FISHING SALMON SELECTIVELY IN BRITISH COLUMBIA

Report of the Third Selective Fisheries Multi-Stakeholder Workshop

November 22-24, 1999
Richmond, B.C.

Sponsored by
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Canada

Fishing Salmon Selectively in British Columbia

Report of the Third Selective Fisheries Multi-Stakeholder Workshop

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INTRODUCTION

The third Selective Fisheries Multi-Stakeholder Workshop was held in Richmond, BC from November 22 to 24, 1999. The purpose of this workshop was to provide a forum for information exchange and review of the selectivity program in the Pacific through the presentation of several 1999 fishing selectivity experiments.

The workshop was designed to provide information and an opportunity for discussion to representatives of the commercial, recreational and First Nations fisheries sectors, environmental groups and coastal communities. Plenary sessions included a review of the selectivity program and policy of Fisheries and Oceans Pacific Region, the preliminary results of selected 1999 program experiments, a presentation on stock assessment by Fisheries and Oceans biologists, and a presentation on the status of the commercial industry's Canadian Code of Conduct for Responsible Fishing Operations. The global context of selectivity was highlighted through the keynote address by Dr. Martin Hall of the Inter-American Tropical Tuna Commission. Working group sessions were organized for discussion on policy development; fisheries management; research; enforcement, training and awareness; and marketing and value-added possibilities.

The workshop was coordinated by the Ocean Centre of Excellence of the British Columbia Institute of Technology (BCIT) and sponsored by Fisheries and Oceans Canada and Fisheries Renewal British Columbia.

This reports provides highlights of the program and policy, summaries of the 1999 selectivity project presentations and reports from the working group sessions.

WELCOMING STATEMENT

Welcoming Address by
Donna Petrachenko, Regional Director General, Pacific, Fisheries and Oceans Canada.

In her welcoming statement, Donna Petrachenko, Regional Director General, Fisheries and Oceans Canada presented an overview of the actions taken by Fisheries and Oceans Canada to address fisheries issues in the Pacific Region. She placed the Region's commitment to selective fishing in a global context and provided a summary of Canada's commitment towards more conservation-based fisheries. Excerpts of her statement follows.

> *"Selective fishing is the fishery of the future. It has a long history, not only in Canada, but globally. According to the United Nations Food and Agriculture Organization, over three-quarters of the world's major fisheries are in trouble. There are problems of over-harvesting and over-capacity. Uncertain environmental conditions are causing unpredictable stock abundance and making it extremely difficult to accurately predict stock composition and size. In response, Canada has signed on to a number of international agreements, some binding, some voluntary, to develop fisheries that are sustainable and adhere firmly to the precautionary and risk adverse management principles. For the most part, they commit Canada and other nations to conservation and to sustainable use of biological resources. For example, the United Nations (UN) Convention on Biological Diversity requires governments to integrate its principles into national policies and legislation. In particular, it requires governments to promote the protection of ecosystems, natural habitats, and the maintenance of viable populations of species in natural surroundings.*
>
> *Other international agreements to which Canada is a signatory include:*
> - *The United Nations Fish Agreement*
> - *United Nations – FAO – Code of Conduct for Responsible Fishing, from which the Canadian fishing industry has developed a Canadian Code of Conduct for Responsible Fishing Operations.*
>
> *In response to the need for a new direction in fisheries management, the Pacific Region is meeting the challenges of the fishery of the future. In its October 1998 "New Directions" document, Fisheries and Oceans outlines the principles of conservation, sustainable use and improved decision-making. The October 1999 "Allocation Policy for Pacific Salmon" sets out the policies for allocation. A future view of selective fisheries is outlined in the discussion document, "Selective Fishing in Canada's Pacific Fisheries", released in May 1999. The soon-to-be-released "Wild Salmon Policy" will deal with the conservation side of Pacific salmon. We are also working very hard to develop an improved decision-making framework that will provide a formal, predictable and more effective process to consult with harvesters and other stakeholders who have an interest or investment in the salmon fisheries.*

To meet the vision of the fisheries we have set out in the "New Directions", we have embarked on a restructuring of the Pacific salmon fisheries. The components include:

- *A very significant voluntary salmon licence retirement program for those who wish to retire from the industry.*
- *Fisheries diversification and the development of new and experimental fisheries.*
- *A tourism promotion and awareness campaign to encourage recreational fishermen to continue to come to British Columbia and fish selectively and in a conservation-based manner.*
- *Community economic development and adjustment programs, administered by our federal partners, Western Economic Diversification and Human Resources Development Canada.*
- *Resource rebuilding programs to strategically enhance salmon stocks and protect and restore habitat.*
- *The Selective Fisheries Program.*

Selective fishing is an extremely important piece in the new directions we are developing. It is the most positive solution for harvesters and the resource in the face of serious conservation concerns for a number of salmon stocks. In many cases, it will be the only way we are able to continue fishing. The federal government is investing more than $20 million to assist harvesters in becoming more selective.

Participants in all sectors of the Pacific fishery have played a key role in finding solutions which will define a conservation-based fishery of the future. First Nations, commercial and recreational fishermen, academics and environmental organizations and community groups have been instrumental in changing the direction of the fishery with their innovation and enthusiasm. I would like to acknowledge a few of the key proponents who have shown their commitment to the development of sound practices of selective fishing. Some of these people form the multi-sectoral steering committee responsible for this three-day workshop. Bob Rezansoff of the Fishing Industry Selective Salmon Harvester's Association, Dr. Craig Orr of the BC Aboriginal Fisheries Commission, Martin Paish of the Sport Fish Advisory Board, Sharon Chow of the Sierra Club, Dr.'s Patricia Gallaugher and Rick Routledge of the Fisheries Centre at SFU, and Andrew Walls of the Ocean Centre of Excellence at BCIT.

We have made great progress developing and testing selective fishing gear and methods. It is now time to consider how these new tools can be applied—while continuing to develop new and better gear and methods."

THE WORKSHOP

KEYNOTE ADDRESS

REDUCING BYCATCH IN THE EASTERN PACIFIC TUNA FISHERY

Speaker: Dr. Martin Hall, Head, Tuna-Dolphin Program,
Inter-American Tropical Tuna Commission

Dr. Martin Hall is the Head of the Tuna-Dolphin Program of the Inter-American Tropical Tuna Commission (IATTC). This Commission is charged with monitoring the incidental mortality of dolphins, studying the causes of such mortality and encouraging fishermen to adopt fishing techniques which minimize it. Even though our fisheries are extremely different, there are some things that are similar with respect to resolving bycatch problems. Dr. Hall's speech focussed on the process of the bycatch reduction program rather than on the technical aspects. Excerpts from his address follow.

"One of the longest and most controversial bycatch problems, that of the incidental mortality of dolphins in the purse-seine fishery for tuna in the eastern Pacific Ocean, serves as a model to illustrate the development of a program to reduce bycatches in a fishery. Tuna are found in three ways: associated with groups of dolphins, associated with floating objects and in schools are on their own. In the late 1950s and the early 1960s, dolphin mortality was extremely high. Since 1986, dolphin mortality has been reduced by 97%. A combination of factors: technical developments and education are among those that have influenced this reduction.

Fishermen did not give up fishing to make this reduction; they are now fishing at a very high level. What has changed is the average mortality of dolphins per set and it was the work that the fishermen have done which has reduced the bycatch. It was not by following regulations. It was by the fishermen doing things.

For any bycatch problem, there are two things you can do to solve the problem and to find a way to reduce bycatch without giving up a good way of fishing. There are sets of tools to achieve this:

Bycatch = "effort"	***X***	***Bycatch-per unit "effort"***
Regulatory bans		*Technological changes*
Regulatory limits		*Training*
Trade sanctions		*Regulations*
Consumer boycotts		*Marketing*
Gear changes		

The process started when the leaders of the industry decided they had to tackle the problem, they could not keep running away from the dolphin mortality issue. It was on TV, in newspapers and magazines, it was in the public perception, their families were reminding them of the subject. They decided to tackle the problem and they were very effective and visionary.
What was done to reduce mortality?

The first task was to understand how bycatch started and why it happened by gathering an extensive database of when, where and how much was the dolphin bycatch. With that information, solutions could be produced and technological change fostered. There were many changes; most originated with the fishermen.

In summary, mortality was reduced through:

- *data collection,*
- *technological and operational change,*
- *training of crews, and*
- *management actions.*

Observers collected data to identify causes of mortality. With this information there was something to take back to the fishing crews, so that the crews could see the problems, find solutions and start using them. The information was also used to monitor the performance of the crews and how they report.

Examples of the process to resolve the tuna/dolphin problem:

Nature (environment)	***Captains***	***Boat Owners***
Currents	*Crew training*	*Gear available*
Visibility	*Gear use*	*Captain motivation*
Species	*Gear deploy. & retrieval*	*Maintenance*
Group size	*Release*	
Catch	*Decisions*	
Malfunctions		

The major technological changes all originated with the fishermen. Once proven to work, performance by everyone was mandatory and also monitored. The fishermen pass on their skills and knowledge to the rest of the team and made it a part of the way they fish. Nothing was expensive or difficult but rather a combination of things. Lots of things didn't work. Changes occur over decades, not overnight.

Training involves gear deployment techniques, gear recovery techniques, release techniques and decision-making. IATTC has convened Dolphin Mortality Reduction workshops. There are about 15 to 20 crew members in each workshop. These workshops are important educational forums during which fishermen, boat owners, other industry personnel and IATTC staff members discuss:

- *causes of mortality*
- *new ideas for solutions*
- *exchange information on who is trying what*
- *transfer and try to adapt these ideas*
- *responsibilities of boat owner, fishing captain and crew*
- *dolphin safety gear*
- *mortality limits, regulations.*

Through education we can avoid problems and improve responses when problems occur. There is a very fluid interaction with the fleet – 120 to 130 boats with a captain or skipper who all know one another by name. Through training we have gone from 11% to 5% dolphin mortality in the past decade.

Management actions in the process include:

- *bycatch limits (both global and per vessel),*
- *adaptive or fixed closures,*
- *regulations on gear,*
- *regulations on deployment (sets by night or day),*
- *incentive programs, and*
- *full retention (keep what you catch and fully utilize it).*

The most important are the first two. Bycatch limits: this started by setting limits on dolphin mortality for a full fleet and by assigning limits on individual vessels, so each crew has one limit for a year. For example, if a crew was careless and reached their limit by February then they would have to stop fishing for the rest of the year. This worked wonders in reducing mortality. It gave the challenge to the individual fisherman to resolve. If you look at the process as a biologist, this is natural selection and evolution of fisheries: find ways of fishing that are ecologically sound. Those people who are most capable of finding a way to do it will surface with the evolution. We evolve by using tools and procedures. When a company is allowing that type of selection, then the fishermen who figure it out are left fishing. Those who do not figure out how to lower mortality are out of the fisheries. The ones that are operating are the ones who can produce the results with the lowest mortality of dolphins.

Lines of defense for bycatch problem:
Reduce incidental captures

- *Decisions by fishermen or regulations concerning gear (type, mesh, materials, etc. area or season).*
- *Deployment conditions (time of day, duration of deployment, fishing depth, position with respect to currents, visibility, accessories).*
- *Release from the net.*
- *Release from the deck.*
- *Utilization (changes in fishing operations, storage, processing & marketing).*

It is important to work with other nations as different people think differently. For example, there are flaws in the dolphin-safe label:

- *Objective is protection, not conservation.*
- *Alternatives are not ecologically sound.*
- *Label is misleading.*
- *Certification is deficient.*

The objectives of the bycatch reduction program were:

- *Elimination of bycatch.*
- *Maintain total bycatch at some “acceptable level.*
- *Maintain some “acceptable” ratio of bycatch to catch.*

In our case dolphins were not in danger of anything. The mortality of dolphins that we have right now is easily 100 times below sustainability levels.

Incentives in the program included:

- *Individual vessel bycatch limits*
- *Bycatch standards*
- *Selective licensing*
- *Economic advantage*
- *Individual awards, honors or 'shame'*
- *Full retention of capture*

Individual responsibility plus performance requirements plus incentives (survival of the fittest fishermen).

Characteristics of a 'good' bycatch program include:

- *Clear and attainable goals*
- *Scientific goals*
- *That it be fair and equitable*
- *Management objectives and consistency*
- *Individual responsibility*
- *Incentives and disincentives."*

(Note: Two papers: "Working with Fishers to Reduce Bycatch: The Tuna Dolphin Problem in the Eastern Pacific Ocean" and "Solving the Tuna-Dolphin Problem in the Eastern Pacific Purse-Seine Fishery" were distributed to participants at the workshop. The keynote address presented by Dr. Hall included much of the information provided in these papers.

I. SCIENCE REVIEW

STOCK CONSERVATION / STOCK STATUS
Panel:
Jim Irvine, Research Scientist, Stock Assessment, Fisheries and Oceans Canada
Bill Shaw, Management Biologist, Fisheries and Oceans Canada
Rick Routledge, Mathematics & Statistics, Simon Fraser University

1) Setting the Stage: the importance of selective fishing.

Presented by Jim Irvine, Fisheries and Oceans Canada

As stated in the New Directions document, conservation of Pacific salmon stocks remains the primary mandate for Fisheries and Oceans Canada and will not be compromised to achieve salmon allocation targets. Many salmon stocks are declining and species-at-risk legislation is on the horizon. The Department's Wild Salmon Policy draft confirms the need to conserve the long-term viability of Pacific salmon in their natural habitat. A precautionary management approach has been adopted by the Department and the salmon fishery is being restructured by moving to selective harvesting. In times of reduced salmon abundance and conservation-based management, selective fishing may provide an opportunity to continue some level of fishing that otherwise would not be available.

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2) Preliminary Catch Summary Results, including coho encounter and mortality estimates in Southern B.C.

Presented by Bill Shaw, Fisheries and Oceans Canada

Management Actions

- Non-retention/non-possession of coho
- Red, Special Management, Yellow Zones
- Area/time closures
- Barbless hooks, brail, shorter gillnet sets
- Revival tanks
- Logbooks, Observers
- Test fisheries
- Existing monitoring programs

In-Season Recording

Participation by everyone involved.

- Monitoring program by observers
- Logbook program
- Hail-in by charter patrol vessels to fishery managers
- Phone-in by vessels
- Biological sampling (DNA, coded-wire tag information collected in-season)

Gear Mortality Estimates

(Note: These are the same as were used in 1998)

- Gillnet 60% (based on results of the selective fisheries evaluation report 1995)
- Troll 26%
- Seine 25%
- Recreational 10%

Table 1 Preliminary Summary of 1999 South Coast/Fraser Coho Salmon

Total Mortality by Sector

Updated to the end of StatWeek 11/2 (Nov.13/99)

Yellow Zone Fishery	**Total Coho Encounters**	**Estimated Coho Mortalities**
Recreational	6,804	6,129
Commercial	3,818	1,113
Test Fisheries	1,369	385
Total (Yellow Zone)	**11,991**	**7,627**
Special Management Zone Fishery	**Total Coho Encounters**	**Estimated Coho Mortalities**
Aboriginal	8,442	4,829
Recreational	61,124	6,112
Commercial	243	130
Test Fisheries	2,073	764
Experimental	6,472	1,608
Total (SM Zone Fishery)	**78,354**	**13,445**
Red Zone Fishery	**Total Coho Encounters**	**Estimated Coho Mortalities**
Test Fisheries	4,675	2,023
Experimental	1,293	156
Total (Red Zone)	**5,968**	**2,179**
TOTAL (Preliminary Estimate)	**96,313**	**23,521**

Table 2. Preliminary Estimates of Coho Encounters and Mortalities in the Recreational and Commercial Fisheries: South Coast & Fraser River
(Note: estimates are to the end of StatWeek 11/2 (or Nov. 13/99)

A. RECREATIONAL Fishing Area	**Coho Encounters**	**Coho Retention**	**Coho Mortalities**
Yellow Zone WCVI	6,284	3,281	5,609
SMZ Zone WCVI	25,581	-	2,558
Total WCVI	**31,865**	**3,281**	**8,167**
Yellow Zone JdeF	90	90	90
SMZ Zone JdeF	729	-	73
Total Juan de Fuca	**819**	**90**	**163**
Yellow Zone St. of G	430	-	430
SMZ Zone St. of G	34,814	-	3,481
Total St. of Georgia	**35,244**	**-**	**3,911**
Fraser R. still to come			
TOTAL RECREATIONAL	**67,928**	**3,371**	**12,241**
B. COMMERCIAL Fishing Area	**Coho Encounters**	**Coho Retention**	**Coho Mortalities**
Yellow Zone Troll	3,463		900
SMZ Zone Troll	58		15
Total Troll	**3,521**		**915**
Total Seine	**-**		**-**
Yellow Zone Gillnet	355		213
SMZ Zone Gillnet	185		115
Total Gillnet	**540**		**328**
TOTAL COMMERCIAL	**4,061**		**1,243**

Table 3. Preliminary Estimates of Coho Encounters and Mortalities in the Test and Experimental Fisheries: South Coast and Fraser River.
(Note: estimates are to the end of StatWeek 11/2 (or Nov. 13/99)

A. Test Fishery Fishing Area	Coho Encounters	Coho Retention	Coho Mortalities
SMZ Zone Troll	876		298
Total Test Troll	**876**		**298**
Yellow Zone Seine	1,281		320
SMZ Zone Seine	720		180
Red Zone Seine	2,321		580
Total Test Seine	**4,322**		**1,081**
Yellow Zone Gillnet	88		64
SMZ Zone Gillnet	477		287
Red Zone Gillnet	2,354		1,442
Total Test Gillnet	**2,919**		**1,793**
TOTAL TEST GEAR	**8,117**		**3,172**
B. Experimental			
SMZ Zone Exper. Troll	2,322		724
Total Exper. Troll	**2,322**		**724**
SMZ Zone Exper. Gillnet	879		674
Total Exper. Gillnet	**879**		**674**
SMZ Zone Exper. Sport	135		31
Red Zone Exper. Sport	222		22
Total Exper. Sport	**357**		**53**
SMZ Zone Exper. Seine	3,136		180
Total Exper. Seine	**3,136**		**180**
Red Zone Ex. Trap/Wheel	1,071		134
Total Exper. Tr/Wheel	**1,071**		**134**
TOTAL EXPER. GEAR	**7,765**		**1,765**

3) Coho Salmon: Preliminary Post-Season Overview

Presented by Jim Irvine

1999 Fisheries Management

1. The objective of zero mortality on coho stocks of most concern (upper Skeena, Thompson).
2. The entire B.C. coast designated as red, special management, or yellow zones based on the prevalence of upper Skeena and Thompson River coho.
3. Extremely limited fishing in Red Zones (stocks of concern may be prevalent)
    - some experimental selective and test fishing
    - limited First Nations food, social, and ceremonial fisheries.
4. Special Management Zones: special restrictions
    - fisheries were only permitted when stocks of concern could be avoided or released alive and unharmed
    - coho non-retention and non-possession was mandatory
    - fisheries monitored and coho sampled
5. Yellow Zones: stocks of concern not prevalent
    - selective fisheries on non-coho permitted but with mandatory release of coho for commercial fisheries, retention of coho in some recreational fisheries.
    - Fishing methods designed to avoid coho or minimize release mortality were mandatory in all fisheries
        - brailing by seines
        - day-time only for gillnets
        - time and area restrictions

Preliminary 1999 Coho Spawner Status

Coho spawners are still being enumerated in most streams. There are some results and these are very preliminary. Surveys will be largely complete by mid-December but some will continue through January. The brood year refers to years in which parents spawned.

Transboundary Rivers

- Coho escapes to Transboundary Rivers are near or above average in 1999.
- Preliminary escapement estimates for the Canadian section of the Taku is ~64,400 coho, above the goal of 27,500-35,000, but less than the previous 10-yr average. Mar. survival ~10% compared to an average of 14%.
- On the Stikine, the 99 index count was 51% above the previous 10-year average.
- In the Alsek drainage, the Klukshu weir count was 2,421 compared to a previous 10-year average of 2,359 coho.

Queen Charlotte Islands

- 1999 escapement are variable, generally above recent levels, but below historical escapements.

Nass Area

- Meziadin River fishway count was approximately twice the brood year escapement and near the average for the 1990s.
- Fence count on the Lachmach River was slightly above brood years and recent average escapements.

Skeena River

- Skeena test fishery index to Aug. 25 is about twice the 1990s average.
- Babine Fence count to Nov. 16 is 12,800, well above recent escapement levels (97 was < 500).
- Upper Bulkley weir count is 1100, runs in some recent years were below 100.

Central Coast

- Coho are reported to be below 1998 levels but well above the 1990s average.
- Docee fence count 4,500.
- Atnarko tower count 20,000 (very preliminary).

Johnstone Strait / Mainland Inlets

- This appears to be a transition area - runs to northern streams like Seymour and Keogh are generally much better than in southern streams like Tsitika and Heydon.
- The marine survival of Keogh R. coho was good, ~12% (similar to last year).
- Most runs in the region were less than last year.
- Fry abundances increased this year in response to the larger escapements in 1998.

Strait of Georgia / Juan de Fuca Strait

- A dry fall has delayed coho spawning so conclusions are tentative.
- Spawners will probably be significantly fewer than last year with many examples of runs apparently remaining at or receding to pre-1998 levels, before most severe fishing restrictions.
- So far, the Black Creek indicator stream has had the second lowest escapement in 16 years of records: about 2% of the smolts probably survived, the lowest survival on record.
- Marine survivals in the northern Strait of Georgia will be less than 2-3% unless more spawners appear.
- Numbers to the south are more uncertain, but appear to be poor also, especially south of Parksville.
- Record low abundances are likely as was predicted.
- Runs in Juan de Fuca area are less than last year so far. Some are better than 97 and the brood year of 96.
- Fry abundances in the Str. of Georgia/Juan de Fuca area were up this year after last year's improved escapements.

West Coast of Vancouver Island

- So far 78% of monitored runs are less than last year's large escapements, however runs are generally better than in 1997 and the brood year of 1996.
- All the runs that are less than 1996 or 1997 levels are in the Nootka Sound to Kyoquot Sound area (Area 25). Runs to this area also increased the least in 1998.
- Fry abundances have not been analyzed but appear to be variable: one area of concern is Clayquot Sound streams, many of which had poor fry densities in 1999.

Lower Fraser River

- Fence counts at Salmon River (Langley) and mark-recapture study for upper Pitt River are still in progress and too preliminary to be conclusive.
- Counts at Salmon and numbers in upper Pitt River to November 14 are similar as in 1998. Salmon R. returns will probably be less than in brood year.
- Extensive foot surveys of 15 wild coho stocks in Howe Sound and the lower Fraser River are still in progress. Initial results suggest the runs are about two weeks earlier but generally lower than the seasonal peaks experienced in 1998.

Thompson River

- Highly variable among surveyed streams, flows currently leading to difficulties with estimation.
- Escapements to Spius Creek and Coldwater River (Nicola drainage) similar to 1998. Deadman River and Spius Creek > 1000 fish each; Coldwater River >700.
- Coho observed above Little Hells Gate for second year in a row. Too early to determine magnitude. Escapements to other North Thompson streams are approaching peak, but flows are impeding assessment activities. Lion Creek >700 fish observed on peak.
- South Thompson: Eagle >1900; Salmon R. poor (<100). Coho present in many surveyed systems.

Upper Fraser River

- Recent high water and warmer weather impeding surveys.
- Coho observed in Chilko R. and Mitchell R. (Quesnel Lake). Numbers <100 but Chilko sightings confirm presence in wider area than previously surveyed.
- McKinley Cr. fence numbers (204) lower than 98 (>700).
- No coho observed in Summit Cr. and Horsefly R.
- Nahatlatch R. peak nos. to date <400 vs. ~1100 in 98.
- Numbers to date also lower in Bridge R. and Cayoosh Cr. than in 98.

Summary

1. Preliminary information suggests that coho fishing closures in 99 resulted in improvements to spawning escapements over recent years in many, but not all areas.
2. In some areas, including transboundary rivers, Skeena, portions of the Central Coast, and northern Vancouver Island, the improvement appears to be substantial.
3. Coho survivals were above average in the Skeena as predicted which boosted escapements in many Skeena areas to levels not seen for decades.
4. In the Nass, Queen Charlottes, and the West Coast of Vancouver Island, increases appear to be more modest.
5. Low marine survival remains a continuing concern for Strait of Georgia coho stocks, including the Fraser/Thompson.

4) Pacific Salmon Conservation: A scientist's view

Presented by Rick Routledge, Simon Fraser University

This presentation focussed on the steps taken to answer the question: how likely is it that a small coho stock will go extinct?

Method of Reasoning:

- Look at observed records of fluctuations in numbers.
- Make predictions based on past, benign conditions, and recent, less favourable conditions.

Important Factors:

- How fast can the population rebuild from low abundance levels?
- How large a population can the freshwater habitat support if it is well seeded?
- How predictable are the returns?

Data from Black Creek coho were used to set up the baseline predictions. The marine survival was set to higher values before recent decline.
Survival Probabilities: Benign Conditions:

- Smaller version of Black Creek
- Healthy marine survival
- 100-year survival rate: over 95%.

Must look at the effect of decreasing marine survival: if stocks can, on average, barely replace themselves, chance variation can drive 15% per year to extinction. The effect of decreasing freshwater habitat capacity, the effect of greater unpredictability and the effect of straying between adjacent spawning areas (small amounts of straying between small stocks can reduce their extinction rate close to the rate for a single, combined stock) must be examined. To preserve bio-diversity into the future, it is important to look at other species as well as coho.

Panel Discussion

Some of the discussion among panelists and participants focussed on the following:

1. Comment was made on the fact that management is currently based on the information collected on stocks that are known. Is there any idea of the percentage of unknown stocks of every species? In response: the percentage of stocks that are unknown is quite high, which makes input from every source valuable. It would be difficult to look at every stock every year.

2. The reason for the difference in marine survival rates between the West Coast of Vancouver Island and the Strait of Georgia is not known with any certainty. However, it was pointed out that it is not only the survival that has changed, but also the distribution of the fish. The Strait of Georgia has gone through a number of oceanographic changes in recent years – the salinity has decreased and the water is warmer. The changes are not just restricted to the Strait. It is believed that it is an overall global environmental change—increased frequencies of El Ninos, significantly warmer marine temperatures. As a result, a number of marine species have adjusted their range and have moved

further north. This has benefited some salmon and worked to the detriment of others. It is believed that the stocks that are doing the poorest are the ones that used to reside in the Strait of Georgia. There are different opinions on whether this is a transitory change or whether it is normal.

3. At what point will it be possible to provide encounter data on stocks of concern to allow more precise definition of areas where fishing can or cannot take place? The Department is building a database through DNA sampling in order to do this.

4. Questions arose about the sources for the coho mortality estimates presented in Preliminary Catch Summary Results presented by the panel. Response: coho encounter estimates: recreational data is gathered through creel surveys in the Strait of Georgia /Juan de Fuca compiled from April to October 15, and from contract program creel surveys on the West Coast of Vancouver Island. Commercial data is gathered through in-season hail-in (vessels phone in their catch by species information on a daily basis). This is verified by information collected from logbooks. Test fisheries data is gathered through observers and logbooks.
Response to question about coho mortality estimates: these percentages were taken from a variety of studies carried out five or six years ago. Gillnet 60% (based on results of the selective fisheries evaluation report 1995). Troll 26% from studies carried out in 1993 and 1994 by the US Department of Fish and Game which provide a range of coho mortality. Seine 25% from previous studies done in the South Coast. Recreational 10% from studies conducted by Terry Gjernes.
Participants' comments that it was time to apply new percentages taken from more recent work, was agreed to—that a closer look should be taken at the work that has been done in the past two or three years. It was also noted that the percentages used in this presentation were not cast in stone and one of the purposes of this workshop was to refine these numbers.

5. Questions about coho decline, specifically whether or not fish farms are an influence. Response: lots of reasons why coho stocks are declining in different areas. It is known that in marine survival, the declines have been widespread. Research on ocean survival is an active area of work within the Department. Marine Survival for most species is monitored.

II. SELECTIVE FISHING POLICY

SELECTIVE FISHING IN CANADA'S PACIFIC FISHERIES

Don Lawseth, Selective Fisheries, Fisheries and Oceans Canada

Selective Fishing is defined as the ability to avoid known non-target species and stocks or, if encountered, to release them alive and unharmed.

The need for selective fisheries arises because:

- stocks/species are often mixed with weaker, less abundant fish that may be endangered or threatened,
- ways must be found to catch the target stocks or species with acceptable survival of the weaker, less abundant fish, and
- unacceptable bycatch is an impediment to many potentially lucrative fisheries.

The policy paper released by Fisheries and Oceans Canada in May 1999: "Selective Fishing in Canada's Pacific Fisheries: A New Direction" states that:

"All Pacific fisheries in which bycatch is an issue will meet specified standards of selectivity. In fisheries where selective harvesting standards are not met, and bycatch remains a constraint to achievement of conservation objectives, fishing opportunities will be curtailed."

Selective Fisheries Strategies

1. Setting and meeting targets
Working together, harvesters and the Department will develop standards and target dates for meeting the standards.

2. Avoiding encounters
Time and area restrictions will continue to be implemented to avoid encounters of non-target species

3. Avoidance gear and release of non-target species
Fish harvesters will be encouraged to test and experiment with selective gear and methods that minimize catch, and facilitate release of non-target species.

4. First Nations Fisheries
First Nations will be encouraged to use selective methods in their fisheries to maintain or increase opportunities to fish.

5. Recreational Fisheries
Recreational harvesters will become more selective by minimizing encounters of species and stocks of concern; experiment with and adopt improved fishing gear and methods; and reduce mortality of released fish.

6 Commercial Fisheries
Commercial harvesters will become more selective by minimizing encounters of species and stocks of concern; experiment with and adopting improved fishing gear and methods; and reducing mortality of released fish. Allocation within the commercial sector will be tied to the ability.

Selective Fisheries Goals

- Target dates are set for meeting selectivity standards:
  - 2001 for salmon harvesters
  - 2005 for harvesters of other species.
- Future costs of experimenting, gear changes and catch monitoring will be borne by industry.

Next Steps

- Review, evaluate and consult in late fall of 1999 on projects and policy direction.
- Implement proven selective strategies in the 2000 salmon fishery.
- Develop and implement training and education programs with harvesters.
- Facilitate further experimentation by harvesters for increased selectivity.
- Release selective salmon fisheries policy in early 2000.

Setting Standards

Objective

- To establish predictable, transparent and attainable goal posts for selective fisheries management and harvesting.
- Classify each fishery in a manner that matches risk with access.

Concept

- Each fishery is classified 1 to 10 according to a set of criteria
  - Class 1 fishery is very high risk, Class 10 fishery is very low risk.
- Access to a fishery is determined by the ability for harvesters to meet entry criteria that matches with the risk of the fishery.

Classifying the fishery. (Criteria may include)

- level of current stock knowledge
- bycatch characteristics: numbers, species, stock status, conservation
- ecosystem concerns of the fishery
- economic value of the fishery

Access to the fishery: (Criteria for access may include)

- selectivity of gear (avoidance/release mortality)
- monitoring requirements
- compliance risk/record
- accreditation of harvesters
- cost of management
- bycatch ceilings.

Setting Standards

An expansion and refinement of the red, yellow and special management zone concept. Currently, can only access a red-zone fishery under special selective fishing rules e.g. Skeena red-zone pink fishery in 1999 - release of sockeye, harvesters paid for observers, followed conservation rules established for selective fishery experimental pilot projects.

Advantages

- access to fisheries would be more predictable for harvesters,
- provides increased access opportunities by becoming more selective, and
- sets standards that are transparent and flexible.

III. PROVINCE OF BRITISH COLUMBIA

PERSPECTIVE ON SELECTIVE FISHING

Bud Graham, ADM, Programs and Operations, BC Ministry of Fisheries

"The Province recognizes that more selective fishing is a necessary and important element of the fishery of the future. I want to acknowledge the support of Fisheries Renewal BC in the support of many selective fisheries experiments and the involvement of BC Fisheries staff in the selective fisheries working group. However, I have a number of concerns associated with the implementation of the selective fisheries policy that need to be addressed.

On standards: DFO has been in the process of implementing the new selective fisheries policy for two years now and the industry still does not know what standards they are expected to meet from selective fishing. Most of the work to date has occurred with salmon but the policy applies to all fisheries and progress in other fisheries is not clear nor are the expectations of the DFO regarding standards. The key question for industry is how low is the bar that represents acceptable mortalities from selective fishing. From the Province's perspective, zero mortality is not acceptable, as it represents no fishing.

On the time frame for implementation: The DFO policy document states the target dates for meeting selective fishing objectives will be the year 2001 for salmon and the year 2005 for shellfish and groundfish fisheries. The move to a more selective fishery represents a fundamental shift in the way fisheries will be prosecuted in a very short period of time. (Especially when we do not know the standards that will be required for the 2001 season). The example which is often sited regarding forcing legislated performance standards for gas emissions in the automotive industry in California or effluent standards in the pulp mill industry in Canada. In both of these examples the time frame for implementation or industry compliance was much longer and allowed the industry a time period to develop/test technology to comply with the new standards.

Costs: Everyone must recognize that the design and development of new gear technology is an expensive and time-consuming business. For example, in the net fleets, new web needs to be ordered and nets need to be constructed which requires a significant up-front cost. In addition, the DFO policy document states that salmon harvesters will assume the full responsibility for the costs of experimenting and testing new gear after 2001; and fish harvesters will be responsible for the incremental costs, including enforcement requirements associated with monitoring new selective fisheries. All this when the salmon fleet in particular has not made money for several years.

Application of the Policy: The DFO policy that the recreational sector <u>will</u> become more selective, the commercial sector <u>will</u> become more selective; and First Nations <u>will be encouraged</u> to use selective fishing methods. It is not clear why the commitment to selective fishing does not apply to all groups who harvest fish in BC. While recognizing that First Nations have constitutionally protected rights for harvest fish, dead fish are dead fish regardless of who operates the gear that harvests the fish.

In conclusion, while the Province supports the move to develop more selective fisheries in BC to ensure the sustainability of the fishery in future, there remain a number of important policy issues that must be resolved if the industry is to survive."

IV. SUMMARIES: SELECTIVE FISHING PROJECTS

Forty selective fishing projects were funded in 1999 under the Selective Fisheries Program. Summary results of 31 of these projects are contained in the booklet, *Preliminary Summaries of Selective Fisheries Projects October 1999*, which was distributed at the workshop by Fisheries and Oceans Canada.

Eleven of the projects presented in the booklet accomplished all their objectives. This is considered quite successful in a highly experimental and developing field. Highlights include selective fishing achievements using fish wheels, trap nets, rigid grids in seine nets, commercial toll gear and a variety of sport fishing gear, and the startling recovery of fish, previously considered dead, using a re-designed revival tank.

Summaries of some of these projects were presented at the workshop. Further details can be found in the booklet. It should be noted that the findings reported in the booklet, are, in many instances, interim or preliminary, and their final analysis may vary.

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1) COMMERCIAL FISHERIES PROJECTS

Presented by Les Rombough
A brief overview of the seine, gillnet, troll and other commercial projects.

A. SEINE PROJECTS

1. Rigid grids in a seine net bunt (SNGNCO6)

Project Proponent: P. Brajcich

The objective of this project was to determine the selectivity capabilities of various rigid grid designs placed in a seine net bunt. Flexible, clear plastic and aluminium grids were tested while targeting chum and sockeye in the Central Coast (Area 6) and the North Coast (Area 3). Over the 10 day fishing period, 1,599 lbs. of sockeye, 16,798 lbs. of pink and 20,116 lbs. of chum salmon were caught.

Results

The rigid grids tested were successful in fishing selectively. The findings:

1. The soft plastic grids were flexible & elastic enough to use effectively in the seine.
2. The girds sorted the fish more quickly & with less stress than traditional methods.
3. There was an 80% reduction in the containment of pink salmon when the test grids were used compared with non-grid use.

More study is recommended to duplicate and to improve on results, especially in the colour, shapes and location of the test grids. The proponent cautions that while selective fishing using rigid grids is feasible, it is important to have grids that will allow all sizes of the selected species to escape to prevent a decline in overall fish size.

2. Seine Selectivity Grids and Bunt Comparison Study (SNGSC05)

See details in the Project Review section of this report.

3. Seine Brailer and Wet Sorting Study (SNGSC10)
See details in the Project Review section of this report.

B. TROLL PROJECTS

1. Rainey Bay (Area G) Mortality Study (TRGSC07)
Project Proponent: W. Caron
The objective of this project was to compare the mortality of coho released at the waterline using a Kempton Cage versus taking fish on board and using a revival tank prior to release with simultaneous blood and tissue analysis (by SFU). The gear used involved commercial troll gear, a Kempton Cage and a blue box revival tank tested while targeting coho in Area 23 (Rainey Bay, Pili Point to Chup Point). In the 10-day study in September 1999, 153 coho were caught.

Results
Due to the low numbers of hooked fish it wasn't possible to draw any conclusion in the comparison of waterline release to use of the revival tank. Blood and tissue analysis were undertaken. Visual observations appeared to conclude that there were negative fish impacts using the revival tanks and that vigorous fish (classified as a 1 or 2) should be released at the waterline with the tanks beings used only for fish classified as a 3 or 4 (very poor condition). The use of a common #5 hook and a true barbless hook resulted in catching coho with minimal damage, with most wounds confined to the jaw. There was also a noticeable increase in the number of fish that escaped off the hook.

Further study and recommendations:
- continued study with site location to take advantage of coho stocks,
- studies using other salmonid species,
- improvements to net pens to reduce predation,
- multiple net pen arrangements to truly measure time periods, and
- ongoing modifications to the Kempton Cage to increase its seaworthiness.

2. Area H Troll Mortality and Gear Comparison Study (TRGSC12)
See details in the Project Review section of this report.

3. West Dixon Entrance Experimental Pink Fishery (TRMNC02)
See details in the Project Review section of this report.

C. GILLNET PROJECTS

1. Trammel or Baltic Sea Net Test (GNGNC06)

Project Proponent: D. Emes

The objective of this project was to test feasibility of using a Trammel or Baltic Sea type net in the Nass River (Area 3) to target sockeye. In a 3 to 6-day fishing period during July and August; 2,500 sockeye were caught.

Results

The use of a Trammel or Baltic Sea-type net (3 panels consisting of 2' mesh, 4" mesh, and 2' mesh) resulted in high catch quality.

Difficulties were encountered during the test period: the correct twine strength, limited fishing days and a learning curve for proper net hanging methodology affected the amount and variety of testing. Focus was on catching fish to recoup costs rather than on experimenting with the equipment in a variety of conditions.

Future recommendations include further testing over a longer period for proper and varied experimentation, and modifications to deepen and shorten the length of the net to reduce setting and hauling times and fish mortality.

2. Nitinat Alaska Twist Gillnet Bycatch Study (GNGSC09)

Project Proponent: G. Arkko

The objectives of this project were to determine whether Alaska twist gillnets catch more chum salmon while catching less coho and steelhead than conventional nylon nets and to map hotspots or locations of high incidence of coho and steelhead prior to the opening of commercial fisheries. Alaska Twist 90 mesh net with a two metre becket (or drop) and nylon 90 mesh net with the same becket were used in Areas 21 and 121 (between Pachena and Bonilla Points) to target chum salmon. Zero sockeye, 53 coho, 19 pink, 8,711 chum, 3 chinook, and 8 steelhead were caught between September 25 and October 3, 1999.

Results

Data had not been analyzed at the time of the workshop. However, it was noted that the project effectively identified and mapped coho and steelhead hotspots for fisheries management use. Initial observations include:

- the Alaska Twist net was not as durable as the standard nylon;
- the two-metre becket was awkward to handle; and
- the effect of net colour remains unknown;
- the Alaska Twist net is not as flexible as the nylon, resulting in less fish-size selectivity. On average, the nylon net seems to catch heavier fish, whereas the Alaska mesh tends to keep fish of the same size. In general, the nylon net was better, though under certain light conditions and net colouring, the Alaska Twist had some success. Further study is recommended.

3. Revival Tank Redesign and Physiological Testing (GNGSC10)

See details in the Project Review section of this report.

4. Area D Gear, Time & Area Real Time Monitoring Study (GNGSC11)

See details in the Project Review section of this report.

5. Tangle Tooth Gillnets (GNGFR02)

Project Proponent: W. M. Petrunia

The objective of this project was to refine mesh and twine size selectivity for sockeye, pink and chum, and the holding of bycatch in a live tank for 24 hours to determine increased mortality. Tangle tooth gillnets were tested while targeting chum salmon in Areas 29-13. Fishing took place 3 to 4 days a week for a total of 38 days from late August to mid-November. 700 chum were caught. Due to poor runs, no tests were conducted on sockeye or pink salmon.

Results:

Preliminary results show that the study succeeded in catching target species (chum) with a short-term coho bycatch mortality of less than 4%. Four net sizes (31,37, 2H and 27) were tested. A 31" mesh with four panels of twine sizes varying in thickness from 16, 19, 23 and 26 was tested with findings that showed the 3 ½" mesh (19 or 23) as the most productive for chum with minimal differences in coho mortality. The finer mesh net (16) demanded too much maintenance to be economically viable and the coarser mesh (26) was too coarse and easily visible to the fish. Fishing for ten minute sets with these nets would appear to be unacceptable in the traditional net fishery. However, proponents of this study believe that a new fishery with a new attitude, on-board observers, and a quota to reduce the need for speed and to protect the bycatch, would open the door for increased opportunities to sell live, high-quality fish for 25-50% more value.

Further study, tagging and releasing fish is recommended to determine long-term mortality rates. As of October 21, the project has caught 400 coho with only two net mortalities.

6. Gillnet Test Using Multi-Panel Net, Weedline and Lateral Separation (GNGFR06)

Project Proponent: Modified Gillnet Working Group

The objective of this project was to test the effectiveness of using a 21" mesh weedline with 7" mesh chum net in the Fraser River to minimize steelhead, coho and chinook interceptions. Three vessels fished at the same time at three sites in the lower Fraser River. Each vessel fished a 100 fathom net consisting of a 50-fathom test net and a 50-fathom control net of 7" mesh, 60 meshes deep. Chum salmon were targeted during a total of 20 fishing days (per vessel) from October 15 to November 15, 1999. As of October 31, 4,036 chum, 52 coho, 16 chinook, 8 steelhead, 9 pink, and 16 sturgeon were captured.

Results

No results were available at the time of the workshop.

7. Modified Gillnet (6 3/8" mesh weedline) at Mouth of Fraser River (GNGFR07)

Project Proponent: D. Kadyschuk

The objective of this project was to test a drop weedline on a chum gillnet with 6 3/8" mesh. The gillnet was a total of 150 fathoms in length. Fifty fathoms shall be a control panel of 6 3/8" mesh, approximately 70 meshes deep. The test portion of the panel was a five foot drop weedline with 6 3/8" mesh, 60 meshes deep. The panels were used for fishing on a rotational basis on alternate days. The vertical distribution of all fish caught was recorded.

Modified Gillnet, *continued*
The test took place on the lower Fraser River within Subareas 29-13 and 29-14 at three sites at “lower”, “mid” and “upper” portions of the reach comprised of these subareas for a total of 14 fishing days from October 5 to November 15, 1999. Chum salmon was the target species. The number of fish caught as of November 1 were 2,008 chum, 2 steelhead, 58 coho, 19 chinook, and 9 pink salmon.

Results
No results were available at the time of the workshop.

8. Horizontal Two-Panel Gillnet with 16 Meshes of 9” Weedline (GNGFR08)
Project Proponent: R. Jacobsen, G. Jacobsen and R. Blyth
In this project, the study used a modified gillnet with a 100-fathom test panel with 9” weedline of 16 meshes over 30 meshes of 6¾” mesh chum net, and a 50-fathom chum net control panel. Net sets were no more than a half hour each. Vertical distribution by species was assessed for both the test and the control panels. Fish were counted by species, net location, revived if necessary and released. The test targeted chum salmon and took place in the lower Fraser River (Cottonwoods), within Subarea 29-13, for a total of 22 days from October 15 to November 15, 1999. As of October 30, fish caught were 2,071 chum, 3 steelhead, 32 coho, 6 chinook, and 3 pink salmon.

Results
Work was still underway at the time of the workshop and no results were available.

9. Upper Skeena River Coho Mapping Study (GNMNC01)
See details in the Project Review section of this report.

D. OTHER COMMERCIAL PROJECTS

1. Lax Kw’alaams Mobile, Floating Fish Trap Net (TNNC07)
Project Proponent: S.H. Dennis
The objective of this project was to construct and test a mobile, floating trap net. The test took place over a total of 10 days from June 28 to August 16, in the Nass and Skeena Rivers, targeting sockeye, pink and chum salmon. The trap net captured 6 sockeye and 30 pink. The control gillnet captured ~500 sockeye and ~1000 pink.

Results
Results are inconclusive due to insufficient time, steep learning curve and equipment. The proponents believe the equipment could be effective and mobile, given opportunities to modify. It is recommended that the trap net be longer and deeper. Further study is recommended to test selective fishing capabilities for sockeye.

2. Hawkshaw Fish Trap (TNNC09)
See details in the Project Review section of this report.

3. Campbell River Indian Band Trap Net Study (TNSC08)

Project Proponent: D. Sinclair

The objective of this project was to test a trap net for post-capture survival. The test took place from September 1 to November 20 in Heydon Bay and Loughborough Inlet (Sub-District 13N; Area 13-43). The targeted species was chum salmon.

Results

Preliminary findings show that the use of a selection tunnel positioned at the outlet end of the trap (spiller) allowed effective selective fishing without handling. Further study is recommended to develop a more flexible and portable trap net design which would extend its use to a variety of sites and situations. Consideration is being given to adapting this process and testing these findings in the seine fishery by crowding the fish from the pursed seine through a selection tunnel positioned in an adjacent well boat where they can be quickly sorted. Consideration is also being given to adapting this process for handling fish during tagging through an enumeration fence.

4. Free-Floating Trap Net at Mouth of Fraser River (TNFR02)

See details in the Project Review section of this report.

5. Paddle Trap Net (TNFR03 & TNFR17)

Project Proponent: B. Mowat and B. Pearson

The objective of this project was to test a floating fishtrap with a fish paddle as a selective gear. The test took place on the lower Fraser River at Canoe Pass, over a total of 31 fishing days from August 23 to October 31. All species were targeted with 225 chum, 80 coho, 71 pink, 1 steelhead, 6 sockeye and 1 chinook being captured.

Results

Early results show that the gear fished selectively with only one mortality. Modifications are needed for the gear. Seal predation caused ongoing problems. The best times to fish with a trap net were during the run-out tides. Fish were not concerned with the depth of water leading into the trap but were extremely nervous if the width of the leads was too narrow. Further study is recommended to modify the trap and paddle and test during a variety of tidal conditions and timeframes.

6. Trap Net and Power-Assisted Fishwheel Tests (TNFR10 & FWFR02)

Project Proponent: B. Manuck, Fraser River Fishermen Society

The objective of this project was to a test fishtrap and power-assisted fishwheel as selective gears. The tests took place during a 29 day period from August 23 to November 15 in the lower Fraser River and the mouth of Stave River. The targeted species was chum salmon. The fishwheel captured 26 pink, 25 chum, 5 coho and 1 chinook. The trap captured 20 coho and 4 pink.

Results

Test were ongoing at the time of reporting. No preliminary analysis is available.

7. Floating Trap Net at the mouth of the Fraser River (TNFR20)

Project Proponent: W. Wilson

This objective of this project was to test a floating fishtrap as selective gear and assess medium-term mortality using a net pen. The tests took place over a maximum of 21 fishing days from August to October at the mouth of the Fraser River, Canoe Pass near W. Ham Bridge. All species were targeted. Species captured were 5 sockeye, 403 pink, 12 coho, 4 chinook and 2 steelhead.

Results

The static floating trap net successfully fished selectively, resulting in a near-zero impact on endangered species, and proved that a high quality live produce could be harvested near major markets. Fish were caught and retained with zero mortality. After October 1, coho were present in the trap in larger numbers. All coho were coddle-punched for DNA analysis. Other findings included:

1. The trap requires a stronger and bigger heart (constructed from boom sticks) to provide the necessary rigidity
2. The trap door on the inner-heart which locks in fish and leads them into the spiller needs improvements
3. A lead time of two months is necessary

8. T'Sou-ke Trap Net in the Fraser River, near New Westminster (TNFR22)

See details under the Project Review section of this report.

9. Fishwheel and Fishtrap Kitselas Canyon, Skeena River (FWNC01)

See details under the Project Review section of this report.

10. Fishwheel in Area 29 (FWFR03)

Project Proponent: I. Bjerky/J. James, Yale First Nation Fisheries Stewardship Authority

The objective of this project was to test the fishwheel for selectivity, enumerate and release all captured species, tag chinook and sample coho for DNA. The fishwheel is powered by water current and flow. The test took place in the Fraser River 1.5 km downstream from Yale for seven days a week from July 29 to October 5. The target species were chinook, sockeye, coho, pink and chum salmon. Numbers caught were: 9,176 sockeye, 119 coho, 16,237 pink, 6 chum, 450 chinook and 22 steelhead.

Results

There were no results available at the time of the workshop.

2) FIRST NATIONS FISHERIES PROJECTS

Presented by Craig Orr, BC Aboriginal Fisheries Commission

1. Traps

There were 14 funded projects which included First Nations and alternate gear. The proponents of those funded included: Kristmanson, Lax Kw'alaams, Hawkshaw, Daikow, Campbell River Band, Mowat/Mombouqett, T'Sou-ke, Tsumura, Fraser River Fishermen Society, Tahltan, Metlakatla, Tsimshian, Shuswap, Heiltsuk.

The outstanding issues and potential impediments to progress include:

- Communal versus individual fisheries
- Intellectual property rights
- Biases: apparent statistical bias (however, there is no such thing as unbiased).

2. Beach Seines

There were 20 beach seine projects. The proponents include:

- Skeena: Skeena Fisheries Commission, A'tlegay
- Vancouver Island: Pacheedaht, Ahousaht, Ehattesaht, Kyuquot, Nucatlaht, Tla-oqui-aht, Nanaimo
- Central Coast: Kitasoo
- Fraser River: Katzie, Lakahahmen, Sumas, Tzeachten, SNFC, Tsawwassen, Squiala, Sea Bird Island, Nautley (CSTC)

Comments re the Skeena: Gitksan and We'sewet'en are experts at beach seining and have been doing it for years.
Comments re Vancouver Island: Major strides for Vancouver tribes in coastal areas, some lakes and in rivers.

3. Fishwheels

There were 8 fishwheel projects. Some of these are listed under "other commercial" summaries above. Project proponents include: Taku, Nisga'a, Kitselas, Gitskan, Sumas, Yale, Siska, and the Fraser River Fishermen Society (non-aboriginal fishermen working with First Nations groups).

4. Others

- Dip Net projects: 3 newly funded
- Tangle Net Projects: (3) Shuswap, Okanagan and Gitwangak
- Weirs/counting fences: (4) Mowachaht/Muchalaht, Huu-ay-aht, Uchucklesaht, Tsaicuz

3) RECREATIONAL FISHERIES PROJECTS

Presented by Martin Paish

1. Short-term mortality study using various recreational fishing methods (RECNC01)

Project Proponent: D. Dudley, Chatham Sound Charterboat Association
The objective of this project was to determine mortality rate differences among mooching with cut-plug herring, trolling with bait and trolling with artificial lures. The test took place in Area 4 (Squadderie) from August 7 to August 18, targeting coho. Number caught: 325 coho were held for mortality observations.

Results

Data still being analyzed. Proponents believe the use of barbed hooks will benefit salmon stocks> Barbless hooks resulted in a higher incidence of fish remaining on the hook for a longer period of time, only to eventually wriggle free—their condition and future unknown. Fishing with barbed hooks is quicker, as limits are achieved more easily with fewer losses, and less fish are caught that require releasing. Further study recommended with the same fisherman, on the same day in the same area fishing with the same gear, half of the time barbed, the other barbless. It was also noted that the use of a treble hook increased the release time of a salmon.

2. Buckley/Morice River Recreational Catch Monitoring (RECNC02)

Project Proponent: M. O'Neill & D. Struthers
The objective of this project was to monitor coho encounters by recreational anglers fishing for chinook and pink salmon. Various types of gear were tested in the Buckley Morice rivers from August 1 to August 15. Chinook and pink salmon were the target species. The fish captured were: 17 chinook, 6 pink, 5 coho and 1 steelhead.

Results

After 999.5 hours of monitoring, coho were not present in any significant numbers in the either river. It was only on the last day of the study (August 15), that the 5 coho were captured. Future work is recommended to confirm run timing and catch data.

3. Chinook Catch and Release in the Yukon River Recreational Fishery (RECNC05)

Project Proponent: D. Otto
The objective of this project was to look at the short-term mortality on chinook caught and released in the Yukon River recreational fishery. The gear tested included a roebag, single barbless hook (3/4 inch between shank and hook). The study took place August 1 to August 31, targeting chinook in the Yukon River.

Results

Due to a poor chinook run, the sample (30 fish released) was insufficient to provide significant results. Observations included:

- Gear worked will with only two mortalities (those fish were bleeding heavily upon landing and were hooked in the gill arches)
- The fish holding tubes (constructed of 8" diameter PVC with mesh caps) were ineffective due to an uncommon number of jacks. In order to reduce escapees, the use of smaller cap mesh or more costly nylon bags may be required.

- Access to recovery site and transporting fish in tubes from actual fishing location was treacherous; recommend a more accessible recovery site or the use of a boat with a live well.
- Amount of time a fish was played did not appear to influence death; instead fish mortality seemed linked to heavy bleeding.

4. Skeena River Recreational Catch Monitoring Program (RECNC06)

Project Proponent: J. Culp, J & S Outdoor Adventures

The objective of this project was to monitor and record the angler catch of coho in the chinook salmon sports fishery on the Skeena River and to determine the fishery's selectivity towards chinook. Recreational fishing gear with single barbless hooks was used in the lower Skeena River, downstream of Terrace from July 26 to August 7. Pink, chinook and steelhead were the targeted species. Fish captured: 52 sockeye, 185 pink, 226 chinook, 52 steelhead, 46 coho, 35 Dolly Varden and cutthroat.

Results

The study proved the selective capabilities of the chinook sport fishery as few coho were caught relative to the number migrating. The use of large #0 and #2 spin n'glo', with barbless hooks, was the most effective selective gear. Monitoring covered 50% of each fishing day and a minimum of 60% of all angling activity. Many anglers seemed amenable to barbless hooks, citing that though more fish are lost with this hook, easy release of non-target species is sufficient compensation. Recommendations: a)examine use of bait fishery on the lower gravel bars to determine if more coho are caught compared with artificial lures; b) observe landing methods of anglers and consider developing training to improve methods for better survival rates.

5. Area 20 Recreational Gear Selectivity Study (RECSC03)

Project Proponent: W. Harling, B.C. Wildlife Federation

The objective was to investigate differential incidence of hooking coho using bare, coloured hooks (pink, orange, red, blue/black), pink hootchies and conventional coho tackle (control). Fishing took place near Sooke and Port Renfrew, three days a week for four weeks, August 5 to September 5. Species targeted were sockeye and pink. Species captured: sockeye 53, coho 576, pink, 476, chum 0, chinook 79.

Results

Pink and sockeye abundance was significantly less than predicted. Bare hooks and pink hootchies caught fewer adult coho than conventional coho tackle, but pink gear caught more coho grilse than bare hooks or conventional gear. It was recommended by the proponent that terminal tackle in an "offshore" sport fishery in Area 20 be restricted to the use of bare hooks and small, pink hootchies to reduce coho interceptions. Further work is recommended to determine whether or not bare hook or flasher colour makes a significant difference in coho interceptions.

6. Selective Test Fishery Using Red Sockeye Gear (RECFR01)

See details in the Project Review section of this report.

7. Selective Fishing by Georgia Strait Sportfishing Guides (RECFR02)

See details in the Project Review section of this report.

8. Recreational Selective Fisheries Study – Coho Encounters (RECFR05)

See details in the Project Review section of this report.

V. CANADIAN CODE OF CONDUCT FOR RESPONSIBLE FISHERIES OPERATIONS

Guest Speaker: Rick Misner, Chairman, Canadian Responsible Fisheries Board
Excerpts of Mr. Misner's remarks follow.

"The Canadian Responsible Fisheries Board has been appointed by fishermen and their organizations from across Canada. Our job is to oversee the ratification of the ***Canadian Code of Conduct for Responsible Fishing Operations****.*

The concept of the Code first arose at the international level in response to the need to improve management of world fisheries. The United Nations Food and Agriculture Organization Conference adopted an International Code for Responsible Fishing in 1995. At the same time, the Canadian fishing industry recommended the development of a code which would address the diverse needs of Canada's fisheries. Industry consultations were held across Canada, with the support of the federal government, culminating in a National Fishing Industry Workshop in 1998.

That workshop, with over 60 representatives from all fishing industry sectors, including 10 from BC, agreed on the text of our Consensus Code. The workshop delegates also appointed a Canadian Responsible Fisheries Board as the governing body to oversee the ratification of the Code at a grassroots level, and to oversee the implementation of the Code. I was appointed from the Great Lakes. John Sutcliffe, Bob Rezansoff, and Ron Fowler were appointed to represent the BC industry, while Christine Hunt was appointed to represent aboriginal commercial fisheries from across the country.

The Code is made up of 9 Principles and 36 Guidelines addressing the protection of the resource and environment, fishing gear, vessels, access and enforcement, cooperation/partnership, education and research, and public awareness. These are not mere words, but provide fishermen with tools to continually improve and modify their fishing plans, to ensure that fish are harvested in a sustainable way that can ensure conservation of fish stocks for future generations.

The Code, conceived and owned by fishermen, provides a basic set of rules that reflect the individual commitment of fishermen to the goals of conservation and sustainability. By helping to implement the code, fisheries managers can:

- *increase the involvement of harvesters in fisheries management,*
- *improve collective conservation efforts,*
- *improve overall fisheries management, and*
- *ensure cooperative partnerships between industry and government.*

The fact that the Code has been ratified by fishermen's organizations from all regions of Canada reflects the diversity of fisheries with a commitment to conservation and the sustainable harvest of fish resources. In BC, organizations representing all three commercial salmon fleets, as well as the shrimp fishermen, the underwater harvesters, the halibut and groundfish sectors have ratified the Code.

Ratification is being sought from individual fishermen through direct voting within their organizations. This process is continuing and many associations are planning to hold

ratification votes this fall. For example, I understand from Christine Hunt that the Native Brotherhood of BC has it on their agenda for some time next month.

Aboriginal commercial fisheries from Nunavut, Northern Quebec, and Labrador have already ratified the Code, as well as the aboriginal freshwater fisheries from central Canada that operate under the Freshwater Fish Marketing Corporation.

In Victoria in 1998, and again in Quebec last September, the National Council of Fisheries and Aquaculture Ministers endorsed the Code.

By using the Code guidelines to develop responsible fishing plans for each individual fishery, industry and fish managers can work from a common framework. In effect, the Code can become the basis of a more cooperative and effective partnership between fisheries managers and the fishing industry.

Many of the projects that are being discussed at this workshop reflect the implementation of the Code; for example:

- *Principle 6 addresses issues of bycatch reduction and selectivity.*
- *Guideline 2.1 requires the development of protocols including the use selective fishing gears, to reduce the catch of non-target resources.*
- *Guideline 2.4 requires industry to conduct research to assess fishing gears and promote and utilize new fishing gears and practices that are consistent with sustainable fishing practices.*
- *Guideline 2.5 requires industry to participate in research and assessment initiatives aimed at resource and environmental protection.*
- *Guideline 6.3 requires industry to participate in the planning and implementation of research and assessment initiatives aimed at protecting bio-diversity.*

I think that everyone will agree that the selectivity experiments taken in the BC commercial seine, gillnet, and troll fisheries flow directly from these elements of the Code.

The fishing industry is often better equipped than most to judge the impact of fishing technologies on the ecology. Importantly, the industry should be involved in any discussions on the matter. The Code is a public declaration of the Canadian industry's commitment to conservation and ecology. The Code logo is now a registered trademark. This can provide a Canadian industry-owned and controlled eco-label.

The Code addresses issues in policy development, fisheries management, research, and enforcement/awareness/training. I would urge you to consider the Code and endorsement of it in each of the working group sessions in this workshop.

Conservation requires the cooperation of all resource users; for example, recreational fishermen also share access rights to fish resources, but may not have collectively addressed conservation concerns in this codified manner. If stakeholders such as recreational fishers were looking to establish a similar type of code, it would seem appropriate that linkages between the commercial industry Code and theirs might also encourage cooperative resource management.

I would encourage all resource users to make the commitment to responsible use of marine and freshwater resources that we in the commercial fishing industry have made."

VI. SELECTIVE FISHERIES PROJECT REVIEWS 1999

1) RECREATIONAL FISHERIES PROJECTS

1. Saltwater Coho Avoidance

Presented by David Korseh.

A. Selective Test Fishery Using Red Sockeye Gear (RECFR01)

Project Proponent: L. Milligan

Project Objective

To ascertain coho encounters when fishing simultaneously with one vessel targeting sockeye and pink using red gear and another vessel targeting coho using coho gear. The study took place at the mouth of the Fraser River (Area 29), for 14 days from August 23 to September 24.

Gear Tested

Red Gear (traditional sockeye gear: small hoochies with pink or red hue).

Results

Small sample size due to lack of fish. Therefore drawing any conclusions regarding the selectivity differences between red and coho gear is difficult. There was an extremely low rate of coho encounters (less than five), and of the 14 sockeye that were caught and released, five were captured using coho gear. Further study is recommended in order to test this gear when fish are more abundant. No coho were caught on the bare hooks. Bare hooks were selectively effective. Both bare hooks and red gear each caught 27 pinks, so fairly effective for catching pinks.

Table 1. Study A. Comparisons of Red Gear and Bare Hook CPUEs
(CPUE catch per unit effort: in this study a rod hour)

Species	Red Gear	Bare Hooks	Ratio of Bare Hooks to Red Gear
Sockeye/pink	0.0961	0.0812	0.8450
Coho	0.0087	0.0000	0.0000
Chinook	0.0117	0.0000	0.0000
Total Adult Salmon	0.1165	0.0812	0.6970
Total Strikes	0.1864	0.0992	0.5322

B. Selective Fishing by Georgia Strait Sportfishing Guides (RECFR02)
(Comparison of red gear and coho/chinook gear)
Project Proponent: W. Michie, Georgia Strait Sportfishing Guides

Project Objective
To test the ability of sockeye and pink gear (red gear) to avoid coho and Harrison River chinook against that of bare hooks and attractor/flasher gear. The study took place in the south end of the Strait of Georgia, mouth of the Fraser River (Area 29) for 14 fishing days during the period August 25 to October 8. Sockeye and pink salmon were targeted.

Gear Tested
Red gear for sockeye and pink salmon versus bare hooks and attractor gear. Two boats were fishing each day during the 14-day period.

Results
Analysis ongoing at the time of this workshop. No coho were caught on the red gear. Samples size extremely small. Very low coho catches. Coho and chinook gear again caught sockeye and pinks but significantly less.
Observation: red gear is effective for avoiding juveniles. But there is have nothing statistically valid yet as analysis is still underway. Study does show that red gear is not that bad when it comes to avoiding coho.

Future Work
Recommended, particularly when sockeye are more abundant, in order to gather better data on whether or not bare hooks are a viable alternate. This year with 'scattered' fish, it was difficult to confirm this. Also, because of the low numbers of sockeye, the gear was open and available for coho and chinook to take the line much more so than in an average year.

Table 2. B. Comparisons of Red Gear and Coho/Chinook Gear CPUEs
(CPUE catch per unit effort: in this study a rod hour)

Species	**Red Gear**	**Coho/Chin Gear**	**Ratio of Red Gear to Coho/Chin Gear**
Sockeye/Pink	0.0952	0.0547	1.7404
Coho	0.0000	0.0055	0.0000
Chinook	0.0054	0.0082	0.6585
Total Adult Salmon	0.1006	0.0793	1.2686

2. Freshwater Coho Encounters

Presented by Peter Sellmer/Chris Gadsden

A. Recreational Selective Fisheries Study – Coho Encounters (RECFR05)

Project Proponent: S. Ritchie, SFAB Upper Fraser Sub-Committee/Fraser River Valley Salmon Society.

Project Objective

To test whether or not recreational anglers could selectively fish for pink and sockeye salmon in the upper Fraser River during coho migration (end August-end Sept) and avoid coho. To determine the number of coho encounters.

Description

Type of fishing method: bottom-bouncing. Gear: a standard drift fishing rod, 6, to 8 lb. test line, drop or ball sinker of 1 to 4 oz. weights depending on water velocity, 1/0 or 2/0 single barbless hook with wool, spin n'glo, corky or drifter (plastic beads) lures. Cast upstream, drift through the centre point of stream (weight bounces along the bottom) and fish start to pick up on the hook downstream.

The experiments took place over six days (September 11 & 12, 18 & 19 and 25 & 26) at three locations on the Fraser River near Chilliwack, chosen for their different water (velocity) characteristics: Grassy Island, slack water; Queens (Victoria) Island, heavy water; and Wellington Bar, medium-type water. These were not considered "hot" areas for coho. The best bars for coho are not very conducive to bottom bouncing. Approximately 165 anglers with a diverse range of experience participated. One observer to every 6 to 8 anglers collected data, ensured that all fish caught were correctly identified and that the fishing and handling techniques were correct.

Results

Preliminary results only. The participants successfully selectively fished and released their target species of pink and sockeye. Coho encounters were extremely low. Of the total 2,266 fish caught, only 3 were coho. All fish caught were released and it appeared (personal observation) that an extremely high survival rate of 98% was achieved. It was felt that the real key to survival depended upon correct handling techniques rather than any stress on the fish from playing on the line. Male to female ratio of catch was estimated to be 50/50. Not scientifically determined. The study showed that fish can be selectively caught using a particular method.

Table 1: Summary of Total Fish Angled at each location

Location	Coho	Chinook	Chum	Pink	Sockeye
Wellington Bar	1	15	19	516	79
Grassy Island	2	38	17	507	162
Queens Island	0	25	42	742	42
TOTAL	**3**	**78**	**78**	**1765**	**283**

Total fish: 2266 (Steelhead: 0; Other: 59)

Future Work

Further study is recommended to test the selective fishing in other parts of the river in a larger scale fishery and for chinook while sockeye are returning.

3. Science Presentation--Hooking Release Mortality Studies

A. 1999 Coho Catch and Release Studies: Summary of Results (Preliminary) North Coast British Columbia

Presented by Stephen Cox-Rogers, Don Anderson: Fisheries and Oceans Canada

Objectives

- To determine short-term (24 hour) mortality rates for coho captured on similar gears fished in different locations.
- Gather data on factors affecting mortality, such as hook location, fish size, fish condition.

Fishing Methodology and Gear Used

a) Dundas Island (Area 3) July 26-30.

Three boats with the same anglers on each boat fished each day. Observers were also placed on each boat. Fish were caught on:

- motor-mooched cut-plug herring
- trolled cut-plug herring (downriggers)
- trolled artificial lures (downriggers)
- all tandem or single barbless 4/0-5/0 hooks.

b) Stevens Island (Area 4) August 12-18

Six boats with different anglers fished each day. The gear was rotated among boats. Observers were on board each. Fish were caught on:

- motor-mooched cut-plug herring
- trolled herring (downriggers)
- trolled artificial lures (downriggers)
- primarily tandem or single 4/0 to 5/0 barbless hooks.

c) Langara Island (Area 1) August 23-30

Part A: Observers accompanied anglers in boats(skiffs). Volunteer anglers. Four lodges participated. Fish captured on motor-mooched cut-plug herring and tandem barbless 4/0-5/0 J hooks.

Part B: Observers in retrieval zodiacs. Volunteer anglers in skiffs. Four lodges participated. Fish were captured on motor-mooched cut-plug herring and tandem barbless 4/0-5/0 J hooks.

Fishing Handling and Holding

The majority of the fish were netted at the side of the boat with a special soft-mesh net supplied by FOC. The observers recorded hook location and associated data for each fish upon landing. The fish were transferred into holding tubes held at side of the boat for pick up (5 to 15 minutes). A zodiac picked up each fish, applied a floy tag, and returned the fish to a holding site 2 to 10 minutes away. At the holding site, each fish was measured, bio-sampled, sexed and transferred into one of six holding tanks, aboard a 53' holding vessel, or into a floating net pen held along side the holding vessel. Daily holding goals set at 30 fish per day minimum, 60-100 fish per day maximum. Mortalities were counted and survivors released the next morning following a maximum 24 hr. holding period.

Results: (Preliminary)

- Landing rates (all species):
  - were highest for trolled gear, and lower for motor-mooched herring.
  - barbless hooks may have affected landing rates; no data to substantiate this.
- Mortality rates:
  - similar for all gears tested at Dundas and Steven Islands (E.G. 5% - 17%).
  - Mortality rates were highest at Langara Island for motor-mooched cut-plug herring (E.G. 22%).
- Mortality rates were highest for hooks located in the critical deep mouth area:
  - Hook location in the landings and mortalities varied by gear type.
  - For trolled gear, the outer mouth and outside mouth were common hook locations.
  - Deep mouth mortalities typically exhibited tearing or puncture wounds to the gills, throat, or internal organs (heart, liver, etc.)
  - Outer mouth and outside mouth mortalities typically exhibited puncture wounds to the tongue, isthmus, eye and brain.
  - Motor-mooched herring at Langara Island resulted in higher overall mortality rates because more fish took the baits deeply compared to coho captured at Dundas or Stevens Islands. This might be because fish were larger and observed to be more aggressive at Langara Island.
  - The larger fish (more than 65cm) captured on motor-mooched herring had higher mortality rates compared to large fish captured on trolled gear.
  - Larger fish tended to ingest motor-mooched baits more readily than trolled baits or lures and exhibit high mortality because of it.
- Bleeding was associated with mortality:
  - A high proportion of the mortalities, for all gears tested, were bleeders.
  - Fish hooked in the deep mouth area exhibited higher rates of heavy bleeding than fish hooked in the outer mouth or outside mouth areas. 54.3% of all heavy bleeders died, while only 4.5% of all light bleeders died.
- Handling/Holding Effects were felt to have been small influence, as most fish that died exhibited critical hooking injuries, and died within the first few hours of holding.
- Tanks versus net pens: this was only evaluated at Dundas and Stevens islands. There were no significant differences in mortality rates between the two.

Conclusions

1. Landing rates for barbless hooks were in the 40% to 70% range for the gear types tested. Given the high proportion of fish lost, drop-off mortality could be an important component of total mortality for coho captured and released in the North Coast marine recreational fisheries.
2. Short-term mortality rates for coho captured on trolled herring or lures were very similar (5% to 17%) at two different study locations assessed in 1999 (Dundas and Stevens Island).
3. Short-term mortality rates for coho captured on motor-mooched cut-plug herring were significantly higher (22%) at Langara Island compared to Dundas and Stevens Island (less than 10%).

4. Mortality rates were associated with hook location. For all gear types tested, fish hooked in the critical deep mouth exhibited the highest mortality rates, a finding consistent with other studies (NRC 1999).
5. Bleeding was associated with mortality: a high proportion of all mortalities (>80%) exhibited bleeding when landed. Mortality rates were highest for heavy bleeders (>50%). Most heavy bleeders were those fish hooked in the deep mouth.
6. Factors other than gear and method, such as stage of maturity, fish size, and fish behaviour (reaction to the gear) may influence mortality in different ways and at different times of the year. The stability of mortality rates throughout the season in different fishing locations is not clear.

B. Fraser River Inter-tidal Zone *(Preliminary Summary of Results)*

Presented by Don Anderson, Head, Fraser River Salmon Section
Fisheries and Oceans Canada
Project Proponents: Lower Fraser Valley Local Committee of the Sport Fishing Advisory Board (SFAB).

Purpose

The purpose of the study is to measure the hooking and release survival (mortality) of coho salmon caught in both transition and freshwater zones by typical Fraser River bar fishermen. The null hypothesis is that survival rates are similar in freshwater and salt-water zones for the Fraser River bar fishery.

There are few studies on the mortality rate of any salmon hooked in the recreational fishery and released in the intertidal zone. Speculation has it that the morphological change in the fish while travelling through this zone increases mortality rates in hook and release fisheries as opposed to similar hook and release mortalities in fresh water.

Status

The study was completed as scheduled, running for 20 days. Volunteer anglers fished for coho at two Fraser River bars (Brownsville Bar and Duncan) for 20 days. Data on all captured species and specific information for coho has been collected and is undergoing analysis.

Fishing Methodology and Gear Used

This was a prototype study, to determine whether adequate data for statistical analysis could be collected with respect to the hypothesis under study. The study was conducted at Duncan and Brownsville Bars, the former being a freshwater bar. These are common fishing bars for coho. A standard two hook bar rig (barbless and not to exceed 2-ought) and roe bait were used for all fishing. A representative mix of fishermen were selected and placed on the two bars. Observers recorded all coho caught and noted landing time, hook location, severity of hooking, and assessed landing stress from 1-5, signifying gentle to harsh landing techniques. Mortality at landing was noted and examined for cause. The surviving caught coho were transferred to holding pens designed to be predator proof and were deep enough to allow the held fish to select recovery depth. Each fish was floy tagged and DNA

sampled. The fish were held 24 hours, (any mortality noted) and recorded by tag, and then released.

Thompson Coho Concerns
In order to minimize mortality on Thompson coho, the program was conducted through October 3 to 27 (for 20 days). Go-no go indicators were instituted, based on the number of coho landed and possible risk of mortality to Thompson Coho. The following table was developed to calculate the go-no go indicators:

Projected Thompson Coho Mortalities for the Coho Hooking Mortality Study RECFR03

For October 1999

Week	%Thompson Coho	Allowable Mortalities	Coho Cutoff Catch
1	2.58	2	310
2	1.92	1	208
3	0.24	1	1667
4	0.24	1	1667
Total Mortality		**<= 5**	

Expected Worst Mortality Rate %: 25

Projected Thompson Coho Mortalities for the Coho encounter Study RECFR05

For first 3 weeks of September 1999

Week	%Thompson Coho	Allowable Mortalities	Coho Cutoff Catch
1	15.96	2	50
2	15.96	2	50
3	8.1	2	99
Total Mortality		**< = 6**	

Analysis Strategy
The main hypothesis was tested as a test of independence/association as a 2X2X2 table design with a hierarchical fit of a log-linear model. The factors are:

- Location (salt or freshwater),
- Maturity (jack or adult)
- Survival (released or dead).

Problems
The main issue with this model is that small sample sizes within any component will reduce the power of the tests and therefore make any fit (test) problematical. A power analysis indicates that a sample size of at least 50 is required for each cell to achieve an adequate level of power to detect the effects being measured. After the first 10 days of the experiment we have collected more than the expected jacks and less than expected adults at each of the two bars. We believed that enough adults would be captured in the remaining 10 days of the experiment to ensure adequate sample sizes.

Results (preliminary and incomplete)
The following table summarizes the capture/survival summary for the two Bars over the entire project cycle.

Location	Age	Caught/Released	Mortalities
Brownsville Bar	Adult Coho	39	6
	Jack Coho	256	77
Duncan Bar	Adult Coho	38	7
	Jack Coho	168	72

Briefly, the result of this procedure on the above data indicates that there are no significant interactions between all the factors and hence the complete interaction term can be dropped from the model (G= 0.01267 P(G) = 0.91037). Tests of conditional independence indicate that only the effect of location on mortality is significant (G= 8.620060 , P(G) =.01319). Tests of independence indicate that within each location, the age and mortality are significantly associated.

Conclusions
The data indicate that the design was sufficient to acquire an adequate sample size to establish a base line level of mortality by bar fishers on coho. The results of the preliminary analysis indicate that as suspected, location and age of the fish appear to be significantly associated with mortality.

The levels of the mortality will be estimated in the next step of the analysis.

C. Clayoquot Sound: South Coast BC *(Preliminary Summary of Results)*

Presented by Don Anderson, Head, Fraser River Salmon Section
Fisheries and Oceans Canada
Project Proponents: Fisheries and Oceans Canada, the Sport Fishing Institute of British Columbia (SFI), and Weigh West Marine Resort.

0bjectives

1. To determine short-term (24 hour) mortality rates for coho captured on similar gear fished in the same location at different times.
2. Collect data on factors affecting mortality, such as hook location, fish size, fish condition.

Time frame

- Session 1 August 8 to 17
- Session 2 September 9 to 16
- Session 3 September 27 to October 6

Fishing Methodology and Gear Tested

Charter boats with guides and observers on each were used for the study. Volunteer anglers with varying levels of experience (novice, intermediate, advanced) fished each day. Fishing styles:

- Trolled artificial lures (Downriggers) with or without flashers using tandem or single barbless 4/0-5/0 hooks.
- Cast or trolled (Bucktail) flies using single or tandem barbless #1-2 hooks.
- Drift or jerk fishing lures using double (treble hook with one hook removed) or treble barbless 1/0 hooks.
- Spin casting artificial lures using double (treble hook with one hook removed) or treble barbless 1/0 hooks.

The majority of fish were fish netted at side of the boat with soft-mesh nets. Observers recorded hook location and associated data for each fish upon landing, and tagged the fish. The fish were transferred into holding tubes held at side of boat for pickup (5-60 min.). A transport vessel with holding tank picked up each fish, read the tag and measured the fish, and then transported the fish to a holding site 10-30 minutes away. At the holding site, each fish was put into an anchored floating net pen (10 X 10 X 20 feet). Daily holding goals were set at 30 fish per day minimum, 60 fish per day maximum. Mortalities were counted and survivors released the next morning following a maximum 24 hour holding period

Results

- Fishing Styles:
  - Fishing during session 1 and 2 was predominately troll fishing with downriggers and flashers. Trolling with downriggers and flashers is the predominant fishing style in Clayoquot Sound during the spring and summer months.
  - Fishing during session 3 was characterized by fly, drift, and spin cast fishing. These fishing style are common in Clayoquot Sound during the fall.
- Landing Rates:

Landing rates for coho varied among sessions and were highest for trolled gear and lower for non-troll gear (Table 1). Barbless hooks may have affected landing rates, but no data to substantiate effect of barbless hooks on landing rates.

- Mortality:
  - Mortality rates varied among sessions (2.73 to 8.25 %) and were highest for session 2 (Table 2).
  - Mortality during session 2 was significantly higher than the DFO standard of 10%.
  - Coho during session 2 were larger and more aggressive than at other times and this may account for the higher mortality rate.
  - Troll fishing had a higher mortality rate (6.6%) than non-troll fishing (2%).
  - Non troll fishing tended to use smaller hooks and the coho were less aggressive and less likely to strike later in the season.
  - Mortality for the whole study (5.93%) was significantly lower than the 10 % presently used by DFO.
  - Hook location affected mortality.
    - The outer mouth and outside mouth were the most common hook locations.
    - Mortality rates were highest for hooks located in the critical deep mouth area (Table 3).
    - Deep mouth mortalities typically exhibited tearing or puncture wounds to the gills, throat, or internal organs (e.g. heart, liver, etc).
    - Outer mouth and outside mouth mortalities typically exhibited puncture wounds to the tongue, isthmus, eye, and brain.
  - Bleeding was associated with mortality (Table 4).
    - A high proportion of the mortalities, for all sessions, were bleeders (63%).
    - Fish hooked in the deep mouth area exhibited higher rates of bleeding than fish hooked in the outer mouth or outside mouth areas.

Conclusions

1. Landing rates for barbless hooks were in the 40% to 65% range for the gear types tested.
2. Short-term mortality rates for coho captured during sessions 1 and 2 (predominately troll gear) was 4.8 and 8.25% respectively. Mortality varied with time. Coho in session 2 were larger and tended to be more aggressive and this could account for the higher mortality rate.
3. Short-term mortality rates for coho captured on non-troll gear were low (2%) and were associated with smaller hooks and reduced fish aggression.
4. Mortality rates were associated with hook location. For all gear types tested, fish hooked in the critical deep mouth exhibited the highest mortality rates, a finding consistent with other studies.
5. Bleeding was associated with mortality and 62% of all mortalities exhibited bleeding when landed.
6. Factors other than gear and method, such as stage of maturity, fish size, and fish behaviour (reaction to the gear) may influence mortality in different ways and at different times of the year. The stability of mortality rates throughout the season in different fishing locations is not clear.

Table 1. Clayoquot Sound Coho Landing Rate Summary (Landings/Hookups) by session and gear treatment Non troll includes fly, drift and spincast fishing.

Session	Dates	Gear	Hookups	Landings	Landing Rate
1	Aug 8-17	Troll	476	312	0.656
2	Sept 9-16	Troll	510	303	0.594
3	Sept 27-Oct 1	Drift/fly	145	65	0.450
	Oct 2-6	Spincast/fly	109	45	0.412
Totals		Troll	986	615	0.624
		Non Troll	254	110	0.433
		All Gear	1218	725	0.595

Table 2:

Table 2. Summary of mortality by session and gear type. N is the total number of fish landed. Z and P values used to analyse mortality rates relative to the DFO standard mortality rate of 10% (Statistical Test: H_o: p=10% v.s. H_a: p< 10%). Non troll includes fly, drift and spincasting.

	Dead	Alive	N	FL(cm)	Mortality	Variance	z-value	p-value	Significant
Session									
1	15	297	312	61.09	4.81%	1.467E-04	-4.28715	9.055E-06	Yes
2	25	278	303	65.25	8.25%	2.514E-04	-1.08592	1.388E-01	No
3	3	107	110	59.88	2.73%	2.412E-04	-4.6831	1.414E-06	Yes
Gear									
Troll	41	582	623	63.10	6.58%	9.868E-05	-3.44168	2.891E-04	Yes
Non Troll	2	100	102	59.85	1.96%	1.885E-04	-5.85597	2.379E-09	Yes
Total	43	682	725	62.64	5.93%	7.696E-05	-4.63836	1.758E-06	Yes

Table 3. Release status (dead or alive) after a maximum of 24 hours holding time by lethal and non-lethal hook locations and session. Lethal hook locations are upper and lower gills, roof of mouth, deep in throat, and pharynx. Non-lethal hook locations are upper and lower jaw, head and body. Hook locations assessed at time of capture.

		Hook Location					
Session	Status	Lethal		Non-Lethal		Total	
1	Dead	10	25.64%	5	1.83%	15	4.81%
	Alive	29	74.36%	268	98.17%	297	95.19%
	Total	39		273		312	
2	Dead	24	45.28%	1	0.40%	25	8.25%
	Survived	29	54.72%	249	99.60%	278	91.75%
	Total	53		250		303	
3	Dead	3	27.27%	0	0.00%	3	2.73%
	Survived	8	72.73%	99	100.00%	107	97.27%
	Total	11		99		110	
Study	Dead	37	35.92%	6	0.96%	43	5.93%
	Survived	66	64.08%	616	99.04%	682	94.07%
	Total	103		622		725	

Table 4. Release status (dead or alive) after a maximum of 24 hours holding time by bleeding condition and session. Bleeding includes heavy, moderate and light conditions. Bleeding assessed at time of capture.

		Status				
Session	Condition	Dead		Alive		Total
1	Bleeding	11	73.33%	119	40.07%	130
	None	4	26.67%	178	59.93%	182
	Total	15		297		312
2	Bleeding	14	56.00%	73	26.26%	87
	None	11	44.00%	205	73.74%	216
	Total	25		278		303
3	Bleeding	2	66.67%	20	18.69%	22
	None	1	33.33%	87	81.31%	88
	Total	3		107	2.73%	110
Study	Bleeding	27	62.79%	212	31.09%	239
	None	16	37.21%	470	68.91%	486
	Total	43		682		725

2) FIRST NATIONS FISHERIES PROJECTS

1. Kitselas Selective Fishing: Fishwheel and Fishtrap (FWNC01)

Presented by Project Proponent: Willie McKenzie, Kitselas Band Council

Objectives

1) To test the selectivity of a Kitselas-designed fishwheel and fishtrap, and their leads, in the Skeena River;
2) to take DNA samples of coho and sockeye;
3) to test the survivability of fish.

Fishing Methodology and Gear Tested

The test was conducted on the mainstem of the Skeena River in Kitselas Canyon during the last week of July to the first week of October using the Kitselas-designed fishwheel and fish trap. Chum, sockeye, chinook and pink salmon were the targeted species. Fish captured: 947 sockeye, 263 coho, 3,907 pink, 60 chum, 9 chinook, 180 steelhead, 2,384 jack sockeye, 159 trout and 544 lamprey.

Results

Interim findings were quite positive:

- The fishwheel and fishtrap proved to be effective selective fishing gear in the strong currents of the Skeena River.
- The required DNA samples from coho and sockeye were taken and delivered to the Department of Fisheries and Oceans.
- Coho and steelhead were captured and released, unharmed.

Further tests are recommended in the lower Skeena River in slower moving water within the tidal zone areas.

2. T'Sou-ke Trap Net in the Fraser River, TNFR22

Presented by Project Proponent: D. Lightly, T'Sou-ke First Nation

Objective

To test a floating fishtrap as a selective gear and test the operation and effectiveness of an aquatic sorting tray. The test took place in the lower Fraser River ('the Grass' area) over a 33-day fishing period from August 3 to October. All species were targeted.

Fishing Methodology

A brief history of reef net technology and the results of last year's study were presented. The same net trap was used again in the 1999 study, with modifications for more efficient handling of the fish. The fish handling device enabled the fish to be handled and released in water. DNA samples could also be taken in the water. Fish were moved through the 'ramp' gently, with no thrashing.

Results

Fish Species	Number Captured	Mortality
Sockeye	45	0
Pink	691	25
Coho	47	1
Chinook	18	1
Chum	82	15
Sturgeon	16	0

The trap net caught 900 fish. All of these were released with the exception of 42 mortalities. All mortalities resulted from seal predation. However, the catch from this gear was very small in proportion to the strength of the run. There is some belief by the proponents that if the traps were built for specific site locations, this methodology could be applied to the broader fishery. There are problems with moving the trap and the sorting tray requires some modification. The 47 coho captured were released alive after DNA sampling (with the exception of one mortality). As a result, the trap is being considered as a capture method for tagging coho next year.

3) COMMERCIAL FISHERIES PROJECTS

1. Seine Fishery

A. Seine Selectivity Grids & Bunt Comparison Study (SNGSC05)

Presented by Project Proponent: Bob Rezansoff

Objective

To compare the effectiveness of knotless bunt with grids versus standard knotted 4-inch bunt mesh.

Fishing Methodology and Gear Used

Based on studies from 1996 through to 1998, this year's study determined the effectiveness of installing selectivity grids in an experimental seine bunt to permit the escape of coho and undersized fish in Area 20 (six days in Juan de Fuca from August 28 to September 2, and three days in the Strait of Georgia [mouth of the Fraser] from September 15 to 17). Two vessels, one with modified gear and the other as the control vessel were used in the studies. The bunt on the control gear had a small mesh escape panel added to it.

The catch was brailed on board through the use of a sock brailer and a chute system which minimized damage by handling. This method of brailing and handling was developed as a result of the 1998 Barclay Sound experiment The bunt of the net was made of smaller mesh *knotless* netting which minimized damage normally caused by abrasion from the knots. Significant problems in Area 20 are the gilling of juveniles (mainly coho) and small pinks when using the traditional bunt (due to small knotless netting and escape grids the small non-target species will escape and pinks will not gill).

Further work was done with modified grids to determine the grid spacings which would allow small pinks to escape while targeting the large ones. The grids, ten in total, were designed and manufactured with an optimum grid spacing of 50mm for coho to escape easily without damage. The grids were then inserted into the new knotless netting, close to the cork line and spaced to optimise escape. Five more grids were designed and manufactured for the second phase. These grids were made stiffer so that the bars would not flex when fish escaped. The spacing between the bars was also reduced to 47mm to see the effect of this on the escape of pinks.

Species caught:

Juan de Fuca (outside)		Fraser River (Mouth)	
Sockeye	2429	Sockeye	30
Coho	2881	Coho	5
Pink	2184	Pink	664
Chum	25	Chum	14
Chinook	133	Chinook	44
Steelhead	2	Steelhead	0

Results

- The test bunt, once modified, worked well – catching commercial fish, releasing juvenile coho and smaller fish—resulting in reduced handling of bycatch. At a peak coho length of 25cm the increase of escaped fish over the control gear near 40 percent. It was observed that some of the escaped fish, because they were restrained from fully escaping (due to the escape containment net), came back through the grid into the main bunt. This distorts the results. It was noted that on the fourth day, when considerably more fish were captured than on the previous days, the grids were allowing fish with a girth size of more than 50mm (the distance between the bars) to escape through them. Most of these had girth size of 50 to 60mm. The grids were stiffened by using twine as reinforcement between bars. This did not completely solve the elasticity of the grid bars. The experimental net allowed larger coho to escape compared to the control net. The control net retained considerably more larger coho (60mm girth). There is no explanation for this but it is not a desired effect in the case of coho (in the control net).
- Observations: fish go through the grids if, on entering between the bars, they can see both bars at the same time. The distance between the eyes is smaller than the girth. To date, the grid bar spacing has been based on the girth measurements. The elasticity of the body and at the girth, in particular, allows the fish to squeeze between the bars. This is not the case in netting where, even though the fish may be able to go through at the point of the eyes, the diamond shape of the netting will not allow the rest of the body to go through and then the fish may be gilled. The smooth finish of the bars allow the fish to go through without damage to the scales or skin.
- The selectivity of the grids: since the sets during the trials captured much less than the required 100 fish for determining the selectivity of the grids with any degree of confidence, no attempts were made to fit a sigmoid curve to the data. Nevertheless, the data nearly follows such a curve**.** There are fewer escapees than could be predicted by a sigma curve between 40 and 50mm lengths. This was likely due to the escaped fish going back into the bunt through the grids (mainly due to the escape bunt netting causing congestion among the fish). During the trials conducted two years ago when no escape bunt was used, it was observed using underwater video camera that the fish swam well away from the net on escape through the grids. This would therefore not occur in a commercial fishery where there would be no escape bunt.
- Because marketable size pinks were seen to escape through the grids, it was decided to test the grids with a smaller spacing between the bars. Grids were modified to decrease the 50mm bar spacing to a 47mm spacing and tested during the last three days of the second part of the study (mouth of Fraser River). The grids with a 47mm bar spacing retained more smaller fish compared to the 50mm. However, the escaped pinks were still considered too large and the bar spacing was further reduced to 43mm by wrapping twine tightly round each alternate bar of each grid. This did not allow any pinks to escape. It was concluded that a 45mm bar spacing would allow the retention of all marketable pinks.

- The use of the sock brailer improved the quality of the fish taken onboard. This was mainly due to the water contained in the brailer when taken inboard and to the less abrasive nature of the knotless netting.

Conclusions and recommendations

1. Grids are effective in releasing under-sized fish of a given species when installed in a suitable location in the bunt; in the experiments there was a lack of numbers of "fish of concern" to come to a statistically significant conclusion.
2. The 47mm grids would suit fishery in a sockeye year and 42mm grids in a pink year; five to ten grids would be sufficient in the bunt and they should be located to suit the vessels handling technique during the drying operations.
3. The sock brailer operated to give the highest quality of fish taken onboard; this was assisted on the test vessel by the use of knotless netting.
4. The data on the girth width has been collected for the various species (coho, pink and sockeye) encountered to enable the selection of the grid spacing to ensure the release of non-targeted size and/or species. There is, of course, a concern about the size variations between different runs of a given species.
5. To ensure that projects such as this produce data which can be compared with others and stand the test of time, they should be conducted under the guidelines/protocols which have been produced by DFO (in1998).

B. Seine Brailer & Wet Sorting Study (SNGSC10)
Presenter and Project Proponent: Glen Budden

Objective

This study is a continuation of the 1998 study efforts. The 1999 objective was to carry out more comprehensive testing on the most successful brailer designs – the wet and sock brailers and expand the study to examine the merits of a wet sorting box.

Fishing Methodology and Gear Tested

The study took place over 10 days between August 4 and September 5 in Areas 12 and 20.

Brief descriptions of the gear:

1. Standardized Brailer: the conventional design for fleet-wide mandatory brailing.
2. Wet Brailer: a design which keeps fish in water and provides a gentler release into the sorting area. The entire brailer is laid in the sorting area, the purse released, allowing the fish to slide through a polyvinyl sock. Scale loss is reduced and there is less trauma to fish.
3. Sock Brailer: a design which keeps fish in water and eliminates the need to transport and then release fish into the sorting area. They are simply lifted until they begin sliding through a polyvinyl sock, directly to the sorting area. The sock allows fish to remain immersed in enough water to substantially minimize pressure and scale loss.
4. Sorting Box: aluminum and designed to attach to the top of a seine boat's fish hatches. Three exit ramps for target species. Rounded top rails and 45 degree corners to make sorting easier and more fish-friendly.

Gear was tested in various sea and weather conditions, outside of regular commercial openings. Data was collected for analysis on:

1. Brailer / Sorting Box: visual observations of fish activity levels, length of time to brail and sort, fish quantity; sorting box and brailer water levels; set locations and weather conditions. The brailers and sorting box were evaluated for the ability to increase coho survivability and operating efficiency and effectiveness.
2. Coho Stress: Blood and muscle tissue samples collected (SFU analysis).
3. Catch and Release: coho encounters and condition to be used in conjunction with stress test results to evaluate and compare the various gear.

Fish Captured

Area 12: 2224 sockeye, 167 coho, 6530 pink, 101 chum and 79 chinook.
Area 20: 28 sockeye, 75 coho, 118 pink, 1 chum and 16 chinook.

Results

The conclusions are based on preliminary results (mostly visual observation). The completion of the SFU stress tests analysis (March 2000) will provide more definitive results.

- The most significant finding: that salmon appear less active and less stressed when brailed and handled in water. Results indicate good potential to increase the survivability of caught and release non-target species.
- The sock brailer and wet box were the most fish friendly combination. The sock brailer demonstrated the best performance overall. The benefits to coho survivability were significant, with relatively few concerns or drawbacks. The benefits gained from the wet box do not seem justified given concerns with identifying and removing non-target species; water and fish spillage in adverse weather, high costs, and added time requirements.
- Only through a mortality study, could the most successful seine harvesting and handling methods be determined.

By using new selective gear and standardized handling practices, seines may realistically achieve near-zero mortality of non-target species.

Recommendations

- A fish friendly sorting box, but not necessarily filled with water. Used in combination with the sock brailer, a ‘dry’ sorting box will retain enough water from the brailing process to benefit the fish.
- A broader application of the sock brailer and a sorting box via a red zone test fishery so that a larger yet manageable group of seines can experiment with these gear modifications.
- Education and training seine licence holders, skippers and crews on handling methods.
- Penalties for non-compliance should be severe and should be directed at the individual not the entire fleet.

2. Troll Fishery

A. Area H Troll Mortality and Gear Comparison Study (TRGSC12)

Presented by Project Proponent: Mike Griswold, Gulf Trollers Association

Objectives

1) to compare the mortality rate of coho released at the waterline to taking fish on board and using a revival tank prior to release.
2) to assess whether the use of "red gear" would be effective in reducing the encounter rate of coho.

Fishing Methodology and Gear Tested

The study was conducted over a four month period with three separate tests.

Test 1: Coho mortality rate and gear tests, during sockeye fishery in Area 12-16 (Johnstone Strait), for five days, July 18 to July 22.

Test 2: Gear test, sockeye fishery, Area 13-32 (Johnstone Strait) for one day, August 5

Test 3: Coho mortality rate and gear tests, chum fishery, Area 13-23, 13-26, for five days, Sept. 29 to Oct. 3.

During the 11-day test period, eight vessels participated in the study. Four vessels participated in Test 1 and four vessels in Test 3. Eight vessels took part in the gear comparison Test 2.

In the coho mortality experiment (tests 1 and 3), two vessels were equipped with two revival tanks each and two vessels with a suspended cage towed alongside the vessel. The cage consisted of an enclosed metal cage (with a lid) attached near the stern of the vessel, with the opening close to the waterline. Cages were towed at trolling speed. The tanks on board the two vessels were capable of receiving a constant flow of seawater and equipped with a tight fitting lid. Coho were taken from the revival tanks and cages and released into a net pen and held overnight before being released the following morning.

For gear comparisons, vessels fished with either traditional coho gear or red gear. Total fishing time, number of hooks used, depths, and speed often varied between vessels and for the various test period. During Tests 1 and 3, one cage vessel and one tank vessel fished traditional coho gear and the other vessel with red gear. During Test 2, only one of the eight vessels was equipped with coho gear, the others with red gear. Gear restrictions limited vessels to six lines.

Total fish captured in the three tests: 615 sockeye, 2,252 coho, 617 pink, 930 chum and 806 chinook.

Results

- Revival tank mortality: of the 952 fish caught and placed in tanks, 13 died prior to release to the net pen and 107 died during the overnight holding period. Overall mortality for coho place in revival tans was 120 fish (12.6%).
- Cage mortality: of the 992 fish caught, 11 died prior to release and 90 died during the overnight holding period. Overall mortality rate for coho placed in cages was 101 fish (10.2%)

- Gear comparison: red gear proved to be more effective for catching sockeye, pink and chum salmon, but did not seem particularly effective in reducing coho catch. While coho catch was reduced somewhat by vessels using red gear compared to those coho gear, the figures were not significant.
- The actual catch rate of coho seemed to be related to the area fished rather than gear.
- High trolling speeds resulted in higher coho bycatch.

Conclusions and Recommendations

1. The study showed a lower overall mortality rate for fish released at the waterline (cages) 10.2%, in comparison to those brought onboard and placed in revival tanks (12.6%) The study was conducted in a controlled environment and what needs to be addressed is how this will differ from an actual commercial fishery. There were factors occurring as a result of the test fishery that were thought to cause an increase in coho mortality in comparison to a regular fishery. These included wind (causing stress to fish in cages) and a diesel spill at the net pen site.
2. Recovery tanks may have a place in the recovery of bycatch but it may be on a reduced level where only fish assessed as condition 3 or 4 are actually place in tanks. For these fish it may be worth the time and effort to attempt to improve fish condition prior to release.
3. The most effective method of reducing coho encounters is to adopt area selective fishing strategies that will avoid those areas with high coho concentrations. To do this, it would be necessary to have pre-fishery knowledge as to what stocks are present in the area of fishing operations.
4. Determine realistic and acceptable limits on coho mortality.
5. Continue studies using revival tanks, focussing on effectiveness on fish assessed as a specific condition.
6. Allow flexibility in release procedures for prohibited species. Waterline release should be permitted under certain conditions; i.e. fish in good condition, no predators in the area.

B. West Dixon Entrance Experimental Pink Fishery (TRMNC02)

Project Proponent: S. Haukness. J.O. Thomas presentation/report.

Objective

To demonstrate the ability of the troll fleet to harvest pinks in Dixon Entrance while avoiding non-targeted species, and to be economically responsible.

Fishing Methodology and Gear Tested

Ten freezer vessels with three crew and one observer each, and two ice boats with two crew and one observer each participated. The study took place in Area 1, primarily in the northern half of West Dixon Entrance, over a total of 22 fishing days. The first part was from July 15 to 27 and the second part from August 20 to

September 3. Each part of the study involved six of the 12 vessels. Pink troll (red) gear was tested in targeting pink salmon.

Data on fishing effort was gathered for Sub-Areas 101-3 through to 101-6, and Areas 101-8 to 101-10. The hours fished per area were recorded, with 65% of the fishing effort directed to Area 101-4 (this suggests that coho abundance may not be equally distributed in Area 101).

Of the total catch, 86% were pink salmon and 10% were coho.
Fish captured: 34,197 pink salmon, 4,161 coho, 776 chinook, 561 chum, 169 sockeye and 2 steelhead.

Results
Findings from the data show:

- The overall coho mortality was 16% (this included dead and lethargic fish).
- Coho survival rates were similar by time (July or August) and Area.
- Coho mortality average about 5% for 64% of the vessels, suggesting that proper handling during release can decrease mortality by up to 5%.
- Relative abundance estimated by catch/hour indicates coho abundance varies by time and area.
- Pink abundance relative to coho varies significantly by time and area.
- Only 6.5 hours of fishing effort in Area 101-3 in July, yielded a catch of 221 pinks per hour (8 coho per hour). This fishing area and period may provide the best opportunity to mount selective fisheries.
- In July, based on coho and pink catch/hour data, Area 101-3 and 101-9 are the preferred areas to fish. Next, Areas 101-5 and 101-6 have lower pink abundance but would provide significant fishing opportunities (Table 1).

Table 1: Preferred Fishing Areas in July (lowest Coho Abundance)
(Numbers are rounded).

JULY Area	Catch/Hour Pink	Catch/Hour Coho
101-3	221	8
101-9	45	5
101-5	23	4
101-6	20	2
101-8	12	2

- In August, based on coho and pink catch/hour data, Areas 101-3,-4,-8 and -9 provide excellent fishing opportunities. Areas 101-5 and –6 will provide fishing opportunities but lower relative abundance (Table 2).

Table 2: Preferred Fishing Areas in August (lowest Coho Abundance)

AUGUST Area	Catch/Hour Pink	Catch/Hour Coho
101-3	47	2
101-4	40	2
101-5	23	2
101-6	20	2
101-8	41	2
101-9	34	3

- Area 101-4 is the only area to be avoided in July due to a very high incidence of coho.

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3. Gillnet Fishery

A. Upper Skeena River Coho Mapping Study (GNMNC01)

Project Proponents: Native Brotherhood of BC, Northern Gillnet Association and the UFAWU. Project administrator: J. Thorkelson, Community Fisheries Development Centre.
Presented by Joy Thorkelson, and Steven Cox-Rogers, Fisheries and Oceans

Objectives

- To map areas of 'warm' versus 'cold' coho areas in the Skeena River and approach waters to determine where coho may be avoided while gillnet fishing.
- Examine day versus night catch differences.
- Determine catch locations in the net.
- Examine 'hot' or short set survivals.
- Further refine coho run-timing in Area 4.
- Quantify savings that avoidance achieves.

Fishing Methodology and Gear Used

Ten groups of four gillnet vessels (40) fished for two consecutive periods (one 5- day and one four-day) from July 19 to 30. Six vessels fished the 'Outside" study areas and four fished the "Inside" study areas. Normal Skeena gillnet mesh sizes were replicated in the study. All fish captured were released alive (if possible), mortalities were deliver to the Tsimshian Tribal Council for distribution as Section 35 food and ceremonial fish.

Different information was required from the River Gap Slough area than from the Skeena River approach areas. To record and identify locations, the mapping area was divided into an "Outside" area and an "Inside" area.

a)The Outside Area (Skeena R. approach areas) was subdivided into six sub-areas.

Area 1: Outside of Dundas Island from Boat Harbour following the shoreline on Dundas Island to Edith Harbour, then to the outside of Melville Island then out to the Tree Nob Islands, north to the bottom tip of Zayas Island and then back across to Boat Harbour.

Area 2: Outside of Stephens Island out to the blue line.

Area 3: Inside of Stephens Island, including Edye Pass. The inside boundary was a line from Avery Island through Gull Rocks to Hunts Point on Porcher Island.

Area 4: Top end of Finlayson Island to Ryan Point, including Big Bay.

Area 5: From Ryan Point down to the bottom end of Digby Island with the same outside boundary.

Area 6: Bottom end of Digby Island to Kitson Island, then to the tip of Lelu Island, across to Smith Island, following the shoreline round to Hazel Point, then out to Hunts Point on Porcher Island.

- Vessels fishing the Outside Area divided their nets into three panels numbered one, two, and three. Tying construction tape to the corkline and leadline at the appropriate spots identified the panels. The panel closest to the beach was always designated panel 1.
- Observers recorded the set number and the time each panel went into the water, was fully deployed, started to come out of the water, & when it was fully retrieved. Number, species & fish condition in each panel was recorded.
- DNA samples were taken from each coho captured.
- Revival boxes were used.

b) The Inside Area (River Gap Slough area) was divided into four sub-areas.

Area 7: A line from Leer Point on Lelu Island across to the outermost point on the northern end of T'sum Tsadie Inlet on Smith Island, encompassed all waters of Inverness Passage to a line from Clara Point on De Horsey Island to Gust Point on the mainland shore.

Area 8: The normal commercial fishing boundary to Lambert Point directly west to a prominent point on the east side of De Horsey Island.

Area 9: From Fleming Bay across to Daring Point on Kennedy Island, to Marked Tree Bluff on the north east corner of Kennedy Island, east halfway across Telegraph Passage north to intersect the line designating the bottom of Area 8.

Area 10: Boundaries covered all other waters in Telegraph Passage out to the inside boundary of sub-area 6 except for De Horsey Passage.

In the Inside River sub-areas, the study attempted to find out the area in the net where the most fish strikes occurred to determine if changing the net (e.g. weedlines or shortening the net) would result in fewer coho encounters. The net was "marked" by recording catches visually identified in the top 3 feet of the net, the bottom 3 feet and the middle of the net.

Results

The project objectives were met in that data was collected and provided to the Department of Fisheries and Oceans for analysis.

- Catch per unit effort (catch per hour) (CPUE)in all areas.
  - Outside Area data: indications of higher hourly CPUE for early morning and late evening time periods. Highly variable among study areas, most noticeable in areas 1 and 2. Hourly means not significantly different.
  - Inside Area data: highest CPUE's during mid-day. Likely tidal influences. Highly variable among study areas 7-10. This was not unexpected. Hourly means not significantly different.
- Warm coho areas:
  - Outside Day: Areas 1 and 3
  - Outside Night: Areas 1 and 2
  - Inside All Periods: Area 7
- Day versus Night:
  - Weak evidence for strong day/night catch differences in any study area.
- Location in the net: Most coho and sockeye were caught in the middle of the net. Most steelhead caught in the tope of the net, but not consistent.
- Hot or short set survivals: analysis is continuing on this aspect of the study.
- Coho migration through Area 4: analysis continuing.
- Quantify savings avoidance achieves: analysis continuing.

Recommendations

Continue the project in 2000 to validate the findings of this year's survey. The rate of coho encounters may be due to the low returns of sockeye in 1999.

B. Area D Gear, Time and Area and Real Time Monitoring Study (GNGSC11)

Presented by Project Proponent: Les Rombough, Area D. Gillnet Association

Objectives

- Gear Selectivity: to use various net configurations to determine whether the different gear affects the encounter rate and mortality of non-target species:
  - Phase 1 (sockeye selectivity) to compare the incidence of coho to the hang ratios of Alaska twist nets targeting sockeye in Johnstone Strait.
  - Phase 2 (chum selectivity) to compare the efficiency and incidence of coho catch between the standard 60 mesh multi-strand gillnet to a 90 mesh Alaska twist net for chum salmon in Johnstone Strait.

and within these two phases to also:

- identify and document areas of high coho concentration to assess coho avoidance selectivity.
- conduct time of day experiments to determine whether non-target species catch rates are lower at specific times of the day.
- Phase 3 (Pilot "real time" catch monitoring): comparing the efficiency of transmitting catch information by two satellite systems in a real-time manner from the fishing vessels.

Fishing Methodology and Gear Used

Phase 1: Sockeye Selectivity

Nine vessels (3 groups of 3) fishing for 2 days each week for a total of 5 days (July 25 – Aug. 7) in Johnstone Strait. Vessels within a group set gear in a direct line, with the objective of having three test nets fishing as "one net". Sets were conducted at various distances from shore (i.e. 1, 2, 3, miles). A minimum of 8 one hour sets were made, commencing and picking up nets simultaneously. To compare time of day catches, all vessels met the requirements of a morning set, a dark set and day sets. Each vessel with a group set and hauled nets at the same time. For gear comparison, each vessel within the group was equipped with an Alaskan Twist Net. Nets were identical in terms of mesh size, number of meshes and length. The comparison was made between the hang ratios: one group, the control at 2.15:1, a second group at 2.00:1 and the third at 2.30:1. Total number of sets 424.

Fish captured: 9,908 sockeye, 315 coho, 411 pink, 131 chum, 43 chinook. Observers collected data on fish handling procedures by assessing the condition of all coho encountered at the time of capture and at the time of release. Revival tanks were used to determine whether there was a change in the condition of coho at the time of capture to the time of release, and whether the tanks were a factor in this change.

Phase 2: Chum Selectivity

Six vessels (2 groups of 3 vessels) fishing for 2 days per week for three weeks each, from September 26 to November 2. This phase compared the selectivity of 90 mesh Alaska Twist to the conventional 60 mesh multistrand gillnet. Vessels fished in Johnstone Strait, and for time of day experiments, conducted 8 one-hour sets per day (as in sockeye). Fish captured: 11,324 chum.

Phase 3: "Real Time" Catch Monitoring

(See "Real-time Catch Reporting" below)

This pilot project compared 2 satellite systems, Orbcom (Panasonic) and Argos (VMS) to evaluate technologies, ease of use, cost effectiveness, possible future use.

Results

Phase 1: Sockeye Selectivity

- Coho encounters and mortality rates are affected by:
  - areas of coho abundance (most significant)
  - time of day (significant)
  - hang ratio of net (least significant)

In terms of reducing overall coho bycatch, the most significant gains can be achieved through the practice of selective area fishing.

Overall time of day comparisons did not provide an accurate representation of that the catch per unit effort was in each of the areas for specific times during a fishing day. The overall conclusion is that time of day restrictions can be effective tools for reducing coho catch if that is what is required for a specific area.

The net with the least webbing caught the fewest coho and caught the most fish with the highest chance of survival. Certain hang ratios and times of day resulted in few coho interruptions (i.e. coho swim deeply during the day and can be avoided by appropriate net depth). Although no statistical difference between the various hang rations, results showed there was less coho and more sockeye caught with the 2.0:1 and 2.15:1 hang ratios.

Recommendations:

- Assign a coho allocation along with the Area licensing sockeye allocation.
- Conduct further testing using nets with various hang ratios to determine if the use of these nets can result in low coho encounter rates.
- Continue with pre-fishery abundance testing.
- Review fish handling procedures and the use of onboard revival tanks.
- Conduct stock assessment fisheries in areas that have been closed to commercial gillnets for several years.
- Phase 2: Chum Selectivity. Showed that 90 mesh Alaska twist was about 50% more efficient on the target species of chum. In terms of coho abundance, less coho per hour were caught than in the sockeye fishery. Timing of the chum fishery is a factor; more chum and less coho the later the fishery.
- Phase 3: Real Time Monitoring
  - Generally, both systems worked without flaws.
  - Very user friendly, fishermen didn't mind using them, preferred them to written catch reports
  - Use of systems would:
    - allow safe access to areas we don't normally fish because immediate catch reports would be available
    - determine exactly what/where and when bycatch problems were occurring, act accordingly
  - Greatly improves ability to practice avoidance oriented selective fisheries

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C. "Real-time" Catch Reporting as a Tool for Selective Fisheries

Presented by Brigid Payne, Fisheries and Oceans Canada

With real-time catch reporting, data entry is done "on the spot" soon after fish are caught and transmitted directly from the fishing vessel to the fisheries manager. A satellite or other communications link used. Satellite system provides coast-wide coverage, with minimal time delay. It is relevant to selective fishing because is allows an avoidance-based approach to selectivity where bycatch problems can be quickly detected, and fishing effort redirected if necessary. It is very applicable in the gillnet fleet and takes advantage of mobility and flexibility of gillnet fleet.

Objectives

- Can satellite systems provide reliable, timely and easily accessible information?
- Are the systems easy to use during regular fishing?
- What are the costs?
- Is the real-time information useful to fisheries managers and the industry?

Study Design

Two satellite systems tested on six vessels: 3 vessels with Argos (Argonet) and 3 vessels with Orbcomm (Bfound). The tests took place in three locations along Johnstone Strait. Skippers entered catch numbers after each fishing operation. "Real-time" data was compared to observer reports

Results

- Timeliness and reliability of real-time data.
- Ease of use of on-board equipment.
- Cost per vessel.
- Both satellite systems had the same basic components: On the vessel: GPS receiver for positional data, hand-held unit for catch report entry, and satellite transmitter. On the receiving end: map-based software for data display.
- The main differences between systems were:
  - Messaging : one way vs. two way, data capacity
  - Data access: Bfound: via internet; security achieved via password protection (like e-banking); Argonet: to authorized users with specialized software
- Timeliness of data: Mean time delay between data transmission and receipt by processing centre: 6 minutes (Bfound); 15 minutes (Argonet)
- Range: Minimum: < 1 minute, Maximum: several hours
- Reliability of data: Total chum reported:
  - Observer: 4037
  - Real-time: 3892
  - Difference: 6 %
- Ease of use

Costs per vessel

- On board equipment: $ 2,394 - $ 2,850
- Transmission costs: $5 /day (one-way system), $150 / month (two-way system)
- Monthly service fee: none (one-way system), $ 37.50 / month (two-way system)

*Costs would likely drop with larger number of vessels

General applicability to selective fishing: technically, satellite communications systems can be used on any vessel. Actual utility of real-time reporting systems for selective fishing will depend on: integration with current fisheries management decision-making processes and acceptance by fishermen

Secondary benefits (fisheries management): Streamlined catch reporting: reduced need for costly field monitoring, time-consuming data entry steps eliminated. More accurate and timely data on: number of vessels, fishing effort, catch (target species and bycatch). Enforcement: vessel tracking, closed area enforcement.

Secondary benefits (industry): Better on-board communications: private and secure two-way messaging (boat to boat or boat to shore). Coast-wide communications coverage SAR / EPIRB function. Personal catch records: time and area specific Increased opportunity to achieve full allocation of target species

4) POST-RELEASE EFFECTS: SIMON FRASER UNIVERSITY

1. Revival Tank Redesign and Physiological Testing (GNGSC10)

Presented by Project Proponents: Jake Fraser (industry), T. Farrell and P. Gallaugher and Danielle Pike (SFU)

Objectives

- To redesign the revival box to promote quicker and more effective salmon recovery, and to test swimming performance in a swim tunnel.
- The revival of coho salmon considered to be dead and involved tests on swimming, 24-hour holding, release for tag recovery, and sampling.

Description

This project follows the Barkley Sound blood/stress studies undertaken in 1998 which examined the physiological factors of captured fish and their ability to recover. Fish captured can experience muscle fatigue; physical damage to scales, gills and the mucous layer sand; air exposure and stress. All of these may affect how well the fish recovers after release.

Field work took place in September and October 1999 in a commercial fishing situation targeting coho salmon in Alberni Inlet. The gear used was a reconfigured sockeye gillnet; a hybrid net designed for the lowest impact on coho which functioned as more of a tangle-tooth-type net rather than a traditional gillnet.

Most of the experiments were conducted on coho (457) captured in the gillnet; however experiments were also conducted on small numbers of coho captured using troll and seine gear. In addition about 250 sockeye were used in land-based experiments in Alert Bay. These experiments attempted to induce exhaustion to simulate capture.

To test swimming performance, coho from the gillnet gear and sockeye from the Alert Bay experiment were tested in the swim tunnel.

The recovery box was redesigned using the same dimensions, with a longitudinal divider to keep fish in the same direction as the flow of water, and with an increase in water flow from .2 to .6 litres of water per second. When the fish recovered, they were released without any handling through an open door to the water surface via a chute.

Physiological testing involved:

- induced exercise to simulate fish (sockeye) condition after capture.
- control experiments on the effects of air exposure
- testing methods to obtain blood and tissue samples without causing further stress.

Muscle samples were collected immediately after a fish was killed and then frozen. Blood samples were taken at the same time. Lactate levels elevated as a result of stress.

The condition of captured fish was visually ranked as:
#1 Vigorous, not bleeding
#2 Vigorous, bleeding
#3 Lethargic, not bleeding
#4 Lethargic, bleeding
#5 Dead (no movement/ventilation)

Results

- Fish appeared to recover more quickly in the new recovery box design. No. 5 fish (previously thought to be dead) appeared to be fully revived in the new recovery box. Overall survival rate using the new recovery box was 2.19% mortality (10/457). Significant improvement in mortality rate of #5 coho in the new box (8.6% mortality [9/104]) versus 50% mortality (7/14%) in the old box.

Fish Condition	Survival Rate
#1 (0/143)	100%
#2 (0/5)	100%
#3 (1/202)	99.5%
#4 (0/3)	100%
#5 (9/104)	91.4%

- Coho do recover in 24 hours: coho captured in all three fishing gears were held in a net pen for 24 hours after capture. Lactate values at this time were low, indicating that the fish had recovered from the very high levels associated with immediately after capture.
- Troll-caught fish appear to be less stressed than gillnet and seine-caught fish and recover quickly when placed in a recovery pen.
- Swim Tunnel Performance:
  - Vigorous fish recover quickly and can be released; there is little advantage to holding the fish for an hour.
  - Lethargic fish: after 1 hour of recovery these fish are at the same swimming stage as vigorous fish.
  - Fish previously considered dead (#5) could be revived using the redesigned revival tank and, within several hours, could swim in a water flume at a velocity of over 1.2 metres per second.
  - Swimming performance of revived fish was good.

Future Work:

- Undertake a tagging study to determine whether or not these fish complete their migration after capture and whether or not they spawn as effectively as non-captured fish.
- Measure short-term swimming ability after capture under a broader range of commercial capture conditions to assess ability to resume normal functions (i.e. avoiding predators, resuming migration)

5) NON-TRADITIONAL COMMERCIAL FISHERIES PROJECTS

1. Hawkshaw Fish Trap TNNC09

Presenter and Project Proponent: Fred Hawkshaw

Objective

To test a floating, mobile trap to permit live capture of sockeye (Nass River), chum and pink and the release of non-targeted coho, chinook, steelhead and sockeye (Skeena River).

Fishing Methodology and Gear Used

The study took place during July and August 1999 in Areas 3 and 4, the Nass and Skeena rivers, using a floating mobile trap. Three gillnet vessels are used-two to two the trap (slowly) and one to maintain net configuration. Sockeye salmon were targeted in the Nass River (areas 1-12 & 3-9 {the northern half of areas 3-7}). Pink and chum were targeted in areas 3-7, 3-12, 3-9, 3-8, and Area 4-12.

Fish Captured (Preliminary)

Trap Net	Control Net
76 sockeye 2,941 pink 2 chum 36 coho 1 chinook 7 steelhead	582 sockeye 1,067 pink 174 chum

Results

- Successfully demonstrated the trap's ability to catch significant numbers of fish, with near 0 mortality.
- The trap net was very successful at catching the target species and releasing unharmed non-targeted species when fishing for pink salmon.
- Most targeted fish were kept alive. Exception: in one 1 ½ hour set, only 600 out of 1250 captured were alive. Fifteen pinks were held from August 26 to October 1, and then put on display (still live).
- The testing opportunities on sockeye were limited due to various reasons and further study is recommended in Area 4.
- It is believed this gear could be used as an assessment tool on returning adults, and out-migrating juveniles (smolts).
- Strong tides can create problems when pick up the net if the fish have not all moved to the cod-end.

Recommendations

- Further study on sockeye in Area 4
- Gear changes to improve effectiveness:
  - a purse seine under the wings could improve effectiveness
  - increased entrance hole size from 12 to 20 feet in diameter to allow comfortable entry and any required adjustments to distrance between the first entrance hole and the next lead hole.

2. Free-Floating Trap Net (TNFR02)

Presented by Theresa Godin, University of British Columbia
Project Proponents: Six gillnet fishermen (3 North Coast & 3 South Coast)
D. Matsuo, H. Nomura, R. Nomura, R. Omori, J. Tsumura and S. Yesaki

Objective
To determine the effectiveness of a free-floating trap net for live capture of selected salmon species.

Fishing Methodology and Gear Used
The study took place in the mouth of the lower Fraser River, up to the Massey Tunnel over 42 days from August to October. All species were targeted.

The first trap design had a centre lead which directed the fish to the centre of the apron and heart area. In the second design the lead was moved to one of the wings. The wing lead trap was easier to retrieve and deploy than the centre lead, but unidirectional with respect to fishing.
The net was deployed by pushing the pipe framework over the stern of the vessel and assembled as the webbing was fed out over the roller.
Initial trap net configurations were test fished without success in the North and South coasts. Extensive modifications were made to the gear. It was difficult to find the right materials; very expensive.

Results
- Though the free-floating trap net is developmental and wasn't operating at full capacity, this study found that the sockeye, chum, pink and coho captured in the trap net could be released unharmed if required.
- 88 sets were made before catching any fish, in total 107 salmon were captured. About 1/3 of the fish made their way into the trap box, the rest were caught in either the inner heart or the outer heart.
- Seal predation was a problem.
- If the whole trap is set out, it takes two boats to move it.

Further work
- Continue testing to improve funnel, trap box, large-meshed wings and main lead design.
- New materials and improvements to operational techniques are required.
- Recommendations to concentrate future tests on deeper water sites and when there are move available target species.

VII. WORKING GROUP SESSIONS

Five working groups (or breakout sessions) were held on the third day of the workshop. These focussed on:

1. Policy Development
2. Fisheries Management
3. Science and Research
4. Awareness, Training and Enforcement
5. Marketing and Value-Added Possibilities

Participants in each of the working groups were not satisfied with the short time allocated for these sessions. All considered them valuable and for future workshops, recommended a longer time period. It should be noted that the commercial, First Nations and recreational sectors were not equally represented in these working groups.

1) POLICY DEVELOPMENT

1. Goals & Standards

- In consultation with user/interest groups, the Department needs to set goals and standards. Some of the questions asked focussed on: How far down the road do we have to go before we reach acceptable fisheries practices? While a lot of this has to be based on science and biology, the users want to be involved in the process.
- Goals must be realistic and attainable. 0% mortality…means no fishing. Although some people in the group say that in some cases (site or time specific) zero bycatch might be workable, there was fairly wide agreement that blanket zero bycatch standards won't work. Recommend looking at ways of achieving a goal that is realistic.
- Flexibility: goals and standards need to be flexible in both ways, increase standards or relaxing them depending on stock size changes.
- Data: one of the reasons that we don't have goals and standards is because we still don't have enough information/data on stock sizes, risk factors, etc.

2. Communications

- Better and more communication among and between user groups and the interest groups and also between the user groups and the Department of Fisheries and Oceans.
- Criticism: two hours not sufficient time to come up with specific policy directions.
- Better define risk. We have heard a lot about risk-averse management and how selective fisheries is one way to address this. There was belief that we need to better define risk. What are the risk factors and which of those factors can user groups address themselves?
- Define entry conditions for selective fisheries. Involve the industry in discussions.

3. Compliance

- More enforcement of selective fishing standards, more field staff, higher penalties
- More fishing time should be available in selective fishing
- Trust- need to build trust among/between groups and government.
- Observers: 100% observer coverage is not realistic, not cost-effective in small boat commercial fisheries, sport and Native fisheries.
- Incentives would help address compliance. A selective fisherman can perhaps increase his fishing.

4. Measure Progress

- Participants from all user groups remarked that selective fishing practices were already being practiced (i.e. barbless hooks in the sport fishery, recovery boxes in the commercial fishery, beach seining in the Native fishery) but the Department is still using out of date bycatch mortality estimates.
- We need to measure progress in selective fishing so we know where we came from, where we are today, and how much farther we need to go to meet goals and standards. For example, some DFO managers are still using a by-catch mortality rate of 60% for gillnet fisheries. Under laboratory conditions, researchers claim a by-catch mortality of only 1.8%.

5. Allocation

- Once the job of experiments is done, the 5% TAC should not become a permanent institutionalized tax. It should be dropped when the implementation phase is reached.
- Contributors should be involved in the selection process.
- Pocket-Area Fisheries/TAC: There is perception that most of the TAC comes from Fraser and Skeena-bound sockeye salmon. A suggestion was made to minimize the impact of this 5% by looking at pocket-area fisheries and achieving part of the TAC from these.
- Contribution by need: Contribution of TAC should be paid in relation to the need by the group. The viability of this should be explored – if one user group has achieved selectivity, then they shouldn't have to pay the full price.
- Commercial fishermen stated that once TAMs (Total Allowable Mortality) are set they should be allocated first by gear types and then subdivided into individual vessel by-catch quotas. There was wide support for this concept.

6. Quotas

- Many of the problems of implementing selective fisheries could be solved by quota fisheries. An IVQ fishery for salmon may not be workable. Considerable interest was expressed for an IVQ for bycatch in the salmon fishery.

7. Next steps

- A need to focus now on what there is left to do and how we get there. Two hours of discussion is not enough. Have come a long way compared to five or six years ago.

2) FISHERIES MANAGEMENT

At the outset the group expressed its unhappiness with the 2 hour time limit for this discussion.

1. Communication and Information

- There is a need to continue and to improve test fishing and in-season monitoring (this is two-way communications between fishermen and DFO).
- Find better ways to access information from DFO by using better technology whether phone systems, internet, etc.
- Need for better education and more workshops on these topics to give broader information about selective fishing and how it might work.
- Broaden stock assessment base to include more salmon stocks.

2. Gear/Implementation Issues

- Need for DFO to develop clear testing, approval and or rejection, and implementation processes for new selective fishing gear types and a separate process for approval of modifications of existing gear.
- Suggest more testing of recreational technologies; in particular, salt and freshwater approaches.
- Need for DFO to update mortality assumptions; strong feeling that the presentation given on the first day which based its assumptions using percentages of 60%, 26%, 25% and 10% from many, many years ago, is not that accurate and DFO needs to up-date its own assumptions, take account of new techniques, gear modifications and give credit for improvements made so far.
- Year-2000 implementation (or as soon as possible) of the number of selective fishing practices that have been found to work.
- A phased-in implementation process for major changes in new and alternate gears; that change from one gear to another not be undertaken too quickly (i.e. one year).
- There is a need for an increased understanding of all species by-catch, not just coho or salmon.
- There is a need to identify new opportunities arising out of selectivity practices.

3. Setting Mortality Limits

- Important that rebuilding programs be based on an understanding of socio-economic factors as well as biological factors
- DFO should be clear on the time frame of the program; whether more urgent (a 1 to 4 year period) or a longer program – 12 years, for whatever the species of concern.
- There is a need to define a practical lower limit for mortality and to move away from a blanket assumption of 0%, which is unattainable in the real world.
- There is a need for broader assessment of all salmon stocks. We can only work on the information we have today.
- There is a need to reward improvements made by groups or individuals in selectivity.

- Focus on conservation.
- Get information about standards and limits of mortality out quickly to the fishermen.
- Suggestion that DFO not apply standards (as suggested in outline prior to break-out), but instead set mortality limits and let the fleet determine how they would go about harvesting.
- All limits have to be species specific, not blanket-wide.

4. Allocation

- Need to have allocation for other species and predators.
- Need to have individual (whether vessel or person important, but not determined by the group) mortality limits for all fisheries. This might not be practical in some areas where the biological information is insufficient.
- Need an allocation of by-catch in the broad sense; once again taking into account socio-economic factors and equity concerns.
- Need to use the existing allocation between gear types as a baseline in moving forward with any changes in gear and selective fishing practices which will impact on the allocation.

5. Risk Management

- Need for area/time specific information or decisions about risk. There is a call for clearer understanding of DFO risk management processes and DFO's perspective on what is risk: if DFO has a risk-averse, risk-neutral approach, how much, in terms of risk, is DFO willing to tolerate and why do they come to that conclusion.
- A full understanding of risk will require broader stock assessments and re-establishment of better information sources (i.e. stream counts).
- Real-time monitoring was seen as a very effective solution to reducing risk of over-harvest; a very practical step that could be taken.
- Other information from: re-establishing stream counts, communicating with other jurisdictions/governments around risks to habitat and the resource (i.e. forest management, urban development) that are not under DFO's control.
- A call to phase out DFO's risk-averse approach and to explicitly identify how much of the escapements targets include a "fudge-factor" which is there for risk, and to reduce that amount as better information is brought forward.
- Use of a performance bond to increase DFO confidence in individual behaviour.
- Need to reassess risk to habitat and global issues.
- Direct the fines collected from non-compliance towards rebuilding programs.

Suggestions

- There was a call for another workshop, but change the balance in the agenda in order to have more project discussion; i.e. poster displays and a trade-show environment could be included so that people can talk and get more information.
- Distribute project information prior to workshop.
- Focus more on the discussion aspect (2 days) to give more time for people to talk and to move between working groups.
- Suggestion that there be more DFO staff participation so that they can explain the rational behind actions and also to hear participants comments/feedback first hand.
- People outside the lower mainland are at a disadvantage in terms of travel and costs. Suggest that travel is made easier or that DFO take this type of workshop on the road to different locations.
- There was a call for DFO to release the Decision-Making Paper as quickly as possible.
- Place advertising for workshops such as this one more frequently and in a wider media.
- There is a need for project evaluation.

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3) SCIENCE AND RESEARCH

Discussion structured in two parts:
1) Avoidance Selectivity Research: gathering encounter data, migration patters, real-time monitoring, etc.
2) Unharmed release of fish: technology, recovery boxes, etc.

1. Defining Objectivity

- General comment that there are a number of outstanding questions really want answered before they are ready to engage in a discussion of this kind:
  - what goals will be set and standards implemented,
  - define allowable bycatches of endangered species
  - define mortality targets by species, gear and area

2. Assessing Existing Data

- We need to understand what we know now. There is a sense that research can go forward in terms of what should be done next, but it is possible that in the process, we have overlooked information that is already there but has not been processed. What do we have now in the way of data, both historically and from the experiments conducted over the past two years. There is a need to do an inventory, to do a gap analysis – identify what isn't known, and what needs to be known. Then the process of designing a research program could begin. This opens a whole area of potential exploration.

3. Avoidance Selectivity Research

- Widely-shared feeling that we don't understand the migration patterns, not only of stocks of concern, but other stocks on the coast.
- A desire for research into behavioural patterns and research into how these patterns may vary season to season. Migration patterns are only one piece of the puzzle and these may change over time.
- Research of oceanographic impacts on behaviour and migration patterns: water temperatures, currents (with respect to El Niño and its impact on (new) predation patterns, and water quality impacts such as oxygen content and pollution.
- Real-time reporting seen as a tool in avoidance selectivity. Feelings both pro and con for this:
  - cultural difficulties with the idea of sharing information freely that has not previously been shared,
  - pragmatic concerns about cost (of system shown in presentation),
  - real-time management can provide this validation of abundance, but not necessarily clear on what tools should be used to accomplish real-time reporting,
  - interest in exploring other ways that real-time information might be collected.
  - real time-information may not be as important as good, well-used information.

4. Unharmed Release of Fish

- Enthusiasm and interest in revival boxes, a need for this technology to be explored more fully.
- Need to know the results of release. Do salmon get to the spawning grounds? Do they spawn? Interest expressed in knowing the true long-term mortalities. Need for broader tagging programs designed to answer specific questions.
- Need to fully research, understand and disseminate information on the optimal handling procedures for each species.

5. Other Research Topics

- More focus on handling practices essential for long-term survival of released fish.
- Need for research on socio-economic impact of selective fishing on communities
- Further research into seal behaviour.

Summary:

1. Reservations about setting a research agenda in the absence of clear management goals and standards.
2. First step should be reviewing and compiling existing data
3. Disseminate information in a simple, usable format to stakeholders.
4. Continue the development and implementation of long-term mortality research, via tagging studies on all species.
5. Continue considering real time reporting options through experimentation with different systems.
6. Continue to test effectiveness of revival boxes.
7. There is a desire to understand not just the migration and behavioural pattern of stocks of concern of the moment, but to understand stock behaviour on a coast-wide basis.
8. Determine the effects of selective fishing on the long-term mortality of stocks.

4) AWARENESS, TRAINING, ENFORCEMENT

It should be noted that only two persons from the commercial sector were present at this working group session. There were no representatives from the recreational sector.

1. Awareness

A. Awareness of the Department's Selective Fishing Policy

Commercial Fisheries
There is awareness, but also skepticism. There isn't the buy-in to the degree there could be. One way to overcome this would be to provide some fishing opportunity. If it could be seen that selective fishing leads to fishing, there would be more support.

Aboriginal Fisheries
The First Nations represented at the workshop were coastal aboriginal people. The up-river people, who by definition, are selectively fishing because by the time the fish get to their territory, they are already fishing individual stocks, no mixed stocks. The absence of representation of these people was noted.
Generally agreed that DFO is not doing a good job of making the aboriginal community aware of the selective fishing policy. It is not good enough to produce documents, however well-written. It is necessary to get out into the communities and communicate directly. The opportunity to do this is to re-direct some money that is available in the AFS to broaden awareness in a community information program.

B. Awareness of Pre-season Plans and In-season Changes

Commercial Fisheries
Things are working well.

Aboriginal Fisheries
It was difficult to separate concerns from the First Nations people relating to how in-season decisions for the general fisher (Section 35) have historically been made, communicated, and enforced from those relating to selective fishing. The problems did not really seem to be with awareness of fishing plans, more with the plans themselves and what is frequently seen as unfair and excessive restriction of harvests.

2. Training

A. Technologies
Across all sectors: opportunity to fish is seen to be the incentive to adopting the technology, but it has to be viable technology and the goal posts have to be clear.

Commercial Fisheries
Subject to the qualification that if a viable technology is developed and clear goal posts are set by DFO then in terms of buy-in to training and participating in training, then the commercial sector would support, because the incentive is the opportunity to fish.

Aboriginal Fisheries
Within the Aboriginal fishing sector there is a strong willingness to adopt new technologies and a strong desire to lead from within. Result will be a stronger buy-in. If the technology is seen to work and be successful, then it will be seen that there will be more opportunities to fish.

B. Accreditation

Commercial Fisheries
Very sensitive issue, but for the two representatives participating, there seems to be a willingness to embrace a partnership between DFO and the BC Professional Fish Harvesters, in terms of accrediting participants in the fishery. Discussion also focussed on the concept of a grandfathering clause for people who have been in the fisheries for a long period of time.

Aboriginal Fisheries
A sensitive issue. In some cases they already have accreditation—local fisheries committees check out gear and fishermen prior to participation in fisheries. (Not clear if this is limited to Section 35 Fisheries or to fisheries under AFS). Must recognize accreditation from within instead of imposed from outside.

3. Enforcement

Again, no representation from the recreational fishing. The commercial sector very limited representation. The breakout session failed to elicit a useful discussion of enforcement issues or opportunities as applied to selective fishing.

Commercial Fisheries
Mention was made of the reference earlier in the workshop to the fact that if sufficient levels of compliance are not achieved, the entire opportunity to fish is put at risk. This means that compliance will rely on peer group pressure.

Aboriginal Fisheries
Frustration about the Fisheries Guardian Program: a lot of effort has been put into training people, but they are underutilized. There seems to be a real opportunity to take advantage of the staff already in place and eager to work more.

Summary

- Not enough time to go into depth. Need a full day.
- Need a non-competitive working group environment, people need to be able to attend more than one working session.
- Strongly argued that future workshops must be held outside Richmond.

5) MARKETING AND VALUE-ADDED POSSIBILITIES (Selectively Caught Salmon)

It should be noted that there were no recreational participants and no representatives from the processing sector. The working group consisted of commercial fishermen.

General Observations:

- marketing a positive issue
- everyone in favour of adding value to salmon; this was not a contentious point, group realistic about potential benefits of higher quality realizable under selective fishing
- there are many niche markets for salmon products
- value-adding often brings an added level of risk (cost, inventory, etc.)
- harvesting is a “link in the chain” of producing value
- marketing is expensive, world competition is allocating significant resources to promotion, B.C. faces major competition
- selective fisheries provide opportunity to fully harvest surpluses, while enhancing values vs. current (historical) levels.
- opportunity to increase the “revenue pie”
- marketing comes first: the group noted that marketing should be the *first element* in the salmon business. There was full endorsement of the suggestion that future selective fishing projects include marketing/quality comparisons to status quo harvesting methods; group felt that no project should be approved unless it contains a meaningful market component.

Future Selective Fishing Projects

- to-date, marketability (quality, value) of selectively-caught fish has been given little consideration
- in future, selective fishing projects - both modified and alternative gear - should contain market elements
- both subjective quality criteria (appearance, texture, etc) and objective market criteria (sales proceeds) should be included...

Keys to Achieving Added Value from Selective Fisheries:

A. Landing Higher Quality Product
- management cooperation - advance notice of openings, timing of openings, duration of openings
- fishermen motivation - must believe that he will maximize his revenue by improved handling, vs. maximizing volume
- fishery must be slowed… with increased opportunities for harvest… reduced competitiveness?

B. Realizing Greater Value
- advance communication with customers
- advance communication between fishermen and processor
- "branding" - organic or selective…
  - discussion re: difference between selectively caught and premium quality
  - perception that selective techniques may earn a price premium
- opportunity to enhance value of "low value" species (pink, chum)
  - eg. Chum roe from live-haul fish, live sales of chum, value-added pink products ("lots of scales!")
- new products from "high value" fish
  - eg. caviar from sockeye roe
- Infrastructure must be in place for high quality / live product to be processed & distributed to market in order to realize full benefits
  - existing processors may need to upgrade facilities & procedures
  - independent fishermen may require access to facilities
  - synergy with other sectors
    - eg. aquaculture technology & methods

COMMENTS AND QUESTIONS FROM THE FLOOR

Next workshop, allow time/mechanism for people to rotate and attend more than one working group to allow for a more representative viewpoint of workshop participants.

Suggest that future workshops move to areas where others can participate. Different perspective can be gained from inland fishermen. It is important to hear them.

How do we use selective fisheries when looking at test fisheries. This wasn't dealt with in management. Then it needs to be linked to research.
(response from Pacific Salmon Commission rep: the Commission has raised this question of how test fishing is carried out. Assurance that issue is being discussed).

Value-added is different for First Nations where it can embrace the idea of eco-tourism.

Output from workshops such as this needs coastal and interior perspectives.

Note: the February Shared Visions workshop.

Selective Fishing Policy not just about salmon, but carp, whitefish, etc.

This policy now in draft form. First Nations have not been consulted and have not agreed to the policy. They have rejected the Allocation Policy.

Surprise that the term "surplus" keeps re-appearing. Implies that fish are up for grabs.

Need to have the policy looked at by all people concerned, especially in northern areas, (those that cannot afford to be at the workshop).

Workshop Closed