high but were improving. There was an increasing fishery for skate.

The group thought that there had been serious long term mismanagement of the fisheries: policies aimed only at maximising catch were thought to be misguided. DFO was seen as responding to change too slowly. Some recent changes were seen as improvements: for example shortened trips and soak times for gillnets. But everyone was tired of hearing of yet another government scheme that imposed "big pain for big gain". A move to community–based management was seen as very desirable, and if prosperity deriving from fisheries was improved, many more would support conservation measures. The local management system used in Alaska was regarded as something that should be introduced in BC.

Most of the groups thought that rebuilding fish populations was possible if management got things right, and saw an era where restored abundance would create many opportunities to use sustainable fisheries. We discussed how BTF modelling could be used to explore policy/ management options that might achieve these things, and then tried to identify tasks that group 4 would like the modelling team to address.

Group 4's requests for modelling

Group 4 considered that a '1750' restoration goal was unrealistic and wanted to see what results our model could produce for the 1950s. The group wanted all of today's fisheries in the modelling, including Aboriginal and recreational fisheries. There was a request to try to include in the simulation fish wheels for catching salmon, and to look at the possibility of a fishery for lampreys. 'Bycatch' should be reduced to levels that are technologically feasible, but not eliminated from the modelling. The group felt that the best objective for the modelling would be to maximise fish biomass and dollars. There was some confusion over how the modelling would find fisheries that were sustainable. The group was interested to hear that the workshop results will be available on the web.

REPORT ON DISCUSSIONS: GROUP 5 (MODELS)

Cameron Ainsworth,
Eny Buchary and Sheila Heymans
UBC Fisheries Centre

During the working group session, some participants elected to discuss the models themselves, rather than various policy options. Some interesting improvements were suggested, some of which were implemented by the UBC-FC team at the end of Day 2 and presented on Day 3. The BTF team noted other useful suggestions, but further research will need to be conducted in order to incorporate those improvements into the models. Various functional groups were discussed, particularly salmon, eulachon, and halibut. The participants suggested that we should elaborate the recreational fisheries sector in the model, and revise the fleet structure to differentiate locally-owned fishing vessels from corporate-owned fishing fleets. Finally, the group suggested contact persons who are considered to be knowledgeable, and may be able to provide more information for model revision. The summary of the working group discussion is given below.

Discussion Model Functional Groups

Salmon

Participants suggested that most salmon migrate in and out of the area. Juveniles migrate up to Alaska with the adults from rivers further south (viz. Fraser and Columbia). Adults subsequently migrate back and go up the rivers to spawn. Thus, in some sense most of the salmon are transient in the system.

Transient salmon

The group felt that transient salmon, mainly sockeye, are only in the system for about 1-2 months as juveniles, while they migrate north. Further, the adults spend only about 2 weeks in the system while migrating south. They suggested that tagging studies done by DFO showed that adult sockeye move down from the system to the Columbia River, and further south.

The group doubted the biomass level (i.e., 40,000 t) of transient salmon in the present day model. Russ Jones suggested that the UBC-FC team checks reports on transient salmon in river systems such as the Skeena, Nass and Charlotte systems, especially river systems in statistical areas 3, 4 and 5.

The group also questioned the 65% exploitation rate of transient salmon in the models, and whether this level included the Babine River waste (it does not). The group indicated that catch records and fence counting provide good estimates, and therefore should be considered in revising transient salmon parameters. Foster Husoy and others pointed out that ocean survival of salmon is 'guesstimated' to be about 10–15%, and that ocean temperature affects ocean survival of salmon.

Chinook salmon

It was agreed that chinook (spring) salmon do not stay in the local ecosystem. Adult chinook migrate north to Alaska where their main feeding area is located. Juveniles stay and feed in the system for about 6 months on average. However, in the nearshore areas juvenile chinook can remain for up to 3 years. Chinook tagging data could be used to verify this.

The discussion group voiced the following concern: if through Canadian restoration efforts, the abundance of transient salmon was increased then financial return on the investment may not be realized because Alaskan vessels could intercept them during their migration before returning to Canadian waters.

Halibut

The group pointed out that we had no sports fishing for halibut in our models, and we subsequently added a preliminary estimate for recreational fishing on halibut of 5% of the commercial catch. The group also felt that halibut was discarded by the fishery, and that we should add that to our model. Foster Husoy said that big trawlers from Britain came to the Hecate Strait in early 1900's for about 8 years, and started wiping out halibut stocks.

Eulachon

Russ Jones indicated that the eulachon biomass in our present-day, and 1750 models might be too high. He suggested that we speak to Doug Hay (Pacific Biological Station, Nanaimo) and Mark Bowler (Haisla Fishing Commission, Kitimat) to confirm our numbers.

Catches, Discards, Recreational Fishery, Fishing Costs and Fishing Fleet

On the issue of bycatch and discards, Erica Boulter from the World Wide Fund for Nature (WWF) suggested that, although seine nets usually have less by-catch than gillnets, it doesn't mean that seine nets are more environmentally friendly. Although the seiners claim that inadvertently caught (bycatch) fish are carefully released into the sea, Ms. Boulter believes that these animals are disorientated, and therefore susceptible to predation and increased mortality.

The group indicated that recreational sport fishers appear to discard large quantities of salmon: up to 20 coho for every chinook they catch. This discard has not been included in the model yet as it is not easily quantifiable, but it does need to be included in the future. The group also suggested that sports fishers would probably keep on fishing after catching their quota so that they may keep larger fish. Even though the fish might not be dead when they are discarded, the survival of salmon after catch-and-release is not 100%.

The recreational fishery was under-represented in the model and subsequent to the group discussion we made the following changes to the model:

- We included a recreational fishery for coho and chinook salmon equal to 20% of their commercial catch.
- A recreational fishery for halibut was included, equal to 5% of the commercial catch.
- The recreational fishery caught some juvenile and adult lingcod, so we included an adult lingcod recreational fishery of 20% of the commercial catch.
- Inshore rockfish was also added to the recreational catch, at a rate of 5% of their commercial catch.

After making these changes to the present-day model, we re-calculated the starting catches for the policy simulations for each model: 1750, 1900, 1950 and 2000. (The initial value of the total catch for each species was set at 1% of that species' biomass). Note that starting values are needed only to initialise the simulations- the policy search software adjust then to as it maximises the objective required. [In later work we have used the figure of 2.5% of model biomass - Eds]. Similarly, some changes were made to the market values in the model.

Group members also suggested that fishing sectors in the models should be revised to disaggregate the locally-owned fishing vessels from corporate-owned fishing fleets. This is important to address social issues, but not straightforward to implement. We suggest that this be addressed in the next phase of the project.

The group also made a suggestion on how the UBC-FC team should go about the model simulations. They suggested that we provide several optimal policy options, each serving a different sector of the fleet in order to gauge reaction from the people in industry. Foster Husoy suggested running a series of policy searches to optimize for each gear type, in order to determine which fleets are more or less "selfish". That is, to determine for which gear type the catch may be increased at minimal cost to the other fleets, and for which gear types performance can only be improved at the expense of others. This may serve as a tool to evaluate equity in the fishery.

On the issue of logging in BC, the group members wonder how logging effects are represented in the models. In particular, how do the models chronologically emulate the effect of logging in the ancient past (1750), the past (1950 and 1900) and the present-day (2000) models? The group members feel that logging has a strong impact on the viability of the fisheries, especially on the salmon fishery. The group indicated that the harmful effects associated with Atlantic farmed salmon and oil/gas exploration should also be included in the models.

The average fishing cost that is currently used in the economic analysis for the models is 0.6 (i.e., only 40% of the total revenue is profit). The group confirmed that this number is reasonable, but suggested we may revise our estimate to include a four-year average on fixed costs and income.

INTRODUCTION TO RESULTS OF THE SIMULATIONS REQUESTED BY THE WORKING GROUPS

Melanie D. Power
UBC Fisheries Centre

The final day of the Prince Rupert community workshop provided an opportunity for the BTF team to show workshop participants the results of their modelling requests. As discussed above, participants were asked to participate in working groups to consider and reach consensus on which of the four modelled ecosystems each group preferred to restore the present ecosystem to, and what fishing fleet structure should be permitted in the future.

Following the close of Day Two of the workshop, the Fisheries Centre's ecosystem modellers worked late into the night to adapt the models to reflect the comments of the working group, and subsequently run simulations of the suggested fishing fleet. Day Three began with presentations of the results by the modellers, followed by discussion amongst the workshop participants.

This exercise offered several opportunities. First, and most obviously, it provided an opportunity for the Fisheries Centre's researchers to address specific fishing and ecosystem concerns as raised by members of the community. Secondly, time avaliable and other logistic concerns demonstrated limitations of the procedures, whilst also providing an opportunity to further explore the credibility of the methodology. Thirdly, the activity provoked thought and discussion which will be of benefit for not only development of the models, but also for further collaboration between the researchers and the community.

SIMULATIONS REQUESTED BY GROUP 1

Cameron Ainsworth
UBC Fisheries Centre

Group 1 wanted simulations based on the current ecosystem as the lost valley starting point, with essentially today's fishing fleet (see Fig 1, right). The only change requested was the reduction of the sport fishery to half the current level (as estimated by Forrest, this volume).

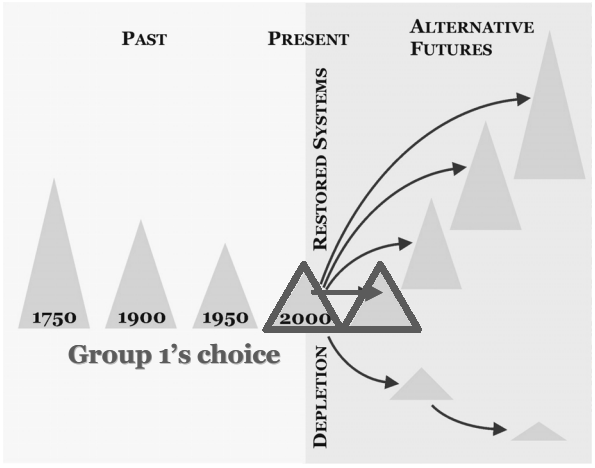
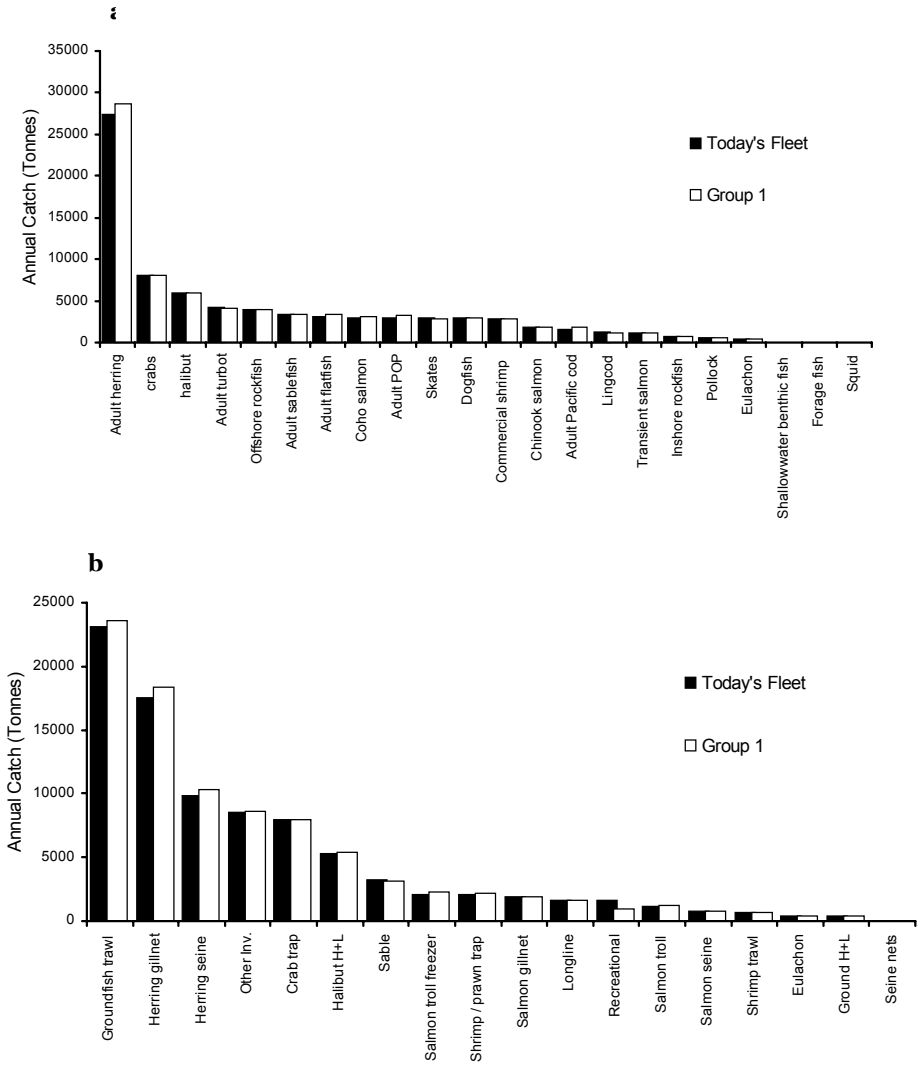


Figure 1. Diagrammatic representation of the simulation selected by Group 1.

In order to model this scenario we had to make our present day recreational fleet more realistic. Our sport fleet originally caught only lingcod. Catches for halibut, Coho, Chinook, lingcod and inshore rockfish were included in the revised recreational fishery (see models section for further discussion on the adjusted landings matrix). A policy search routine was conducted with the 1990s model, first using the standard fleet, giving equal weight to economic and ecological goals, and then using the modified fleet with the sport fishery reduced. The optimum fishing fleet returned from the policy search included only a miniscule recreational fishery, one that caught just 6 x 10^{-6} tonnes/km^2 of all species combined. The policy search using the group's choice fleet was foregone, since it could only have resulted in a still smaller recreational fishery, and would essentially yield an identical result to the baseline policy search.



Figures 2a and 2b Annual catch in tonnes by species (a) and by gear (b), as predicted by a 20 year ECOSIM simulation of the 1990s ecosystem under two scenarios: today's fleet and secondly using a reduced landed catch from the recreational fishery.

Instead we ran an ECOSIM simulation over 20 years, beginning from the 1990 baseline model

first using the standard fleet and then using the group's choice fleet with a reduced sports landing. An increase in fishing pressure of 2% per year over the simulation was assumed for all commercial functional groups. The results are given by gear and by species in Figures 2a & 2b. Under the 50% reduction in recreational fishery regime groundfish trawl, herring gillnet, herring seine, salmon troll and salmon troll freezer benefited the most. The increased catches were small, but noticeable.

There was a general consensus among the participants that the simulation had underestimated the catch of the recreational fishery even assuming 20% of the commercial catch for some of the target species. They also pointed out that the commercial sector was decreasing, while the recreational sector was on the rise. The first comment was dealt with in a subsequent revision of the simulation by increasing the recreational fishery by a factor of 2, first for the baseline fisheries, and then for the reduced recreational fishery criteria. The latter is simply the original baseline fishery. The second criticism, that the commercial sector is decreasing while the recreational sector is increasing, cannot be dealt with using existing ECOSIM software as there is no provision to adjust F by gear type in the CSV file, only by functional group.

SIMULATIONS REQUESTED BY GROUP 2

Johanna J. Heymans
UBC Fisheries Centre

Group 2 requested simulations based on a restored 1750 ecosystem (see Figure 3) with today's fleet, no discards and an additional run with no recreational fishery or shrimp trawls, a 50% reduction of salmon and herring seine catches and a 20% reduction of groundfish dragger catch.

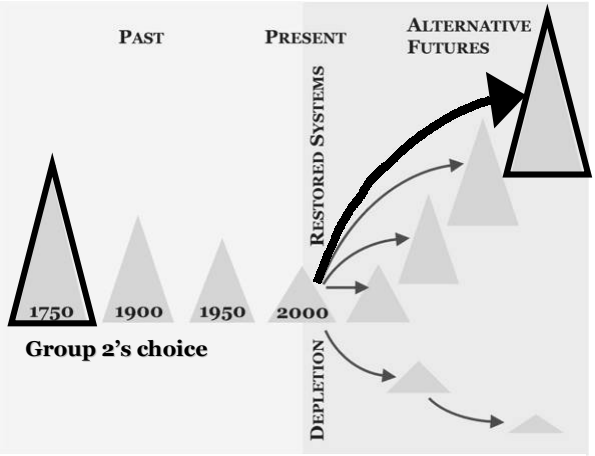


Figure 3. Diagrammatic representation of the simulation selected by Group 2.

Changes made to the Model

Some changes were made to the model subsequent to this discussion. The recreational fishery was under-represented in the model.

- We included salmon (Coho and Chinook) fishing at 20% of the commercial catch as a recreational fishery.
- Originally there was no recreational fishery for halibut in the model, so we included a halibut fishery of 5% of the commercial catch.
- Lingcod juveniles and adults are caught by the recreational fishery, so we added a fishery of 20% of the commercial catch of adult lingcod.
- Inshore rockfish was also added to the recreational catch (5% of commercial catches).

After making these changes to the present day model, we re-calculated the starting catches (total catch for each species was set at 1% of the biomass) for the policy simulations for each model: 1750, 1900, 1950 and 2000. These starting catches are given in Appendix 1.

Similarly, some changes were made to the market prices of the fish in the model. These changes are given in Appendix 2.

Simulations run for Group 2

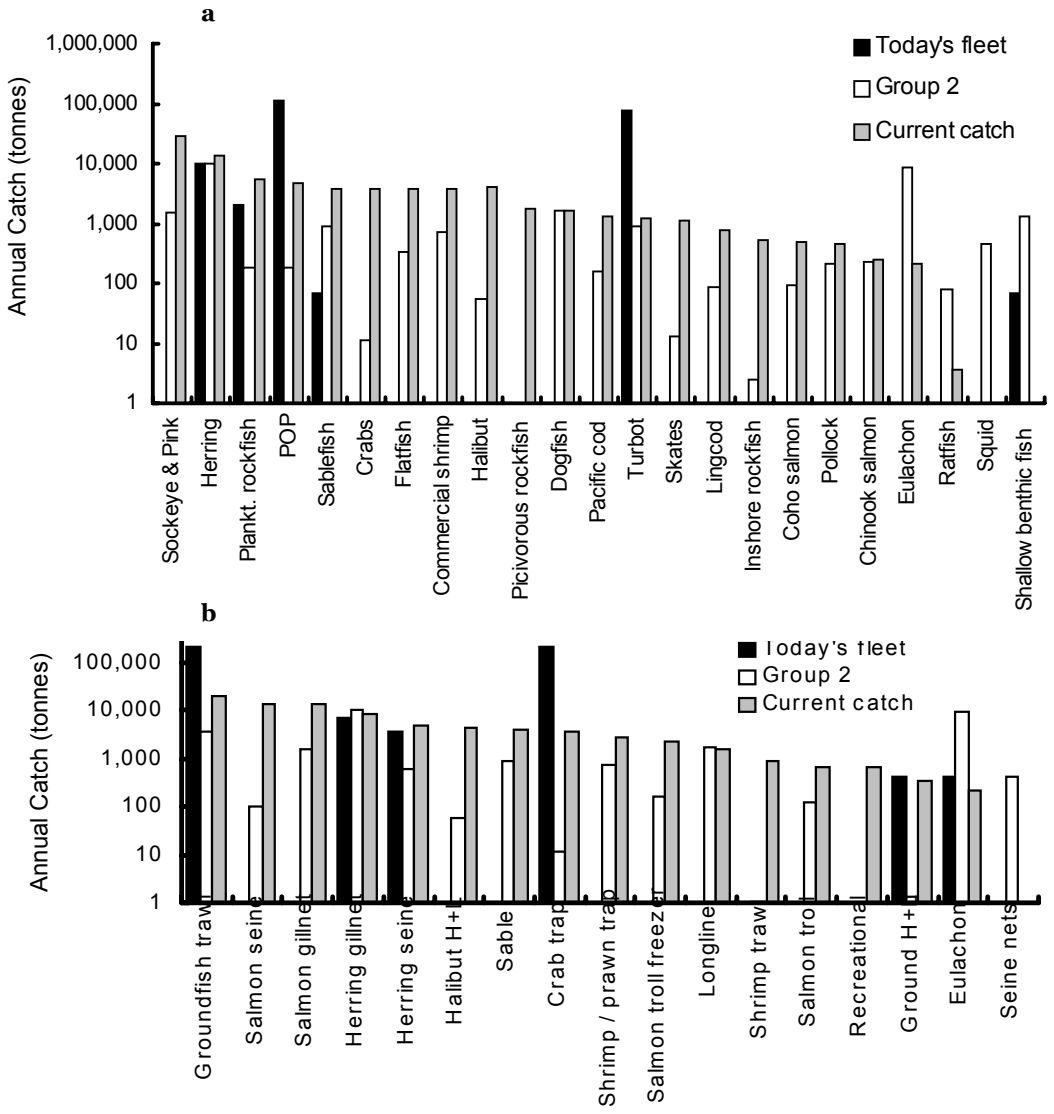
Group 2 wanted to restore the 1750s, and impose some fishing reductions to the current fleet. They also had some suggestions for the fleet structure and constraints to the existing fleets:

- No recreational fisheries;
- No shrimp trawlers (draggers);
- A reduction of 50% for seine nets – both herring and salmon seine nets;
- A reduction of 20% for dragger catches.

We ran the 1750 ecosystem model for 20 years, assuming no discards, under equal economic and ecological policy options. For comparison we ran today's fleet and a modified fleet structure that had no recreational fishery and no shrimp trawlers. Unfortunately we could not incorporate a fixed reduction in the seine or dragger catches as requested, due to limitations in the modelling software, because the policy optimization function searches for the optimal catch rather than the catch as a result of a specific gear restriction. In order to meet this request a new

simulation, rather than an optimization search, would have to be done.

The results from the policy exploration show that, under Group 2's choices, the catch by gear and by species would mostly be lower than both today's catch and the 1750 model managed with today's fleet. In fact, today's catch would be higher than almost all other catches by gear, except for the groundfish draggers, groundfish hook and line, and the new fisheries introduced in the policy search, namely eulachon and seine nets. Moreover, Pacific Ocean Perch (POP), turbot, ratfish, squid and shallow water benthic fish catches would be higher in the fished 1750s ecosystem than their catch today using both today's fleet and Group 2's choice (See Figures 4a and 4b below).



Figures 4a and 4b Annual catch in tonnes by species (a) and by gear (b) as predicted by a 20-year simulation of exploitation of the 1750 ecosystem using today's fleet and a modified fleet described by Group 2, compared to current catches.

SIMULATIONS REQUESTED BY GROUP 3

Eny A. Buchary
UBC Fisheries Centre

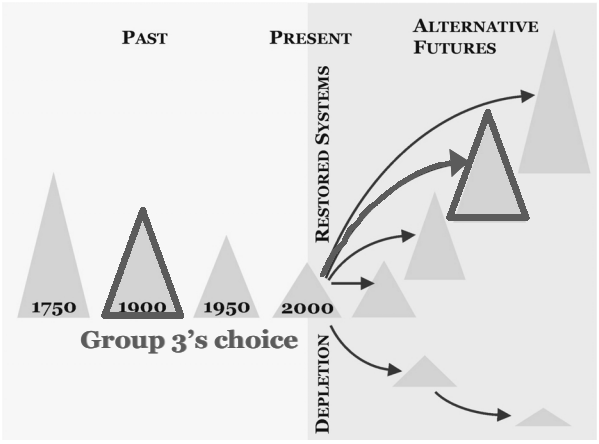
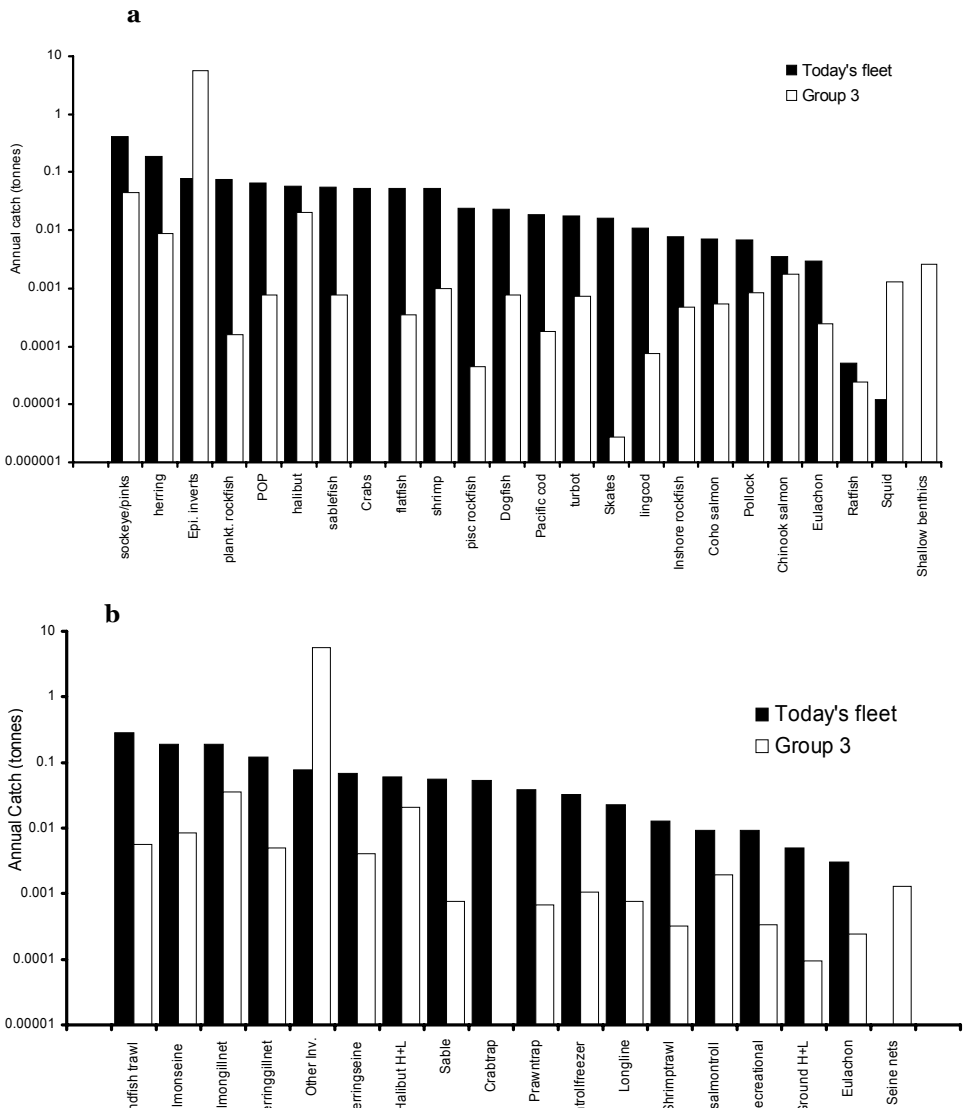


Figure 5 Diagrammatic representation of the simulation selected by Group 3.

Working Group 3 at the Prince Rupert workshop preferred to have an ecosystem restored to the 1900 state (Figure 5), opened with better managed fisheries that reduced the impact of draggers and recreational fisheries. The reason for this choice was based on the historical fact that commercial fishing in northern British Columbia started around 1880. Hence, a 1900 model would capture a 'near-pristine' ecosystem (see "Report on Discussions: Working Group 3" in this volume). The group also decided that no discarding practices and seine fishing on juveniles should be allowed in the restored ecosystem. Specifically, the group decided to have today's fishing fleet structure (see "Evaluation of Participants' Choice of Restoration Goal" for description of fleet structures, this issue), and that model simulations should place equal weight on economic and ecological goals.

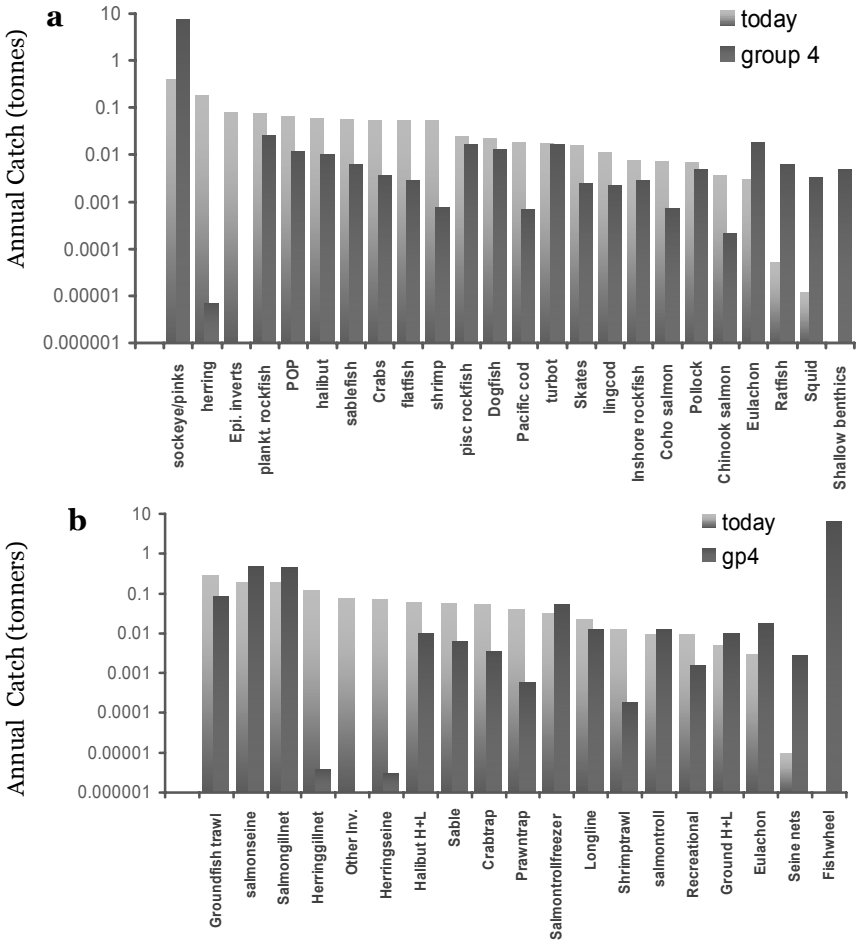
At the beginning of the simulation, the Lost Valley fishery in the restored 1900 model has a starting fisheries catch of 1% of biomass for selected target species. The selection of target species was based on the 'Opening the Lost Valley Fishery' criteria as outlined by Pitcher *et al.* (2002, *in press* - and see Pitcher Table 2, page 11, this volume). An increase in fishing pressure of 2% per year over the simulation was assumed for all commercial functional groups and the model was run for 20 years.

In running the simulations, I encountered a technical problem in



Figures 6a and 6b. Annual catch in tonnes by species (a) and by gear (b) as predicted by a 20-year simulation of exploitation of the 1900 ecosystem using today's fleet and a modified fleet described by Group 3, compared to current catches.

directly reducing the impact of draggers and the recreational fishery in the Ecosim policy search without altering the configured starting fisheries in the input. Instead, an indirect economic approach was used, instead (U.R. Sumaila, *pers. comm.*). Sumaila suggests that impact reduction for any fishing fleet in the model can be indirectly achieved by reducing the prices of the target species of the fleet in question. In other words, reducing the price of the target species of a certain fishing fleet would discourage that fleet to catch that particular species. In the policy search of Ecosim, when economic goals are weighted, the search will also incorporate the prices of the catches and the cost of fishing of each fleet in order to find the optimal level of fishing effort. Hence, in the simulations, I reduced the prices of the target species of draggers and recreational fishery by 50%. [This is one approach to the problem, but other solution might be discussed. Eds].



Figures 8a and 8b Annual catch in tonnes by species (a) and by gear type (b), as predicted by a 20 year simulation of exploitation of the 1950 ecosystem by today's fleet and the modified fleet selected by Group 4.

The results are given by species and by gear in Figures 6a and 6b respectively. Results from simulations suggest that in this scenario, we would see a dramatic increase of 'epifaunal invertebrates' catch (Figure 6a), which is caught by a gear specifically used to catch 'other invertebrates' (Figure 6b). This is because the physical effect of draggers (which directly impacts upon epifaunal invertebrates) was reduced.

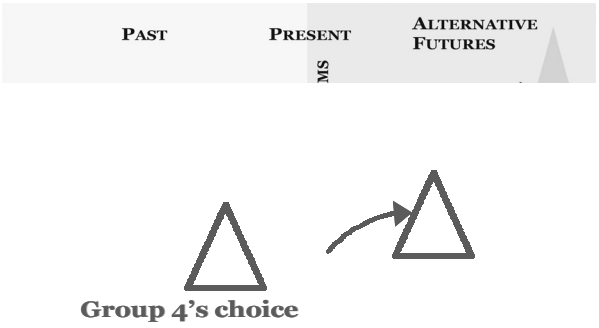


Figure 7 Diagrammatic representation of the simulation chosen by Group 4.

SIMULATIONS REQUESTED BY GROUP 4

Tony Pitcher
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This group requested simulations based on an ecosystem restored to its 1950 state (see Fig 7). Fisheries were based on the present fishing fleet gear types, with 5% discards of non-target species. Prices by gear type were entered, including higher prices for troll-caught sockeye. Recreational fisheries were entered with preliminary catch values, prior to Robyn Forrest's research into the true figures (see Forrest, this volume). Starting values for the fisheries were set to 1% of model biomass. Results are shown by species group and by gear type in the Figures 8a and 8b above.

WHICH RESTORATION GOAL IS BEST?

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Here we present an analysis of the results of comparing the economic values of the four alternatives restored ecosystems with the modified fisheries chosen by each working group. These working groups are: Group 1 (who chose the 2000 ecosystem), Group 2 (who chose the restored 1750 ecosystem), Group 3 (1900 ecosystem) and Group 4 (1950 ecosystem). Details on these selected restored ecosystems and their preferred fisheries can be seen in their respective chapters (this issue).

Two economic valuation systems are employed in this analysis. First, we used the 'conventional cost-benefit analysis (CCBA)'. This is the standard valuation method in resource economics. In this type of analysis, it is standard to discount net benefits from a given policy alternative that will accrue in the future, and value it as a single number in today's dollar, namely the net present value (NPV). This analysis tends to imply that most ecosystem restoration efforts are not worthwhile in economic terms (i.e., costs > discounted benefits), simply because discounting significantly reduces future net benefits from restoration. The main reason why this occurs is because future benefits are discounted using the time perspective (i.e., discounting clock) of the current generation only (Sumaila 2001). As the benefits of any restoration efforts (to depleted ecosystems) would require a long time to take effect, the costs of such projects would be felt immediately, while the benefits of restoration will accrue much later in the time horizon of the effort, frequently later than the current generation, as is considered by CCBA.

In the second analysis, we employ an approach termed 'generational cost-benefit analysis (GCBA)' (*sensu* Sumaila, 2001). In this approach, discounting takes place from the perspective of all generations, by applying different discounting clocks to calculate the flows of benefits that accrue to different generations. One rationale of this argument is that the benefits to the current generation obtained from the use of ecosystem resources today would never have shown up in the calculation of CCBA by the generations from one hundred years ago. Similarly, the benefits of the use of the same resources for the generations that will exist in one hundred years' time may not be seen in the CCBA of current generations. GCBA enables the 'proper' estimation of benefits to future generations. Further details on the algorithms and theoretical background on this approach can be found in Sumaila (2001) while the extension of the theory can found in Sumaila and Walters (*submitted*).

At the Prince Rupert workshop, the team presented the results of applying both CCBA and GCBA methods to the four different restoration goals from the four working groups. In practice, the different restored ecosystems with their fisheries are not strictly comparable because each working group requested slightly different adjustments to catch, bycatch, prices and gear types. Nevertheless, we tried to show expected indicative net aggregate benefits in total profits per year that the various restored ecosystems could yield. Since we measure the indicative aggregate benefits in total profits (CAD$) per year, we include only valuation of commercial species. Inclusion of non-commercial species in the analysis was in-built in the policy search routines performed earlier, for example by excluding or reducing charismatic species or species of cultural value in the catch, rather than by including them in the monetary analysis *per se*.

In Figure 1, we see comparison of total profits (in million CAD$) per year from each different restored ecosystem using both the CCBA and GCBA, while Figure 2 shows flows of these profits or benefits through time over a one hundred year period. In the GCBA analysis, we assumed that we only have two discrete generations, each with a 50 year time span. We used 5% as the discount rate in all analyses. Prices used were derived from Pacific DFO website (http://www.dfo-mpo.gc.ca/communic/statistics/Historic/landings/HLAND_E.htm), and modified during the workshop to accommodate field-based information (Pitcher, *pers. comm.*). Fishing cost was predefined at 0.6 of landed value (Anonymous 1994), and later confirmed and accepted by most fishers during the workshop.

Figure 1 (overleaf) shows that in all restored ecosystems, we see valuations calculated using GCBA provide higher benefits than those calculated using CCBA, and that choosing the 1750 ecosystem as a reference point – regardless of the cost-benefit analysis used – as a restoration aim makes more sense in economic terms[3]. As stated above, when one employs CCBA in the process of choosing a policy, one may miss the

[3] It should be noted that both valuations produce the same qualitative results, most likely because the cost of restoration in terms of reduced fishing is not calculated. This is left to future research.

future potential benefits of a given restoration effort simply because the time perspective used in CCBA is solely based on the time preference of the current generation.

Figure 2 describes this concept. In the CCBA (solid lines in Figure 2), the flows of benefits continue to decline precipitously over one hundred years, making the restoration effort useless for future

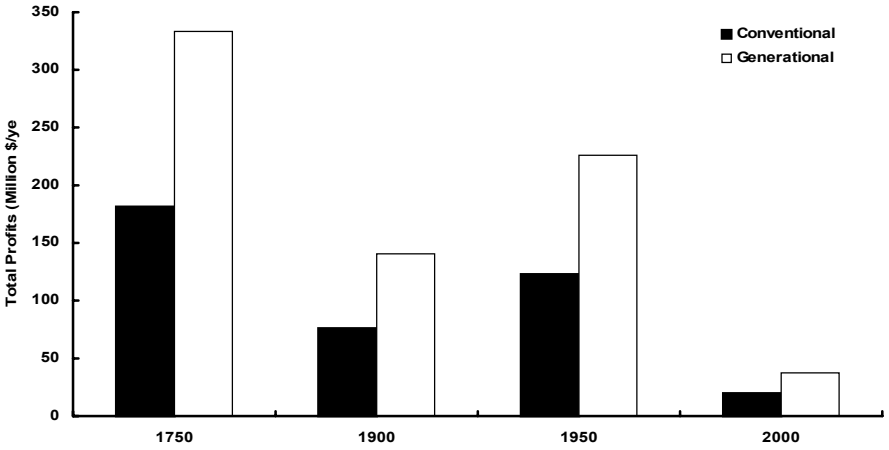

Figure 1. Comparison between conventional cost-benefit analysis (CCBA, dark bars) and generational cost-benefit analysis (GCBA, open bars) applied to all four alternatives of restored ecosystems.

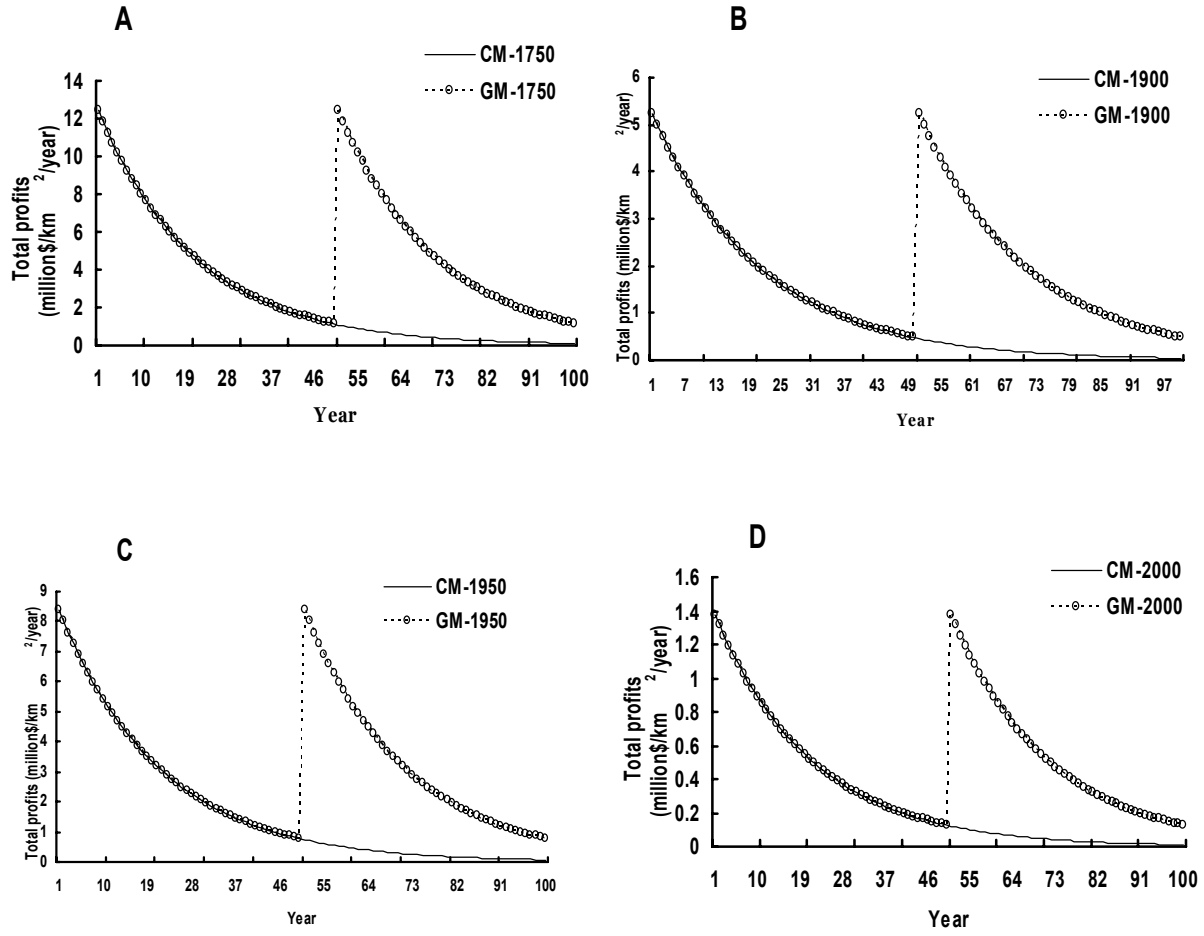

Figure 2. Flows of discounted profits accrued from all commercial species (in million CAD$/km²/year) for: (A) 1750 restored ecosystem, (B) 1900 restored ecosystem, (C) 1950 restored ecosystem, and (D) 2000 restored ecosystem. Solid lines represent flows estimated using the CCBA (here labelled as CM = conventional model) while the dotted lines with open circles represent flows estimated using GCBA (i.e., GM = generational model). *NOTE: differing vertical scales.*

generations in the eyes of current generations. This is not the case, however, when one employs the GCBA (dotted line with open circles in Figure 2). The discounting clocks were reset to zero when the 'new generation' enters, with the result that the value of benefits of restoration to future generations renders it economically rational for present generations to undertake restoration efforts.

In reality, generations are not discrete; instead they overlap and therefore a continuous estimation of intergenerational cost-benefit analysis (*sensu* Sumaila and Walters, submitted) would be more accurate when rationalizing a restoration effort. However, this is the first time that past ecosystems have been economically evaluated and compared in the 'Back to the Future' research process, and so the results are reported here for that reason. Refined evaluations are given in later project reports.

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EVALUATION OF PARTICIPANTS' CHOICE OF RESTORATION GOAL

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Rationale and Methodology

At the December 4-6 workshop in Prince Rupert, a paired comparison study was conducted to enable a determination of preferences of options for the fishery in the future amongst workshop participants. The paired comparison methodology was based upon that successfully employed by Power and Chuenpagdee (forthcoming), Chuenpagdee *et al.* (2001), and Chuenpagdee (1998). The methodology enables identification of a respondent's preferences among a set of choices through presentation of every choice in paired combination with each other choice (Peterson and Brown, 1998).

Each participant was presented with 28 pairs from which to choose a preference, based upon the ecosystem simulations prepared by the Fisheries Centre's team in advance of the workshop. The pairs were comprised of the 4 ecosystem time periods (1750, 1900, 1950, and 2000) combined with each of the two fleet simulations ("Today's Fleet" and "Team's Choice"). These combinations are presented in Table 1. Thus, each ecosystem was combined with each of the two fleets for a total of 8 options or scenarios; these scenarios were each paired against one another for a total of 28 pairs[4]. The scenarios in each pair were presented in boxes labelled 'A' or 'B'. Within the questionnaire booklet, each scenario appeared in the 'A' and 'B' boxes an approximately equal number of times. The pairs were presented one to a page, and furthermore the position of the pages within the questionnaire booklet was randomised such that each booklet was unique to further avoid bias. The participants were asked to choose either 'A' or 'B' within each pair. The final page in each booklet included general demographics questions. Figure 1 presents the front cover of the questionnaire booklet; Figure 2 presents a sample pair from the questionnaire booklet; Figure 3 presents the demographics pages from the booklet.

For each response, the choice for each pair was entered into a matrix such that the chosen scenario received a score of 1 and the scenario not chosen received a score of zero. The number of times each scenario was selected was totalled, and the totals for each scenario from each individual booklet were entered into an Excel spreadsheet. The individual totals were then summed across all respondents, and divided by the maximum possible number of times that scenario could have been selected across all respondents.[5] That number was then multiplied by 100 to normalise the results on a scale of 0-100.

Table 1: Scenarios included in the paired comparison survey.

Scenario Number	Fleet	Ecosystem
Scenario 1	Today's Fleet	2000 Ecosystem
Scenario 2	Team's Choice	2000 Ecosystem
Scenario 3	Today's Fleet	1950 Ecosystem
Scenario 4	Team's Choice	1950 Ecosystem
Scenario 5	Today's Fleet	1900 Ecosystem
Scenario 6	Team's Choice	1900 Ecosystem
Scenario 7	Today's Fleet	1750 Ecosystem
Scenario 8	Team's Choice	1750 Ecosystem

Results

A total of 15 questionnaire booklets was collected during the first two days of the workshop. For the methodology to work, each respondent must make one choice within every pair. The importance of this was emphasised in the instructions, and as a result, only two could not be included due to non-responses. One of the booklets not included in the results in fact contained only comments on the demographics page; no actual choices were made in the paired comparison section.

Of the 13 booklets completed, one indicated a 'perfect' response, such that the respondent was perfectly consistent across all choices. According to the transitivity axiom, a respondent "…who prefers A to B and B to C, will prefer A to C" (Peterson and Brown, 1998). Thus, in this study, only one of the 13 respondents did not demonstrate intransitivity. Inconsistency is not unexpected. As Chuenpagdee (1998) writes, "Individuals are not always perfectly consistent in their choices." Indeed, some choices may in some instances be more preferable, but less so in other circumstances. Chuenpagdee (1998) further notes that intransivity is not uncommon, "…especially when the choices are multidimensional…" as they were in this particular study.

[4] The total number of pairs for n scenarios is n(n-1)/2. (Chuenpagdee *et al.*, 2001)

[5] For this study, the total number of times an individual respondent could have selected a given scenario was 7. As 13 respondents were included in the study, the total number of times a given scenario could have been selected across all respondents was 104.

Survey of Fishery Preferences

In this questionnaire, you will be asked to decide between 2 possible fleet structures (the present fleet structure, known as "Today's Fleet", and a designed structure, known as "Team's Choice"), and 4 possible ecosystems, each representing a different time period. Each fleet structure will be combined with each possible ecosystem, and then (in pairs) compared against each possible combination. Each combination represents a possible future fishery. Information on the two fleet structures and the four time periods is provided below. For each of these pairs, please select only the **ONE** possible future fishery that **YOU MOST PREFER**. In making your choice, please consider the impacts on commercial species and catches (especially eulachon, halibut, herring, and salmon), non-commercial species (especially whales and sea otters), and money (value of the fisheries), both now and in the future. Guidelines regarding the possible impacts of each of the choice is provided along with each pair. Please consider these guidelines as you make your choice.

Please read each pair, and circle only A or B, even if you prefer the two options equally. There is no right or wrong answer. We simply want your own personal opinion on these issues. Please make sure that you complete every page in this questionnaire booklet.

There are 28 pairs in total. Please also answer the general questions found on the last page.

Thank you for your time and for your kind cooperation.

The four ecosystem time periods are:

1. 1750
2. 1900
3. 1950
4. 2000

The Fleet Structures are:

"Today's Fleet" = Current fleet structure	**"Team's Choice" = *no trawl or gillnets***
1. Groundfish trawl	~~Groundfish trawl~~
2. Sable trap	Sable trap
3. Herring gillnet	~~Herring gillnet~~
4. Groundfish hook and line (rockfish)	Groundfish hook and line (rockfish)
5. Salmon gillnet	~~Salmon gillnet~~
6. Crab trap	Crab trap
7. Shrimp/Prawn trap	Shrimp/Prawn trap
8. Other invertebrates	Other invertebrates
9. Halibut hook and line	Halibut hook and line
10. Salmon troll	Salmon troll
11. Salmon seine	Salmon seine
12. Salmon troll freezer	Salmon troll freezer
13. Herring seine	Herring seine
14. Shrimp trawl	~~Shrimp trawl~~
15. Eulachon	Eulachon
16. Longline (dogfish)	Longline (dogfish)
17. Recreational	Recreational

Figure 1. Cover page of Paired Comparison questionnaire.

From the booklets completed, a few preliminary results are available. Overall, the top choice was "Today's Fleet" combined with the 1950 ecosystem (51), and the least preferred were the scenarios combining "Team's Choice" with the 1900 ecosystem and the 2000 ecosystem (tied at 38).[6] Overall scenario preferences are presented in Figure 4.

More generally, "Today's Fleet" (45) was slightly preferable to "Team's Choice" (43), and the 1950 ecosystem (49) was chosen slightly more often than the 1750 ecosystem (47.5). The 2000 and 1900 ecosystems were tied and least preferred (39). These results are presented in Table 2.

However, given the low response rate, confidence in the results is low. A minimum of twenty completed responses would have been preferable, and as such the results presented herein should be taken as preliminary rather than definitive.

[6] The results have been normalised to a scale of 0-100. Thus, a score of 51, for example, means that that scenario was chosen 51 of every 100 times it appeared in a pair, or slightly more than half the number of possible times.

***Which of these two possible future fisheries do you prefer**, given the impacts of each on fishery catches, commercial and non-commercial species, and value? (Please choose only **A** or **B,** and **please be sure to make a choice,** even if you feel they are equally important.)*

A	**B**
Today's Fleet, 2000 Ecosystem	Team's Choice, 2000 Ecosystem

Guidelines to consider:

Choice A:	**Choice B:**
Eulachon Catch ↑, Value ↑	Eulachon Catch ↑, Value ↑
Halibut Catch ↓, Value ↓	Halibut Catch ↓, Value ↓
Herring Catch ↓, Value ↓	Herring Catch ↓, Value ↓
Chum/Pink/Sockeye/Steelhead Catch ↓, Value ↓	Chum/Pink/Sockeye/Steelhead Catch ↓, Value ↓
Chinook Catch ↓, Value ↓	Chinook Catch ↓, Value ↓
Coho Catch ↓, Value ↓	Coho Catch ↓, Value ↓
Sea Otters ↓	Sea Otters ↓
Baleen Whales ↔	Baleen Whales ↔
Toothed Whales ↑	Toothed Whales ↑

Figure 2. Example of pair from paired comparison questionnaire booklet.

Furthermore, given the low response rate, no further statistical tests have been conducted.

Methodology – Lessons Learnt

Several lessons were learnt from this exercise. As the survey was distributed to and being completed by workshop participants, it became evident that there were several problems with the questionnaire itself. These observations were largely confirmed by comments made either verbally or in writing by survey participants. Indeed, not all workshop participants were willing to participate in the survey due to doubt in the methodology or confusion and/or skepticism regarding the process.

In particular, it became evident that the choices presented to the participants were unclear and over-complicated. A reference chart detailing the quantitative impacts of each was initially prepared for distribution with the surveys, however it was felt that the detail provided in the chart was excessive and thus unhelpful. In an effort to simplify the choices, "Guidelines" for consideration were included at the bottom of each choice page. These, however, were simplified to the extent that they effectively became almost meaningless. Instead of providing quantitative information on the impacts of each choice on the catch, value, and/or biomass of each species (as applicable), the guidelines merely indicated the directional trend of the impact, with the result that in almost all cases the catch and value of the commercial species appeared to remain the same for each choice. (The only notable exception is chinook salmon in the 1750 ecosystem model for both fleet simulations, where the catch declined while, inexplicably, the value increased.) Therefore, for most choices the only difference was in the numbers of sea otters and whales (baleen and toothed).

Respondents were encouraged to consult the posters which graphically detailed the impacts of each choice for additional information, yet the connection between the survey and the posters was unclear for some respondents, and many struggled with the information.

Another workshop participant, who chose not to complete the questionnaire, indicated that the choices were too abstract. Had the choices been presented as, for instance, between the ecosystem and jobs, they would have been far more realistic and practical, and thus more applicable to respondents.

Please answer the following questions. ***Note that all responses are confidential.***

1. What is your age? _____

2. What is your occupation? _____

If your occupation is fishing, please answer the following questions:

2a. In what fisheries do you currently participate? Please indicate gear type and target species, beginning with the most important fishery:

1. _____
2. _____
3. _____
4. _____

2b. How long have you been fishing in your primary fishery? _____

2c. Do you own the fishing vessel? _____

2d. Do you also work outside of the fishery? If yes, please indicate. _____

3. Where do you live? _____

4. What is your gender? _____

5. What level of education have you completed? _____

6. Do you have any additional comments? _____

Figure 3. Demographics page from paired comparison questionnaire booklet

As presented, the information muddied rather than clarified the impacts of the choices. In short, too much information was presented with too little detail – thus becoming both overwhelming and uninformative at the same time.

When the initial results were presented at the final day of the workshop, one workshop participant enquired as to whether respondents perhaps simply randomly selected responses without due thought or consideration simply to complete the questionnaire. This may very well have happened, and may have been the case in at least one survey, in which the respondent selected the "B" choice only 4 times out of 28 pairs.

As a result of frustration with either the questionnaire or the workshop process as a whole, several individuals chose not to participate in the survey[7]. Most simply returned the questionnaire uncompleted. However one respondent did not complete the questionnaire at all, but rather used the demographics page found at the end of the survey to provide comments on the workshop as a whole and on the issues raised by the workshop. Other respondents included overall comments regarding the workshop in the survey booklet. Two issues become apparent: first, that the survey was overwhelming to some participants and as such they were unable or unwilling to participate; and secondly, that for all workshop participants a feedback mechanism regarding the workshop as a whole was necessary.

The demographics page of the survey asked respondents to provide such information as age, fishing experience, formal education, and so on. While not all participants answered all questions (one respondent, for instance, responded "What does it matter?" to the question of gender), most provided the requested information.

One demographics question asked specifically of fishing experience, particularly the species and gear types of the fisheries in which the respondents currently participate. Unfortunately, the wording of this question effectively excluded

[7] Due to the fact that workshop attendance varied from day to day and even fluctuated during the course of each day, it is impossible to estimate the number of workshop participants who declined to participate in the survey.

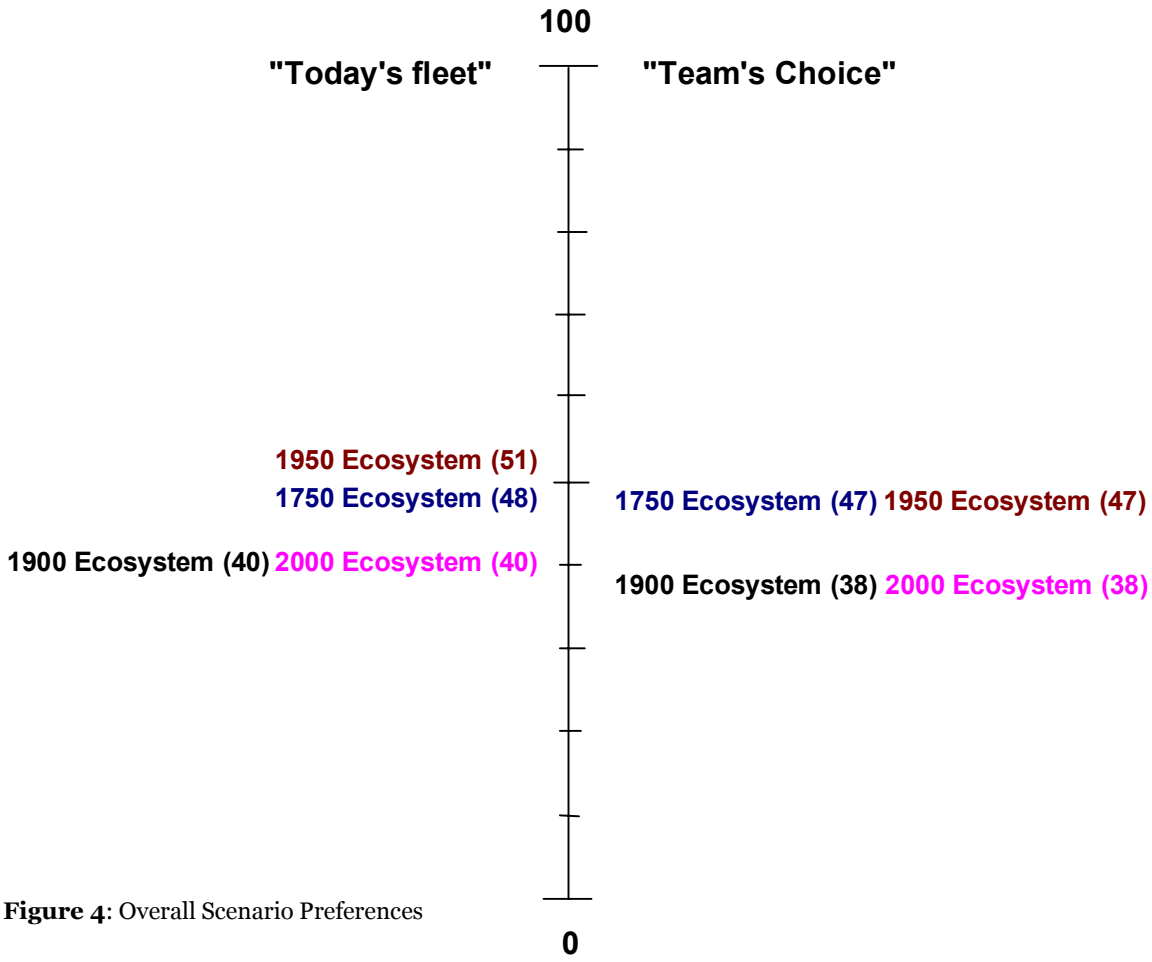

Figure 4: Overall Scenario Preferences

retired fishermen, of whom there was a large number at the workshop. For future surveys involving retired fishers, this question should be reworded to include previous fishing experience, or supplemented with a question specifically designed with retired fishermen in mind.

Some frustration was expressed over the fleet choices being limited to "Today's Fleet" and "Team's Choice". Some participants indicated that they did not want to choose the "Team's Choice" at all because this would in effect exclude the gillnet and dragger sectors. While this survey may be an interesting academic exercise for the researchers, to those who live in the region and rely on the fishery, these choices mean that participants are being asked to choose *against* other members of their community.

Due to the time necessary to prepare the questionnaires, it was not feasible to prepare the choice questions in Prince Rupert based on the results from the suggestions of the four working groups. However, the controversy over "Team's Choice" (see "The Thoughtful Use of Words", this volume) had a snowball effect with this study, in that respondents seemed to feel somewhat cornered into supporting what appeared to be the Fisheries Centre team's preference. As a result, some respondents may have always chosen "Today's Fleet" over "Team's Choice", regardless of the ecosystem impacts, whether in protest of the composition of "Team's Choice" or in solidarity with the gillnet and dragger sectors.

A few Aboriginal respondents raised an interesting issue about the substance of the questionnaire. Specifically, respondents were asked to consider in particular the catch and value of several fish species, including eulachon. As these respondents commented, eulachon is not a commercial fishery, and as such should not be assigned a commercial value. It would seem, then, that since eulachon were included as a point for consideration, that species should have been treated in the same manner as sea otters and whales, in which case the change in numbers (biomass) were to be considered.

Table 2. General Preferences for Fleets and Ecosystems for the paired choice analysis.

Fleets		***Ecosystems***	
Today's Fleet		**2000**	
2000	40	Today's Fleet	40
1950	51	Team's Choice	38
1900	40		39
1750	48		
	45	**1950**	
		Today's Fleet	51
Team's Choice		Team's Choice	47
2000	38		49
1950	47		
1900	38	**1900**	
1750	47	Today's Fleet	40
	43	Team's Choice	38
			39
		1750	
		Today's Fleet	48
		Team's Choice	47
			47.5

Conclusions

One workshop participant who chose not to complete the survey indicated a disappointment with the questionnaire. This person had prior exposure to the methodology and was quite eager to participate in the expectation the exercise would be useful and informative, but was very disappointed with the questionnaire as distributed and as a result declined to participate.

Indeed, the methodology has previously been proven to be very useful as a process to determine preferences amongst respondents. In this particular case, various constraints resulted in less-than-stellar results and significant confusion amongst respondents.

Ideally, the questionnaire should have been subjected to a test round, such that the major difficulties could have been identified and corrected. A test run had been planned; however the results of the modelling and economic evaluation were not made available in sufficient time to conduct the planned test. Adequate time would have allowed for improvements in the choices themselves (i.e., more practical and less abstract) and in the supporting information, thus overcoming at least some of the difficulties associated with this survey. For any future surveys (of this style or otherwise), all necessary information must be made available well in advance, allowing ample time for test runs of the survey materials.

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INTRODUCTION TO WHAT THE TEAM LEARNED FROM THE WORKSHOP

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As with the interviews conducted in Prince Rupert in the summer of 2001, the community workshop was a first-time effort for the Back to the Future team, and therefore provided opportunities to learn how to better conduct such activities.

While some individual members of the team had prior experience with this type of workshop, or were familiar with the community and various workshop participants, as a team we were relatively inexperienced. Aware of this, we devoted considerable time and effort to pre-event planning, discussing not just the broader agenda and who was responsible for what, but even small details such as whether the Day Two working groups should be assigned or self-selected.

Despite all our careful planning, the start of the workshop was delayed when inclement weather closed down the Prince Rupert airport before all team members had arrived. However because of the level of preparation, once all were assembled, we were able to quickly adjust our agenda and make up for the lost time without losing any planned activities. Without a clear idea of our intentions and plans for our goals, the workshop would have been more significantly impeded by the delayed start.

A brochure was prepared (*see Annex 3*) and distributed to all who had been interviewed by the team during our July visit, and we largely relied on word-of-mouth to advertise the workshop. Day One attendance was lower than anticipated, and while this may in part have been due to the inclement weather and delayed workshop start, it is more likely that we should have advertised the workshop more broadly. (Indeed, the weather may have helped, as fishers decided to stay ashore.) Following the close of the first day, word spread throughout the community of both our presence and what we seemed to be doing (see "The Thoughtful Use of Words", this volume). The significantly improved attendance on Days Two and Three indicates that community members were interested in our activities and willing to participate, but that we had initially failed to make known our event. Despite budgetary constraints, we now realise the importance of paid advertising to complement individual invitations and word-of-mouth.

Although the UBC team were certainly pleased with the increased attendance following Day One, it is unfortunate that this was realised due to a misunderstanding of our intentions. As described in "The Thoughtful Use of Words" (this volume), workshop participants were initially under the mistaken impression that the UBC team was seeking to close down all gillnet and trawler fleets. Our poor word selection, referring to "Team's Choice" rather than, for instance simply "Example", telegraphed a preference on the part of the Fisheries Centre. Moreover, in wishing to develop credibility within the community, there appeared to be some concern that we would not only be taking pains to make this opinion known but also that the opinion would carry weight with policy-makers. As a result, we inadvertently hindered the development of trust between the community and the Fisheries Centre's researchers.

Fortunately, in this case there was no lasting harm and in fact the workshop process eventually benefited from the misunderstanding. By the end of workshop, the community members were happy that ther was no 'hidden agenda' in the UBC team's approach to the process. Furthermore, we learnt that we must pay attention to even the smallest details, and particularly to be aware of community perceptions and sensibilities and how we and our activities are viewed by others.

Finally, we learnt the value of following up with the community and those who have generously shared with us their knowledge, time, and good will. Unfortunately, our limited budget means that we are unable to return to the community or to visit other communities as we should and we would like. It is apparent, however, that for our collaborative research to prosper, we must work to cultivate trust between us and the community (indeed, we need to trust them as much as we would like them to trust us), and that this will require a longer term commitment. There must be no 'hit and run' research.

As a first attempt, the workshop was clearly a learning experience for the Back to the Future team. It is also likely that it was also a time of learning for the community, coming to know us, our methodologies, and how we can work collaboratively. It is important that we learn not only what they can give us, but what we can give them in return and what they expect of us. This workshop was an important step in this direction.

THE THOUGHTFUL USE OF WORDS

Melanie D. Power
UBC Fisheries Centre

During her opening comments at the first day of the December, 2001, workshop in Prince Rupert, Debbie Jeffrey, president of the Tsimshian Tribal Council, noted the posters lining the meeting room and reminded us to be cautious in the use of the word 'exploitation'. She indicated that this word immediately separates humans from nature and puts human activities at odds with nature.

The use of words with inadequate thought and planning surfaced as an unexpected complication during the workshop process. Perhaps most problematic was the use of the phrase 'Team's Choice' to describe the fleet structure applied in the simulation prepared in advance of the workshop and introduced on the first day. This phrase inadvertently and incorrectly indicated to workshop participants that the Fisheries Centre team had a specific preference for the fleet structure described. As this simulation involved the removal of gillnets and trawlers from the Hecate Strait fisheries, the chosen phrase implied, however mistakenly, that the Fisheries Centre team wished to eliminate these sectors. As the phrase, and the fleet structure it represented, was introduced during Day One of the workshop, Day Two of the workshop was greeted with a greatly increased attendance, largely by gillnetters and draggers believing that their fishery was under attack. One can imagine the series of phone calls amongst these two sectors during the evening following the first day of the workshop! With the opportunity to make their feelings known to us, and with appropriate explanations and *mea culpas* from the Fisheries Centre team, the members of these two sectors came to understand the goals of the workshop (i.e., not trying to close down their fisheries!) and became interested and active participants in the remainder of the sessions. Although several people attended Day Two out of anger, the workshop enjoyed a boost in attendance as a result of the misunderstanding caused by the careless choice of words.

Although the use of the phrase 'Team's Choice' was by far the most blatant and problematic instance of poorly-chosen words, it was not an isolated example. For instance, the word 'value' had been inappropriately applied to eulachon in the paired comparison survey (see "The Choice Evaluation", this volume). As was pointed out by one Aboriginal participant, eulachon is not a commercial fishery, and as such the 'value' of the eulachon cannot and should not be described in the same manner as with salmon, halibut, or herring.

As an early effort at conducting and participating in community workshops, this particular workshop can provide guidance for future activities in the community. Indeed, the choice of words, and the consequences of using inappropriate words, will need to be afforded increased attention in future workshops.

WHAT THE INTERVIEWS HAVE SHOWN

Cameron Ainsworth
UBC Fisheries Centre

The results of the July interviews and the methodology used to process the information were presented at the December community workshop by use of a power point presentation and poster. Interviewees represented a cross section of fishers, processors, and other stakeholders who work on the sea and have local ecological knowledge of the marine environment.

The summer interviews, and those conducted at the December workshop, were divided into two sections. The first part attempted to identify what changes the participants had noticed in the ecosystem by showing them images of over 100 mammals, birds, fish and invertebrates, and asking whether they thought the abundance of each animal had increased, remained the same, or decreased during their careers. Secondly, a rapid appraisal (RAPFISH) survey was conducted in which attributes were scored that relate to the sustainability of the interviewee's primary fishing sector. [more information on the rapid appraisal results will be presented in later report. Eds].

Until the time of the December workshop, only the information from the first segment of the July interviews had been processed. Information received from those interviews was used to generate a relative change in abundance for many of the functional groups in our Ecopath models.

The process used to incorporate the interview information was as follows. If the interviewee claimed that a particular species had increased for example, then each of the years that that person had worked at sea received one vote for increasing. The same 'vote' process was operated for 'same' and 'decreasing' opinions. An

increasing vote was considered +1, a same vote was considered 0 and a decreasing vote was considered –1. All the votes offered by each participant for a particular species were combined to produce an average vote that was negative if the species was decreasing that year, and positive if the species was increasing. The relative rate of change of each functional group was determined by combining estimates for all species in that group.

The interview data were used to construct a time series rate of change for each functional group, first with information from all participants receiving equal weighting, and then using a weighting scheme. Under this scheme, the vote of a participant was worth twice as much if they were considered experts in that functional group (i.e. +2 or –2 instead of +1 or –1) and was worth half if they had little interaction with that functional group (i.e. +0.5 or –0.5 instead of +1 or –1). Votes received from group interviews were worth half. The criteria were as follows (note that '+' denotes double weighting, '-' denotes half weighting and '0' denotes unmodified weighting):

1.) Expertise by gear type (+) on relevant functional groups
2.) FN group 'consensus' interviews (-) except for eulachon, halibut and seals/sealions (0)
3.) Processors (-) on all groups
4.) Interviewee 21 is a rockfish expert, (+) all rockfish groups
5.) Interviewee 20 is a biologist, (+) all groups
6.) Recreational fishers are (-) on all groups except their specialty
7.) Non-fishermen are (-) on all groups

The relative rate of change from 1950 to present was then converted into a time series estimate of relative abundance by fixing the average abundance and amplitude of change of the interview data, to that of the scientific estimates. Comparisons between the weighted interview estimates of abundance, and scientific estimates were presented to the attendees of the December workshop.

A Spearman rank sums correlation had also been performed. Statistically significant agreement between the interview and scientific data was found for coho, lingcod and sablefish using unweighted interview data, and only for coho and lingcod using the weighted interview data ($P = 0.05$).

As of the December workshop, the interview information had not been used to directly drive the models. However, the general trend in abundance suggested by the summer interviews had been used to confirm the relative change of some of our functional groups between the 1950 and present day models. This 'reality check' is particularly useful for non-commercial groups, for which time series biomass estimates are often unavailable.

Future efforts must determine how to convert the dimensionless relative rate of change suggested by the interview data, into an absolute abundance for data deficient, non-commercial groups. The converted abundance estimates from the interview data should then be used to drive the abundance trend of suspected errant functional groups in a time simulation to determine if the model's fit to available data can be improved.

CAN WE SPLIT THE ECOSIM FISHERIES BY LICENSE TYPE?

Cameron Ainsworth
UBC Fisheries Centre

It is possible to construct an ECOPATH model with fisheries specific to all license types available. In order to do this we will have to determine the average catch yielded by each license type per vessel, allocate that amount to the target species, and then multiply by the number of vessels operating under that license, adjusting for discard rates associated with each gear type involved with that license. Extending this method to ECOSIM would allow us to determine the optimal number of licenses per gear type that should be used to achieve ecosystem objectives.

In fact, handling fisheries by license type rather than gear type may be more relevant to the community discussion. It would also allow us to predict the effects of specific DFO management schemes using the present day model, an analysis that would be of interest to the fishing community.

During the 'modelling' roundtable discussion Foster Husoy suggested running a series of policy searches to optimize for each gear type, in order to determine which groups are more "selfish".

HOW TO MODEL SALMON – AN ISSUE ARISING FROM THE PRINCE RUPERT WORKSHOP

Richard Stanford
UBC Fisheries Centre

Salmon are extremely important species in British Columbia. They have constituted a primary food source for First Nations peoples over millennia, and more recently have supported a large commercial fleet along the Pacific north-west. Even more recently a recreational salmon fishery has developed. These various user groups have different attitudes to the resource and so management approaches must be carefully balanced in order to encompass their conflicting objectives. Management of salmon is further complicated by its lifecycle. Salmon migrate through different jurisdictions, and at different stages of the year will be available for capture to the various user groups. Their reproduction in rivers links the marine and riparian environments and mortality is not restricted to predator-prey relationships but also depends on terrestrial factors such as deforestation and pollution. Furthermore, there are independent salmon species and stocks, which have varying degrees of dominance.

Clearly salmon are not "regular" marine species that will slot neatly into an Ecopath model. During the three day workshop in Prince Rupert a number of issues were raised that needed to be included in the model.

The principle issue was a frustration from commercial fishers and First Nations over the alleged burial of large quantities of salmon from the Skeena River system. The Skeena River is currently the second largest producer of salmon in British Columbia (Nigel Haggan, pers. comm.) and quotas are allocated to each of the commercial sectors, with the aim of leaving enough salmon to provide the First Nations, and enough to spawn. This is a difficult task because estimating numbers of returning salmon is problematic. In the summer of 1992 an overestimate resulted in too many being caught in the fishery (Pearse, 1992). More recently fishers argued that the number returning had been underestimated. When a certain number of fish have passed through the Skeena to spawn, a barricade prevents further movement upstream by the "latecomers". This results in the death of salmon which have not spawned and localized de-oxygenation of the river. These dead fish were removed and buried. Fishers were angered by this perceived waste of fish. In summary the first problem with modeling salmon is how to incorporate the unpredictability of returning numbers of salmon to the ecosystem.

A second, related problem is the independent stocks of salmon. 70 % of the BC salmon fishery is based on 5 Fraser River, Rivers Inlet and 2 Skeena River sockeye stocks. Yet there are 14 sockeye stocks in the Skeena River alone plus the other salmon species (Nigel Haggan, pers. comm.). Fishing all salmon stocks at the same rate will thus drive weaker stocks to extinction. How can Ecopath incorporate the different stocks? in order to manage the system such that genetic diversity is maintained?

Thirdly, the river and marine environments are distinct systems linked by estuaries, and also by salmon. There are some species, such as bears, which are strongly associated with rivers but not the marine part of the ecosystem (Hecate Strait). How can Ecopath accommodate this?

One fisher raised the question, "is it possible for your model to include unpredictable events?" referring to the impacts stochastic events such as oil spills would have on the system. It was important to clarify that while an Ecopath model will normally produce unpredictable results it cannot predict the occurrence of events that have not been programmed into it. For example the explosion of an exotic species following climate change would not be modeled if the exotic species had not been included as a group in the original model. Hence it cannot distinguish between stocks if the basic information about those stocks has not already been collected and included in the model. This means that in order to manage the independent salmon stocks using Ecopath, each stock would need to be considered as a distinct functional group, and the timing of each stock's migration would need to be known. It is important to note that a trade-off exists in the productions of a more detailed model: The difficulty and expense of acquiring the more detailed data required may exceed benefits of the increase in accuracy of the model.

The responses:

1. Currently, the first stage of salmon estimation is based on historic trends, ocean conditions and counts of young fish before they went to sea several years earlier. As salmon move inshore, abundance is estimated by test fishing, and stock composition by analysis of scales and other characteristics (Pearse, 1992). From these data a forecast is made of the size of each stock.

How could Ecopath improve on this? The first change that would need to be made, as suggested above, would be separate functional groups in the model for each stock. One of the big advantages of Ecopath over single species stock assessment is that it incorporates the relationships between species. Hence it could improve estimates of the numbers of returning salmon by combining the forecast information with data on other species. For example, if the abundance of a predator has increased such that a salmon stock will be reduced as it moves through a certain area then this could be indicated by the model. Similarily, Ecopath/Ecosim could be used to create better estimates of the mortality over the life cycle of the young fish after they leave the river. Deforestation and pollution could be incorporated as mediation effects so that the number of adult salmon reaching the spawning grounds is better predicted.

2. Having modeled a response to the first problem, the estimates of returning salmon from each stock will be more accurate. It would then be necessary to understand the timing of and area over which stock migration occurs. The best tool for this is Ecospace. Theoretically the data could be entered into the model and the movements of the stocks over time could be tracked. The effect of predation and fishing mortality on each stock could be identified at a variety of locations in the Hecate Strait. Fishing effort could then be directed towards a specific place and time, to maximise the catch of the dominant stocks and minimize that of the weaker ones.

3. Linking different models could be very useful. This would mean that a detailed model of both the marine and riparian ecosystem could be created, avoiding cutting corners in an attempt to make a generic model. Salmon entering the river model to spawn and leaving it as juveniles would drive the numbers of salmon entering the marine system. (Martell, *in prep*)

It is important to note the limitations of the model. It has already been mentioned that modelling certain things may be prohibited by the cost of doing so. It is also true to say that migrations are not adequately dealt with by Ecopath/Ecosim and that Ecospace is better suited to species such as salmon. Perhaps the most crucial point is that of scale. There are trade offs between scale and resolution of coverage, so that in modelling the entire Hecate Strait, the detail in modelling a single river is lost. When designing the model, the purpose for which it is being created is of utmost importance in how the model will look. The aim of the Fisheries Centre team was to model the entire Hecate Strait with a view to broadly optimizing all of the fisheries.

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ESTIMATING THE TRUE SPORTS FISHING CATCH IN NORTHERN BC

Robyn Forrest
UBC Fisheries Centre

One of the main concerns arising from the Prince Rupert community workshop was the perception that sports fishers and charter companies in British Columbia take a large portion of the salmon catch but are not subject to the same accountability or regulation as commercial fishers (see reports of Group Discussions, this issue). The Fisheries Centre team had not anticipated the importance that participants would place on the sport fishery. The possibility that our estimates of recreational fishing mortality were inadequate became a serious concern and it became clear that much better estimates of the size of the sports catch needed to be incorporated into the model.

Following the Prince Rupert workshop, a study was done to try to gain better estimates of the sports catch in Northern British Columbia. The full report will be published in a forthcoming Fisheries Centre Research Report (Forrest, *in press*). Highlights of the findings are given below.

The concern of the Prince Rupert community members about the size and regulation of sport catches is part of a widespread issue. Recreational catch figures are commonly lacking in fisheries statistics, even though they can often approach or exceed commercial catches (e.g. Pollock, 1980; West and Gordon, 1994; Young *et al.*, 1999). There is still a widespread perception that recreational fisheries do not pose the same threats to fish stocks as commercial fisheries and need not be subject to the same regulations (Post *et al.*, 2002) and in many Western countries, allocation disputes between the commercial and recreational sectors frequently arise (Leadbitter, 2000; Kearney, 2001). Small-scale commercial fishers, who make up much of the commercial fishing sector in western Canada, are vulnerable to competition from the recreational sector (Leadbitter, 2000) and many experience

frustration as recreational catches appear to increase, as their own access to the resource becomes more restricted.

The Department of Fisheries and Oceans, Canada (DFO) holds two, independently-gained sets of estimates of sport catches in northern British Columbia. The official annual estimates are collected by the regional offices of DFO-Pacific and are obtained using creel surveys and log-book data from charter companies. Another, unofficial, set of estimates is held by DFO's Statistical Services Unit, Ottawa (The Surveys of Recreational Fishing: DFO, 1998; 2002). These five-yearly estimates are made using mail-out and telephone surveys. Both official and unofficial sets of estimates are publicly available on the internet[8]. The two sets of estimates were compared for the years 1995 and 2000, to help evaluate which to use in the model. There were large differences between the official estimates and those obtained using the mail-out surveys for most species, especially in 1995 (Figure 1). In all cases, the estimates from the Surveys of Recreational Fishing (mail-out surveys) were greater than the official estimates, sometimes by more than twice as much. Strengths and weaknesses of the two approaches were evaluated, with the assistance of the scientists in charge of the two datasets (Dr M. Reagan, DFO-Pacific and Dr K. Brickley, DFO-Ottawa).

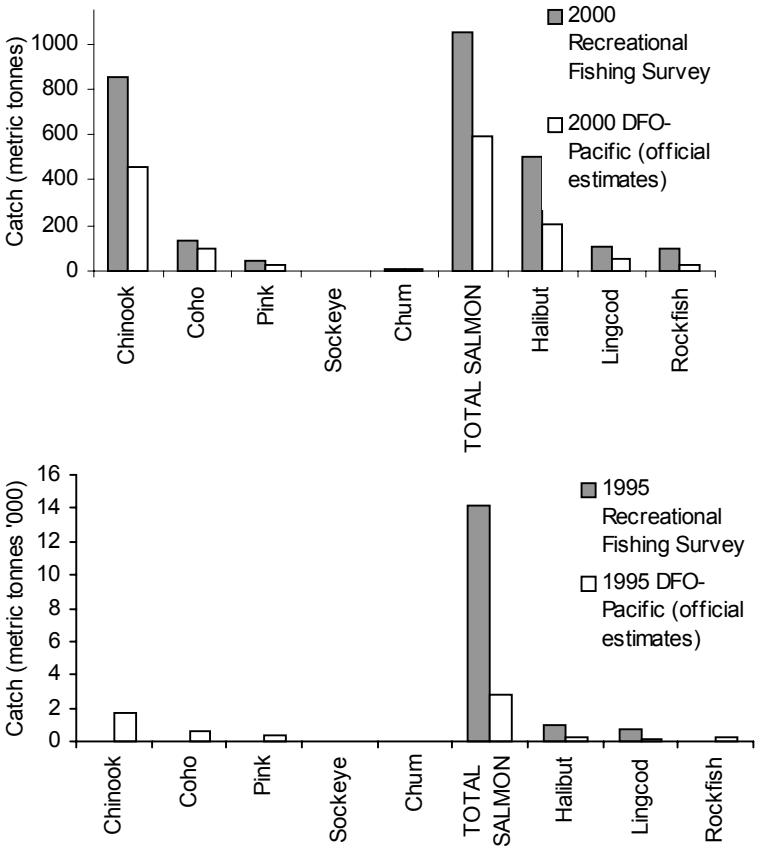

Figure 1. Estimates of catches for a) 2000 and in Northern and Central BC (Statistical Areas 1-10) in pieces of fish; and b) 1995 in the whole of BC. Estimates from the 1995 and 2000 Surveys of Recreational Fishing are of fish kept rather than caught. Note that estimates of individual species of salmon were not available for the 1995 Survey of Recreational Fishing.

Based on our findings (Forrest, in press), we elected to use the estimates from the 2000 Survey of Recreational Fishing (DFO, 2002), as these appeared to better represent recreational catches for the whole region. An adjustment to account for discard mortality in the recreational fishery, based on estimates from the literature, was also added. The final figures were added to the present-day model for northern British Columbia (Ainsworth *et al.*, 2002).

Recreational catches are almost never monitored with the same accuracy as commercial catches. They are usually estimated using sampling programmes that may have weaknesses associated with them. It is important to consider these weaknesses and to compare estimates from different sources to try to obtain the most realistic figures. This is a political and sensitive issue and, with many of British Columbia's fish stocks in decline, there is little doubt that in future, fisheries agencies will have to allocate more resources to better evaluate recreational catches.

[8] DFO-Pacific: www-sci.pac.dfo-mpo.gc.ca/sa/Recreational/recpage.htm; DFO-Ottawa: www.dfo-mpo.gc.ca/communic/statistics/ rec_e.htm

Acknowledgements

Dr Kieth Brickley (Chief Analyst of the Statistical Services Unit, DFO, Ottawa) and Dr Mark Reagan (Regional Manager of Recreational Fisheries, DFO North Coast Area) were invaluable in providing data, advice and information.

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RAPPORTEURS' REPORT ON PLENARY DISCUSSIONS

Cameron Ainsworth
UBC Fisheries Centre

Participants mentioned
GB – Gregg Best (F)
EB – Erica Boulter (WWF)
JB – James Bryant (F)
EBu – Eny Buchary (FC)
HC – Heber Clifton (F)
RF – Robyn Forrest (FC)
NH – Nigel Haggan (FC)
BH – Bill Harrower (F)
GH – George Hays (COP)
SH – Sheila Heymans (FC)
FH – Foster Husoy (F)
DJ – Debbie Jeffreys (TTC)
RJ – Russ Jones (HG)
TP – Tony Pitcher (FC)
MP – Melanie Power (FC)
CS – Cyril Stephens (COP)
RS – Rashid Sumaila (FC)
PT – Pablo Trujillo (FC)

Affiliations
COP – City of Prince Rupert
F – Fisher
FC – Fisheries Centre
TTC – Tsimshian Tribal Council
WWF – World Wildlife Fund

Day 1
Present: 18 community members & FC team
(Late start 11:30am because some group members were delayed due to inclement weather.)

Introductions

Welcome from NH (UBC FC) and DJ (Tsimshian Tribal Council, TTC).

Tony Pitcher Presentation

Abstract
An introduction to the Back to the Future (BTF) technique describes the process of creating models to represent past and present ecosystems. These models are evaluated as possible restoration objectives. Our goal is not to set policy, but to establish a meter with which to value the ecosystem produced by a given restoration policy. This will allow us to weigh the costs and benefits of exploitation versus conservation.

Comments

DJ: the term "exploitation" puts fishers at odds with DFO. TP concedes that we should say "catch" instead. Quotes from Aldo Leopold, The Land Ethic.

GB: what sources of information suggest that the halibut fishery is not being managed well? The strategy is conservative, and based on good science. Halibut and crab stocks are larger now than during the 1950s, and the ecosystem is not collapsing. Also, no industry is represented here at this workshop; problems will not be solved without the input of all stakeholders.

TP: Halibut stocks have increased since the 1950s. However, they were even more abundant in the ancient past and were also larger than they are today.

FH: Has anyone tried to determine why halibut came back after the big trawlers were removed? They are very sensitive fish and may have been avoiding the noise created by these larger boats.

NH: Bring along anyone that you think would be interested (to tomorrows meeting).

FH: Many older people are reluctant to come in this weather.

LUNCH

Nigel Haggan Presentation

Abstract
Through the BTF approach we hope to combat Ludwig's (bio-economic) ratchet and Pauly's (cognitive) ratchet. The former describes a positive feedback loop where overcapitalization leads to resource scarcity that in turn reinforces the need to improve gear. The latter implies that the acceptable standard of what constitutes a healthy ecosystem is lowered after each generation of fisheries scientists (and others). The efforts in fisheries ethics of the "Just Fish" project is mentioned, and the work of the International Halibut Commission.

Comments

GB: The Halibut Commission is under-funded. He defends the Commission's work.

FH: Halibut fishermen recorded what bait they used and how much in his day.

GB: They still do. The Halibut Commission records a lot of information.

Rashid Sumaila Presentation

Abstract
Cost-benefit analyses can tell us how much a restored system would be worth. Using the new *intergenerational discounting* analysis will allow us to value the restoration policy in a way that considers the needs of future generations.

Comments

RJ: Why does the catch increase after 25 years?

RS: It is not catch, it's net present benefit, which includes economic values.

GB: The price of fish products is rising. Fishers are confused by the downward trend because prices are rising so they don't acknowledge that the availability is decreasing.

RS: My paper on the east coast deals with that issue.

TP: GB is correct - and this coast is not the worst example in the world of this. Prices of fish previously considered trash are increasing. So we if we conserve resources, In Canada we can have a small valuable fishery, unlike the rest of the world which, sooner or later, will look more like Hong Kong, having only tiny fish, jellyfish and plankton.

DJ: We need to think of several generations down the road to ensure cultural identity (eg. Tsimshian). More than money must be returned to future generations. When people drill for oil the vitality of the ecosystem is sacrificed.

FH: That is not true. FH gives an example of a town with an oilrig and suggests that excellent fishing occurs around the rig. Further, no oil has come ashore.

RS: When considering oil ventures, there is more competition for the marine environment.

CS: Officials claimed that "there is no problem" with the Exxon Valdez too.

NH: We should consider oil/gas and ecotourism in the long-term generational benefit analysis as well. You could set aside oil and gas revenue to make sure that it is as safe as possible, and rebuild the fishery. That's one of the values of the modelling, because we can consider that sort of thing.

CS: What if the oil rig sits on a fault, and no (seismology) work has been done.

FH: Earthquakes in S. America are bigger than here, and yet oil never spilled. This shows us that it can be done right.

TP: Brunei has many oil rigs in the sea. No one fishes near to the rigs because they're protected by the army. A healthy fish population surrounds them and hence Brunei supports a small but valuable fishery. A California study found that rockfish were colonizing abandoned oilrigs. Suggests you could design oilrigs like artificial reefs and enhance fishery opportunities.

NH: There is a generation of kids in Newfoundland that have never seen a cod. The illegal catch is enough to stop them from ever coming back.

Coffee break

TP: Results of the BTF models. Which future do you want? We'll break into working groups tomorrow. TP showed the change in biomass over time slide (handout).

Poster Presentation

This section is a discussion of one of the FC team's posters. It compares the ecosystem states of 1750 and 2000. Major functional groups from the model are represented in boxes, arranged vertically by trophic level with predators on top. The relative size of each box represents biomass on a logarithmic scale. The poster indicates that 1750 abundances were larger for all groups than the present day.

Comments

TP explains the origin of the biomass data and gives a brief explanation on balancing the model.

EB: Is that Ecosim? A. No, that is Ecopath.

DJ: Why are there sea otters? A. The model is not just of Hecate Strait but of northern BC.

TP: I suspect that the seabirds shouldn't be grouped together. They don't change very much in the past. We need more information about seabirds.

DJ: What about fluctuations caused by disease?

TP: You could have asked what about the changes in climate? We have a partial answer for climate but we do not know about disease. For 1750 we have tree ring and ice cores to talk about climate change over 100 years. We can force the model to follow a climate trend.

DJ: I was talking about epidemics in people, not marine creatures.

TP: Oh Yes, the number of people in the ancient past does affect our estimate of catches.

SH: We need an estimate of how many people there were in order to calculate how catch has changed. This information can be included in the models.

TP: Tomorrow we'll talk about how you want to harvest the lost valley.

PT: Explains what the team's choice of a fishery is. We will ask participants what fisheries they want to include.

SH: With regards to the results of our models, we may salvage the future by restoring the past. This encapsulates the BTF process. Workshop participants will have to decide how to fish the (restored) lost valley.

GB: What's driving the sockeye and pink to go up in that model? They spend most of their time in the open ocean. It's hard to see why the models would restrict herring fishing. You have to truth this stuff out. Where you get natural mortality from?

Answer: *Fishbase*. GB reminds us that natural mortality is difficult to determine. Has this been run through peer review? Answer: Ecopath has many times but not the Hecate material.

TP: there is a fundamental difference between whole-ecosystem and single species science. Take halibut for instance. You don't have to tell Ecopath what their natural mortality is because the model is driven by who eats whom. All we have to do is tell Ecopath what is the baseline mortality of the unfished population.

GB: Is there no predation on adult halibut in the models?

A. Only on juveniles at this stage.

SH: The natural mortality of halibut in past models is much lower because there is no fishing

FH: Have you factored in the loss to the fishing industry by allowing over-escapement in pink and sockeye?

NH: I doubt it; the models aren't strong on salmon.

FH. 1.5 million sockeye were wasted in the Skeena River last year, which didn't spawn and didn't get caught.

TP: This is a migration problem – can we model this?

SH: Migration is probably not as high as it should be in the models.

Anon1: Are you talking about actual fisheries or ideal fisheries? Can you incorporate a hypothetical fishery? For example, make up one that solves political problems?

SH: Yes, if you tell us what a hypothetical fishery should be we could put it into the model. However, we cannot yet arrange fisheries by license type.

NH: It is possible to simulate a quota fishery. You could also maximize the value of a quota fishery. Mandated rebuilding is possible.

Anon2: That's pretty much what's happening now. The whole fishery is geared to protecting halibut. Salmon fences are a bad idea - take them out and you would have a better situation.

FH: Fishermen know what the catch and escapement is going to be when they are still in the salt water. They do not need DFO's information at the end of the year. They know and talk amongst themselves and they are always right.

NH: We believe you, but what we're doing is asking 'what if?'.

Anon2: You have to modify the quota not to take the small ones. They aren't marketable.

GB: It's only the natives that take the small fish.

DJ: Disagrees with the previous remark.

RS wants to discuss the criteria fleet. Pre-contact (PC) versus 1900.

RJ: Are you saying there's more eulachon than herring in the PC?

SH: No, the value of eulachon is higher.

Ebu: explains how we determined the value of eulachon (i.e. through the value of euchalon 'grease'). [Note: euchalon are high in oil content. The oil is unique among fish oils in that it is a solid at room temperature with the consistency of soft butter and a golden hue. Apart from being used as a source of food, eulachon is culturally used by the First Nations as a source of 'grease'. Eulachon grease is extracted from eulachon lipids, and continues to be an important part of First Nations diet.]

DJ: Value varies - eulachon is only valuable to natives.

SH: Please tell us how much it would be worth to you per kilogram.

GB: Establish the value for eulachon by trade value.

NH: The value was $200 per gallon 4 years ago.

DJ: You can't assign a dollar value to eulachon since their primary value is cultural.

NH: We are trying to get a collective sense of the value of these things.

DJ: Natives are reluctant to share information because they are afraid it will bite them.

NH: Ecosystem restoration can't be done piece meal, we need cooperation from every sector.

MP distributes paired comparison booklets. In this exercise we ask participants which combination of fishery attributes you prefer.

Adjournment

DAY 2

Present: 28 community members and FC team.

Cameron Ainsworth Presentation

Abstract
The FC team calculated an abundance trend for most functional groups in the models based on the July interviews. That information is compared to stock assessment data, then it is compared to the output of our models. Several functional groups are found to be in conflict with fishers' perceptions. These will be dealt with in subsequent revisions of the models.

Eny Buchary Presentation

Abstract
The day's activities are outlined. Participants are arranged into groups where they will choose one of the four past ecosystem states to represent the restored system (i.e. the *Lost Valley*). They will choose what gear types will harvest the *Lost Valley*, and tonight the FC team will conduct the requested simulations. Tomorrow, the results will be presented so that participants can see which scenario offers the most benefit and how each sector is affected by their policy choice.

Comments

CS: How can you encompass disease and random cataclysmic events in the models?

NH: The models are predictive and we can accommodate those events.

Anon: Why focus on the past; why not figure how to fish the current system?

NH: The BTF process can determine what we have lost. We see that the restored Hong Kong ecosystem is demolished in only 1.5 years at current fishing rates.

Anon: Explain what the point of your project is.

NH provides a re-cap of yesterdays BTF introduction. The principal question is: what was the former system really like and what have we lost?

Anon4: It's not the gillnetters that have increased in fishing power

Anon5: And it's not right to eliminate the trawlers.

Anon6: It is important to consider areas beyond the Hecate Strait. Salmon and other species are intercepted before they reach that area.

Several people voice their concern about the "team's choice" fishery

RS: "Team's choice" is only an example, we want to know what sectors you would have included in the hypothetical fleet.

Anon: You should have advertised this meeting better.

Anon: Computer models have been done and they aren't reliable. Have you done any Alaska examples? A: No. What happens in Alaska has a large effect on the Hecate Strait.

NH: We're trying to mesh all the scientific data together: DFO, fishers knowledge and surveys.

Anon: How far back do you have reliable data?

TP: The point of the project is to try to recreate the ecosystem right back to 1750. Official catch and survey data is sparse prior to 1950, so archeological and traditional information can be used, plus the power of model to show how much food must have been present for everything – called the concept of " mass balance".

Anon: There's no "streetwalker" information that's reliable before 1990, do you work on carrying capacity.

EBL: didn't want to do the paired comparison because she didn't want to eliminate gillnetters and trawlers.

JB: There has to be a strong enhancement in all species, not just the salmon. He wants the government to fund hatcheries.

NH: Funds are limiting

Anon: Overescapement is a problem. We need to first protect within our boundaries. DFO said this will be a bad year, it's because the streams are suffocating.

RJ: This modelling approach can be a benefit to fishermen. The UBC team is trying to estimate how many fish there were at various times in the past. Many species have gone down hill, because of our fisheries. They wants to confirm that the models are accurate, and to what extent we should believe in them. They aren't asking how to get back to the 1750s, that's not for this meeting. Rather, they are asking what would the fisheries of the future look like.

Rest of day: working groups and then discussion followed by work by the UBC modelling team to implement group choices.

DAY 3

Present: 22 community members and FC team

NH welcomes all.

Tony Pitcher Presentation

Abstract

"There is no free lunch"; economic/ecological trade offs become apparent in harvesting the *Lost Valley*. The results of last night's simulations are presented; they were conducted according to the participants' choice of restored ecosystem period and fleet. Fortuitously, each of the four groups selected a different time period: 1750, 1900, 1950 and 2000 were all represented in the simulations.

Presentation of group results
(*see above pages 19 to 33*)

Group 1: Rather than an optimal policy search as with the other groups, a straight simulation was conducted to compare the present-day ecosystem after 20 years of harvest: first using the existing (real-world) fleet, and then using a truncated fleet (recreational sector halved). The comments suggested that we underestimated the recreational catch. They point out that no proper records are kept for the recreational sector, whereas commercial fishers must record everything.

Group 2: The 1750 model was chosen by the group to represent the restored state.

Group 3: The 1900 model was chosen to represent the restored state. The FC team reduced market price by 50% for draggers and the recreational sector as per the group's request to reduce the impact of those sectors. RS explains that this is a modelling shortcut to reduce effort on those gears.

Group 4: The 1950 model was chosen by the group to represent the restored state.

RS: Based on discussion, RS notes that some workshop participants feel that the goals set by the optimum policy search are unrealistic. Participants feel that policy makers will not listen to UBC researchers.

TP: The FC team agrees. At this stage the work is very preliminary. However, getting community involvement is the main point.

Anon: Another concern is that we have not considered the human population or pollution. The commercial sector represented at this

meeting maintains that the recreational sector serves no benefit to local communities. This is a social concern.

TP: We're working on this social concern. The dollar value that we have assigned to animals should be changed in some cases. This method may be used to address the concern that Aboriginals depend on the resource in more ways than financially. That is, Aboriginal people assign special (e.g. cultural) value to the vitality of the resource. The ecological weighting may be applied in the Ecosim policy search routine to address this. By assigning an ecological objective to the routine, the software can be made to suggest scenarios that favour the continuation of the resource.

Anon. pollution effects are not considered in the model.

RF: An FC member is currently attempting to include pollution into a model.

FH: We are neglecting that 50 years ago they had meetings with DFO and they listened to them, but now does not happen. Now (the DFO) are fish cops, but they used to have good rapport with industry.

Anon. agrees.

NH: Yes, cooperation with DFO is critical. They didn't come to this meeting.

FH: doesn't think that DFO has scientists anymore, just cops.

Coffee break

Anon: Soon the recreational sector will have to keep decent records because they want an official allocation. They want 30% of the fish.

MP presents paired comparison results. 1950 was most often chosen with the existing fleet. People didn't want to exclude anyone.

Anon. asks what was the point of this work?

MP: The paired choices analysis should be able to rank the priorities of the community participants. The work is a part of my thesis, however the sample we had here wasn't big enough, and the choices in my survey sheets proved to be too complex, so it's not reliable. A mail-out survey may be useful.

Anon. What would a new survey deal with? A. The four scenarios suggested by yesterday's groups.

Cameron Ainsworth Presentation

Abstract
Ecosim results are presented. A 20-year harvest is conducted on the 2000 model first with the unabridged real-world fleet, then with a reduced recreational fleet.

Comments

Anon: quotas prevent the assumed 2% annual increase in effort.

Anon. suggests filing an official recommendation to disband DFO.

Anon: Any efforts will be hampered by politics.

NH mentions next February's BTF workshop at UBC. All are invited; unfortunately we do not have enough funding to pay travel costs.

GH: wants a regular report to the people who were here. A. We will try to come back for a short visit if funding allows.

RH: We will put you all on the mailing list for the regular FC reports.

TP: All this is meant to be open science. Everything will be downloadable from our web site.

GH: At least we've come a long way from the first meetings 5 years ago

Anon: You should have more Aboriginal input.

TP: Agreed. We do have Aboriginal partners at UBC and with the BC Aboriginal Fish Commission. and the first Aboriginal graduate student recently graduated from the FC.

Anon: The scenarios we discussed were not good. We didn't know all the dynamics of the models. The choices that have to be made in modelling are not represented well enough by our work this trip. This effort needs more people anyway.

NH: This workshop was only an exploration, it is not meant to be representative. Another trip might produce a more concrete policy goal.

Anon: Was the purpose of this to relate the value of the fishery or just to protect the stock?

NH: The purpose was to conduct an audit of where we are, where we have been, and ask how we would conduct a sustainable fishery on those past systems. Future work should look at environmental changes too.

Lunch
HC: We should be working on recreational fisheries to get a better record of how many they catch.

BH: The sport fishermen should have to keep log books.

TP: As result of this workshop, we do aim to look at the sport catch figures more carefully.

TP: Closing comments. Thank you for coming. This is open science. We want to keep an ongoing relationship; you're all invited to our February 2003 workshop at UBC. Call for more interviewees to volunteer to improve the database. The FC Team is here in Prince Rupert tomorrow).

DJ. Closing comments. This is the beginning of the dialogue. We got a good start; we need involvement and better models. This forum is important to create solutions and be more open about our relationships. Aboriginal people are unique in that these are our territories. We need to find ways to live together and protect the environment. These forums are a good idea.

CS: Thank you. Treaties and land resolution require cooperation.

CS: provides the following suggestions: provide notice way ahead of time, e.g. in the paper. Include outlying communities. Spawning beds should be looked at, they must be included in the model. This meeting was good because there were no political hands holding the university. Thank you to everyone involved.

Adjournment

FINAL DISCUSSION ON THE MODELS OF NORTHERN BC

Eny Buchary, Sheila Heymans and Cameron Ainsworth
UBC Fisheries Centre

The workshop in general had both positive and negative results. On the positive side, the models were improved, and our understanding of the ecosystem and fishing interactions were vastly improved. Also, the team had the opportunity to interact with the "people on the ground" who have first-hand experience with the fisheries, which probably helped in our interpretation of the results. The workshop also saw continuing attempts to develop mutual trust and understanding between the fishing community in the study area and Fisheries Centre's researchers.

Unfortunately, there were also some problems identified. Participants pointed put that several user groups were under-represented or absent at the workshop: notably the recreational fishers, seiners, fish farmers and DFO. Most participants were commercial fishers, and no members of the sports charter or lodge industry were present. It should be noted that there was dissatisfaction among participants towards the recreational fishery sector. Participants indicated that our models underestimate the impacts that the recreational fishery has on the marine ecosystem of the study area. There was a general consensus that sports fishermen had an unreasonable amount of discards, took an unacceptable portion of the catch, and were not accountable in any way for the number of fish they catch. Conflict with the recreational sector was the biggest concern in many of their minds, except perhaps resentment towards DFO.

On the issue of revising recreational fishery data in the models, the team was advised to contact Washington State (USA) to get information and data on recreational fisheries by American sport boats. Participants believe, that unlike the DFO, Washington State Recreational Fishery Authority has good data on their sport fishery. Another possibility is to contact airline companies that regularly dispatch fish that are caught in BC waters by the sport fishers. These airline companies are believed to have good records of fish weight.

During the course of the workshop, some misunderstandings due to inappropriate choice of words (see "The Thoughtful Use of Words, this volume) complicated the collaboration process.

This included our use of 'trawlers' to represent 'draggers' in the models, where the pronunciation of 'trollers' and 'trawlers' is very similar. In the future it would be better to use 'draggers' and 'trollers' to avoid confusion, and keep our use of 'trawlers' to a minimum.

The use of the phrase "team's choice" to represent a hypothetical simulation without gillnets and draggers in our models was also an example of careless use of words on the part of the Fisheries Centre team. Nevertheless, this unfortunate incident was a 'blessing in disguise' for the Fisheries Centre team. On Day Two of the workshop, we saw a greatly increased attendance, largely by gillnetters and draggers who believed that their fishery was under attack. At the end, after careful explanation from the Fisheries Centre team, this misunderstanding was resolved.

The workshop participants are also concerned about the use of 2% as the assumed annually compounded increase of fishing effort in our Ecosim simulations. Their concern is based on the premise that DFO over-regulate commercial fishers in northern BC. As a consequence, commercial fishers are catching less and less. Therefore, an assumed annually compounded fishing effort increase of 2% is considered to be too high.

Other suggestions that were put forward by the participants are: (1) to have the models treat herring as discrete stocks, (2) inclusion of spawning ground effects in the models, (3) to include the effects of logging in the models, and (4) explicit acknowledgement of land treaty issue in BC as a political reality of BTF in northern British Columbia.

On the issue of the Coasts Under Stress (CUS) Project and its progress, participants suggested that the Fisheries Centre team provide periodic reports to the community. [*The first stage of this will be to distribute copies of this report to workshop participants– Eds*]

CRITIQUE OF THE WORKSHOP

It was ambitious to expose brand new methods and complex modelling science to a fishing community: much of the methodology used in the modelling was still being developed at the time. A follow-up workshop in Prince Rupert would be helpful to present the latest BTF results, even if it had to retrace some ground already covered for new participants

Successes

- Successful presentation of the rationale for BTF to a non-scientific audience.
- Presentation of ecosystem models that incorporated information provided by Prince Rupert fishers and public.
- Incorporation of scenarios and goals chosen by the local community for ecosystem simulations
- Overall, the workshop served to generate some trust between the FC team and Prince Rupert fishers.

Failures

- The workshop was not fully representative of all fishery gear types and all sectors.
- Many participants were not present on the first day when the basis of the BTF method was explained in detail.
- The team did not have enough time to accurately explore all of the options requested by the community.

ANNEX 1

PARTICIPANTS IN THE PRINCE RUPERT COMMUNITY WORKSHOP

Ainsworth	Cameron	UBC Fisheries Centre				
Boulter	Erika	WWF-Canada Pac Region Office	305 3rd Ave W	Prince Rupert	BC	V8J 1L3
Bryant	James			Laxkw'alaams	BC	
Buchary	Eny	UBC Fisheries Centre				
Butler	Caroline	UBC Dept of Anthropology	PO Box 754	Prince Rupert	BC	V8J 3S1
Christison	Jim	Salmon, Herring, Trawl	110 Alpine Dr	Prince Rupert	BC	V8J 4C6
Clifton	Heber	Halibut, Salmon gillnetter	1468 Atlin Ave	Prince Rupert	BC	V8J 1E5
Dennis	Stan	Councillor Lax 'Kw'alaams		Laxkw'alaams	BC	
Dickens	Justin	Herring Halibut, Salmon, Dral	PO Box 754	Prince Rupert	BC	V8J 3S1
Forrest	Robyn	UBC Fisheries Centre				
Gardiner	Ray		1451 The Plaza	Prince Rupert	BC	V8J 3A9
Haggan	Nigel	UBC Fisheries Centre				
Hawkshaw	Fred	Gillnet (tanglenet), Rockfish	421 6th Ave	Prince Rupert	BC	V8J 1W6
Hayes	George	NW Maritime Institute	1517 Overlook St	Prince Rupert	BC	V8J 2C7
Heymans	Sheila	UBC Fisheries Centre				
Hill	Robert H.	Herring and Seine	131 Gull Cres	Prince Rupert	BC	V8J 4G4
Husoy	Foster	Retired –all gear types	548 Cassiar	Prince Rupert	BC	V8J 3Z5
Jeffrey	Debbie	President, Tsimshian Tribal Council	138 1st Ave W	Prince Rupert	BC	V8J 1A8
Johnson	Robert L	Gillnetter (salmon and herring)	344-6th Ave E	Prince Rupert	BC	V8J 1W4
Jones	Russ	Haida Fisheries	Box 98	Skidegate	BC	V0T 1S0
Kristmanson	Richard	Gillnet	924 6th Ave W	Prince Rupert	BC	V8J 1X6
Kristmanson	Ken	Gillnet	121 McCaffery Pl	Prince Rupert	BC	V8J 3T8
Mavin	Doug	Halibut, Prawn, Salmon, Cod	935 Ambrose Ave	Prince Rupert	BC	V8J 2C5
Ostrom	Norman	Troll	521 Herman St	Prince Rupert	BC	V8J 3A6
Parkin	Charlie	NW Maritime Institute	508 4th Ave	Prince Rupert	BC	V8J 1N9
Patterson	Michele	WWF-Canada Pac Region Office	305 3rd Avenue W.	Prince Rupert	BC	V8J 1L3
Paulson	Paul	Gillnetter (Salmon)	1558 10th Ave E	Prince Rupert	BC	V8J 2V3
Pitcher	Tony	UBC Fisheries Centre				
Power	Melanie	UBC Fisheries Centre				
Proctor	Bart		687 Evergreen	Port Edward	BC	
Ritchie	Alf		146 7the Ave E	Prince Rupert	BC	V8J 2H4
Roberts	Don Jr	Salmon gillnet	Box 282	Terrace	BC	V8G 4A6
Rolston	Dave	Research, Limited commercial	General Delivery	Oona River	BC	V0V 1E0
Ryan	Laurie			Laxkw'alaams	BC	
Sample	Quinton	Halibut, Cod, Prawns, Salmon	1412 Overlook St	Prince Rupert	BC	V8J 2C8
Sample	Esther	Halibut, Cod, Prawns, Salmon, Longline, Trap, Gillnet	1412 Overlook St	Prince Rupert	BC	V8J 2C8
Stace-Smith	Art	Dragger	164 Van Arsdol St	Prince Rupert	BC	V8J 1E3
Stace-Smith	Carl	Trawl	168 Van Arsdol St	Prince Rupert	BC	V8J 1E3
Stanford	Richard	UBC Fisheries Centre				
Stephens	Cyril	Councillor	618 Smithers St	Prince Rupert	BC	V8J 3N7
Thompson	Judy	Educator	1243 2nd Ave W	Prince Rupert	BC	V8J 1J3
Thompson	Wally	Gillnetter, past shoreworker	508 8th Ave	Prince Rupert	BC	V8J 2M9
Trujillo	Pablo	UBC Fisheries Centre				
Warren	Robert L	Gillnetter	2121 Graham Ave	Prince Rupert	BC	V8J 1C9

ANNEX 2

RESTORING THE PAST TO SALVAGE THE FUTURE
PRINCE RUPERT COMMUNITY WORKSHOP DECEMBER 4-6, 2001

Detailed Agenda Sheet for UBC Team

Tuesday, December 4 - Why we are here, what you told us, and what we learned

9:00-9:30 NIGEL HAGGAN Welcome and introductions

9:30-10:10 **What is Back to the Future?**
TONY PITCHER INTRO – BUILD UP PRYAMIDS, END ON LOST VALLEYS SLIDES
NIGEL HAGGAN INTRO – COMMUNITY KNOWLEGDE USED AND CONSENT REQUIRED
RASHID SUMAILA INTRO – HOW TO PUT VALUE ON THE FUTURE

10:10-10:30 Discussion
TEAM PRIMED TO EXPLAIN HOW THINGS WERE DONE

10:30-11:00 Coffee Break

11:00-12:15 **What the past was like, and what would it be worth today?**
TONY PITCHER - ECOSYSTEM MODELS OF PAST AND PRESENT (POSTER)
PABLO TRUJILLO - FISHERIES USED TO OPEN THE LOST VALLEY (POSTER)
SHEILA HEYMANS - CATCHES FROM RESTORED PAST: HOW WE GOT THEM (POSTER)
RASHID SUMAILA - WHAT THE RESTORED PAST WOULD BE WORTH (POSTER)

12:15-1:30 Lunch (provided)

1:30-2:30 **What we learned from what you told us**
CAMERON AINSWORTH - THE INTERVIEWS (POSTER)
- WHO TALKED ABOUT WHAT
- WHAT YOUR RESULTS TELL US
- HOW YOUR RESULS MATCH SCIENTIFIC INFO
- INVITATIONS TO MORE INTERVIEWS (WED PM, THUS PM, FRI)

Discussion

2:30-3:30 **Which future do you want?**
MELANIE POWER – EXPLAIN CHOICE TASK & HAND OUT CHOICE SHEETS
CHOICE SHEETS RETURNED TO MELANIE

3:30-3:45 **Set-up working groups**
ENY BUCHARY – EXPLAIN FISHERY SELECTION TASK (OPEN ENDED, NO CONSTRAINTS)
AVOID "HOW DO WE GET THERE"; EMPHASIS ON POLICY GOAL
SET UP WORKING GROUPS; ALLOCATE TEAM MEMBERS TO WORKING GROUPS

4:00 Coffee
4.15 Discussion
NIGEL HAGGAN – WHAT WE DID TODAY
TONY PITCHER – WHAT WE ARE DOING TOMORROW

Wednesday, December 5 - What do you think?

9:00-9:45 **Panel Discussion: Perspectives on the marine ecosystem**
NIGEL HAGGAN – FACILITATES
TEAM MEMBERS – PRIMED TO EXPLAIN WHAT WE CAN DO AND WHAT WE CANT

9:45-10:45 *Working Groups · Which fisheries would you prefer**?***
TEAM MEMBERS TO TAKES NOTES ON THE WORKING GROUP DISCUSSIONS

10:45-11:15 Coffee Break
11:15-12:00 *Working Groups Continue*
12:00-1:30 Lunch (provided)

1:30-2:00 **Which fisheries would you prefer?**
Plenary: Working groups report on fisheries preferences and harvest options. TONY PITCHER - FACILITATED DISCUSSION TO PRIORITISE THE POLICY OPTIONS AND ECOSYSTEMS TO CONSIDER.
Eny Buchary – Record desired scenarios from each Working Group on Flip Chart

2:00-3:00 *Computer simulations*
Participants welcome to stay or to take the rest of the day off.
UBC Team conduct computer simulations.
MODELLERS: ENY BUCHARY, CAMERON AINSWORTH; SHEILA HEYMANS; TONY PITCHER; RICHARD STANFORD; RASHID SUMAILA
3:00-3:30 Coffee
3:30-4:00 *Simulations continue/Additional Interviews* ROBYN FORREST

Thursday, December 6 - Results

9:30-10:30 **Results of community choices; What is the value of restoration?**
TEAM: MODELLERS PRESENT CATCH RESULTS FROM THEIR SCENARIOS
RASHID SUMAILA – ECONOMIC VALUES

10:30-11:00 Coffee

11:00-12:00 **The future you want - Results**
MELANIE POWER – RESULT OF COMMUNITY CHOICE ANALYSIS

12:00-1:30 Lunch (provided)
1:30-2:00 **Final discussion/What next?**

ANNEX 3

WORKSHOP INVITATION BROCHURE

Back to the Future

in the Hecate Strait

"Restoring the Past
to Salvage the Future"

Workshop:
Tuesday, December 4 - Thursday, December 6

Metlakatla Room, Highliner Inn
Prince Rupert, British Columbia

What is Back to the Future?

Back to the Future marine ecosystem restoration projects bring resource users, researchers, First Nations, government, and other interests together to create computer simulation models of present and past ecosystem states. Comparison of the ecological, social, and economic value of past states enable collaborators to set restoration goals and work to achieve them.

When is the workshop?

The workshop is spread over three days, Tuesday, December 4 through Thursday, December 6.

The schedule for each day is given in this brochure.

Where will the workshop be held?

The workshop will be held in the Metlakatla Room of the Highliner Inn in Prince Rupert.

Who are we?

The Fisheries Centre is an interdisciplinary research centre of the Faculty of Graduate Studies at the University of British Columbia.

The Back to the Future project in Hecate Strait is a component of Coasts Under Stress (www.coastsunderstress.ca), a large national project designed to assess the impact of changes in society and resource harvest patterns on individual, community and environmental health. The major objective of CUS is to work with First Nations, government, community and industry partners to explore local, regional and national policies and options to ensure the long term survival of vibrant and healthy coastal communities.

World Wildlife Fund (WWF) is dedicated to protecting the world's wildlife and wetlands including the marine environment.

Workshop Sponsorship Provided by:

UBC FISHERIES CENTRE

Coasts under Stress

WWF

ANNEX 4 OPENING THE LOST VALLEY GRAPHIC

ANNEX 5

PUBLISHED REPORTS AND PAPERS ON BACK TO THE FUTURE

Ainsworth, C., Heymans, J.J., Pitcher, T.J. and Vasconcellos, M. (2002) Ecosystem Models of Northern British Columbia For The Time Periods 2000, 1950, 1900 and 1750. Fisheries Centre Research Reports 10(4), 41pp.

Beattie, A., Wallace, S. and Haggan, N. (1999) Report of the Back to the Future Workshop on Reconstruction of the Hecate Strait Ecosystem. Pages 1-10 in Haggan, N and A. Beattie (1999) (eds) Back to the Future: Reconstructing the Hecate Strait Ecosystem. Fisheries Centre Research Reports Vol. 7, No. 3, 65pp.

Buchary, E.A., Cheung, W-L, Sumaila, U.R. and Pitcher, T.J. (2002) Back to the Future: A Paradigm Shift to Restore Hong Kong's Marine Ecosystem. 3rd World Fisheries Congress, Beijing, November 2000. (in press).

Dalsgaard, J., Wallace, S.S., Salas, S. and Preikshot, D. (1998) Mass–Balance Model Reconstructions of the Strait of Georgia: the Present, One Hundred, and Five Hundred Years Ago. Pages 72-91 in Pauly, D., Pitcher, T.J. and Preikshot, D. (Eds) Back to the Future: Reconstructing the Strait of Georgia Ecosystem. Fisheries Centre Research Reports 6(5): 99pp.

Haggan, N. (1996) Integration of Traditional Environmental Knowledge. Page 88 in Pauly D. and V. Christensen (eds.) Mass-Balance Models of North-eastern Pacific Ecosystems. Fisheries Centre Research Reports 4(1): 131pp.

Haggan, N. (1998) Reinventing the Tree: reflections on the organic growth and creative pruning of fisheries management structures. Pages 19-30 in T.J. Pitcher, P.J.B. Hart and D. Pauly (eds) Reinventing Fisheries Management. Kluwer, Holland. 435pp.

Haggan, N. (1998) Back to the Future with Ecopath and Ecosim. Page 26 in Use of Ecopath with Ecosim to Evaluate Strategies for Sustainable Exploitation of Multi-Species Resources. Fisheries Centre Research Reports 6(2): 49pp.

Haggan, N. (2000) Back to the Future and Creative Justice: Recalling and Restoring Forgotten Abundance in Canada's Marine Ecosystems. Pages 83-99 in Coward, H., Ommer R. and Pitcher, T. (eds). Just Fish: Ethics in the Canadian Coastal Fisheries. ISER Books, St. Johns, Newfoundland, 304pp.

Haggan, N., Archibald, J. and Salas, S. (1998) Knowledge gains power when it is shared. Pages 8-13 in Pauly, D., Pitcher, T.J. and Preikshot, D. (eds) Back to the Future: Reconstructing the Strait of Georgia Ecosystem. Fisheries Centre Research Reports 6(5): 99pp

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