

# HOW WE CARRIED OUT THE BACK-TO-THE-FUTURE COMMUNITY INTERVIEWS

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## ABSTRACT

The Back to the Future team interviewed forty-eight community members from Prince Rupert and Haida Gwaii, British Columbia in 2001 and 2002. Commercial, aboriginal and recreational fishers contributed, also processors and others who are familiar with the marine habitat of northern British Columbia. The local ecological knowledge was recorded in a Microsoft Access database, including interviewee demographic information, fishing experience and extensive biological information on 129 marine species (mammals, birds, fish and invertebrates). The relative change in abundance perceived by the fishers is of special importance in 'Back to the Future' methodology. Respondents also answered a *Rapfish* questionnaire, in which they judged the relative sustainability of their primary fishery in ecological, economic, social, technological and ethical fields.

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## INTRODUCTION

The Back-to-the-Future (BTF) team from the UBC Fisheries Centre interviewed forty-eight community members from the Prince Rupert region and Haida Gwaii, BC. Thirty-four interviews were conducted at the Crest Hotel in Prince Rupert during July 2001; nine were at the Highliner Inn in December 2001; and a research associate conducted five more interviews on Haida Gwaii in early 2002 (see Ainsworth 2002).

Interviewees represent a broad cross-section of commercial, recreational and aboriginal fishers as well as processors and others who are familiar with the marine ecosystem of Hecate Strait, Dixon Entrance and Queen Charlotte Sound (DFO areas 1-10). As the local ecological knowledge (LEK) gained from these meetings was to be used in improving detailed computer models of the region, we did not select participants randomly. Instead, we sought the community members most knowledgeable about the system, relying initially on personal

recommendations from partners and colleagues in the region, and then on referrals from other interviewees.

Participants were told about the nature of the Back to the Future project and a meeting time was arranged by telephone. We described how we were gathering LEK to be used in constructing, verifying and fine-tuning computer ecosystem models. In the case of our first Prince Rupert trip, we indicated how the models would be used to manufacture gaming scenarios, representing an optimal profile of exploitation that will maximize benefit according to various experimental policy objectives. The improved models and example scenarios were presented to community members during our December trip. At that workshop, *Lost Valley* policy exploration took centre stage, (Pitcher 2004), but some additional interviews were conducted. The contents and outcomes of the December workshop are summarized in Pitcher *et al.* (2002) and achievements discussed in Power *et al.* (2004).

Two or more researchers conducted each interview. Participants were told that they could decline to answer any question, or discontinue the interview at any time. With their permission, we made an audio recording. Respondents were assured that their information would be processed to preserve anonymity. They signed a permission slip allowing us to use the information in our described capacity, in accordance with UBC Ethical Committee requirements. Finally, they signified whether they wished to be credited with their contribution or remain anonymous. Interviewees are acknowledged in Ainsworth (2004b).

## METHODS

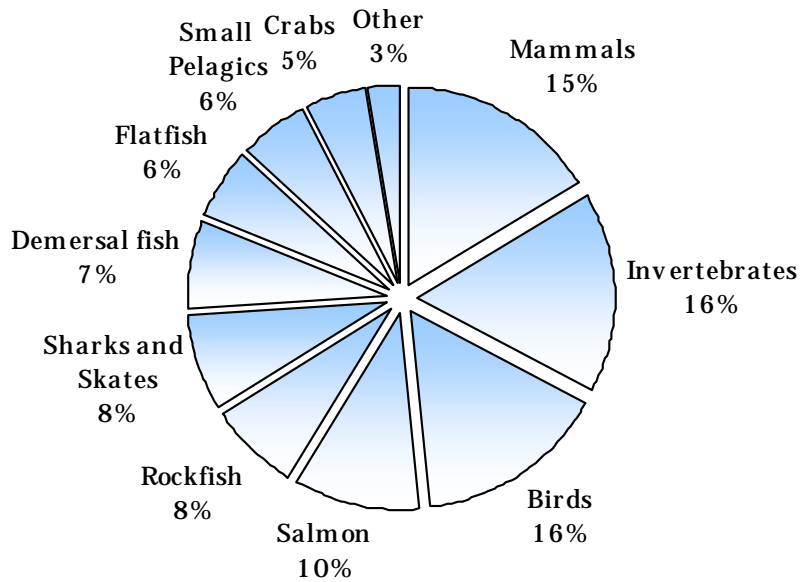
### Section 1: Back to the Future

Appendix A shows part one of the interview form, where demographic information was recorded, such as age, occupation, number of generations in the area, etc. Fishing experience was documented, including where and when they had fished in each sector, what type of gear was used, whether they owned their boat and where they learned to fish.

We showed the interviewees flashcards with images of 129 mammals, birds, fish and invertebrates (listed in Appendix B). Flashcards can be viewed on our website at [www.fisheries.ubc.ca/projects/btf/](http://www.fisheries.ubc.ca/projects/btf/). On the back of each flashcard was a physical description of the animal and other identifying information (e.g.,

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Ainsworth, C. (2004) How we carried out 'Back-to-the-Future' Community Interviews. Pages 117–125 in Pitcher, T.J. (ed.) *Back to the Future: Advances in Methodology for Modelling and Evaluating Past Ecosystems as Future Policy Goals*. Fisheries Centre Research Reports 12(1): 158 pp.



**Figure 1.** LEK comments from the Prince Rupert community interviews, breakdown by taxonomic group.

range, habitat, habits). With a nautical chart on hand, we went through the species list, asking respondents the following questions about each creature.

1. Is the animal observed locally? Where is it observed on the map? During what season or month?
2. Has the abundance increased or decreased during their career, and by how much. (i.e. increased <1X, 1-3X, 3-10X, >10X, or decreased <50%, 10-50%, >10%).
3. What other common names is the animal known by?
4. What gear types are used to catch this animal?
5. Where did you learn this information?

Respondents were free to provide answers for as many of the listed species as they wished, and in as much detail as they wished.

## Section 2: *Rapfish*

The second part of the interview, asked of fishers only, consisted of the *Rapfish* questionnaire in Appendix C. We asked fishers to rank the sustainability of their primary fishery in 8-10 attributes in each of 5 fields: ecological, economic, social, technological and ethical. The *Rapfish* analysis, short for Rapid Appraisal of Fisheries, uses multi-dimensional scaling to ordinate the fisheries' scores into an overall measure of sustainability for each field. The relative sustainability of each fishery can then be compared and other differences identified.

Results from the *Rapfish* analysis and a more complete description of the technique appears in Ainsworth (2004a).

## RESULTS

### Section 1: Back to the Future

In total, 2145 comments were received; 57% concerned mammals, invertebrates, birds and salmon. Figure 1 shows the breakdown of comments.

The anecdotal comments from Section 1 (Back to the Future) were reduced to votes of 'increase', 'decrease' and 'stable' for use in the models. Ainsworth (2004b) describes

how the interview information was processed and incorporated into the ecosystem models (Ainsworth *et al.*, 2002).

Verbatim comments were entered into a Microsoft Access database, along with demographic and career information. Personally identifying information was not included; respondents were given only an interview number. The database is cross-referenced by the following fields: sector, gear type, target species, fishing years, locales and number of generations in the fishery. Erfan (2004) provides a more complete description of the database, which also includes historical records. One can search the database by species on our BUS-BTF website: <http://fisheries.ubc.ca/projects/btf/>

### Section 2: *Rapfish*

A *Rapfish* analysis, based on the July and December Prince Rupert interviews, was conducted by Ainsworth (2004). Power (2003) analyzed the ethical component of the *Rapfish* forms from Prince Rupert and Haida Gwaii respondents.

## CONCLUSIONS

Ainsworth (2004a, 2004b), Ainsworth *et al.* (2002) and Power (2003) have so far used only a fraction of the LEK information collected for this report. There remains detailed socioeconomic and biological data that can be applied to future BTF analyses, including unique and valuable

spatial information. Pending approval from the UBC Ethics Committee, the processed LEK records will be offered online to other researchers. Hopefully, also available through the BTF website will be online interview forms to allow invitees to contribute directly to a growing knowledge base.

As projects evolving at the Fisheries Centre call on LEK information to supplement scientific data, the infrastructure we have assembled in this report will become an important tool. Besides consolidating and preserving vital community knowledge, we may establish criteria by which we can assess the quality of our own data sources - challenging them with an independent authority and identifying where fishers' perceptions depart from accepted scientific data.

## REFERENCES

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**APPENDIX A – PERSONAL INFORMATION**

**Interview Schedule # 1**

Subject ID #  
 Chart #  
 Date:  
 Location:  
 Interviewers:

**Fishing Experience**

Check all that apply:

- Commercial fishery
- Recreational fishery
- First Nation (type?) \_\_\_\_\_
- Boat owner past or present?
- DFO
- Processor
- Conservationist
- Other (explain)

Year when started fishing:

Age range: (<30) (30-50) (50+)

Last Season Fished:

Number of years fished? (0-5) (5-10) (10-20) (20-30) (30-40) (40+)

Number of generations family has been in the fishery:

Always in this community/region?

Sectors fished?

**Offshore** (Hecate Strait, Dixon Entrance, Queen Charlotte Sound, West Coast Haida Gwaii more than 1 km from shore)

	Crew years	Skipper years	Primary Species
Trawl			
Trap			
Longline			
Troll			
Other			

**Inshore** (Coastal inlets)

	Crew years	Skipper years	Primary Species
Seine			
Gillnet			
Troll			
Trawl			
Hook and line (longline)			
Trap			
Dive			
Other			

Who taught you how to fish?

**APPENDIX B – SPECIES LIST****Mammals**

- 1 Sea otters  
*Enhydra lutra*
- 2 River otter  
*Lutra canadensis*
- 3 Dall's porpoise  
*Phocoenoides dalli*
- 4 Harbour porpoise  
*Phocoena phocoena*
- 5 Pacific white sided dolphin  
*Lagenorhynchus obliquidens*
- 6 Northern right whale dolphins  
*Lissodelphis borealis*
- 7 Killer whales  
*Orcinus orca*
- 8 Sperm whale  
*Physeter macrocephalus*
- 9 Northern fur seals  
*Callorhinus ursinus*
- 10 Northern elephant seals  
*Mirounga angustirostris*
- 11 Steller sea lions  
*Eumetopias jubatus*
- 12 Harbour seals  
*Phoca vitulina*
- 13 California sea lions  
*Zalophus californianus*

**Birds**

- 14 Gulls  
Family: *Laridae*
- 15 Cassin's auklet  
*Ptychoramphus aleuticus*
- 16 Rhinoceros auklet  
*Cerorhinca monocerata*
- 17 Tuffed puffin  
*Fratercula corniculata*
- 18 Common murrelet  
*Uria aalge*
- 19 Marbled murrelet  
*Brachyramphus marmoratus*
- 20 Pigeon guillemot  
*Cephus columba*
- 21 Merganser  
*Mergus serrator*
- 22 Pelagic cormorants  
*Phalacrocorax pelagicus*
- 23 Northern fulmar  
*Fulmarus glacialis*
- 24 Sooty shearwater  
*Puffinus griseus*
- 25 Double-crested cormorant  
*Phalacrocorax auritus*
- 26 Common loon  
*Gavia immer*
- 27 Grebes  
Family *Podicipedidae*
- 28 Lesser snow goose  
*Anser caerulescens*
- 29 Bald eagle  
*Haliaeetus leucocephalus*
- Salmonids**
- 30 Sockeye salmon  
*Oncorhynchus nerka*
- 31 Chum salmon  
*Oncorhynchus keta*
- 32 Pink salmon  
*Oncorhynchus gorbuscha*
- 33 Coho salmon  
*Oncorhynchus kisutch*
- 34 Chinook salmon  
*Oncorhynchus tshawytscha*

- 35 Steelhead trout  
*Oncorhynchus mykiss*
- 36 Atlantic salmon  
*Salmo salar*
- Forage fish**
- 37 Sandlance  
*Ammodytes hexapterus*
- 38 Pacific herring  
*Clupea harengus pallasii*
- 39 Rainbow smelt  
*Osmerus mordax*
- 40 Longfin smelt  
*Spirinchus thaleichthys*
- 41 Surf smelt  
*Hypomesus pretiosus*
- 42 Pile perch  
*Rhacochilus vacca*
- 43 Shiner perch  
*Cymatogaster aggregata*
- Flatfish**
- 44 Halibut  
*Hippoglossus stenolepis*
- 45 Arrowtooth flounder  
*Atheresthes stomias*
- 46 Rock sole  
*Lepidopsetta bilineata*
- 47 Dover sole  
*Microstomus pacificus*
- 48 English sole  
*Parophrys vetula*
- 49 Petrale sole  
*Eopsetta jordani*
- 50 Rex sole  
*Glyptocephalus zachirus*
- 51 Butter sole  
*Isopsetta isolepis*
- 52 Yellowfin sole  
*Limanda aspera*
- 53 Starry flounder  
*Platichthys stellatus*
- 54 Curlfin sole  
*Pleuronichthys decurrens*
- 55 Pacific Sandab  
*Citharichthys sordidus*
- 56 Sand sole  
*Psettichthys melanostictus*
- Rockfish**
- 57 China rockfish  
*Sebastes nebulosus*
- 58 Copper rockfish  
*Sebastes caurinus*
- 59 Quillback rockfish  
*Sebastes maliger*
- 60 Pygmy rockfish  
*Sebastes wilsoni*
- 61 Tiger rockfish  
*Sebastes nigrocinctus*
- 62 Black rockfish  
*Sebastes melanops*
- 63 Puget Sound rockfish  
*Sebastes emphaeus*
- 64 Silvergray rockfish  
*Sebastes brevispinis*
- 65 Yellowmouth rockfish  
*Sebastes reedi*
- 66 Canary (Orange) rockfish  
*Sebastes pinniger*
- 67 Chilipepper  
*Sebastes goodei*
- 68 Redstripe rockfish  
*Sebastes proriger*
- 69 Bocaccio  
*Sebastes paucispinis*
- 70 Sharpchin rockfish

71	<i>Sebastes zacentrus</i> Stripetail rockfish	105	<i>Berryteuthis magister</i> Giant squid
72	<i>Sebastes saxicola</i> Widow rockfish		<i>Dosidicus gigas</i>
73	<i>Sebastes entomelas</i> Rosethorn rockfish	106	<b>Crabs</b> Dungeness crab
74	<i>Sebastes helvomaculatus</i> Yelloweye rockfish	107	<i>Cancer magister</i> Red crab
75	<i>Sebastes ruberrimus</i> Yellowtail rockfish	108	<i>Cancer productus</i> Snow crab
76	<i>Sebastes flavidus</i> Blue rockfish	109	<i>Chionoectes spp.</i> King crab
77	<i>Sebastes mystinus</i> Harlequin rockfish	110	<i>Lithodes spp.</i> Hermit crab
78	<i>Sebastes variegatus</i> Darkblotched rockfish	111	<i>Pagurus spp.</i> European green crab
79	<i>Sebastes crameri</i> Northern rockfish		<i>Carcinus maenas</i>
80	<i>Sebastes polyspinis</i> Splitnose rockfish	112	<b>Shrimp</b> Sidestripe shrimp
81	<i>Sebastes diploproa</i> Pacific Ocean perch	113	<i>Pandalopsis dispar</i> Pink shrimp
82	<i>Sebastes alutus</i> Rougheye rockfish	114	<i>Pandalus borealis</i> Humpy shrimp
83	<i>Sebastes aleutianus</i> Shortraker rockfish	115	<i>Pandalus goniurus</i> Pacific ocean shrimp
84	<i>Sebastes borealis</i> Shortspine Thornyhead		<i>Pandalus jordani</i>
85	<i>Sebastolobus alascanus</i> Longspine Thornyhead	116	<b>Bivalves</b> Abalone
	<i>Sebastolobus altivelis</i>		<i>Haliotis katschatkana</i>
86	<b>Bottom fish</b> Pacific cod	117	Butter clam
87	<i>Gadus macrocephalus</i> Sablefish	118	<i>Saxidomus gigantea</i> Horse clam
88	<i>Anoplopoma fimbria</i> Ratfish	119	<i>Tresus capax</i> Blue mussel
89	<i>Hydrolagus colliei</i> Lingcod	120	<i>Mytilus edulis</i> Pacific oyster
90	<i>Ophiodon elongatus</i> Sculpin	121	<i>Crassostrea gigas</i> Spiny scallop
91	<i>Myoxocephalus spp.</i> Eelpout	122	<i>Chlamys hastata</i> Rock scallop
92	<i>Bothrocara spp.</i> Kelp poacher	123	<i>Crassadoma gigantea</i> Pink scallop
	<i>Agonomalus mozinoi</i>	124	<i>Crassadoma rubida</i> Pacific geoduck
93	<b>Pelagic fish</b> Eulachon		<i>Panopea generosa</i>
94	<i>Thaleichthys pacificus</i> Pollock	125	<b>Other invertebrates</b> Red sea urchin
	<i>Theragra chalcogramma</i>	126	<i>Strongylocentrotus fanciscanus</i> Green sea urchin
95	<b>Sharks</b> Spiny dogfish	127	<i>Strongylocentrotus droebachiensis</i> Purple sea urchin
96	<i>Squalus acanthias</i> Large sharks	128	<i>Strongylocentrotus purpuratus</i> California sea cucumber
	<i>Galeorhinus spp.</i>	129	<i>Parastichopus californicus</i> Giant Pacific octopus
97	<b>Skates and Rays</b> Deepsea skate		<i>Octopus dofleini</i>
98	<i>Bathyraja abyssicola</i> Longnose skate		
99	<i>Raja rhina</i> Starry skate		
	<i>Raja stellulata</i>		
100	Pacific electric ray <i>Torpedo californica</i>		
	<b>Squids</b>		
101	Opal squid <i>Loligo opalescens</i>		
102	Nail squid <i>Onychoteuthis borealijaponica</i>		
103	Flying squid <i>Ommastrephes bartramii</i>		
104	Red squid		

## APPENDIX C – *RAPFISH*

### Respondent #:

**Fishery:**

*Species:* \_\_\_\_\_ *Gear Type:* \_\_\_\_\_

*Area:* \_\_\_\_\_

### Ecological analysis

Ecological attributes reflect how the fishery impacts sustainability in terms of the ecology of the exploited fish and their ecosystem. Fisheries management practices that increase the risk of overexploitation, quickly change trophic levels etc. are scored towards the 'bad' end of the scale while fisheries management practices that protect the species or ecosystem score towards the 'good' end of the scale.

1. What is the exploitation status of this fishery?
  - a. under-exploited
  - b. fully-exploited
  - c. heavily exploited
  - d. over-exploited
  - e. almost completely collapsed
2. What is the recruitment variability (COV) of this fishery?
  - a. low (less than 40%)
  - b. medium (40-100%)
  - c. high (greater than 100%)
3. Is the trophic level of the catch in this fisheries sector of the ecosystem decreasing? (Indirect information, such as the average size of the fish caught decreasing, can help to score this attribute.)
  - a. no
  - b. somewhat or slowly
  - c. rapidly
4. How many legal jurisdictions (including international waters) does this species move through during its life?
  - a. 1 to 2
  - b. 3 to 4
  - c. more than 4
5. Is there evidence of geographic range reduction for this species? Is the animal found in few places now than previously?
  - a. no
  - b. a little
  - c. a lot or quickly
  - d. almost complete
6. Has the average size of the fish being caught changed in the past 5 years?
  - a. no
  - b. yes, a gradual change
  - c. yes, a rapid large change
7. Are many of the fish caught before they reach maturity?
  - a. none
  - b. some (more than 30%)
  - c. lots (more than 60%)
8. How much of the catch is (discarded) bycatch? (as percentage of target catch) (If the target catch + retained by-catch is a low percentage of the catch, then discarded by-catch is high (i.e. bad).)
  - a. low (less than 10%)
  - b. medium (10-40%)
  - c. high (more than 40%)
9. How many species are caught (target and by-catch)?
  - a. low (10 or fewer species)

\*\* For these attributes, in most cases data will come from other sources such as FAO website, FishBase, etc., rather than through interviews. Document other sources.

- b. medium (10 to 100)
  - c. high (more than 100 species)
10. What is the primary production of the area? (in g C/m<sup>2</sup>/year) \*\*
- a. low (0 to 50)
  - b. medium (50-90)
  - c. high (90 to 160)
  - d. very high (more than 160)

### Economic analysis:

Economic attributes reflect how fisheries management practices impact the economic sustainability of the fishery and related human communities, as ultimately predicted on ecological sustainability. Therefore in a *Rapfish* analysis scores at 'good' end of the scale of an attribute reflect economic sustainability and are not a risk to the fishery or ecosystem, whereas the 'bad' end of the scale may be a risk. A fishery where the average wage of a fisher is above the average national wage scores towards the 'good' end because there is an incentive or likelihood that fishers will manage for sustainability to ensure that their wages remain high or improve.

1. Is this fishery profitable? How profitable? (Include subsidies)
  - a. Highly profitable
  - b. Marginally profitable
  - c. Break even
  - d. Losing money
  - e. large losses
2. How important is this fishery in the economy, in comparison to other industries or sectors (of the area in question)?
  - a. low
  - b. medium
  - c. high
3. Do fishers make more or less than the average person?
  - a. Much less
  - b. Less
  - c. About the same
  - d. More
  - e. Much more
4. Is entry to this fishery limited (formally or informally)?
  - a. Open access
  - b. Almost no limitation
  - c. Very little limitation
  - d. Some limitation
  - e. Very limited
5. Do participants in this fishery have a marketable right/quota/share?
  - a. No
  - b. Some
  - c. A mix of property rights
  - d. Full Individual Transferable Quotas, Community Transferable Quotas, or other property rights
6. In just this fishery, is fishing mainly: (consider only this fishery, not all fishing activities)
  - a. Casual
  - b. Part-time
  - c. Seasonal
  - d. Full-time
7. Compared to all other fisheries in the same area as this one, what percentage of employment is in this fishery and related activities (such as processing, selling, etc.)?
  - a. Less than 10%
  - b. 10-20%
  - c. More than 20%
8. Do the profits from this fishery stay locally, or do they go elsewhere? Where?

- a. The profit mainly stays here in the local area
  - b. Profit mainly stays within this country, but not locally
  - c. Profit mainly leaves the country
9. Where is the market for the fish caught in this fishery?
- a. Mainly local or national
  - b. Mainly national or regional
  - c. Mainly international
10. Are subsidies provided to support the fishery, and if so how much? (include hidden subsidies, such as unemployment insurance, fuel subsidies, etc)
- a. No subsidies
  - b. Some subsidies
  - c. Large subsidies
  - d. The fishery depends on subsidies
  - e. The fishery would likely not continue without subsidies

### Ethical analysis:

Ethical analysis within *Rapfish* is designed to analyse fisheries for five types of justice: creative, productive, ecosystem, restorative, and distributive. Creative justice includes issues such as fair management of the fishery; productive justice and ecosystem justice consider treatment of and behaviour within the fisheries ecosystem; restorative justice covers the repairing of previous damage; distributive justice deals with how the resource is shared. The package of ethical attributes assesses fisheries based on these various ethical concerns, and integrates sustainability on many levels, including ecological and social.

1. Do the people who fish in this fishery live close to the area of the fishery, or do they come from a distance? Have they fished in the fishery for many generations, or are they new to the fishery?
  - a. Fishers live far away and have only recently begun to fish in this fishery
  - b. Fishers live far away and have fished in this fishery for some time
  - c. Fishers live near the fishery and have fished in this fishery for some time
  - d. Fishers live near the fishery and have fished in this fishery for a long time (several generations)
2. Are there alternatives to the fishery for employment within the community? For example, are there other industries in which people could work rather than in the fishery? (Do not consider processing or other activities which depend on the fishery to survive.)
  - a. No, there are no alternatives forms of employment in the community
  - b. There are some alternatives to the fishery
  - c. There are many choices for employment in the community, beyond the fishery
3. Is entry to the fishery based on traditional or historical access to the fishery?
  - a. Traditional/historical access to this fishery is not considered at all
  - b. Traditional/historical access to this fishery is considered
  - c. This is a traditional indigenous fishery
4. Are fishers included in the management of this fishery?
  - a. No, not at all
  - b. Fishers are consulted in management
  - c. There is co-management in this fishery, with government leading the way
  - d. There is co-management in this fishery, with the community leading the way
  - e. There is co-management in this fishery, with all groups being equal
5. Has there been damage to the environment in which

the fish live (the fish habitat)? Have there been efforts to correct that damage?

- a. There has been much damage to the fish habitat
  - b. There has been some damage to the fish habitat
  - c. There is no damage happening now, and there are no attempts to correct damage
  - d. There have been some efforts at correcting damage to the fish habitat
  - e. There have been many efforts at correcting damage to the fish habitat
6. Has there been damage to the fisheries ecosystem? For example, have some types of fish disappeared or others appeared because of activities within this fishery? Have there been efforts to correct that damage?
- a. There has been much damage to the fisheries ecosystem
  - b. There has been some damage to the fisheries ecosystem
  - c. There is no damage happening now, and there are no attempts to correct damage
  - d. There have been some efforts at correcting damage to the fisheries ecosystem
  - e. There have been many efforts at correcting damage to the fisheries ecosystem
7. Are there illegal activities within this fishery, such as illegal catches, poaching, or transshipment of catches?
- a. No, none
  - b. Yes, some
  - c. Yes, lots
8. Is there discarding and/or wasting of fish caught in this fishery?
- a. No, none
  - b. Yes, some
  - c. Yes, lots

### Social analysis:

Social attributes reflect how fisheries management practices impact the sustainability of the society or community associated with that particular fishery, as ultimately predicated on ecological sustainability. In a *Rapfish* analysis the 'good' end of the scale of an attribute reflects social sustainability but low risk to the fishery or ecosystem, whereas scores at the 'bad' end may reflect a risk. Therefore a fishery where fishers can influence fishery regulations scores towards the 'good' end of the scale, while a fishery where there is conflict with other fisheries or industries scores towards the 'bad' end of the scale.

1. In this fisheries, do fishers work as:
  - a. Individuals (including as for a commercial company)
  - b. Families
  - c. Community groups (such as in a co-operative)
2. Has the number of people involved in the fishery over the past 10 years increased? (Including fishing-related activities such as processing.)
  - a. Not very much or not at all (less than 10%)
  - b. Yes, a little, by 10% to 20%
  - c. Yes, a fair amount, by 20% to 30%
  - d. Yes, quite a lot, by more than 30%
3. How many households in the community are involved in the fishery?
  - a. Fewer than a third
  - b. Between one and two thirds
  - c. More than two thirds
4. How much do people in this fishery know about the fishery resource and its ecosystem and environment?
  - a. Not very much



- b. Some
- c. Quite a lot
- 5. Compared with others in the area, what is the level of education of most people in this fishery?
  - a. Below average
  - b. About average
  - c. Above average
- 6. Is there conflict between this fishery and other fisheries or industries (such as oil drilling, tourism, etc.)
  - a. No conflict
  - b. Some conflict
  - c. A lot of conflict
- 7. How much influence do fishers in this fishery have on actual fishery regulations?
  - a. None or almost none
  - b. Some
  - c. A lot
- 8. In this fishery, what percentage of family income comes from this particular fishery?
  - a. Less than half
  - b. More than half, but no more than 80%
  - c. More than 80%
- 9. Do family members sell and/or process the fish caught?
  - a. No
  - b. Yes, but very few relatives participate (1 to 2 people)
  - c. Yes, but maybe only 2 relatives participate
  - d. Yes, maybe 3 relatives participate
  - e. Yes, many relatives participate – four or more

- 7. Are fish attraction devices used in this fishery?
    - a. No
    - b. Bait is used
    - c. Other fish attraction devices are used
  - 8. What is the average length of vessels in this fishery?
    - a. Under 5m
    - b. Five to 10m
    - c. Ten to 15m
    - d. 15 to 20m
    - e. Bigger than 20m
  - 9. Have fishers altered gear and vessel to increase catching power over past 5 years?
    - a. No
    - b. Yes, but very little
    - c. Yes, a little
    - d. Yes, some
    - e. Yes, a lot and/or quickly
  - 10. Does the gear used in this fishery result in unwanted side-effects?
    - a. No unwanted side-effects
    - b. Some unwanted side-effects
    - c. Yes, many unwanted side-effects
    - d. The fishery is dominated by destructive fishing practices
- 

**Technological analysis:**

Technological attributes capture appropriate technologies that minimize risk to sustainability of the fishery. Therefore when devices are used to improve the catching power these fisheries score towards the 'bad' end, while a fishery that uses technology such as ice to prevent waste or reduce by-catch scores towards the 'good' end of the scale.

- 1. During a fishing trip in this fishery, how many days would you normally spend at sea, on average?
  - a. One day or less
  - b. Two to four days
  - c. Five to eight days
  - d. Eight to ten days
  - e. Eleven or more days
- 2. Are landing sites for this fishery:
  - a. Widely dispersed
  - b. Somewhat centralised (limited)
  - c. Very centralised (limited)
  - d. The fishery is conducted by a distant-water fleet that rarely or never lands the catch locally
- 3. Is the catch processed (for example, gutting, filleting, salting, etc.) at all before being sold?
  - a. No, not at all
  - b. Yes, but just a little
  - c. Yes, there is a lot of processing
- 4. How much and in what way is the catch handled onboard?
  - a. No special handling
  - b. Some handling (such as salting or boiling)
  - c. Very specialised handling (such as flash freezing or champagne ice)
  - d. Live tanks are used
- 5. Is the gear used in this fishery:
  - a. Passive
  - b. Active
- 6. Are there devices, mechanisms, or methods of handling the gear used to increase selectivity?
  - a. None or few
  - b. Some
  - c. Many

## THE COMMUNITY WORKSHOP: HOW WE DID IT, AND WHAT WE LEARNED FROM THE RESULTS

**Melanie D. Power, Nigel Haggan  
and Tony J. Pitcher**  
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### INTRODUCTION

The Back-to-the-Future (BTF) approach, approach emphasises the importance of community participation and the need to treat different systems of knowledge with respect (Haggan 2000, Haggan *et al.* 1998, Salas *et al.* 1998). This is consistent with the aims of the *Coasts Under Stress* project (CUS: [www.coastsunderstress.ca](http://www.coastsunderstress.ca)), of which the current Hecate Strait project is a part. To date, the CUS BTF project has involved people from the northern British Columbia region in two stages: the first Hecate Strait BTF project built models of the present ecosystem and that of 100 years earlier, and was based on one workshop with First Nations, fishers, scientists and other local experts (Haggan and Beattie 1999). Community involvement in the current project started with interviews with fishers, First Nations, conservationists, and others with detailed local knowledge of the fisheries ecosystem (see Ainsworth 2004, this volume), primarily conducted in July 2001, and subsequently through a community workshop.

The community workshop, entitled 'Back to the Future in the Hecate Strait: Restoring the Past to Salvage the Future', was held at Prince Rupert's Highliner Inn, December 4-6, 2001 (Pitcher *et al.* 2002). The aims of the workshop included presenting to the community the work that the Back to the Future team had completed (including what had been done with the information shared with the team during the interview process), and explaining what work was yet to be done. Furthermore, the workshop provided an opportunity for the team and community to engage in discussions about the *Coasts Under Stress* project (Pitcher and Haggan 2002).

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Power, M.D., Haggan, N. and Pitcher, T.J. (2004) The Community Workshop: how we did it and what we learned from the results. Pages 126-129 in Pitcher, T.J. (ed.) Back to the Future: Advances in Methodology for Modelling and Evaluating Past Ecosystems as Future Policy Goals. Fisheries Centre Research Reports 12(1): 158 pp.

## THE COMMUNITY WORKSHOP

### Preparation

The workshop represented the latest in a series of steps in the Back to the Future process (Pitcher 2004a, 1998). In autumn, 2000, the Back to the Future team conducted science workshops in both British Columbia and Newfoundland<sup>1</sup>, during which the input of scientists with species-specific knowledge could be received and further incorporated into the planned *Ecopath* ecosystem models (Pitcher *et al.*, 2002). For the Hecate Strait region, four ecosystem models were constructed, each representing a different time period: 1750, 1900, 1950, and 2000.

In July 2001, six members of the Back to the Future research team travelled to Prince Rupert, British Columbia, and conducted interviews with those who would have, and were willing to share, detailed local environmental knowledge (see Ainsworth, this volume). The information shared during these interviews was added to the historical database constructed by Aftab Erfan (Erfan 2004), and then used to cross-validate and strengthen the existing models.

*Ecosim* simulations were run based on two fishery fleet structures: the present fleet structure ('Today's Fleet') and today's fleet structure but without dragnets and gillnetters ('Team's Choice'). These two simulations, demonstrating the fishing impacts of each fleet structure on each of the four ecosystems, were used during the workshop as a basis of discussion and exploration (Buchary and Sumaila 2002).

### Who was there?

In addition to all those interviewed in July, 2001, other community members and representatives of related organisations were invited to attend the December workshop. All interviewees were sent a letter detailing the time, place, and programme of activities of the workshop. Attendees included the Tsimshian Tribal Council (represented by the President Ms. Deborah Jeffrey), the City of Prince Rupert (represented by Councillor Cyril Stephens), fishers from several First Nations, commercial gillnet fishers, dragnets, trawl and line fishers, representatives of the World Wildlife

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<sup>1</sup> As part of the Fisheries Centre's contribution to the *Coasts Under Stress* project, Back to the Future projects are being conducted in both British Columbia and Newfoundland. (See Pitcher, 2004b, this volume.) This paper will be limited to the British Columbia component.

Fund and the Northwest Maritime Institute and a number of local biologists and researchers. (A full list of participants is given in Pitcher *et al.* 2002)

Rather than costly advertising, the Back to the Future team relied mainly on word-of-mouth to spread notice of the workshop throughout the area, and through the organisations mentioned above.

The first day of the workshop suffered a low attendance, in part due to a snowstorm the day before. Indeed, a majority of the Back to the Future team were late arriving due to inclement weather, and the beginning of the workshop was delayed as a result. Subsequent days witnessed markedly increased attendance, for reasons to be detailed below.

### **Who was not there?**

The workshop was well attended by First Nations and commercial gillnet and trawl fishers. Salmon seine fishers, trawlers and sport fishers were conspicuously absent, leading to the ready choice of scenarios that excluded these fisheries. Other absentees included the Department of Fisheries and Oceans and agencies of the BC government. This was a significant problem because the BTF philosophy is based on including all interests in the ecosystem, including the general public.

### **What happened?**

Day one of the workshop opened with a series of presentations from the Fisheries Centre's Back to the Future team. These presentations included an overview of the approach and methodology of Back to the Future, as well as more detailed presentations on the four *Ecopath* models and the *Ecosim* simulations (of 'Today's Fleet' and 'Team's Choice' fleet structures for each ecosystem) and planned workshop activities.

Throughout the workshop, posters highlighting the team's work lined the perimeter of the meeting room. Miniature (letter-sized) versions of these posters were also distributed to workshop participants. In addition to the formal, structured discussions of the workshop, informal conversations over coffee and shared meals provided opportunities for team members to hear and respond to thoughts and concerns of workshop participants, and contributed to the growing sense of trust between the UBC group and the community members.

Formal small-group discussions occurred mainly on day two of the workshop, when participants

were divided into five (self-selected) working groups. Each working group included at least one, and usually two, BTF team members. Four of the five groups were asked to discuss the four potential ecosystems and to develop group a consensus as to which ecosystem was preferred for a rebuilt ecosystem. Furthermore, the four working groups were asked to decide what fishing fleet structure would be desirable in the rebuilt ecosystem; the four scenarios to come out of the working groups would then be simulated by the Back to the Future team and presented before the conclusion of the workshop. By coincidence, each group selected a different ecosystem goal, such that all four modelled ecosystems were represented, and the fleet structures recommended by each group were unique (Power 2002a). The fifth group was tasked with an examination of the four basic *Ecopath* models.

Once each of the four working groups identified their preferences, day two of the workshop closed, and the Back to the Future team set about simulating those preferences using *Ecosim*. Day three of the workshop featured the presentation of the results of those simulations<sup>1</sup>, and wrap-up discussion.

In addition to structured workshop activities, members of the Back to the Future team also conducted additional interviews to complement those done during the July visit.

### **The 'Team's Choice' Controversy**

As noted above, day one attendance was somewhat disappointing, but increased markedly on days two and three. The increase may primarily be attributed to what has come to be known as "the Team's Choice controversy" (Power 2002b). One of the two fishing fleet structures modelled in *Ecosim* was based on the actual present fishing fleet, but with a blanket exclusion of all draggers and gillnetters. In labelling this scenario as "Team's Choice", the Back to the Future team inadvertently gave the impression that a decision to exclude them from all possible future fisheries had already been reached. The team explained that this was not the case, but the damage had already been done.

As a result of this miscommunication, on day two, the meeting room was flooded with angry gillnetters and draggers. Clearly, word quickly

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<sup>1</sup> A survey, designed to gauge community preferences regarding the rebuilt ecosystem and the structure of the fishery fleet to operate in that rebuilt ecosystem, was also conducted (and the interim results presented) during the workshop. For more information, see Power (2002).

spread throughout Prince Rupert that this group from the UBC Fisheries Centre was recommending the closure of the dragger and gillnet sectors! The second day of the workshop thus began with the irate, suspicious fishers venting their frustration at the Back to the Future team. Eventually we managed to explain that we were harmless academics who had made an honest mistake, not secret agents of government sent to shut them down. Following abject apologies for the inappropriate word selection, the fishers granted our request for a fool's pardon. Many stayed on for the rest of the workshop.

Attendance thus increased quite significantly, and this potentially disastrous mistake on the part of the team had one positive side-effect – a broader representation amongst workshop participants.

However, this incident illustrated the importance of giving full and complete consideration to all aspects of the planning of this sort of activity. The label, “Team’s Choice”, was unfortunate in that it gave the false and unintended impression that the Fisheries Centre team had already reached a decision. Furthermore, it seemed that community members were genuinely apprehensive that somehow Fisheries and Oceans Canada would act upon such recommendations.

## WHAT WE LEARNED

The Prince Rupert meeting was the first time that ecosystem modelling had been used to run scenarios suggested by participants. Recognising the inherent value of community input, particularly as a basic tenet of BTF, it is hoped to be followed by similar workshops in this and other Back to the Future projects, and as such, important lessons were to be learnt.

The most important lesson learnt was the value of planning. Countless hours were spent preparing for the workshop, not only in preparing the models and supporting materials and in extending invitations, but also in determining the overall structure of the workshop and assigning section responsibilities to team members. Clearly, the extensive planning was crucial to the successful functioning of the workshop (notwithstanding Mother Nature’s best attempts at preventing the arrival of the team!). However such comprehensive planning is extremely time-consuming, and as a result we were unable to spend enough time on some items.

This was the case with the survey conducted at

the workshop; being that the survey was dependent upon the time-hungry models, insufficient time remained for testing the survey materials and as a result the survey itself was unsuccessful (see Power 2002a for discussion).

Furthermore, despite all the detailed planning by the whole team, we failed to foresee the problems raised by the ‘Team’s Choice’ label for one of the two fleet structures modeled. The cost was finding ourselves in a roomful of angry fishers. While the miscommunication had the positive yet unintended consequence of provoking significantly improved workshop attendance, this occurred at the expense of trust and good-will, at least initially. We were fortunate that good-will was restored.

Finally, again relating to workshop attendance, we learnt that word-of-mouth is not necessarily sufficient. Unfortunately, due to budgetary constraints, wide-spread paid advertising was not an option for this workshop. The reliance on word-of-mouth meant that some groups were very well represented and others not at all. Paid advertising – and, if possible, coverage in the local media – might have led to broader representation and should be budgeted in future community workshops of this type.

The Prince Rupert Community workshop provided opportunities, including the informal opportunities nestled within the formal structure, for increased interaction between the community and the researchers. The cultivation of such trust and understanding will help future collaboration between ‘town and gown’ for the benefit of the fishery, and for those who depend on it in various ways.

Overall, the workshop was judged a success. The Fisheries Centre’s BTF team was given the opportunity to present back to the community an analysis of the information they had previously supplied. The BTF team showed that it is possible to present the restoration of past ecosystems as a practical policy goal, and showed that this approach can aid discussion of the shape of the fishery – and fishery ecosystem – of the future.

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For discussion after the oral presentation of this paper, see page 145.

## **ROUND TABLE DISCUSSIONS FROM THE BACK-TO-THE-FUTURE SYMPOSIUM FEBRUARY 2002: ISSUES IN POLICY, VISUALISATION AND PRESENTATION**

**Melanie D. Power and Tony J. Pitcher**

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### **ABSTRACT**

At the symposium hosted by the Fisheries Centre and held in Vancouver in late February, 2002, round-table discussions were convened to focus on the team's approach to presenting our work to the community and whether this approach could actually change policy. Overviews were presented and followed by open discussion with symposium participants. This round table was divided into three sections: the first, Chaired by Melanie Power, addressed the issue of "How can we represent complex models to local communities: what we have done and what have we learned? Examples of what we did"; the second, Chaired by Eny Buchary, "How can we represent policy searches to local communities: what we have done and what we have learned". The third discussion, Chaired by Nigel Haggan, discussed whether the BTF approach stood any chance of actually changing fisheries policy. This section is a transcript of these discussions, edited for clarity and consistency.

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### **INTRODUCTION: THE COMMUNITY WORKSHOP**

Co-operation with local communities is an essential component of the Back-to-the-Future (BTF) approach. In the Hecate Strait CUS BTF project, the community has thus far been invited to participate on two occasions: firstly, through interviews by which detailed local knowledge held by community members could be shared with researchers; and secondly, during a workshop held in the community of Prince Rupert, during which time the researchers were able to reflect back to the community how the information shared had been incorporated and applied, and to seek guidance from the community on what preferences exist for the fishery of the future.

The workshop presented unique challenges, in that the researchers wished to share with the community complex ecosystem models. The task, then, was to explain to an audience that would

include many with little or no previous experience with models the basics of the *Ecopath* approach, the approach taken and data used to develop the models, and finally what the models said. While recognising that some workshop participants may be very interested in the detailed workings of the models, it was also necessary to ensure that all participants had a basic working understanding of the models and their outputs to enable meaningful discussions.

This was accomplished in a number of ways. Firstly, members of the team made oral presentations describing the Back to the Future approach, the basics of *Ecopath* modelling, and the modelling results. Secondly, oral presentations were reinforced with printed materials. Large posters lined the meeting room, summarising the main points of the oral presentations, and letter-sized versions of these posters were made available to all workshop participants. Finally, over coffee and shared meals, researchers and community members engaged in informal discussions. These provided additional opportunities to answer questions or to explore various aspects of the BTF work.

Workshop participants were asked to consider what they would prefer for their fishery – both in terms of rebuilding goals (in terms of temporal ecosystem as modelled) and fishing fleet structure. This was to be accomplished through (self-selected) working groups. The Fisheries Centre's team would then model the groups' preferences and present the results on the closing day of the workshop. Five working groups were established; four were asked to discuss preferences, as described above, while the fifth worked with the Fisheries Centre's modellers to discuss the *Ecopath* models in details. This fifth group thus provided the opportunity for those interested in the inner workings of the models to explore these issues in more detail.

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**How can we represent complex models to local communities: what we have done and what we have learned? Examples of what we did.** *Chair: Melanie Power*

*Russ Jones*

Did many people write on the posters [at the Prince Rupert community workshop]?

*Melanie Power*

Some people did; I am not sure how many.

*James Wilson*

Do you think the way you have done things ameliorates the concerns Charles [Menzies] was

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Power, M.D. and Pitcher, T.J. (2004) Round Table Discussions from a Back-to-the-Future Symposium at UBC, February 2002: Issues in Policy, Visualisation and Presentation. Pages 130–135 in Pitcher, T.J. (ed.) Back to the Future: Advances in Methodology for Modelling and Evaluating Past Ecosystems as Future Policy Goals. Fisheries Centre Research Reports 12(1): 158 pp

expressing [in an earlier discussion] and do you think this is a good way to get information from the fishers?

*Melanie Power*

We made some mistakes but all in all we built up a relationship with the community. We had time to interact and get to know one another. One person even took us out to see his boat. I think it does help more to speak informally than to talk over a straight interview.

*Sheila Heymans*

I think it has made it more logical for the people why we are doing this sort of thing. The community will have a better idea of what we are trying to do.

*Melanie Power*

When we left Prince Rupert, there was a lot more understanding on both sides.

*Nigel Haggan*

We would like to have feedback on how to present material to people.

*Barb Johnson*

Did you just do one-day interviews? Have you had contact with the people again? I know that our elders remember a lot of things after [this type] of interview. Is there any going back after the interview?

*Nigel Haggan*

No. In the first Hecate Strait workshop in 1995 we got recommendations on the people we should have there. We created a model based on what they told us and we sent a report back to them. We did not have the resources to go back to do it again, although we would have liked to. It has taken five years to get enough through the *Coasts Under Stress* project for a very few more visits.

*Melanie Power*

Everyone whom we interviewed in July was invited to the workshop in December. So we did speak to them again, not just in the [initial] formal interview.

*Cyril Stephens*

The workshop in December was a very good beginning; otherwise how do you get to know the needs of the people in the community, the politics that come with [those needs] and the problems they create? I like where you came from but you fell short on the advertisement and getting to all the outlying communities from the whole of the northwest. There are a lot of fishermen in that area but they were not there. Their data was

missing. The other part that I think was not good was that we spoke mostly of trawlers and seiners but not about the sport fishermen. The commercial fishermen have changed to accommodate the sport fishermen where there is the big money. You need to know the scale of the catch from the sport fishermen and the graph will be complete.

*Tony Pitcher*

We have a paper tomorrow on the sport fishing problem, which Robyn Forrest has been working on.

*Melanie Power*

Those concerns were addressed in the [Fisheries Centre Research] Report [detailing the December workshop].

*Tony Pitcher*

We only had the resources to go to one community so we went to Prince Rupert. If this project is renewed, we should at least look into getting into other coastal communities.

*Nigel Haggan*

We are fortunate to get good support from *Coasts Under Stress*. I think BTF is a good set of tools for First Nations and other people to develop a collective understanding of marine ecosystems and the flow of benefits a restored ecosystem can generate as opposed to what it does now. Unfortunately we have a shoestring budget. We were afraid that if we advertised we would get a bigger workshop than we could handle. We are interested in making these models and how they work intuitively understandable. The first time I ran across *Ecopath*, it struck me that this is the first scientific tool that looks at ecosystem connections the same way as First Nations. It is still highly technical. How do we make it accessible?

*Erin Alcock*

How have you been dealing with the local taxonomy? A lot of people have different names for the same kind of fish.

*Nigel Haggan*

We can't do it at this level. There is a wealth of information on the fine scale but we need to aggregate some data.

*Melanie Power*

During the interview we did ask people if they knew the fish by any other name. We have captured it where we could, but I am not sure how much we have been able to use it.

*Nigel Haggan*

The first report on Hecate Strait has a paper on the information content of Tsimshian language names. We need to incorporate it in the models but it is challenging.

*Kim Wright*

A model is only as good as the information you put in it. How did you determine that you had enough information to run an accurate model? Is this something that will keep going on?

*Nigel Haggan*

Once we have a model that we can run backwards through time and recreate what we know was there, we begin to have something workable. You can tune the model to real time data and you can make predictions as robust as single species assessment.

*Russ Jones*

I think it is a good idea to use pictographs but I found the posters very confusing, particularly when trying to find out what has changed. It was hard to compare. It might be better to do it by species and stack it up so it is more like a graph or picture graph.

*Melanie Power*

We focused on species that are commercially and culturally important.

*Russ Jones*

The other thing was that although the graphs were meant to help you with the questionnaire [for the survey which was also conducted during the workshop], it was still really hard.

*Melanie Power*

Is focusing on a few species that were important a valid approach? That sounds ok.

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**How can we represent policy searches to local communities: What we have done and what we have learned.** *Chair: Eny Buchary*

*Nigel Haggan*

If we could rebuild the system that we like, how would we fish it? We can run simulations to maximise what we want but the criterion is to maintain the ecosystem state. What is the best mix of fisheries then?

*Quentin Mackie*

Can you set up real time simulations?

*Eny Buchary*

It is not that straightforward because we are doing [both] economic and ecological analyses. It can take too long to do. We could do it real time [only] if we used a simplified subset.

*Tony Pitcher*

An [ecosystem] simulation runs through in a minute, but it can take half an hour to do one run of a policy search.

*Quentin Mackie*

Go the other way around – say what is the policy and see what are the ecological outputs.

*Eny Buchary*

That would only give you the ecological output. For the [*Ecosim*] optimisation routine you need to put weights on ecological, social and economic values and it is not that straightforward.

*Tony Pitcher*

We can have more done in advance, then show the results at the workshop.

*Sheila Heymans*

We can use what we have and simplify it. Perhaps aggregating into a smaller ecosystem might help. For example, you can put all rockfish in just one group – many people do not need to know there are four groups.

*Nigel Haggan*

I am in favour of that. In order to value the system you need some costs and prices of the fishery. If we find ourselves back in the 1750s and ignore the fisheries we have today, we can ask what kind of fisheries we would like to have.

*Tony Pitcher*

At Prince Rupert, we put in a fishwheel in one of the simulations as a hypothetical gear type, to see whether the simulation picked it up as an important gear type. And it did.

*James Wilson*

Isn't it a search for the Holy Grail though? Isn't it all relative to personal positions? Having a fish wheel is great but how does it fit into our society? Who benefits and who pays?

*Nigel Haggan*

The commercial fishery that we have is an artefact of bad evolution – is that what we want to do if we can rebuild it? I think not. We don't want to force people to defend their gear type.

*Tony Pitcher*

Charles Menzies gave a paper at the [Putting Fishers' Knowledge to Work] conference [in



August, 2001] on traditional stone-built traps. We can include that kind of gear in the model.

*Nigel Haggan*

We need to unlock the creativity of fishermen – how would we do it if we had carte blanche?

*Russ Jones*

I think that is the wrong policy question to bring to a group that has an interest because it brings in the issue of allocation and it is divisive. I would suggest running different case scenarios before the meeting and see how much difference there is in the outcome. You can then ask people about refinements and preferences rather than having them making up things and coming to a consensus.

*Melanie Power*

We got into trouble for doing just that because [we were seen as targeting the trawlers and gillnetters].

*Russ Jones*

You asked people to look at one simulation and then to come up with some other simulations. What you did was based on allocations [between fishery participants]. There are various other issues.

*Tony Pitcher*

Allocation is in effect done by the optimisation procedure. They did not like the results.

*Russ Jones*

You are still asking them to make an allocation.

*Quentin Mackie*

I'd say just follow that up. Your simulation is a tool for educating people about complex interactions. It does not matter whether they like the situation or not or if the results are good or bad. Keep the results qualitative – have a simple and a complex model and people will put in their comments.

*Nigel Haggan*

We would like to bring these things organically to the communities. Instead of bringing a snapshot to a community, we would like to have something that will bring scientists out of their corners into the communities to work until all are satisfied. But we do not have enough resources. The *Oceans Act* calls for ecosystem management, precautionary management and extremely broad-based consultation. It seems to me that by engaging scientists, First Nations, stakeholders, managers and policy makers in simulating ecosystems and asking 'what if' questions you can

satisfy most of the criteria in the *Oceans Act*, but you need Fisheries and Oceans Canada to divert a big chunk of its bilateral consultation funds. The problem is not the size of the computer but the lack of resources to do return interviews and bringing people to work in the model for a collective ownership.

*Tony Pitcher*

The interface needs a complete [public-friendly] front end [if we are to encourage confidence in the modelling].

*Russ Jones*

The other thing to look at is what other policy questions would engage people better? If we do not have forage fish, will we have high value fisheries? What about Marine Protected Areas? People can think about these kinds of questions. I guess the model isn't ready to answer them.

*Nigel Haggan*

Actually it is.

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## **Can we actually change policy using BTF?**

*Chair: Nigel Haggan*

*Nigel Haggan*

Fishers in Prince Rupert were asking if there were any possibility at all that DFO would pick this up. Will it help to make them (DFO) take whatever steps are necessary to rebuild the natural resources and to reverse this decline we are talking about? Can it be done given the trend for larger capital ownership and the fact that small-scale fishers have had to sell out? What are people's thoughts and feelings about that?

*Rashid Sumaila*

The point of entry into the discussion is: Do people want to do anything? Do they really care? Can this help people to see things differently?

*Nigel Haggan*

Who are these 'people' anyway? It is not the coastal communities that drive the decisions; it is the voting public. Do they care sufficiently? I would suggest that for the first time, public concern about conservation is starting to counterbalance the industry lobby.

*Cyril Stephens*

You keep talking about going to a community and getting their input. In the north coast most of the communities are the fishing industry. But no matter how much you scream to look out for salmon, the policy makers are not connected to the salmon industry and it is they who make

decisions for the people who are out on the coast. The DFO are not connecting and that affects depletion and the whole ecosystem. The dollar affects all that too. When a fisherman has only ten days to make his livelihood for the year, you lose that focus because you are thinking about today. Where we want to be tomorrow gets lost in the management system – that has always been there and will be there for a long time.

*Rosemary Ommer*

*Coasts Under Stress* is talking to DFO to develop an internship program. Students from *CUS* will be sent to work with DFO to understand the policy makers' world. They send us their people and we would send them to the people on the coast so they can no longer claim that they do not know what is happening at the local level. I don't think it would have worked out if we did not do it both ways. Once that policy wall is cracked a little it will work. But that takes time and I don't know how to survive in the meantime.

*Sheila Heymans*

*Coasts Under Stress* needs very strong public relations in order to get the 'Powers That Be in Ottawa' to act. We need a PR drive to explain to the general population out there, for example the people in Saskatchewan, what the problem is and what effects it has on their children's future and so we can get them to vote for the right people.

*Rosemary Ommer*

People in Saskatchewan are dealing with their own problems that are not unlike what is going on in the coast. We need a lot of evidence and a lot of information. There were people in Saskatchewan listening to the radio programs and giving their views on the fishery crisis. I got the impression that people are more aware than I realized.

*Bill Simeone*

It seems to me that you have to make this much more international. In Alaska there is a terrible depletion of salmon in rivers and nobody knows what is really happening, or how it is related to global warming and fisheries in the high seas. If they are depleting the resources out there, all our efforts here would be for naught. This needs to be much bigger.

*Art Sterritt*

The question is whether you want to do it and whether the time is right. There has never been a better time from the perspective of the local communities because the commercial fisheries have wiped them out. Communities are looking for places to build their future. Many of the people you have engaged in Prince Rupert are not

talking about their future but about their present. I have less optimism in coming up with a solution for Prince Rupert than, for example, in Kitasoo, where people have already reached rock bottom and are rebuilding their future. Prince Rupert still has something to go on. If you focused your efforts and research getting commercial fishermen out of there you are likely to have less of a social contest.

*Nigel Haggan*

In terms of Back to the Future as a policy agenda, we have always wanted to get the policy makers, DFO and the communities to work with these simulations. The big industry is staying away and it is only now that DFO is becoming more interested. We really need to get these players working with these simulations. We need to say these are the consequences if you persist with these actions.

*Tony Pitcher*

I am still confident enough to think that Back to the Future can change policy. This is something that is science-based, evidence-based and community-based. Whether it is River's Inlet or whether it is Prince Rupert, if we can get the consent and support in broad terms of people living on the coast, then I think the people who make policy will be forced to listen. It could happen. If we don't do this, the alternative is to have people hanging on to today's buck as we saw in Prince Rupert or people who are affected by massive depletions. So if you get people saying let us restore to what was there in 1950s, it actually puts a tangible policy goal in place. If we could get good PR behind this, I think public support can come in.

*Rosemary Ommer*

There is a countrywide CBC program that goes coast to coast. For example, a lady in the prairies was phoning in and talking about the way that prairie farms are surviving like the BC coast fisheries. Rural and coastal people always have had the same issues but they are traditionally pitted against each other. This is the time to do it. There is enough sensitivity and there have been enough disasters.

*Art Sterritt*

I have a comment about your executive exchange program. The reality of the policy that exists today was based on an exchange about sixteen or twenty years ago between the industry and government. That is when that last exchange of knowledge was done and that has driven the agenda. You have still those same people. The industry is paying for politics in many ways. It is

still there. So if you do not find some way to break that log jam in there, what the little fisherman has to say is going to be insignificant. You may need to change the knowledge base on the DFO side if you want a change.

*Rosemary Ommer*

That's what the CUS2 program will do if it can get launched.

*Nigel Haggan*

We'd really like to put these ecosystem models into almost a videogame format to get them out into school systems so that people can run scenarios. It is the people's mind for conservation that will turn DFO around. During the development of the commercial fishery, DFO and the industry were two sides of the same coin. But since then you have other kinds of interest groups like conservationists and the sport fishers, and the recognition of First Nations' rights through the constitution and Supreme Court decisions. The system is struggling to accommodate this. If we can get all the players together to participate in a restoration agenda, there is some hope.

*Rashid Sumaila*

It is a neat concept because it is not just a conservation argument; it is also economic and social. We can go to the public saying if you don't do anything now, you will not preserve this way of life.

*Nancy Turner*

There are a lot of parallels between fisheries and forestry. In forestry we see clearing of big old trees and replacing them with smaller trees. Is there any Back-to-the-Future in forestry?

*Rosemary Ommer*

*Coasts Under Stress* is in forestry as well. I would like to bring some Back-to-the-Future into it.

*Quentin Mackie*

It is ironic that in terms of community development, the push for conservation of the forest came from the Lower Mainland and Victoria. There was a lot of protest from the northern forest communities. This should be a red flag. Turning fisheries over to communities could lead to that kind of confrontation.

*Nigel Haggan*

We want policy makers and communities to run those future scenarios.

*Art Sterritt*

I have been involved in forestry which has agreed to move to ecosystem-based management. The

reality is that you cannot look at ecosystem management without looking at a full ecosystem. For ecosystem-based forestry management, you need to look at the coast and the sea; otherwise you only have some parts of the information. The drive for ecosystem management came from the communities, particularly the First Nations in the North. It was they who brought in NGOs like Greenpeace. This project is headed by the First Nations and the government. The other thing we are looking at is marine use planning and First Nations will also support that. The federal government is not interested in doing it themselves because it is too massive. We will do a pilot project exactly as we did for forestry and talk to the industry to see if they buy into it.

#### SUMMARY OF KEY DISCUSSION POINTS

One theme in particular carried through all portions of the round table discussion, that being the value of simplification. It was suggested that it might be helpful to provide detailed information to communities on only a select few species, notably those which are culturally or commercially important, as these would represent more tangible trade-offs within the community. Similarly, information on other species could be aggregated.

Other concerns raised during the discussion revolved around the need to follow-up on interviews with members of the community, and to aim for greater geographical breadth. While the research team would like to be able to meet with people in diverse locations and to be able to follow-up on the interviews, they have so far been unable to do so due to financial constraints.

Finally, a concern was raised regarding the divisiveness inherent in allocation debates. Although the BTF team has not endeavoured specifically to address allocation between fleets or fishers, the model simulations in effect produce an allocation between user groups. It was pointed out that those involved in the workshop would be affected by allocation disputes and thus such a *de facto* debate could impede rather than encourage meaningful discussion. In a related vein, the need for an easier means to address 'what if' questions has become apparent. To be able to more quickly and more transparently address the community's queries and concerns would be of great benefit to both the community and the research team.

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**RAPORTEURS' REPORT ON  
DISCUSSION AT THE BACK TO  
THE FUTURE SYMPOSIUM, UBC,  
FEBRUARY 2002**

***Rapporteurs:***

**Amy Poon and Yvette Rizzo**  
*UBC Fisheries Centre*

**ABSTRACT**

This section reports edited discussions following 32 oral papers presented at the symposium on BTF held at UBC in February 2002. An Annex shows the Symposium programme. Papers from the symposium that covered methodology are published in this report, while symposium papers reporting results will be published in a subsequent CUS-BTF 'results' volume.

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Each oral paper commences with title and presenter followed by edited questions and comments.

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**Introduction to Back-to-the-Future.  
Tony Pitcher and Eny Buchary**

*Cyril Stephens*

You say that the United States has taken things to another level on the north coast area. I am wondering if this team has gotten together with anyone from Alaska. Up in the northern coast, the two countries are always butting heads in the catch area. There can be a scenario where one is drawing too much from the fish population while the other is trying to enhance it. It is important to have the two countries working on same level; otherwise, there will still be depletion.

*Tony Pitcher*

We have tried talking to the Alaskans several times and were halfway to getting a joint project, but it actually has not happened due to several reasons. The work is way beyond the capacity of a few scientists and their graduate students. This has to be a team project because it involves a huge amount of work. Even with the team we have, there was a great struggle to cover everything. Someone is always going to stand up and point out something we did not cover. It could be a social scientist, a fisher or a fisheries scientist.

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Poon, A. and Rizzo, Y. (2004) Rapporteurs' Report on Discussion at the Back-to-the-Future Symposium, UBC, February 2002. Pages 136–155 in Pitcher, T.J. (ed.) Back to the Future: Advances in Methodology for Modelling and Evaluating Past Ecosystems as Future Policy Goals. Fisheries Centre Research Reports 12(1): 158 pp.

The amount of money needed even for the existing project is considerable, so if we were to try to do things jointly with the Alaskans, we would need a lot of money.

*Nigel Haggan*

This work cannot be done on a species-by-species basis. Many are saying they want to take an ecosystem approach, but are still essentially working on single-species methods on both sides of the border. They have not accepted that ecosystem tools have developed to the point where they can be used.

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**Constructing Models of the Past.  
Sheila Heymans and Tony Pitcher**

*Charles Menzies*

Was the number of Beothuk that you quoted for just one area or for the whole of Newfoundland?

*Sheila Heymans*

That was for all of Newfoundland.

*Charles Menzies*

Based on my knowledge of the Hecate Strait/British Columbia area, that number seems very conservative.

*Sheila Heymans*

There are estimates of anything between seven hundred and fifty thousand people. Ms Marshall said that maybe a thousand would be a maximum for the whole of Newfoundland given the environmental conditions. A lot of the diet was salmon and caribou.

*Charles Menzies*

Were the Beothuk a complex hunter-gatherer society, or a simple hunter-gatherer society? I am concerned because that is really a conservative number, especially compared with the west coast.

*Sheila Heymans*

I don't know what kind of society the Beothuk had, but they cannot be compared to BC coast people because conditions are very mild and resources abundant here. If you are in Newfoundland in January you will see that there cannot have been many people there. The snow is up to 2 meters high and there are few sources of food. In winter it is more like arctic tundra for Inuit. There is a paper on how I constructed the numbers for the model that is available in draft form.

*Tony Pitcher*

There is also a paper which has shown, using

stable isotope analysis, that the diet of First Nations in Newfoundland was largely marine, mostly seals – with a lot more seals than you have used in this model.

*Sheila Heymans*

Yes, but the paper referred to an Inuit population three thousand years ago, when there were more Inuit and they mostly ate seals, while the Beothuk were more recent colonists and were not so bound to seals!

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### ***Coasts Under Stress: Knowledge of the past as the basis for future policy.***

**Rosemary Ommer**

*Kevern Cochrane*

You said that going 'Back to the Future' is an ideal and clearly it is. The reality of what you are talking about must involve trade-offs and costs as well as the underlying benefits. Those costs will have to be sacrificing things that people take for granted today. In the developed world of the 20<sup>th</sup> and 21<sup>st</sup> century, we pursue economic growth and wealth. Canada is a perfect example: cars, television, DVDs, and very high standards of education. All of that is coming from wealth creation and we are likely going to lose some if we move towards sustainability. Has anybody done or are you thinking of doing an investigation into what the costs of moving into sustainable development would be assuming the current technology?

*Rosemary Ommer*

Yes, but not in the input-output model you are thinking of. Rashid Sumaila has done a lot on it. We have codes and we also have principles. If tradeoffs have to be made they should be agreed upon and not imposed. People will make tradeoffs for something they believe in, but they will resent tradeoffs that are imposed on them. I recently talked to a twenty year old man in Newfoundland who did not wish to move to the mainland or to Toronto. This was when it was the policy to move people to the mainland. When I asked why he wanted to stay, he said, "I just want to live and work in Newfoundland, I don't need to fish, I am perfectly happy to do other work but I want to stay in Newfoundland". He was thinking of taking up ecotourism. We tend to have a picture of tradeoffs as something that will decimate us. We need to think of tradeoffs as something that takes us forward, something crucial for our economic well being. But for this we need the hard figures and I believe those are possible to get.

*Charles Menzies*

You put a lot of emphasis on looking to local communities for knowledge on sustainability. What about those communities that are a product of a resource extraction industry? How would you include this type of community in some form of stewardship of the resource? Do you trust that they have the wisdom to do that?

*Rosemary Ommer*

We have single-industry towns in Newfoundland as well. Communities will tell us whether they want to stay or move on. A community that does not have much history invested in the area might just wish to move on. I will put stress on local communities. The problem with policy making is that we don't listen seriously enough. Even single resource communities are resourceful. If we inject education in these communities, we are assisting them to make choices. First you ask communities what they want, and only then discuss whether or not it is possible.

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### ***Seaweed and the Past.***

**Nancy Turner**

*Nigel Haggan*

One of the things we need to come to terms with in this project is how we can use this fine-scale knowledge to improve our understanding of the entire ecosystem. There are other First Nations communities out there with huge amounts of fine-scale information and, if we had the time and funds, we would like to spend time with all of them. However, the work we are doing is large-scale.

*Nancy Turner*

I think of the wave again. This is a wave that can be used to get a focus on the type of scale that you are looking for. I will have to think a lot more about this to give you an answer.

*Nigel Haggan*

It is a real challenge. The *Sea Around Us* project has made a big splash with modeling results for the North Atlantic ecosystem and an analysis of Chinese fisheries. On the one hand we are working at an enormous scale, and on the other we have some extremely detailed information. Maybe what we need is a sub-set in the *Coasts Under Stress* project to deal with this.

*Tony Pitcher*

Simply speaking, we can include the estimate of seaweed harvest into our Hecate Strait model - we have not done that yet.

*Rosemary Ommer*

Barbara Neis is working with specific local ecological knowledge on the coast on exactly this problem. She is working with various villages up and down the coast and looking at mapping and building structures. Local knowledge must be made general in order to be able to share it in a usable way. At the end of the day we are working with a multiplicity of structures. I hope that, along with the techniques that will allow us to move with the local communities, we shall be able to have systems that protect the local communities.

*Nigel Haggan*

Our modelling is cumulative. We cannot simulate one seaweed patch, but we could aggregate the 'patches' for seaweed and other species and factor them into the simulation. Similarly our modelling is not able to detect the impact of one salmon farm, but it could determine the impact of a large number of salmon farms.

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**Why we have to open the Lost Valley.  
Tony Pitcher**

*No questions asked.*

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**How can we value the restoration of the past.  
Rashid Sumaila**

*Tony Pitcher*

Your algorithm implies that discounting of future benefits would depend on the level of harvesting. Therefore, with the very high present-day catch, discounting in the future would have very little difference from the normal method. If there is low catch, then there will be a huge difference. However, it does not sidestep the problem of what is the optimal approach and that would be thrown back at the biologists.

*Rashid Sumaila*

A model has to be bio-economic. The benefits are driven partly by the biology while the economics drive the prices. The cost part is a combination of biology and economy, which tells you what to do in terms of what to restore. The level of the present-day catch will affect the future scenario.

*Nigel Haggan*

There is a policy issue as to who should re-invest into natural capital. If the fishery is owned by big industry, their best return may well be to fish it out and re-invest the proceeds in other sectors that will make more profit for their shareholders.

If ownership is vested in stable communities, then there is a long-term perspective and sustainability is more secure.

*Rashid Sumaila*

And when the responsibility is invested in the country, then taxpayers will pressure the government to sustain the resources.

*Kevern Cochrane*

When you gave the reasons for a discount rate, you did not include uncertainty about the future. I think uncertainty is one strong additional drive to the discount rate for fisheries. If I were a fisherman I would set aside money, not fish, for my grandchildren because of the uncertainty of the resources in the future. How can I minimize that uncertainty?

*Rashid Sumaila*

The uncertainty is built in the discounting model – the impatience of the people reflects uncertainty.

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**Making sense of Ethnographic research for resource managers and fisheries, or why a fisherman takes three hours to answer a simple question.  
Charles R Menzies**

*Nigel Haggan*

Long term relationships between researchers and communities are useful, but there are obvious constraints with time and money. We want to involve these communities in a long-term exploration of possible policies and outcomes, and not just do a one-time interview. We accept the criticisms you made; however, I have to note that our survey was designed by a well-known social scientist.

*Tony Pitcher*

I agree with most of what you say. I have a Argentinian colleague who once walked along the beach with Einstein. That one meeting drove this person's whole career. I guess a one-night stand is OK if it is influential.

*Duncan Stacey*

I would like to add two more points to reinforce your arguments. I have been studying fishermen for twenty years and I was told knowledge is learned, wisdom is earned. If you don't ask the right question you don't get the right answer. Fishermen are expert players in Bull\*\*\*\* poker – they will run you around without telling you the truth, although in many cases they believe in what they are saying.

## **Principles of environmental archaeology. Quentin Mackie and Trevor Orchard**

*Sheila Heymans*

Quantitative as well qualitative information is necessary because we need to know how much of one species people would have eaten at that stage.

*Quentin Mackie*

If your concern is to get a picture of what people were eating, then yes I agree. I recall seeing the rising number of sea otters in your restoration model. Well, we find sea otters wherever we dig, but quantitatively it is hard to turn those bones into numbers – our normal focus is to infer from what is in the middens to what goes into people's mouths.

*Tony Pitcher*

One of the things we really need to know is the relative abundance. I know that archaeologists have statistical methods to turn midden data into numbers of fish, birds or otters. That would be very helpful.

*Quentin Mackie*

The bones are accumulating because of a cultural process. Relative species numbers can be biased. So if people just happen to love herring, than you get a lot of herring at the site and no rockfish. It is hard to get around that. If you have some indicator species that sets the general structure of the food web, maybe you can go around the back door. The cultural filter is hard to get around. Normally that is what we are trying to find out, but in this case it is an obstacle.

*Tony Pitcher*

What sort of uncertainties are there in the statistics that change the number of bones into number of fish?

*Quentin Mackie*

The problem is not the counting. It is adding them up in some way that is meaningful. If you assume that one bone represents one fish, your estimate is likely to be biased towards animals with a lot of body parts or with body parts that are identifiable. For example, it will take you a lifetime to discriminate between different rockfish while salmon identification always boosts their number. So you look for unique body parts. You ask what is the minimum number of individuals that will produce such a number of body parts. That is extremely conservative. I could talk forever about the problems!

## **Filling in the Blanks: the oral history of Haida Gwaii Herring. Russ Jones**

*Cristina Soto*

I am really curious about the spatial distribution of spawning. You quoted someone saying they have come back. It may be a fascinating study to get more information on the possible locations of spawning and where the fishery occurred. Women have been involved with spawning on kelp.

*Russ Jones*

There is a spawn sites database at the DFO that goes back to the thirties. There is also a catch database to make comparisons. I did try to interview some women, but the couple I approached declined and there was a shortage of time so I did not pursue it. They were involved in preparing and selling it. It would be quite hard with oral history to show that because it does not cover abundance.

*Cyril Stephens*

When you compare the early days in the 1940s to now, you know and herring fishermen know that when it is noisy, herring die. As the population and technology grew in Skidegate Inlet, there was more traffic and it may have become too noisy for the herring and so they had to move. That is why the population dropped down so much – because of the technology and population growth.

*Russ Jones*

Overfishing was also a big factor – there was no spawning for over three years. The thing is that the stock did come back after that. There is a lot of traditional knowledge about how herring move from one place to another.

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## **Case studies in environmental archaeology Gwaii Haanas and the Aleutian Islands. Trevor Orchard and Quentin Mackie**

*Tony Pitcher*

The evidence you provided for otters being the keystone species is really neat. We need to check if our model reflects the reality of that switch in keystone species.

*Nigel Haggan*

Do you have evidence about where those bluefin tuna remains come from?

*Quentin Mackie*

They are all over the coast from Washington State and even on Haida Gwaii.

*Tony Pitcher*

They would be in Hecate Strait too?

*Quentin Mackie*

There are a couple of papers written on this. Richard Ingles spoke to the Mowachaht people who knew a lot about it. These people remember a lot of detail: when the water conditions were right, the bluefin tuna would chase their prey along the coast and the Mowachaht followed them by following their phosphorescence. This is not a fluke. It was a rare event but it happened enough times for people to know and remember. There are about seventeen archaeological sites that refer to this.

*Sheila Heymans*

The length-frequency calculations that you did were also very interesting. Some parameters in the models (e.g., Q/B) require knowing the maximum possible length of the fish. The longest fish you referred to is 30% longer than the 'official figures' that we use [*from databases like Fishbase, Ed.*], and that will make a big difference.

*Quentin Mackie.*

Trevor Orchard has developed regression formulae for those seven species. All you have to do is plug in the numbers. He found that one formula covers all rockfish. That is interesting because there are lots of rockfish in every coastal archaeological site.

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**The Northern BC historical  
and interview database for BTF.  
Aftab Erfan**

*Peter Johnson*

Can you link your data to a GIS program?

*Aftab Erfan*

I don't know if there is enough spatial data in the database for a link to a GIS.

*Tony Pitcher*

We are hoping to make it available on the web as part of the project. We are not trying to link it to GIS at the moment, but we are trying to link these comments to a map of the ecosystem. That is something that will take even more programming.

*Nigel Haggan*

If we get it on the web, we can also ask people to send information that will subsequently be validated. Aftab did a tremendous job last summer on one set of interviews, we need to find a way for people to provide more information.

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**Ecosystem Models of past and present:  
Northern BC.  
Cameron Ainsworth**

*Russ Jones*

I wondered if you looked at reduction fishery catches. There was a lot of herring removed in relatively few years. There were few reduction fisheries in Haida Gwaii before the 1950s. It will give you a lower limit to compare.

*Cameron Ainsworth*

Do you think that 1950 is too low because of the impact of the reduction fisheries?

*Russ Jones*

Yes. There were a few years where sixty thousand tonnes were removed from just one location. Now the estimate is just 20 thousand for the whole area. Reduction fisheries kept going on for a considerable time and that must have reduced the biomass by a lot.

*Cameron Ainsworth*

The model is an average of 1950 to 1955 and it covers the whole of the study area.

*Stephanie Henri*

The same thing applies to the eulachon. There is a major crisis with these fish. There have been no eulachon for the last four years. Four years ago we had one run and seven years before that no run at all. I would like some more information on the eulachon.

*Tony Pitcher*

Eulachon is a very hard group to build in a model because they come in to spawn and the rest of the year they are in the ocean. The relative numbers are very uncertain and it is hard to get the biomass. Generally we let the mass-balance part of the model estimate eulachon biomass, but there is a lot of uncertainty in the estimate.

*Nigel Haggan*

Getting DFO and other agencies to buy into it should allow us to get the information that we need for the eulachon. At the moment, that is as good as it gets.

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**Ecosystem models of past and present:  
Newfoundland.  
Sheila Heymans**

*Kim Wright*

I am curious about the overhead you mentioned. How is it calculated?



*Sheila Heymans*

It is calculated from the sensitivity index formula per group. It comes from the work of Bob Ulanowicz and it tries to calculate the system's stability and maturity.

*James Wilson*

What does the fluctuation on the oscillation slide indicate?

*Sheila Heymans*

Every line is one functional group in the ecosystem model. The graph shows how these groups interact with primary production that has been forced by the North Atlantic oscillation Index. Some things will not be as influenced by primary production as others. I am assuming that the lines are affected by the oscillation.

*Tony Pitcher*

Yes, each biomass is relative to what it was in the beginning so fluctuations indicate a change.

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**Ecosystem models of past and present:  
Hong Kong.  
Eny Buchary and William Cheung**

*Mary Gasalla*

Did you say that conservation groups have closer relationships with fishermen?

*William Cheung*

We still lack communication between fishermen and conservation groups. This is an area that we still have to work on. We do lobbying, but do not always get the support of the fishermen. This is a crucial point and we want to build that as a major component into the future phase of Back to the Future in Hong Kong.

*Nigel Haggan*

This is largely based on William's M.Sc. work. He is currently working for the World Wide Fund in Hong Kong.

*Tony Pitcher*

At the moment you have a model of present day Hong Kong and of 1950, but for a full Back to the Future evaluation you should have more past models. What are your plans to get further with that?

*Eny Buchary*

In terms of archaeological information, Elizabeth Johnson at the UBC Museum of Anthropology did lots of archaeological work in Hong Kong.

*William Cheung*

I contacted historians in Hong Kong in the last

few months and they said they have some information on marine ecosystems for the past that will further develop our research. I do not know how much information they have, but that is an option we can explore. When we hold workshops with the community in Hong Kong, we can invite these academics.

*Tony Pitcher*

When the English arrived in Hong Kong in the 1800s, there were only very small coastal fishing communities. These communities would have very different fisheries than those that existed in 1950.

*William Cheung*

The historian I talked to studies the history of marine science, and she found colonial records in England mentioning fisheries in the early 1900s.

*Cyril Stephens*

Before the war you had large fish on the rise. After the war, larger fish were depleted. You are seeing that as being overfished. Now you have a rise of smaller fish. How do you balance a fishery so you do not overfish the small fish so there will still be food for large fish?

*Nigel Haggan*

That is where Marine Protected Areas come in. They protect the breeding population. However, fishers tend to congregate on the borders of the Marine Protected Areas and do quite well.

*Eny Buchary*

There are two Fishing Protected Areas (equivalent to Marine Protected Areas) planned for Hong Kong. They have not been established yet because they are still waiting for the fisheries ordinance to be amended. However, they have established a pilot site where some artificial reefs were deployed. In this pilot site, scientists have also been monitoring fish attraction to the reefs and fish larvae dispersal. The progress of the program is encouraging because reef fishes are starting to be established, though the reefs are not large yet because they were started only 1 or 2 years ago. The latest news is that they are planning to introduce fry of two local species from local mariculture operations, *Lutjanus malabaricus* and *Epinephelus coiodes* into the pilot site to start rebuilding reef fish. They are planning to release the fry this October.

*Nigel Haggan*

If you want to see the future just look at the South China Sea where there are only small fish and invertebrates. Fishers are still making lots of money catching small fish to sell as feed for

chickens and aquaculture operations. That is where we are going.

*Eny Buchary*

Hong Kong is one of the best places to eat seafood, but the large fish that can be found in the restaurants are not from Hong Kong. There are no more large fish in the South China Sea, so those very expensive live fish that businessmen purchase for their banquets are from Indonesia or the Philippines and are fished using poison or cyanide because it is very difficult to catch these large fish using nets.

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**Quantifying qualitative information in a past ecosystem model of Hong Kong.**

**William Cheung**

*Robyn Forrest*

Eny mentioned in her talk that prawns make a very valuable fishery. Are your estimates of prawn biomass driven by increase of catches due to increase of value?

*William Cheung*

Because of fishing down the food web and the increasing value of prawns in Hong Kong, lots of fishermen have changed from small-scale fisheries to prawn fisheries; so yes, there is a bias toward catching more prawns now.

*Robyn Forrest*

Can that be driven by the value of prawns rather than the structure of the ecosystem?

*William Cheung*

Yes, that is one of the biases from my interviews, but it can be negated with cross-references.

*Nigel Haggan*

The prawn fishermen and the trawlers will be the ones who will object most to our proposed changes. Also, there is a big prawn fishery in the East Coast of Canada, mainly because there are no more cod to eat them.

*James Wilson*

There is also a lucrative prawn fishery in Greenland, but there is still a lot of cod there.

*Kim Wright*

I was impressed with the detail you went into with your interviews with the fishermen and how you went into the communities. Did you find it productive?

*William Cheung*

Yes, it was very productive. I had no experience with this, so I had to explore alternative ways to

get into contact with the fishermen. I found that going to fish ports and visiting boats was a very good way to get information. Also, if there were an arrangement with a fisher organisation, it helped because the organisation would select fishermen that were enthusiastic. The interviews take lots of time because they are semi-structured. We spent a lot of time talking to get small pieces of information.

*Cyril Stephens*

What is the size of the areas you went to? How far did you have to travel to do your interviews?

*William Cheung*

I did not have to do much travelling because Hong Kong is very small. It only takes half an hour by public transportation from one end to the other. I did make a point to go to both sides of the water because there are very different fisheries on either side. Fisheries on the West Coast near the Pearl River estuary are seasonal, whereas fisheries on the more oceanic East Coast concentrate on reef fishing.

*Nigel Haggan*

It would cost around \$50 to visit all the fishing communities in Hong Kong. By comparison, it would cost around \$5000 for one person to make one visit to all the Hecate Strait communities.

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**Back to the Future: Driving Models with Information About Past Climate.**

**Tony Pitcher and Robyn Forrest**

*Nigel Haggan*

Can our climate data throw any light on the flip-flop with herring as opposed to sardines and anchovies which prefer warmer water?

*Tony Pitcher*

NO, although the flip could be forced in the model. At the moment, the model is not very good at dealing with populations when they get very low. This afternoon I will talk about local extinctions and offer suggestions on how to deal with local effects. Sheila talked about walrus yesterday. Because they are included in the model, their number can explode in time-series simulations.

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**Micro-level Historical Reconstruction of Newfoundland and Labrador Fisheries between 1891 – 2000: Findings and Issues.**  
**Kara Rogers, Jeff Webb and Barb Neis**

*James Wilson*

Did you try to get any sales or purchase lists?

*Kara Rogers*

I contacted the Department of Fisheries and Oceans, but I have been waiting for a month. We are asking for a lot of information, including gear type, species, and communities. There is information for Rocky Bay and Trout River, but we are just waiting for the information to be compiled.

*James Wilson*

For the historical information, looking back to the turn of the century, what about people who were buying fish that was landed? I assume most of the landed fish were exported to other regions and not consumed locally.

*Kara Rogers*

There were some merchant ships around that time, but most of that data is not available. The Newfoundland government took the data from these ships and compiled it in export data. The merchants used to just sail up the coast and collect fish, but those companies no longer exist; they were perhaps only in operation for 10 years or so. We can see if there were more of one species exported than another species, but it cannot be done on a micro level.

*Nigel Haggan*

I would like to suggest that either or both of you work with the modellers to make a paper for the report rather than ending up with 3 separate ones.

*Tony Pitcher*

This would be really powerful. Our ambition was to start at the 1900s and inch forward, tuning the model with the data that we have, and that could be helped immensely by your study. It can be used to tune the whole run of the ecosystem.

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### **From Local Knowledge to Science and Back.**

**Erin Alcock**

*Nigel Haggan*

This is quite exciting for me. This project is still in its infancy. At a typical conference, we usually only get a lot of papers. What you are seeing in this workshop are models and tools that can integrate multiple sources of information. Instead of just a report coming out of this, we will have people working on issues of scale and time. A model is a living thing that continues to grow.

*Sheila Heymans*

You said that you are only looking at area S3K1. Why are you limiting it to that area? It will not be comparable to other models at that scale.

*Erin Alcock*

There is no reason for me not to scale up to the same size as what you have been doing. I probably will scale up and do a model of the 1970s. The idea was to see how much I could use local ecological knowledge.

*Tony Pitcher*

I would encourage getting Barb and David to do the same. Your one or two time periods will be just right, and it would be great to just be able to slot your models into the last 100 years. That way, we will hit your snapshots as fixed anchor points. We are beginning to bridge a gap between the different philosophies in natural and social sciences. Usually the natural and social scientists stay in their respective caves. It is something we have to try to overcome. As natural scientists, we try to generalize. We make a model. The whole point of science is to generalize things that will apply everywhere with some uncertainties; whereas in social science, the tradition, especially in anthropology, is that you can only study this knowledge at this place and at this time – this knowledge has deep meaning, but you cannot use it to generalize. Those two ends of that polarity are really incompatible. What we have to do in *Back to the Future* is to bridge that gap. As scientists we have to say, "How do we take this information that is rooted in a specific place and make it apply to a general situation?" Your group is trying to piece together things to get a larger picture. We will want to push you more towards this. E.O. Wilson has written a book called *Consilience* that talks about the melding in social and natural sciences, especially in medicine, nowadays.

*Erin Alcock*

That is a very interesting point. Natural scientists are taught that the scientific method is to get a hypothesis that can be tested everywhere. I am taking a course in social sciences now and their methods are so foreign to me. It is a good thing to know that there are other ways of doing things other than using science.

*Nigel Haggan*

Agreed. In British Columbia, we have a treaty process and a history of First Nations resources being exploited. The First Nations have a healthy and well-founded mistrust of science and management.

*Tony Pitcher*

The next phase of *Coasts Under Stress* is to get to the spatial modelling part.

*Stephanie Henri*

That comfort level is hard to find. Working with different organizations, we tend to protect our knowledge of fishing grounds because we think of it as ours for traditional use. Some elders do not want to give up information on fishing hot spots. How did you handle that confidentiality? We have paid the price for speaking of them before, so we have the problem of sharing any more information. We hold tight to our maps.

*Nigel Haggan*

The counterpoint to that is that if we cannot find a way to harness our collective knowledge to understand the decline of salmon and eulachon, we will be in more trouble. The question is how do you protect the information at the same time as you work together with the information to protect the resources that are desperately in need of protection? Back to the Future seeks to involve all 'communities' in setting reconstruction goals for resources we all care deeply about.

*Cyril Stephens*

I come from the Nass River where we harvest eulachon. The reason why there is not too much information on it is that when information is given out, there is a chance that it might become commercialized. Once it is commercialized, the dollar sign kicks in and the depletion starts, like what happened for cod. Not sharing the information is one of the hidden protections we have. That is the reason why the First Nations do not want to give up information on where the hot spots are.

*Erin Alcock*

How to use that knowledge is a tough decision to take.

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**Copper River Subsistence Evaluation 2000 and Traditional Knowledge Project.**  
**Bill Simeone**

*Nikki Shaw*

It was nice to hear your presentation of such a heartfelt nature. We have had trouble with our fisheries and we have been trying for a long time to be heard. I want to acknowledge that we are on Musqueam territory. It is because of them that we are here now, when Mr Sparrow took our cases to court. I do not think this particular group in this meeting necessarily understands how long we have had to fight. Every presentation I have heard

in this workshop began with the assumption that it is due to fisheries management that the fish have declined. I do not know if other factors like logging were taken into consideration in the models. I am glad Alaskans now forbid logging in the watersheds. I am also glad to hear that the Alaskans have such a unique management system where those who protect the resources are those who benefit from it. You are ahead of us on those things. I do not know where such a system came from. Was it from First Nations, or was it just wisdom on the part of the managers?

*Bill Simeone*

It is not from First Nations influence. Most of Alaska is federal land. In 1980, the federal government said that if the state of Alaska wants to manage the game and resources on federal land the State has to give rural priority. That is, if resources decline, then rural people get first shot at the resources. The state did not agree, so the federal government took it over with the notion that the First Nations get first crack if resources go down. There is a regional advisory council, consisting mainly of First Nations people, which makes decisions about the fish in the region. The decisions then go to the federal board, which consists of people from managing agencies, which usually follow the advice given. It is not perfect; Alaska has a lot of people who do not want the First Nations put as a priority. They believe that everyone should have equal access. Local information might finally make its way into management regimes. We are just lucky that it is being done before the fisheries in Copper River collapse.

*Erin Alcock*

The study of different worldviews, how you look at legends and how they are received, is very important. When scientists sit down with locals, it is easy to only use what traditional knowledge will fit into scientific models, but there are a lot of different worldviews out there which have nothing to do with science. I think local ecological knowledge is just as valid and true as other worldviews.

*Bill Simeone*

It goes back to what we were discussing about generalizations. I see myself as a cultural broker. Scientists and First Nations do not talk to each other. They either ignore each other or they shout at each other. I am trying to get into the middle and put the information in a systematic framework. I present to the scientists a legend entirely in the Ahnat language, and explain that this is where the Ahnat people's ideas come from, and see if it can be stuck into the management

scenario. This is self-management and this is where their ideas come from. The legend might be mythological, but a lot of the underlying themes make perfect sense, like taking care of the environment and the salmon. I am reinterpreting the legends but I do not want to be the speaker for them.

*Nigel Haggan*

Ecosystems are really useful as an integrative metaphor. Listening to my First Nations friends talk about the ecosystem as a whole including human, spiritual, biological and other elements which all have value and weighting, I am struck by the thought that this viewpoint is not dissimilar to the ecosystem justice that Rosemary Ommer talked about yesterday. What we are trying to do with this process is to develop a collective concept of the ecosystem. In this the First Nations have a great deal to teach us. What we are doing is mapping some of those connections the aboriginal people have understood on an intuitive level and which are difficult for the rest of us. The intention is there. We are trying to put the pieces back together to get a unified context.

*Bill Simeone*

To affect policy, you have to turn this into something that will be listened to. Policy makers will nicely listen to Ahnat elders and maybe change policy accordingly, but what gets to them is numbers to back it up. They have to be fair. The Ahnat elders have a cosmology that is valuable, but the sports fishers have a cosmology too. The policy makers need something that they can later comfortably justify.

*Tony Pitcher*

In terms of Back to the Future, if you can recapture what it was like in the 1860s, then you will have a policy objective. The much-hyped Copper River has actually lost species. It is important to look at that past with the local custodians of the river. You may then have a policy objective in quantitative terms, put forward with the consent of the peoples. I hope this project will open that dialogue. That is the objective.

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**The Community Workshop:  
How we did it, and what we learnt.  
Melanie Power**

*Cyril Stephens*

I think the phrase 'team's choice' was a problem because the community consists mostly of gill-netters. When that fishery was left off the poster,

the people of the community heard about it, so they figured Nigel was going to close down the community. That is why they nearly took his head off.

*Melanie Power*

I should point out that in the photos I presented, the boats shown were all gill-netters. With the word 'choice', it sounded like we were coming in with preconceived notions of what fishery should exist in the community.

*Karin Mathias*

The word 'choice' perpetuated the distrust that the locals have of the scientific community in general, even with universities. They step back and do not want to talk; and the choice of words just aggravated them.

*Melanie Power*

In July, we talked to someone who was skittish about talking with us. We assured them that we were just academics from the university and not with the Department of Fisheries and Oceans, but they said "You may not be from the Department of Fisheries and Oceans now, but you will be someday." It is important to remember that the things that are theoretical to us are real to the fishers. These things make up their lives. It is important to keep grounded and consider how the things we are doing in front of our computers are going to impact them, especially if this project is intending to have policy influence.

*Cyril Stephens*

That is their livelihood. For about a decade, the community of Prince Rupert has had mismanagement from the Department of Fisheries and Oceans on the fishing cycle, where a fisher has a season of 10 days. Then along come Nigel Haggan and his team, and the fishers wonder when this is going to stop, because of the way they have been treated. I strongly believe that this is a good project. The only obstacles to it getting off the ground are budget and its new ideas. When a project is new, you have to continuously sell it to people. When people see that it is a good project and once you have sold it, it will really get off the ground. This is the second workshop I have attended and I feel comfortable with this project because we do need it given the way fisheries have been managed until now.

*Nigel Haggan*

Even though our livelihoods aren't on the line, a lot of us 'academics' here have a lifetime commitment to fisheries and care deeply about what is happening to oceans. That is what pushed some of us into science to try and understand

what is happening.

*Stephanie Henri*

You only referred to what is happening from the north of Haida Gwaii to the north of Vancouver Island. Is the central coast built into your model? You have to concentrate on localization, especially where there are species at risk like the sockeye.

*Nigel Haggan*

I have been trying to get a central coast project for 4 or 5 years. I have invited many people from the central coast to this workshop, but you are the only ones who made it. I know the Department of Fisheries and Oceans has resources in the central coast, but our project only just touches on the central coast. We need a focused central coast project.

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**The Community Interviews: How we did them and what we learned from the LEK results.**

**Cameron Ainsworth**

*James Wilson*

With your interviews, how did you weigh the ones regarding information from the 1950s? I have problems remembering what I did two years ago. How did you deal with that?

*Cameron Ainsworth*

That is a problem. An additional problem is that the further back you get, the less people are available to ask. There were maybe 30 people out of the 38 we interviewed fishing in 1970, and only 2 of them were fishing before 1950. As for them misremembering, we have to take their word on whatever they tell us. It is either our guess or their guess, and I was not even born in 1950. This is especially important for non-commercial species which the Department of Fisheries and Oceans does not keep records of.

*Kara Rogers*

In my own studies, I found that half the fishermen I interviewed could not even remember their children's birth dates. They do not remember by year, but they seem to remember what happened and what they caught when they associate it with the boat they were using at the time. It might help you if you try to ask them about the species they remember by boat. You might not get year-by-year information, but you could get information by 5-6 year intervals.

*Sheila Heymans*

If we could redo the interviews, we should ask what year they changed boats and what it was like

during that time. That will likely work better.

*Cyril Stephens*

In comparing the graphs for 1950 to the ones for the present day, you have to remember that in the 1950s, they only had 10-14 foot boats with 20-foot gill netters that used linen nets. In the present day they have bow pickers that can cover an area from Prince Rupert to Port Hardy in 4 hours and catch a tide. Through modern technology, they can find a big run and go get it. How will your graphs correlate that? Take, for example, a community like the Heiltsuk Nation. If they owned a 10-14 foot boat in the 1950s, they hung around a certain area that is their catchment area. Nowadays, people can cover a lot of miles getting to fish. How will that affect the graph when you put it together?

*Cameron Ainsworth*

We did not ask for information by year, but rather by period. The question we asked of the fishers was whether the species increased or decreased during their career. If everyone said that one species increased, chances are it did. If half says it increased and half says it decreased, then maybe it stayed around the same level.

*William Cheung*

To address the issue of how to deal with people's memories of non-recent periods, you can ask fishermen about the big events in their lives. For example, you can ask them about the largest fish they saw in their lifetime and when it was, which reminds them of the time period when they caught the fish. Then you can ask about the situation in that time period, rather than just asking about the situation in the 1950s. There were also discrepancies in the correlation between interviews and government statistics. In your interviews, did you ask why they think there is an increasing or decreasing trend? That might give you a clue as to the reasons behind the discrepancy.

*Cameron Ainsworth*

We did not ask specifically for reasons. Sometimes the fishermen offer reasons, but the graphs just offer values of 1, 0, or -1. If everyone agrees that the abundance of a species went down, we can assume it went down.

*Peter Johnson*

Fishing in the 70s is different than fishing now. In the 70s, fishers could pull fish into their boat. This year, we have to dip net the fish into a holding box, sort them, and keep certain species alive. The procedure has changed so much.

*Kim Wright*

In terms of correlation between your data and data from the Department of Fisheries and Oceans, your interviews probably took place at a smaller scale, which might contribute to discrepancies. The Department of Fisheries and Oceans take data on a coastal level, whereas your interviews were at a local level. How do you correlate that?

*Cameron Ainsworth*

The more people we talk to, the better idea we get. We are just looking for relative abundance, not absolute abundance. We are not looking at hot spots.

*Kim Wright*

When you have a conference and invite people to come, the people who attend may be people who are worried about the stocks, so their tendency may be to report a decline. That would bias your interview data. You will get less bias if you go to a community.

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**What are the recreational catches from Northern BC?  
Robyn Forrest**

*Tony Pitcher*

I did not realise the anomaly between the two estimation methods [mailout/phone survey and creel census] was that big. They are done by two different DFO labs it seems.

*Nigel Haggan*

Is the catch really 14,000 tonnes of salmon? That is an awful lot of fish to catch by angling.

*Tony Pitcher*

That is about a quarter of the total catch. It is not insignificant, at any rate.

*Robyn Forrest*

That figure is based on my estimate of the average weight of fish. It might be less if I change the conversion factor.

*Cameron Ainsworth*

Did you find any information on discards? People in Prince Rupert were saying that the sports fishers may catch 20 fish for 1 that they keep.

*Robyn Forrest*

The catch and release figures were 43%.

*Cameron Ainsworth*

The sport fishery discards have nothing to do with catch and release - they get one fish, and if they find a bigger fish they throw the first one out.

People were saying that it was significant enough.

*Cyril Stephens*

I am not quite sure if the numbers are right because in commercial fishing, they have counters that keep records of what is coming in. In sports fishing, there are no records at all. If I go down to Wesbrook, I do not see the Department of Fisheries and Oceans come in at 9:30 pm when sports fishers are returning to dock because the people from the Department of Fisheries and Oceans are done for the day. They only take in the information that comes in during the day. I do not think doing a survey like this will show numbers as they really are. The thing with sports fishing is that the cost to run it is so low compared to commercial fishing. The money is changing the rules for commercial fishing to favour sports fishing. There are no statistics or quota for sports fishing. We do not know the number of fish that die and are thrown away.

*Robyn Forrest*

Yes, it really is a very political issue. All I can say at the moment is that with the resources we have, we have to use the best available estimates, which are better than what we had before. It seems that the Department of Fisheries and Ocean are putting in more effort now into keeping track of recreational catches. They have realised that sports fishing is a big issue. I am hoping that we will have improved estimates in the future.

*Karin Mathias*

In your estimates, you adjusted the number of pieces of salmon two times. Do you have results from the mail-out surveys?

*Robyn Forrest*

The mail-out surveys report 2.4 million fish caught, 1.4 million kept.

*Karin Mathias*

Sports fishing is a hot topic now and the allocation issue between the sport and commercial sectors is really controversial. As it has been pointed out, there are a number of serious problems associated with it; for example, they cannot have observers on every boat.

*Tony Pitcher*

One would like to think a mail-out survey with 8000 respondents would get around the problem of fish coming late at night after the people from the Department of Fisheries and Oceans have gone to bed. However, in terms of anglers' memories after the event, there is a classic case from British Columbia lakes where they stock the lake with trout every year. One year they forgot to

stock one lake with trout, so there were absolutely no trout. When they did a survey of anglers on that lake to ask how the fishing was, the anglers said things were OK and much the same as in previous years. So much for anglers' memories.

The Haida Fisheries Program does a census of sports fishers in the water and asks how much they've caught. Where does that information go?

*Robyn Forrest*

It is incorporated in the report.

*Cyril Stephens*

The problem with the Haida program is that the census takers have problems getting to the lodges.

**The South Brazil Bight Revisited:  
"Digging" cruise charts and fisher's  
knowledge toward ecosystem modeling.**  
**Mary Gasalla**

*Tony Pitcher*

How many interviews did you manage to do?

*Mary Gasalla*

81 so far.

*Tony Pitcher*

How did you turn the interviews into a flow chart?

*Mary Gasalla*

In each interview, we had a list of the resources, and we asked the fishermen to put the relationships (i.e. predators and prey lists) to each species of fish.

*Tony Pitcher*

Did the model balance after this?

*Mary Gasalla*

Not yet, but a new complete diet matrix has been generated.

**Integrating migratory species  
into ecosystem models.**  
**Steve Martell and Stephen Watkinson**

*Stephanie Henri*

I like the linking of the models because it is really hard just talking about salmon, when we are concerned about our eagles and grizzly bears as well, since they are disappearing.

*Sheila Heymans*

Would it be possible to have a terrestrial and

marine link between the two and have them run together?

*Steve Martell*

Last summer we built two models in *Ecopath* which are independent and connected them to each other by diet matrix. One fishery went to one ecosystem then the other back and forth.

*Tony Pitcher*

How did you do the linkages between the models?

*Steve Martell*

It depends. We can build three separate models or build one *Ecopath* model. Otherwise, you can hire a programmer and get them to pass out the necessary information at each time step. In this example I showed here, the spawners get changed outside of *Ecopath* due to fishing or spawning, then get passed back in.

*Tony Pitcher*

Then how do you build in delays? For example, the sockeye have a 4-year cycle.

*Steve Martell*

Just use the delay pointers. It is a fairly standard procedure.

**Problems in modelling  
rockfish in Northern BC.**  
**Erin Foulkes**

*Tony Pitcher*

The problem of reconstructing the past in rockfish may not be as bad as you think because it was not heavily exploited. There were some First Nations catches, and offshore they were not really being caught at all. One stock assessment scientist from the United States, who gave a talk at the Fisheries Centre, talked about  $B_0$  for one of the species.  $B_0$  is a stock assessment concept that deals with pristine unfished biomass for that stock. I do not know if that is compatible, but it could be a starting point for an unexploited rockfish model. You will see some inconsistencies that you will have to adjust.

*Nigel Haggan*

Doug Hay mentioned studies for pristine areas in Alaska that can be used for British Columbia because of the similar ecosystem. There is an increasing body of study that says that almost all marine fish do come back to their place of origin, and that has serious implications for management.



*Tony Pitcher*

I also like idea of splitting up the rockfish group in the model. If we can get to a pre-contact model, there is interesting data from Quentin Mackie yesterday where he showed that the diet of the Haida included a vast number of species including rockfish. That means we can use the ancient diet of the Haida in the ancient fishery in the Hecate Strait model.

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**What was the structure of past ecosystems that had many top predators?**  
**Tony Pitcher**

*Nigel Haggan*

If you have a lot of top predators and the amount of forage fish needed to feed them, is primary production not the primary constraint?

*Tony Pitcher*

No, in the bottom of the ecosystem there is a super abundance of those to drive all sorts of things above them. Primary production is not the problem. The problem is the middle layer.

*Richard Stanford*

Do you have evidence of predator diet shifting with prey abundance?

*Tony Pitcher*

That is a good question. We were very worried about that until three weeks ago. Diet ecology suggests that as abundance changes, diets will change. However, there is a paper by Lincoln Garret on Georges Banks that looks back to the 70s and shows that is not a problem. The proportion of diets reflects the abundance in the system, which is what *Ecosim* does.

*Robyn Forrest*

Did the herring boom after the cod collapse result from a fisheries shift to exploit the herring stock?

*Sheila Heymans*

No, the fisheries switched to crab and prawn, and they are still doing well.

*William Cheung*

There are a few papers studying freshwater ecosystems that suggest that increased biodiversity results in increased productivity of the ecosystem, which is a result of increased consumption facilitation and partition. Could this also be the case in the ocean where an increase in biodiversity helps increase production to provide food for the larger amount of predators in the past model?

*Tony Pitcher*

That could occur, but top predators themselves, by having a broader diet, might specialize within the species. There is a neat study on cod in the North Sea in the 70s where the diet of cod was very broad. Within the group, the scientists found certain groups of cod that specialized. Some cod would be able to suck hermit crab out of their shells. It was not revealed if they looked at the diet over the entire population. That diversity of diet could solve our problems.

*Nigel Haggan*

There is a number of species in Hecate Strait that could have been more abundant. There are several smelt species. Sandlance is a total mystery; no one knows anything about their abundance, although everything in the ecosystem eats sandlance.

*Sheila Heymans*

You assume that the percentages in diet were not the same pre-contact – it was broader. That is what I had to assume to balance the pre-contact model. The percentages of what they had to eat might not be the same. That is the easiest and most realistic thing to do to get mass balance. There is no evidence that is not the case. It is not reasonable to assume that the diet stayed exactly the same anyway.

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**The problem of local extinctions.**  
**Tony Pitcher**

*Sheila Heymans*

Steve just reminded me that there is a way to emulate the presence of extinct species. You can have the biomass of  $10^{-6}$  fixed in the model.

*Tony Pitcher*

We could do that and drive the forcing function by temperature. However, when they go into the model, you want them to be full actors.

*Sheila Heymans*

You can just have the biomass fixed at an extremely low amount for the time they were not there.

*Nigel Haggan*

In the case of Hecate Strait, you could go from pilchard to herring and back, according to the temperature.

*Nikki Shaw*

What is difference between local extinction and extirpation? If you have distinct populations of sockeye, they call it extirpation, but in reality it is

extinction because the genetic pool is lost.

*Sheila Heymans*

Does extirpation also imply human involvement?

*Tony Pitcher*

To me, The word 'extirpation' does imply an active process. I prefer to use 'local extinction'.

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### **Do these models tell the truth?**

**Richard Stanford**

*Cameron Ainsworth*

If your spike in plaice population were due to temperature rather than migration, you would expect to see a lag. If there are more of them with increased growth rather than moving in, then you can identify it with temperature and changes in environment. The population would not respond that year. If temperature goes in their favour, it would take a few years before the population spikes.

*Richard Stanford*

I agree with you in principle, but in practice a good year can make a strong year class.

*Cameron Ainsworth*

Yes, but that will not show up until later years, because the bulk of the biomass would consist of the 4-5 year classes rather than the juveniles.

*Richard Stanford*

The problem is that if fishing rate is increased and the stock becomes depleted, then the majority of the biomass will be the younger, smaller fish and the relationship between recruitment and overall biomass will become tighter.

*Eny Buchary*

Speaking of recruitment, did you separate juvenile and adult plaice in your model to see if there is a correlation?

*Sheila Heymans*

That will be helpful. The forcing function should be used on the juveniles, not the adults.

*Tony Pitcher*

It might be useful to drive the model with primary production and look at it again. If you still get a peak, then use your temperature forcing function. The switch between herring and sardines would be driven by temperature.

*Nigel Haggan*

There are always a few data points you are comfortable with. If you do something to force

your line to fit one of them, you would be looking at several more to see if they correlate.

*Richard Stanford*

It is a question of whether that spike is real.

*Nigel Haggan*

Look at the degree of divergence from the points you are confident in when tuning your model.

*Richard Stanford*

I can set forcing functions specifically for plaice.

*Tony Pitcher*

Does that happen to other flatfish?

*Richard Stanford*

The other flatfish were not as important, so they were just grouped together. Therefore, their result is an average.

*James Wilson*

Were you comparing it to things that were happening in the North Sea and the south coast rather than just in the Channel? There is a lot of precise, localized data available. Are you validating your model for the Channel against bordering cases?

*Richard Stanford*

For some stocks, there is a channel stock, but for most of them, they have a bit of the North Sea stock and a bit of the North Atlantic stock in them, so we have a problem with the ICES data. The northeast Atlantic stock is probably increasing. The English Channel is not an ideal ecosystem to choose. It seemed like a good idea at the time!

*Sheila Heymans*

If you are only looking at one species, there are so many indirect effects that you are not taking into account. If you force only one species, you can throw everything else affected by that species out of sync. You might want to look at several species together.

*Eny Buchary*

Or you could look at a keystone species.

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### **Building Consensus on Restoration Goals that are Ecologically Possible and Socially Acceptable.**

**Nigel Haggan**

*Nigel Haggan*

We talked a great deal about goals that are ecologically possible; that is, what a system will

support in terms of climate and stock. However, the objective of Back to the Future as a policy agenda is to first of all establish an audit of what we have as opposed to what we had. Workshop participants chose four different ecosystems as policy goals in the workshop. That is indicative of the difficulty of finding plans that are socially acceptable. Do you have any thoughts on how we can reach a consensus of what we might find acceptable? The unusual thing about it is that what we ended up with is some variance of today's fishing fleet fishing a restored ecosystem, and that defies common sense. We agree that we have to fish it to make it socially and ecologically possible, but to take our current fishing system which is depleting the populations, and apply it to a restored ecosystem, does not make sense.

*Tony Pitcher*

When talking to a coastal community that has gone through so much pain and cutback, trying to look over and above the troubles to focus on a restoration agenda is really hard. What hits you in the face is one aspect or another of the allocation issue, which is huge. It is not our fault that there is an allocation issue, but it is there. That is why we are talking about a future restored ecosystem rather than how to get that, but it is hard for people to think about a future in 20 years when they are worried about today's problems. That is a real problem not just for the local people but for everybody. Immediately they ask how we would get to the restored ecosystem.

*Robyn Forrest*

A fisherman in Prince Rupert said that the problem is not the number of fishers, but the value of the fishery. Is it not better to value the fish and value the resource rather than put them in cans?

*Nigel Haggan*

That is what I thought we were doing when we asked how much of the species is available for harvest, but the valuation technique uses the prices from today's fisheries. Maybe we should not be doing that. How much money do salmon fishers get from Copper River?

*Bill Simeone*

They advertise Copper River salmon, so they have a high valuation for early fish. As fishers go further west, the prices drop because people are not interested in Bristol Bay sockeye; they want Copper River sockeye.

*Nigel Haggan*

So it is a marketing thing. It is a stunt that people did so that people in New York do not want

anything else. We should also talk about the price for live fish, such as rockfish, rather than dead fish.

*Cyril Stephens*

It is not that the species itself does not turn red or looks nicer to cost more; the fish is always the same. It is what people put the price on. Everything goes hand in hand with it.

*Bill Simeone*

The other thing they have done is to create a limited resource. The Chinook and early sockeye are prime fish. The market opens from the 15<sup>th</sup> of May to the 15<sup>th</sup> of June, and then the price for salmon goes down. That is what they do with the wine market as well. It is not that the wine is better if there are only a limited number of bottles for a particular year. They fool people into thinking that this fish at this particular point in time tastes better than anything else.

*Nigel Haggan*

That is a marketing thing. I have noticed a great lack of creativity on the part of British Columbian fisheries. There are so many things to do with salmon other than just canning them or vacuum packing them in plastic wrap.

*James Wilson*

You are talking about niche markets. By definition, they are small markets, so you are talking about fetching a high price for a small portion of your catch. You have to be aware of the global market and the effect of aquaculture on fisheries in British Columbia.

On the wider issue of building restoration goals, it is difficult for anyone thinking of what they want realistically 10 years down the line, not to come up with an idealized version. How do you overcome that to make things doable?

*Tony Pitcher*

You need to have a policy goal and something to aim towards even if you never actually get there.

*Bill Simeone*

They are narrowing the number of fishers in Alaska by buying out licenses. Not everyone gets a high price for sockeye. They have to treat it correctly, get it to the beach, and then to the helicopter. If it spoils on the way to its destination, they do not get any money for it. Only a few people are getting the big money. One way to deal with that is to have Alaska buy up non-resident permits and getting rid of the people who are not getting the big money out of it.

*Nigel Haggan*

I was involved with the Stikine River fishery when people started putting fish directly onto totes with slush ice and running them downriver to Wrangell in Alaska. You have to work at it to have the salmon of high quality, but you can get a higher price for it. You do not have to can it all. I think you can create a demand. I think farmed salmon is going the way chicken went. It used to be that chicken was saved for special occasions, but now it is just junk food. There has to be a way to create a high-end market for wild salmon. Alaska has pulled a stunt by getting sustainable certification for their salmon fisheries from the Marine Stewardship Council. People are creating a demand for seafood from sustainable fisheries. If a salmon is ecologically certified and linked to the restoration efforts of the Oweekeno Nation, they will have a product identity and fetch a lot of money.

*William Cheung*

There is a new certification process with the World Wide Fund to have certification with the Marine Stewardship Council to further enhance ecosystem management.

*Nigel Haggan*

What we are saying in a way is that getting a higher price for a product is socially acceptable even if it is more difficult to obtain. People who grew up in an area with a long family history have gone from fishing many species all year round to owning huge boats where they can only fish a few days of the year. Is that what we want?

*Robyn Forrest*

What is the effect of aquaculture farms on salmon? Will it increase the demand for wild salmon?

*James Wilson*

They may collapse from a demand for wild salmon. Lately there has been a great number of farmed salmon available in the stores. The Chileans produced a lot of salmon last year and a large proportion of that ended up in North America.

*Pablo Trujillo*

That was deliberate. It was a market tactic to flood the salmon market to lower the price of salmon.

*James Wilson*

The idea of increasing the value of wild salmon is a great idea, but the demand for high value wild salmon is really limited. You will not be selling tens of thousands of tons because there is not a

huge market for it. That will be taking it back to making salmon a rich man's meal as it was before. How much salmon was consumed in the 60s?

*Nigel Haggan*

I think that there is an opportunity to do it, and that might take the pressure off wild stocks, but it is not good for salmon fishermen. Then again, having someone making their livelihood on one species is unwise.

*Sheila Heymans*

Having a high value market is good when the economy is doing well, but the first thing that goes during a depression is the \$20/kg salmon. Just like the climate, the world market is totally unpredictable. We have to take into consideration that we have no handle on it. Having First Nations dependent on one species is crazy.

*Cyril Stephens*

Sockeye is *the* fish, delicacy-wise. When putting a price on sockeye, think about the cost needed to get the fish. The costs include insuring a boat and running the gear; all that costs money. Salmon farming is sabotaging sockeye. Aquaculture costs really little compared to someone going out to get wild salmon, and that is dangerous in the eyes of the people, because farmed fish do not cost anything. There is not enough money from the government to enhance wild stocks. All the money is now going to salmon farms. This species of high quality is getting lost in the shuffle.

*Tony Pitcher*

In traditional times, you might notice that the breadth of human diet was extremely broad. They were harvesting right across the web from low trophic levels to high trophic levels. They were feeding and trading from a wide range of products. One thing that should be thought about in the future is to recapture the broad range of species and exploiting a balance of species. Maybe we can make an algorithm to determine what the balance should look like, something weighted by trophic level.

*Barb Johnson*

There is a high cost for wild salmon and we do not have that. The inlet has been shut down for some time, and people on the outside along the coast are saying that if they do not have boats they will not have a life. I do not remember when the last of our elders sold the last of their boats. There is no fish in our inlet now. Outside they are screaming about not being able to fish anymore, and we have had 40-50 years of no fishing. No fish, no money. We do not sell our fish. We

preserve it, we live on it. In the last five years, we have skimmed and saved from one winter to another.

*Nigel Haggan*

I remember going fishing with Charles, Barb's husband, and getting 13 salmon from 5 minutes fishing with a net that was full of holes. When the Aboriginal Fisheries Strategy was imposed there was discussion of transferring sockeye to Oweekeno and other First Nations for economic and social development and re-investment in fisheries management. Next thing was that the fishing industry marched to Ottawa and succeeded in having an industrial solution imposed, so that First Nations like Oweekeno had to buy gillnetters and licenses to compete when they could have caught top grade sockeye in the river at no cost. That is the type of idiocy we had to deal with. People are too attached to the gears. Maybe they can look at area licensing so there is some ownership there so people can determine what they want in their area and then come up with a way to get it. Fishers are creative.

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**Modeling policy using individual gear types in Northern BC.**  
**Cameron Ainsworth and Sheila Heymans**

*Cyril Stephens*

When you give your presentations of the model outcomes, people will probably see where it went wrong. What is unique about this is that you learn from your experience and can then modify the model.

*Nigel Haggan*

That is the advantage of getting the community to look at the model and spot the absurdities. A lot of issues came up during the Prince Rupert workshop that would not have come up otherwise.

*Barb Johnson*

It would be good if you could show somewhere along the line that if this is what we do, then this is the result we are going to get. We can't do all of this. It is up to those ones up there to see what is going on. If they can't see what is happening on this side because of what is happening on the other side, then we are in trouble. We should find out where we are going if we keep on fishing with the current fleet.

*Sheila Heymans*

We did that in the beginning in the workshop in Prince Rupert but then the people shot us down because of the group policy choices. We will re-

run the results with improvements.

*Tony Pitcher*

The point is not so much to show sustainability but to compare what would happen if we carried on with the present fleet and catch.

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**How to model the impacts of aquaculture.**  
**Pablo Trujillo**

*Karin Mathias*

Are you planning to address things like the impacts of the introduction of growth hormones and the use of antibiotics in your work?

*Pablo Trujillo*

In my thesis yes, but I don't think I can do that in the model.

*Villy Christensen*

You can do that using Ecotrace to model the flow of antibiotics from the pen into the environment.

*Pablo Trujillo*

I suppose I can do it as part of the nutrient flow. There is so much to do. We are very far away from having any sort of sustainable aquaculture in Canada. Hopefully, before there is an opening of the industry, we will have better regulations for control.

*James Wilson*

You are talking about finfish aquaculture?

*Pablo Trujillo*

Yes, I was generalizing again. When you talk about aquaculture here it generally refers to fishfarms, but the term is much broader.

*James Wilson*

In terms of modeling aquaculture historically, in France mollusk culture has been going on since the fourteen hundreds. That would be a good modeling exercise.

*Nigel Haggan*

With mussel aquaculture you are just increasing the amount of mussel habitat, not adding nutrients to the environment.

*James Wilson*

That is what I mean. It is extensive culture but you are encouraging growth as much as anything.

*William Cheung*

In your modeling will you also look at the effect of the introduction of alien species on the ecosystem?

*Pablo Trujillo*

Yes, I can do that. Atlantic salmon is one and Japanese oysters may be another. There may be other species that I would want to do that with. The advantage in modeling aquaculture is that it can be very site specific and thus localized, and can be a constant import to the ecosystem.

*Karin Mathias*

Are you planning to look at the various outcomes? In your talk you tried not to be polarized either way but what are you planning to model in your research?

*Pablo Trujillo*

I will do a comparative model using the data I have from Chile, which has many fish farms compared to BC. I can use the model to assess scenarios; for example, what happens in twenty years' time if we have an increase in fishfarming in BC.

*Nigel Haggan*

There is another impact that people in Prince Rupert talked about. Some intensive farms are on the pathway of migrating salmon smolts. It was suggested at the workshop that the farmed salmon eat the smolts that end up in their pens. If this is true, there is a potential impact of fish farms on recruitment of wild salmon.

*Pablo Trujillo*

In Chile, Atlantic salmon eat only pellets, as opposed to trout which are cannibalistic. If we are going to have salmon farms in BC as is likely to happen, my advice would be try control it beforehand. We can use local native species and ban the foreign ones, for example, or use aquaculture to restock wild populations. You can regulate aquaculture to be as benevolent as possible to the ecosystem.

*Cyril Stephens*

Is there a difference in texture when cooked between the farmed Atlantic salmon and the wild salmon?

*Pablo Trujillo*

It has been said that chefs prefer farmed Atlantic salmon because these fish have an evenly distributed fat and the filet maintains a better appearance when cooked!

*Cyril Stephens*

For those of you who have not tasted a wild salmon, like sockeye or chum, when you are so used to eating the wild stocks, there is no better food than that. If I catch a salmon up the creek and bake it in December, it is very mushy and

very soft. Farmed salmon is not anything close. You don't know what you are missing if you haven't tasted a wild salmon.

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### **Problems in modeling changes in habitat and MPAs using *Ecospace*.**

**Eny Buchary**

*Erin Alcock*

Is the number of habitat cells on the map fixed, independent of the size of the area?

*Eny Buchary*

At the moment *Ecospace* can only accommodate up to eight habitats. But I think the program can be altered to increase the number of habitats when needed [*it has been, Ed.*]. Nevertheless, if you have more habitats in your model, it will get too complicated. For the Hong Kong map, there are 625 cells with 37 functional groups and four habitats. For that model I need ten minutes to run one simulation.

*Tony Pitcher*

This workshop is leading towards a *Coasts Under Stress* project evaluation in September and from now until then the team will be writing up what we have done so far. Using *Ecospace* to model Newfoundland and BC is an aspiration for the next phase.

*Nigel Haggan*

For some of the people here who are doing fine scale modeling, *Ecospace* may be ideal and the team here can give you a hand.

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### **The DFO Hecate Strait Project.** **Villy Christensen**

*Kelly Vodden*

I have been speaking with Jeff Fargo (DFO) about incorporating the human and local traditional knowledge in this ecosystem approach and I know there is a move towards that. Has the team discussed it at this point?

*Villy Christensen*

Their interest is in fisheries and it will take years before they are ready for that. I have heard from the principle investigators in the project that they are interested in linking those concerns in the project. The Hecate Strait project is a hard-core search for numbers and that needs to be done in fisheries.

*Nigel Haggan*

We have a mandate to work with communities

from *Coasts Under Stress*, but our budget is low.

*Tony Pitcher*

Referring to the recruitment for the cod driven by environmental factors, would it be possible to build a forcing function for juvenile cod into EcoSim to make it follow that time series?

*Villy Christensen*

Yes, it would.

*Kevern Cochrane*

You are looking for performance indicators, but these will be influenced by the objectives for utilizing that ecosystem. Are you looking at the policy and objectives or at what it is that people want?

*Villy Christensen*

I cannot speak for the Hecate Strait project because my model is technical. The SCOR ecosystem indicators working group that I lead includes people from all over the world working together. In that context we are working with four or five sub-working groups, one of which is led by Bill Costanza and deals explicitly with the social sciences. It is a component of the deliverables.

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## ANNEX: Programme of 2002 BTF/CUS Workshop at UBC



### BACK TO THE FUTURE: METHODS & RESULTS A Symposium on The Restoration of Past Ecosystems as Policy Goals for Fisheries



February 20-22, 2002, at the Graduate Student Centre, UBC

#### PROGRAMME

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##### Wednesday 20<sup>th</sup> Feb: Day 1

##### The aims and methodology of BTF

- 09.00-09.20 Welcome and Introduction to the workshop – Nigel Haggan  
09.20-09.40 Introduction to BTF – Tony Pitcher and Eny Buchary  
09.40-10.00 Constructing models of the Past – Sheila Heymans and Tony Pitcher  
10.00-10.20 **Coffee**  
10.20-10.40 *Coasts Under Stress* –knowledge of the past as the basis for future policy – Rosemary Ommer  
10.40-11.00 Why we have to open the Lost Valley – Tony Pitcher  
11.00-11.20 How can we value the restoration of the past? – Rashid Sumaila  
11.20-11.40 Principles of Environmental Archaeology - Quentin Mackie and Trevor Orchard  
11.40-12.00 **Discussion:** Can we actually change policy using BTF? - Nigel Haggan

##### 12.00-13.20 **Lunch Break**

##### Clues that help us describe and model the past for BTF

- 13.20-13.40 Case Studies in Environmental Archaeology: Gwaii Haanas and the Aleutian Islands - Trevor Orchard and Quentin Mackie  
13.40-14.00 Seaweed and the past – Nancy Turner  
14.00-14.20 Making Sense of Ethnographic Research for Resource Managers and Fisheries Scientists: or, Why a fisherman takes three hours to answer a simple question – Charles R. Menzies  
14.20-14.40 Filling in the Blanks - the Oral History of Haida Gwaii Herring – Russ Jones

##### 14.40-15.00 **Coffee**

##### BTF project team papers

- 15.00-15.20 The Northern BC historical and interview database for BTF - Aftab Erfan  
15.20-15.40 Ecosystem models of past and present: Northern BC - Cameron Ainsworth  
15.40-16.00 Ecosystem models of past and present: Newfoundland – Sheila Heymans

##### 16.00-17.00 **Round Table 1:** Discussion on Visualization and Presentation

- How can we represent complex models to local communities: what we have done and what we have learned? Examples of what we did (Melanie Power)
  - How can we represent policy searches to local communities: what we have done and what we have learned. (Eny Buchary)
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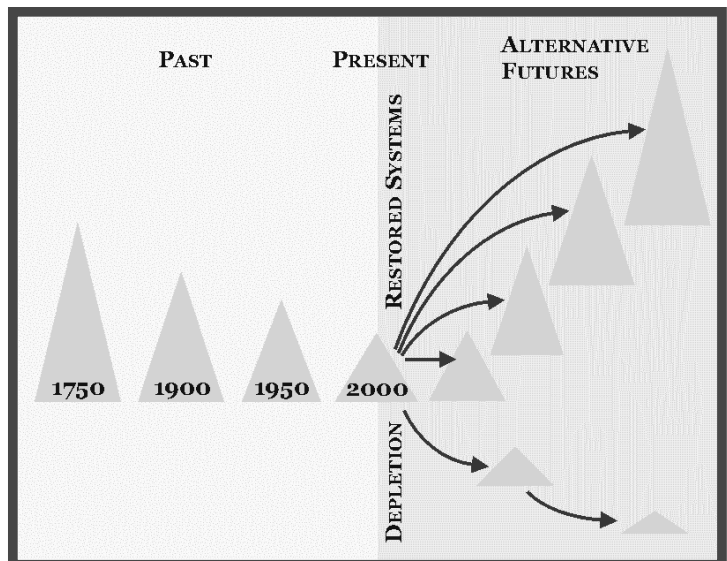


**Thursday 21<sup>st</sup> Feb: Day 2**

- 9.00-9.20 Ecosystem models of past and present: Hong Kong - Eny Buchary and William Cheung
- 9.20-9.40 Quantifying qualitative information in a past ecosystem model of Hong Kong - William Cheung
- 9.40-10.00 Micro-level reconstruction of the Bonne Bay, Newfoundland fisheries between 1891-2000 – Kara Rogers, Jeff Webb, Barb Neis
- 10.00-10.20 **Coffee**
- 10.20-10.40 Management Policies of Snow Crab and Herring Fisheries: From TEK to Science and Back / Decadal Change in Food Webs of the Newfoundland and Labrador Shelf - Erin Alcock
- 10.40-11.0 The Community Workshop: How we did it and what we learned from the results. – Melanie Power / Nigel Haggan
- 11.00-11.20 The Community Interviews: How we did them and what we learned from the LEK results. – Cameron Ainsworth
- 11.20-11.40 What are the sport fishery catches from Northern BC? – Robyn Forrest
- 11.40-12.00 Strictly for the Birds – Tony Pitcher (*for the Bill Montevecchi team, MUN*)
- 12.00-13.20 **Lunch Break**

**Issues in Modelling the Past and Forecasting the Future**

- 13.20-13.40 Problems in Modelling rockfish in Northern BC – Erin Foulkes
- 13.40-14.00 Integrating migratory species into ecosystem models - Steve Martell and Stephen Watkinson
- 14.00-14.20 What was the structure of past ecosystems that had many top predators? – Tony Pitcher
- 14.20-14.40 Running ecosystem simulation models using information about past climate – Robyn Forrest and Tony Pitcher
- 14.40-15.00 **Coffee**
- 15.00-15.20 The problem of local extinctions - Tony Pitcher
- 15.20-15.40 Problems in ‘tuning’ ecosystem models to past data  
Richard Stanford
- 15.40-16.0 The DFO Hecate Strait project  
Villy Christensen
- 16.00-17.0 **Round Table 2:** Building consensus on restoration goals that are ecologically possible and socially acceptable.  
Nigel Haggan



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**Friday 22<sup>nd</sup> Feb: Day 3**

**Issues in Modelling the Past and Forecasting the Future – Continued**

- 9.00-9.20 Modelling policy using individual gear types in Northern BC – Cameron Ainsworth and Sheila Heymans.  
9.20-9.40 How to model the impacts of aquaculture – Pablo Trujillo  
9.40-10.00 Problems in modelling changes in habitat and MPAs – Eny Buchary  
10.00-10.20 **Coffee**

**Issues in valuing restored ecosystems**

- 10.20-10.40 Aboriginal Values – Arnie Narcisse  
10.40-11.00 How do we take aboriginal values into account? – Rashid Sumaila  
11.00-11.20 A Great Leap Backward?? – Nigel Haggan

**11.20-12.00 Final Discussion**

**12.00 Lunch and adjourn**



**The Back to the Future Research Team in mid-2003  
(former members in smaller type)**